



SOCIETY OF ACTUARIES

Article from:

# Risk Management

August 2008 – Issue No. 13

# An Enterprise Risk Management View of Financial Supervision

Dr. Stephen W. Hiemstra

*This research report has been reprinted with permission from ERM-II. Due to space considerations, only the introduction and the first section of the research report appear here. To view the complete report, please visit [www.ermii.org](http://www.ermii.org).*

## INTRODUCTION

**F**inancial supervision refers genetically to the many activities used by government financial regulators to promote safe and sound firm management, including:

- Recommending that Congress pass laws and promulgating regulations and policies to implement those laws that enhance firm safety and soundness.
- Monitoring firm activities through on and off-site risk analysis, including examination.
- Requiring firms publish financial statements and supporting information on their operations.
- Legal and regulatory sanctions imposed on firm staff and management and corporate entities.
- Administration of deposit and other insurance funds.
- Requiring firms maintain adequate levels of reserves and capital.
- Verbal and written public comments about firm operations.

Traditionally, the definition of safety and soundness has been kept vague to preclude regulated firms from undermining regulatory and legal requirements through honoring the letter, but not the spirit of the law.



## ***SAFETY AND SOUNDNESS SUPERVISORS FOCUS ON FIRM SOLVENCY***

Financial firms play a key role in assuring a healthy economy through the expansion of credit. They are able to play this role in a safe and sound manner, however, only if the firm is profitable and remains solvent. If a financial firm is not profitable, it cannot expand credit and credit could contract as underwriting standards are tightened and loanable funds are no longer available. When it becomes insolvent, then its creditors cannot be compensated for their investment, borrowers cannot be served, employees cannot be paid, and management has an incentive to make imprudent investments. For these reasons, governments frequently tie the privileges of operating a financial firm to the requirement that they remain solvent and submit to financial supervision.

continued on page 10

<sup>1</sup> I have quoted occasionally from presentations at the 2006 Enterprise Risk Management Symposium in Chicago. The slides and recordings of the presentations can be found at: [www.ERMSymposium.org/handouts.php](http://www.ERMSymposium.org/handouts.php). Look for General Session 3: The Role of ERM in Regulation and Concurrent Sessions 4: Case Studies of ERM in Financial Regulation. This problem is starting to be noticed. See, for example: (Altman, 2006).

## Enterprise Risk Management ...

▶ continued from page 9

*Virtually every decision made by supervisors is predicated on concern about future firm solvency.* A formal statement of this concern is to measure the impact of a decision on the chance that a firm will become insolvent over a period of time into the future. We define the risk of a future loss resulting insolvency as the probability (a percent between zero and one) of insolvency over the next X years.

Because insolvency is usually a rare event, supervisors typically disaggregate and analyze the firm's losses. In doing so, they are implicitly arguing that likely losses associated with particular activities or investments are correlated with the risk of insolvency. This implicit argument is normally weak because firms offset their day-to-day losses with insurance, reserves, and formal hedging activities. In fact, the argument for focusing on disaggregated losses is only materially significant when insolvency risk is high because only then does hedging not offset disaggregated losses. Understanding the nature and timing of threats to solvency therefore validates the focus on disaggregated losses and provides the supervisor with appropriately weighted priorities in all aspects of normal operations.

The conditions that lead to insolvency are accordingly the focus of financial supervisors and, by implication, the focus of supervisory ERM.

### **STAKEHOLDERS SHARE PROBABILITY NOT LOSS**

The supervisory focus on insolvency risk is not necessarily shared by other stakeholders and may vary between supervisors. Short term pressures on supervisors from staff, firms, and others make it hard to maintain focus.

*Supervisory ERM differs from firm ERM because loss exposures differ.* The losses associated with insolvency depend on one's relationship with

and stake in the firm. Because of limited liability, stock and bond investors will only lose the amount of their investment. Counterparties will lose only the amount of their contractual obligation. Managers and employees may only lose their jobs.

The view of losses taken by supervisors may also differ depending on the mix of activities—chartering authority, insurance fund management, and policy responsibilities—bundled with the safety and soundness mandate. Chartering supervisors will lose the revenue associated with their fees. Indirect (spillover) costs may be extensive and may include:

- Loss of reputation, charter value, and relationship with any financier;
- Market transmission of lower prices for collateral, inputs, products, and securities; and
- Higher risk premiums.

