Risk Management Failures

What Are They and When Do They Happen?

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RISK MANAGEMENT FAILURES:
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In media accounts and popular commentaries on the current financial crisis, a constant refrain is that the risk management function in many of the world’s largest financial institutions has failed to carry out its responsibilities. To cite just one example, an article in the Financial Times declares “it is obvious that there has been a massive failure of risk management across most of Wall Street.”

This paper attempts to challenge, or at least qualify, this assertion by examining what it means for risk management to fail. The main aim of these pages is to show that the fact that an institution suffers an extremely large loss does not necessarily imply that risk management failed, or that the institution made a mistake. With this goal in mind, this paper shows when bad outcomes can be blamed on risk management and when they cannot. In so doing, this paper offers what amounts to a taxonomy of risk management failures.

The question of whether and how risk management failures can be used to improve the practice of risk management is also addressed. This paper concludes that the probabilities of large losses are measured very imprecisely and that, as a consequence, companies should rely less on estimates of such probabilities and pay more attention to the implications of large losses for their survival. Among other suggestions, it proposes that greater use of scenario planning could allow institutions to do a better job of anticipating the likely consequences of low-probability outcomes and developing effective responses to them.

LONG-TERM CAPITAL MANAGEMENT (LTCM)

In 1994, ex-Salomon Brothers traders and two future Nobel Prize winners started a hedge fund called the Long-Term Capital Fund. LTCM was the company that managed the fund. The fund performed superbly for most of its life, but 1998 turned out very differently. In August and September of 1998, following the default of Russia on its ruble-denominated debt, world capital markets were in crisis and LTCM lost most of its capital. Before its collapse, LTCM had capital close to $5 billion. By mid-September, LTCM’s capital had fallen by more than $3.5 billion and the Federal Reserve Bank of New York coordinated a rescue by private financial institutions that injected $3.65 billion into the fund.

Does a loss of more than 70% of capital, and a rescue by banks involving an injection of $3.65 billion of new capital, necessarily represent a failure of risk management? It turns out that this is not an easy question to answer. To define a risk management failure, one first must have a clear understanding of the role and the limitations of risk management.
THE ROLE OF RISK MANAGEMENT

In a typical company, the role of risk management is to identify and evaluate the risks faced by the firm, to communicate these risks to senior management (and possibly the board of directors), and to monitor and manage those risks in a way that ensures the firm bears only the risks to which its management and board want exposure. To guide them in monitoring and managing risk, most companies specify one or more measures of overall risk. The final decision to take known risks rests not with the risk manager, but with top management. This decision depends on the risk appetite or tolerance of an institution, and defining that appetite is one of the most important responsibilities of management and the board.

Effective risk management does not provide a guarantee against failure. Even in companies with the best risk management people and systems, large losses can and will occur as long as taking the risk of large losses increases expected profits sufficiently for top management to be willing to take that risk. With good risk management, such losses will be attributable to an unlucky “draw,” to (for example) a one-in-a-hundred event. Ultimately, the likelihood of such large losses will depend on choices made by those entrusted with determining the firm’s risk appetite. The job of risk management is to ensure that top management knows and understands the probabilities associated with possible outcomes of the firm’s strategy before it makes decisions to commit the firm’s capital.

In the fall of 1997, the managers of LTCM concluded that they did not want to manage a business earning just 17% for its investors, which is what their investors had earned for the year. Instead, they wanted the higher returns achieved in 1995 and 1996. At the end of 1997, LTCM had capital of $7.4 billion but decided to return 36% of the capital to its investors in order to increase its leverage. By increasing its leverage, it could boost the return to its shareholders if things went well—but only by raising the expected losses if things went poorly.

Was increasing leverage a bad risk management decision? This example assumes that the partners of LTCM knew the risks and the rewards from higher leverage. In the well-worn language of financial economics, increasing leverage appeared to be a positive NPV decision when it was made. But after the fact, it proved to be a costly decision since it meant that when assets fell in value, the value of the fund’s equity fell much faster.
While understanding the role of risk management is valuable, it is also important to understand the many ways in which risk management failures may arise.