Supervisors managing insurance funds may additionally lose resolution costs.<sup>2</sup>

Supervisors with program responsibilities may additionally fail to meet program objectives. Insolvencies of large firms can even have tertiary effects like undermining local economies, reducing the local tax base, and exacerbating social tensions. For all these reasons, supervisors are likely to define ERM much more broadly than private managers who focus mostly on shareholder losses.<sup>3</sup>

For all these reasons, while firm managers are likely to define ERM differently than supervisors, supervisors need the firm to execute ERM. ERM provides senior managers a window into firm risk taking that also informs supervisory. Without this window, supervisors must make risk assessments at a distance and with a lag.



Dr. Stephen W. Hiemstra is financial engineer and is also an ERM Symposium program committee member. He can be reached at [Hiemstra@yahoo.com](mailto:Hiemstra@yahoo.com).

<sup>2</sup>Resolution costs are the costs of closing a depository institution.

<sup>3</sup>A good text discussing the conventional view of ERM is provided by: (Lam, 2003).

## ANALYTICAL FRAMEWORK FOR SUPERVISION

The theory of the firm, as articulated by Coase,<sup>4</sup> says that the firm will sell a product when its cost of production is below the market price and buy a product when its cost of production is above the market price. In other words, the efficiency of the firm's operations determines whether it is a buyer or seller.

This theory suggests that the value of ERM to firm managements is a function of market competition. If the firm is inefficient in managing operations, it will be forced to buy more products—limiting its future prospects. Likewise, if the firm improves its efficiency in management, it will be able to sell more products. Over time, it is likely then that competitive markets will encourage better management. Likewise, oligopolistic markets are likely over time to encourage or at least tolerate weak management. They may also lead to inefficient operations.

*What this theory implies for supervisors is that because the value of ERM rises with market competition, supervisors encourage ERM when they promote market competition. In like manner, allowing oligopolistic practices to evolve discourages ERM.*

Supervisors can encourage competition in a number of ways, including:

- Permit new firms to enter the market either through issuing new charters or by permitting acquisition of existing market participants, or both;
- Remove excess market capacity by taking weak firms into receivership promptly;

- Improve market transparency by publishing financial statements, reporting price and loss data, and encouraging objective underwriting standards and collateral appraisal;
- Discourage vertical arrangement among firms that limit competition or market transparency;
- Strengthen corporate governance regulations to encourage director independence and provide compensation incentives to promote prudent risk taking and a risk management culture; and
- Reduce barriers to market entry by competing firms.

While supervisors can improve competition and are in some instances legally obligated to promote competition, government regulation more frequently serves as a barrier to market entry protecting established firms from competition.

## DEFINING THE SUPERVISORY PROBLEM

Because financial supervisors focus on providing information, supervisors need a theory of learning behavior. A key impediment to supervisory learning about safe and sound operations is the *peak-load problem* that characterizes and dominates financial losses.

## LEARNING IS A PROBLEM SOLVING PROCESS

How do government agencies learn and how do they act on lessons learned? They learn by the process of solving problems.

A *process* is a sequence of related actions that bring about a result. *Learning* is the acquisition of ability through experience or study.<sup>5</sup> Johnson (1986) outlines 8 steps in the learning process, including:

continued on page 12

<sup>4</sup>Coase, Ronald. 1937. *The Nature of the Firm*. *Economica*, 4 No. 4. November. pp. 386-405.

<sup>5</sup>**Process:** 1. A series of actions, changes, or functions bringing about a result: *the process of digestion; the process of obtaining a driver's license*. 2. A series of operations performed in the making or treatment of a product: *a manufacturing process; leather dyed during the tanning process*. **Learn:** 1. To gain knowledge, comprehension, or mastery of through experience or study. 2. To fix in the mind or memory; memorize: *learned the speech in a few hours*. 3. To acquire experience of or an ability or a skill in: *learn tolerance; learned how to whistle*. (see: [www.answers.com](http://www.answers.com)).

## Enterprise Risk Management ...

▶ continued from page 11

- Articulate a felt need;
- Define the problem;
- Assemble observations and data;
- Analyze the data and observations;
- Decide on a plan;
- Execute the plan; and
- Bear responsibility for the decision and execution of the plan.

As shown in chart 1, these steps are informed by both objective (positivistic knowledge) and subjective (normative knowledge) information. Steps may be taken out of sequence and may be repeated as new information becomes available.

The repeating of steps in the supervisory learning process should be anticipated. New subjective information, such as what might arise from an election, can easily motivate an agency to rethink its decisions and come out with new research or new programs. New objective information, such as the results of a recent study, can likewise lead policy makers to rethink their preferences.

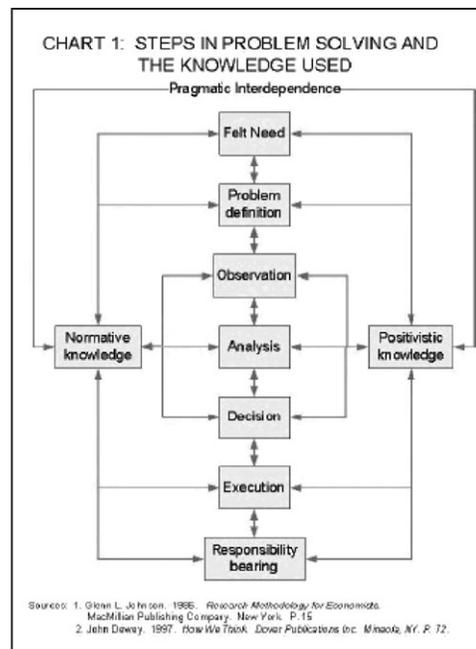
Given this framework, it is easy to see why supervisory agencies have trouble making course corrections. If one assumes that objectives may

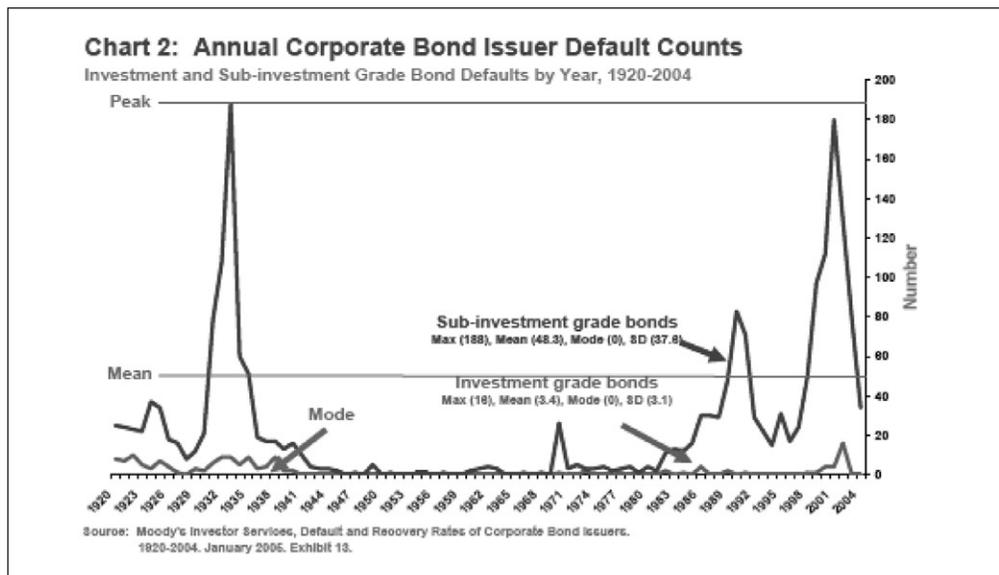
be unclear, significant organizational problems require a multiyear effort to resolve and leadership changes occur frequently (the average federal appointee serves about 24 months), it is obvious that progress in solving problems can be difficult.

Although steps can be taken out of sequence, if steps are the likelihood of success is reduced as knowledge gaps become obvious and credibility suffers. The easiest way for a new manager to loose face with staff, for example, is to make a decision without checking to see whether it has been tried before and what was the outcome. Another favorite path to failure is to infer that an action be taken based on a felt need that is not obviously linked to the proposal. The process of problem solving implicitly provides a vehicle for developing a consensus for proposed solutions and for joint responsibility sharing should problems arise with the execution of the proposal. Taking steps even perceived out of sequence can accordingly be perilous for those making the attempt.