The first step in risk management is to identify and measure risks. Risks are measured with metrics that aggregate various types of risks to help top management understand the risk position of the firm. The choice of risk metrics is the cornerstone of risk management. If the risk managers assess risk using measures that are ill-suited to a firm’s strategy, risk management can fail before the computers are ever turned on.

Once a risk measure is chosen, there are two basic kinds of mistakes that can be made in measuring risk: (1) known risks can be mismeasured and (2) important risks can be ignored, either because they are undetected or wrongly viewed as immaterial.

Once the risks are identified and measured, they must then be communicated to the firm’s leadership. A failure in communicating risk to management is also a risk management failure.

After risks have been measured and communicated, top management decides how much and what kinds of risks to take. At this point, it is the responsibility of risk management to make sure that the firm actually takes these risks and not others.

As this discussion suggests, then, there are five types of risk management failures:

• Failure to use appropriate risk metrics.
• Mismeasurement of known risks.
• Mismeasurement stemming from overlooked risks.
• Failure in communicating risks to top management.
• Failure in monitoring and managing risks.

This paper discusses each of these failures in turn.
Risk management failures can result from using a risk metric that answers the wrong question. A useful analogy is a weather forecast. If you are deciding to go on a three-day hike in the wilderness, a weather forecast for the first day is not really helpful when making the decision to go or not—yes, you can still turn back in the middle of the first day, but you suffer the brunt of the bad weather if it occurs in the second day. Choosing the right risk metrics is similar to choosing the right weather forecast horizon.

The risk metric that is most closely associated with modern risk management is VaR (Value at Risk). The daily VaR measure is widely used in financial institutions for assessing the risk of trading activities. Though VaR has proved to be an extremely useful risk measure, it is useful only as long as the question it answers is well understood. VaR is the largest loss the firm expects to incur at a given confidence level, which means that VaR tells us nothing about the distribution of the losses that exceed VaR. This limitation of VaR has nothing to do with how institutions estimate their VaR. Rather, it is simply a matter of how VaR is defined: VaR is not and was never meant to be an estimate of the worst loss that could occur at a financial institution. For example, at the end of November 2008, the daily VaR of Goldman Sachs for its trading operations was $244 million according to its annual report for 2008. Goldman Sachs computed its VaR using a 95% confidence interval. Consequently, there was a 5% chance that Goldman Sachs would make a trading loss in excess of $244 million. This VaR estimate tells us nothing about where losses would fall within the range of potential trading losses if the trading loss exceeds $244 million. Though appropriate for some purposes, VaR is likely to be useless for others. In particular, VaR is of little use if one wants to understand the nature of potential catastrophic losses that have a low probability of occurring.
Large banks usually disclose VaR data quarterly, and will generally report the number of times in a quarter a loss exceeded the daily VaR (exceedances). UBS reports its VaR at the 1% probability level. In its annual report for 2006, UBS reported that it never had a loss that exceeded its daily VaR. But in 2007, it reported that losses exceeded its daily VaR twenty-nine times. Such a large number of exceedances can occur for a number of reasons. One reason is simply that at times rapid and turbulent changes in the economy make it very difficult for risk managers to track risk on a daily basis. Exceedances could differ across financial institutions for many reasons. For instance, different institutions have different trading books and these trading books are affected differently by unexpectedly rapid and turbulent change in the economy. However, whether an institution has many or few VaR exceedances is not instructive about its financial health because VaR exceedances could have been for small amounts, in which case they would have been unimportant, or for large amounts, in which case they could have endangered the institution.

Thus, though focusing on daily VaR can be intellectually satisfying for risk managers (since it involves up-to-date quantitative techniques), focusing exclusively on it could lead risk managers to ignore critical dimensions of risk. Daily VaR should generally not be the primary focus of top management, which must pay attention to longer-run indicators and implications of risk. Short-run VaR measures can give misleading signals by suggesting low risk until a series of events produces a huge loss and the firm fails.