Interestingly, the learning process plays a key role in risk-management for the U.S. military. A recent study reported that making information available to all members of the military—irrespective of rank—plays a key role in responding to the threat of terrorism. In other words, the military's information needs to be more decentralized, in part, because it is hard for a topdown management culture to respond to a threat from a decentralized opponent (Cartwright, 2006). Peak-Load Problem Complicates Loss Measurement and Management.

Chart 2, on page 13, shows annual corporate bond issuer default counts from 1920 through 2004. The characteristic of these data that jumps out at you is that most of the bonds defaults are bunched up in time. This bunching up of losses in particular periods is known among engineers as a *peak-load problem*. The peak-load





problem in the financial markets has generally associated with market contagion. This problem has important implications for regulation, risk management, and long-term planning which are not well understood.

### **Special Problem Posed by Contagion**

Contagion is a medical term that refers to the rapid diffusion of a disease among a host population. One person with the disease exposes another person who quickly becomes sick and infects still other people. An important characteristic of contagion is the observation that the health of the patient prior to infection does not inoculate the patient against the disease—resistance is a function of previous exposure and the presence of antibodies, not general health.

In financial markets, contagion arises when financial weakness in one firm spreads to other firms in the same market. Supervisors usually think of contagion as having two transmission mechanisms—bank runs and bank correspondent relationships—reflecting the treatment of contagion in the academic research on commercial banks. The more general transmission

mechanism, however, is contagion within the market itself.

Supervisors need to resolve troubled financial institutions quickly to avoid financial contagion. For banks, the Federal Deposit Insurance Corporation (FDIC) is responsible for resolving insolvent banks. A resolution normally involves finding a strong bank to purchase or merge with the insolvent bank. The new, larger bank presumably has sufficient capital to mitigate the need for rapid liquidation of the weak bank's assets which can undermine the pricing of financial assets in other firms.

When trouble financial firms are not dealt with promptly by supervisors, these firms can undermine asset pricing in several ways, including:

- Selling assets to raise capital;
- Placing imprudent bets in asset markets; and
- Under-pricing assets in their transactions.

Asset pricing is important because financial viable firms need to earn a rate of return greater than their cost of funds plus administrative costs. If they cannot earn a reasonable rate of return in

continued on page 14

## Enterprise Risk Management ...

► continued from page 13

**Table 1: Summary of Annual Corporate Bond Defaults, 1920-2004**

	Investment grade	Sub-investment grade	Total bond defaults
Default counts			
Sum	148	2,076	2,224
Mean	3.4	48.3	51.7
Maximum	18	188	197
Minimum	0	0	0
Mode	0	0	0
Standard deviation	3.1	37.6	39.5

Note: Data correspond to chart 2.

Source: Moody's Investor Services, *Default and Recovery Rates of Corporate Bond Issuers, 1920-2004*. January 2005. Exhibit 13.

their usual markets, then they compete more aggressively in new markets where they may drive down pricing in those markets as well causing the problem to spread further. This problem is especially severe for large firms with low per-unit mark-ups because any loss in output volume raises per-unit costs pressuring the firm to maintain volume precisely when the lost profitability signals a need to pull back from—not expand into—that particular market.

Falling market prices can drive sound financial institutions towards insolvency, if they operate at a loss. Contagion accordingly leads to a clustering of financial losses in particular locations, industries, and time periods that may be hard to contain.

### **Implications for Decisions under Uncertainty**

The peak-load problem in financial losses poses a challenge for regulator learning because average losses are a poor proxy for peak losses. Most of the losses during the credit cycle are concentrated in a very short period of time, in specific locations, and in specific industries. This shows up statistically as a very large difference between the mean and mode<sup>6</sup> of the distribution of losses (table 1).

The existence of a peak-load problem complicates both risk analysis and decisions under uncertainty. Risk is the probability of a future loss. Managers do not possess perfect knowledge of their businesses or the future. Regulators possess even less knowledge than managers. A peak-load problem further limits the usefulness of averages of financial indicators and exacerbates volatility in the measurement of losses. Let me address these two problems briefly.

The peak-load problem makes average loss data misleading. Holding a capital against an average loss is like building a levy against an average flood: half the time your average levy will be inadequate and your losses will be catastrophic. Levies are typically built based on the high-watermark flood adding in a margin for error that depends mostly on financial capacity.<sup>7</sup>

The peak-load problem leads to volatility in measured risk. The probability of future losses changes dramatically over time. Model error, for example, that is inconsequential in normal market periods can threaten firm survival during peak periods. Managers and supervisors accordingly provide their largest value added by recognizing early on when market conditions have changed and acting on that knowledge.