Daily VaR measures implicitly assume that assets can be sold quickly or hedged, so that a firm can limit its losses essentially within a day. But in the recent economic crisis, we have seen that markets can become suddenly less liquid, so that daily VaR measures lose their meaning. If a firm sits on a portfolio that cannot be traded, a daily VaR measure is not a measure of the risk of the portfolio because the firm is stuck with the portfolio for a much longer period of time.

From March 1994 to December 1997, LTCM had only eight months with losses and the worst was 2.9%. In contrast, it had thirty-seven months with gains. As a result, one would have a hard time using historical monthly returns to conclude that its risk management was flawed. Yet, in August and September 1998, LTCM experienced losses that were not predictable from its historical record. It was as if an earthquake struck. The best daily or monthly VaR measure would not have shown the possibility of such an event because the probability of an earthquake in any day or month is always extremely low.
MISMEASUREMENT OF KNOWN RISKS

Now consider the case where risk managers have chosen the right metrics, but the risks have been measured incorrectly.

When measuring risk, risk managers attempt to understand the distribution of possible returns. Risk managers could make a mistake in assessing the probability of a large loss, or they could be wrong about the size of the loss given that it takes place. Or they could use the wrong distribution altogether. Further, in the case of a financial institution with many trading positions, although the distribution associated with each position may be estimated properly, the correlation among the different positions may be mismeasured. Such correlations are extremely important in risk management because, as correlations increase, so does the vulnerability of a portfolio to low-probability events.

If the correlation between the incomes from different activities within a firm is high, it is more likely that all the firm’s activities will perform poorly at the same time, which leads to a higher probability of a large loss. These correlations can be difficult to assess—and they can change over time, at times abruptly.

Partly as a result of the experience in 1998 of funds like LTCM, it is now well-known that correlations increase in periods of crisis. Correlations evolve randomly over time and sometimes jump unexpectedly. In such cases risk managers cannot be expected to anticipate such an abrupt increase in correlations. But, once such shifts in correlations are recognized, risk managers must take account of them.

In LTCM’s case, the true probability of a loss of 70% may have been higher than 1%. Assume, for example, that the fund in fact had a 25% chance of experiencing a 70% loss, and a 75% chance of producing a 25% return. In this example, the expected return of LTCM would have been a paltry 1.25%—investors could have earned a higher expected return by investing in T-bills. And such a risk management mistake—assessing the probability of the bad outcome at 1% instead of 25%—would have led the fund managers to make trades that, on an ex-ante basis, were expected to reduce value.

But if LTCM made such a mistake, how would we ever know? The answer is that we cannot know based only on the observation that it realized a loss of 70%. We cannot identify such a mistake after the fact because LTCM lost 70% on only one occasion. Given the assumed distribution of possible losses, LTCM was capable of losing 70% whether the true probability of that loss was 1% or 25%. And given the hypothetical conditions of this example, we can conclude nothing about the effectiveness of LTCM’s risk management from its 70% loss.
The Limits of Risk Measurement

Statistical techniques are generally used to estimate the distribution of known risks. Such approaches work well when there is a lot of data and when it is reasonable to expect future returns to have the same distribution as past returns. But, in other cases, historical data will be of little use—say, because a risk has never manifested itself. For instance, prior to the subprime crisis, there had been no experience of a downturn in the real estate market when large amounts of securitized subprime mortgages were outstanding. In such a situation, it was not possible to obtain a distribution of losses associated with such an event since there was no historical precedent. To evaluate the risks of underwriting and purchasing mortgage-backed securities, a risk manager would have needed to understand both the likelihood of a decrease in real estate prices, and the expected effect of such a decrease on the prices of those securities. Such an exercise would have been complex and worth undertaking only if the likelihood of a large decrease in real estate prices was recognized as material from the start. But without the historical data to evaluate such risks, risk managers cannot model them using conventional quantitative approaches.

In such cases, if probability assessments are made by risk managers, they are bound to have significant elements of subjectivity. When that happens, statistical risk measurement reaches its limits and risk management changes from science to art. Once risk management moves away from established quantitative models, the outcome depends much more on the firm’s risk appetite and culture than its risk management models.
Another kind of measurement failure is the failure to take account of risks. In the taxonomy offered by this paper, such “ignored” risks can take two different forms that have different implications for a company. First, a firm’s risk managers may ignore a known risk, perhaps because of a mistaken assumption that it is immaterial or perhaps because of the difficulty of incorporating it in the risk models. Second is the case of risks that are truly unknown, or at least completely unanticipated.