### **Losses are Correlated, Not Random**

Concentrating losses, like bond defaults and credit losses, in short time periods by itself suggests that losses are correlated and are not randomly or uniformly distributed in time as assumed by most loss models.<sup>8</sup> This problem implies that loss models are likely to

<sup>6</sup>The mode of a distribution is the most frequent observation. It differs from the mean and the median of the distribution.

<sup>7</sup>The economic capital approach takes this problem into account by assuming that average losses are accounted for in product pricing. Capital is held against the difference between expected loss (the mean) and unexpected loss (the mean plus X number of standard deviations). The key problem with the economic capital approach is the practical problem of getting access to data sufficient to account for the historical peak load periods.

<sup>8</sup>Most modelers use logit models to estimate these equations. Logit model explicitly assume independence because they use maximum likelihood estimation (MLE). MLE works by assuming you know a distribution and fitting your data to it. Because MLE assumes that independent observations are multiplied by one another in the likelihood estimator, covariance among the observations leads to an exponential increase in error and a much more complex functional form than is typically assumed. For this reason, econometricians will argue for hours that their observations are independent rather than account for the covariance. This problem is starting to be noticed. See, for example: (Altman, 2006).

underestimate losses just when the models are most needed.

Chart 2 makes the concentration of losses in time fairly obvious. There is, however, a second source of correlation in the chart. Note that losses on investment grade bonds typically peak at close to the time when the sub-investment grade bonds default. Sub-investment grade bond losses are greater, but they are correlated to the investment grade losses. This observation implies contagion both within and across industries. Because these are national figures, this observation also implies contagion across geographic regions of the country.

At least during peak periods, losses are not normally distributed. The statement that loss events are normally distributed implies that:

- The mean values provide useful information about typical losses and
- The tail values are well-behaved and can be accurately estimated.

If losses are concentrated in time (that is, are not normally distributed), both observations are misleading. The mean values provide little insight into the distribution as a whole and tail values are highly volatile and cannot be measured with any degree of precision. This is another way of saying that historical events are unique.<sup>9</sup>

### ***Conflict between Short Run Profitability and Long Run Solvency***

Accounting for the peak-load problem in financial losses over time draws attention to a conflict in incentives between managing for

short-run profitability and maintaining long-run solvency.

Economists distinguish two kinds of costs in the theory of the firm: variable and fixed costs. Variable costs vary in the short term with the level of output. Fixed costs associate with long term investment. Risk is the probability of a future cost to the firm. Credit and market risks tend to be short run and tied to current business decisions like variable costs. Operational risks that threaten firm solvency tend to be long run and tied to firm structure. This gives them fixed cost characteristics.

In a competitive market, economic theory suggests that prices should be set close to variable costs. Competition has this effect because the pricing of fixed costs is arbitrary and large firms are able to lower their per-unit fixed costs by expanding their output up to a point of diminishing marginal returns. The implication for financial regulators is that in competitive markets firms will pass on the costs of prudentially managed credit and market risks, but not the costs associated with operational risks. Firms are less likely to be able to pass on the costs of operational risks because of the fixed cost characteristics of operational risks. Pricing operational risks, like the peak load losses associated with systemic risk, is likely to invite new entrants, customer substitution away from products, and regulatory arbitrage.<sup>10</sup>

### ***Firms May Not Anticipate Ratings Downgrades***

Chart 2 provides some insight into the effect of a systemic event. In a systemic event, counter

**continued on page 16**

“

**Operational risks that threaten firm solvency tend to be long run and tied to firm structure. This gives them fixed cost characteristics.**

”

<sup>9</sup> Central tendency—the law of large numbers—which statisticians use to draw many common inferences does not apply when historical events are unique and do not tend to show regularity.

<sup>10</sup> Parenthetically, when fixed costs need to be imposed, they need to be imposed on the entire industry and all competitors within the industry. A classic example is the imposition of labor contracts on the meat industry during the Second World War. The federal government created a wartime labor relations board to maintain production to support the war effort. Master labor agreements were imposed on the entire meat industry to preclude strikes and competition that would lead to strike behavior. This raised the cost of meat, but labor got a higher standard of living not undermined by industry competition. These master agreements amount to government sponsored collusion and were only eliminated in the 1980s when structural changes in the meat industry introduced.

## Enterprise Risk Management ...

► continued from page 15

parties fail resulting in loss of credit enhancement. Investment grade firms may accordingly be downgraded to sub-investment grade status. The probability of default accordingly follows the path of the sub-investment grade firm—not investment grade firms—where default levels are substantially higher.

The downgrade effect can mask true risk measurement efforts in several ways, including:

- Firm planning may assume investment grade status when sub-investment grade status is the more appropriate assumption.
- Capital is typically allocated after credit enhancement. If credit enhancement fails, capital is by definition inadequate.
- Defaults are typically recorded by those that bear the cost. If counterparties typically absorb normal defaults, the defaults are recorded by the counterparties, not the firm.

Estimating loan defaults based only on firm records may accordingly understate the true risk of default because the observed loss data is really the residual loss, not total loss.<sup>11</sup>

The downgrade effect accordingly suggests that the assumptions about firm losses in a systemic event can be much higher than anticipated by typical worse case scenarios.

These effects can be illustrated with a numerical example from table 1. If risk managers mitigate against an annual bond default event with only a one percent probability and assume losses are normally distributed, investment grade bond losses are likely not to exceed 10.6 bond defaults (3.4 + 2.33\*3.1). This estimate is too low to offset even average losses of 48.3 for sub-investment grade bonds. This observation suggests that loss mitigation efforts, such as credit enhancement,

can hide significant loss surprises in firms that do not anticipate them.

The downgrade effect noted here is really a proxy for the problem of firm revaluation. When firms are revalued, the risk premium associated with a firm's securities rises and the value of the firm falls from market towards liquidation value. Private rating companies may or may not anticipate this revaluation. Depending on the quality of the analysis done, ratings can be downgraded before or after these changes in market valuation, depending on the quality of the analysis done.

*RISK MANAGEMENT IS ATTACHING INCENTIVES TO INFORMATION*

Managers work with directors to define clear firm strategic objectives, translate those objectives into a plan, communicate the plan to staff, and execute the plan in daily operations (chart 1). Because managers cannot do everything themselves, the most critical elements in their work are information processing, communication, and incentives. An effective supervisory program targets these critical elements.

*Problem Definition, Observation, and Analysis.*

In risk management, timing is everything. Taking advantage of market opportunities and avoiding catastrophic losses both require timely responses. The higher portfolio turnover rates that have evolved in recent years exacerbate the timing problem. For risk management, monitoring loss data is key.

Two pieces of loss information drive risk analysis:

- Identifying trends that suggest losses are rising; and
- Recognizing changes in product loss covariances that may undermine the efficiency

<sup>11</sup> The technical term for this problem used by statisticians is data censoring.

of hedging relationships (basis risk) and indicate rising model risk.<sup>12</sup>

Both signal the transition between normal markets and peak-load periods.

A peak-load problem potentially leads to under-investment in prudential measures for two reasons:

- A principal agent problem<sup>13</sup> arises because the term of office of managers and regulators does not typically extend long enough to account for the next peak load period; and
- Because future losses are potentially separated by decades of prosperity, losses are discounted over several decades and their present value may approximate zero.

All forecasts are subject to uncertainty. Until everyone agrees a problem exists nothing gets done. If no one has an incentive to account fully for the risks borne, both firm and supervisor are likely to under-invest in prudential measures.

*Communication.* Once a problem has been defined, information gathered, and analysis undertaken, people must be informed and then convinced to act on it. The first part of this process is providing information. Articulating risk analysis information accurately to directors, managers, and staff in time to take corrective action requires effective written and oral communication.

*Incentives Matter.* Even when people agree that a problem exists, fixing the problem must become a priority. In an administrative context, priorities are communicated through the performance management system—what does boss think is important enough to evaluate staff on? Risk management information, once created, need to be communicated and to be attached to incentives communicated through performance management imperatives. ♦

<sup>12</sup> The standard guideline used to undertake model risk examinations is available online. See: (Brown and Dick, 2000). Also see: (Derman, 1996).

<sup>13</sup> The idea of a principal agent problem is at least in part analogous to the asset-liability mismatch problem in interest rate management. Also see previous footnote.