**Ignored Known Risks**

In a well-functioning, truly enterprise-wide risk management system, all major risks would be identified, monitored, and managed on a continuous basis. Such enterprise-wide risk management systems are much easier to conceptualize in theory than to implement in practice. In practice, of course, many corporate risks tend to be managed in decentralized “silos,” which increases the possibility that known material risks are excluded from the central risk modeling process. When this happens, risks that are not captured by the system are not adequately monitored. And given the tendency of unmonitored risks to expand within large organizations, such risks can become material even if they weren’t before.

For example, consider a trader whose risks are only partly measured and monitored. Most traders have a compensation formula that involves an option-like payoff—that is, they receive a significant share of the profits they generate, but do not have to pay back the losses. Such compensation creates incentives for traders to take risks. If only some of the risks of traders are monitored, they can increase their expected compensation by increasing the risks that are not monitored.

Another example is the situation that can arise where some new financial instruments are not yet incorporated in risk models. Some firms prohibit the trading of such financial instruments—but this choice has costs, since it is often extremely valuable for traders to be active at the beginning of a new market. However, if financial instruments are not included in the models, traders are tempted to build up positions in these instruments, creating the possibility of large losses.

In financial institutions, risks are commonly divided into three categories: market, credit, and operational risks. These distinctions are partly artificial in the sense that they are driven by regulatory considerations. The trading books of financial firms are typically marked-to-market. Securities held in trading books can have credit risk as well as market risk. For instance, a bank might have credit default swaps in its trading book. In some credit default swaps, the bank is the purchaser of protection. But whether the bank actually receives the expected compensation in the event of a default depends on the ability of the protection seller to pay that compensation. And because of this somewhat artificial distinction between credit and market risk, a bank may fail to adequately take into account the counterparty risk of the credit default swaps it holds on its books.
Similarly, normal business risks are often of critical importance and have to be carefully assessed as part of the evaluation of a firm’s risk. Complicating matters, such risks could turn out to be highly correlated with both credit and market risks. For instance, for many banks the loss of income from securitization was the realization of a business risk that turned out to be correlated with not only market risk (namely, the loss in value of securities issued through securitizations) but also credit risk—the inability to use securitization to lay off the risks associated with loans.

Thus, accounting for all the risks in a risk measurement system is a difficult and costly undertaking. But a failure or refusal to attempt to account for these risks means that the firm’s top executives are managing the company with blinders on—they see only part of the big picture they need to manage effectively.

Unknown Risks

Most unknown risks do not create risk management problems. Consider, for example, a statistical model of risk measurement for an individual stock (as opposed to a portfolio of stocks). Suppose a risk manager has modeled the distribution of the stock’s returns, and that each period’s stock return will be a random outcome—like the outcome of the toss of a coin. His model tells him that the volatility of the stock’s return is 20% per year, and that there is a 5% chance of a loss of, say, 30% or more over that period. He does not need to understand or be in a position to explain why a loss took place. If the stock drops by 15% because of the manifestation of some specific risk, the fact that the risk manager did not know about this specific risk is generally irrelevant in risk management as long as the risk manager has a good understanding of the distribution of the stock’s return.

Unknown risks also may not matter simply because they have a very low probability. For example, there is some probability that a building will be hit by an asteroid. But such a risk does not affect managerial decisions. The unknown risks that matter for our purposes are those that, had top management been aware of them, would have resulted in different actions. For example, the risk of a drop in housing prices of 40% from peak to trough could well have been viewed as an unknown risk in the past. But now, of course, that possibility has been realized in a number of regions. Had people been aware of that risk a few years back, many decisions would likely have been different.

In sum, part of the risk manager’s job is to think hard about all major sources of uncertainty. But having said that, some risks will inevitably remain unknown until they actually materialize. After all, how many corporate risk managers anticipated the events of 9/11? And acknowledging this possibility of unknown and unknowable risks, risk managers at some point must concede the limitations of their models—and perhaps recommend that additional capital be set aside for this possibility.
As noted earlier, it is not the job of risk management to determine the firm’s overall target level of risk or the kinds of risks it takes. Those decisions are the purview of top management and the board—of people who, when setting the firm’s strategy, should begin by identifying the firm’s competitive advantages and the risks its investors are “paying” the firm to take. (For example, should the airlines really be in the business of taking oil price risk, or should that be laid off to commodity traders?)

The role of risk management is to provide timely information to the board and top management that allows them to assess the consequences of retaining or laying off risks. But for management and the board to understand these consequences, risk managers must communicate effectively. Even if a firm has the best possible risk systems, if the risk manager is unable to make top management understand their output, the systems may do more harm than good. If viewed as a “black box,” such a system could either lead to distrust and excessive conservatism on the part of top management—or excessive risk-taking stemming from an exaggerated sense of the protection risk management can provide.

As stated in a report by the Senior Supervisors Group (which includes top regulators from the United States, England, and Germany), “In some cases, hierarchical structures tended to serve as filters when information was sent up the management chain, leading to delays or distortions in sharing important data with senior management.” Finally, in the words of an industry commission report on the crisis, “risk monitoring and management reduces to the basis of getting the right information, at the right time, to the right people, such that those people can make the most informed judgments possible.”
Risk management is responsible for making sure that the firm takes the risks that it wants to take and not others. As a result, risk managers must constantly monitor and hedge or otherwise manage known risks to meet the objectives of top management. This may be particularly challenging for financial firms, where risks can change abruptly even if the firm does not take new positions.

The problem arises from the fact that financial firms have many derivatives positions and positions with embedded derivatives. The risk properties of portfolios of derivatives can change very rapidly with no trading whatsoever. This is because complex derivatives often have exposures to risk factors that are extremely sensitive to market conditions. For example, we now have products that can start the day with a significant positive exposure to an interest rate increase but, as a result of a small change in rates, end the day with a significant negative exposure. For such products, adjusting hedges only once a day could end up creating large losses, because the hedge that was optimal at the start of the day could be amplifying risk at the end of the day.

One of the most obvious demonstrations of how risk exposures can change is given by the evolution of the yields on subprime mortgage-backed securities in excess of the yields of Treasuries of comparable maturity (spreads). Initially, the credit spreads on AAA-rated tranches showed almost no variation. And so reasonable assessments of the risk of the AAA-rated tranches using historical data would have indicated little risk. But, as seen in the figure below, in the second half of 2007, the spreads of these securities increased dramatically.

![U.S. AAA-Rated Home Equity Spreads 2005–2008](image)

Note: The Barclays Capital U.S. ABS Home Equity AAA Index is used.
When the risk characteristics of securities can change this rapidly, it is challenging for risk managers to capture these changes and adjust their hedges. This challenge is especially great when risk can change dramatically in response to small changes in the determinants of security prices. As a result, risk managers may fail to adequately monitor or hedge risks simply because the risk characteristics of securities may change too quickly to allow the managers to assess them and put on effective hedges.

Especially in these circumstances, an important component of risk management is to identify solutions that can be implemented quickly if a firm has to reduce its risk over a short period of time. Contingency hedging plans are therefore critical for responding to unexpected difficulties. Moreover, it is important to recognize that when liquidity dries up in the markets, many hedging strategies that are effective in normal periods can no longer be used.

Paradoxically, the introduction of mark-to-market accounting has made it even harder for risk managers to estimate risk and put on effective hedges. For large organizations, observing the value of a complex security affects the value of that security. The reason for this is straightforward: when mark-to-market losses become known, they set off a chain reaction of price adjustments at other institutions as the market better understands the capital positions of different institutions.

In large complex organizations, it is also possible for traders to take risks that remain hidden for a while. How can this happen? All organizations are forced to make tradeoffs, and risk management is no exception. A company’s risk management function could, at least in theory, be designed to know everything at all times. But if it were organized that way, the risk management function, besides being very costly, would likely stifle innovation and reduce the competitiveness of the firm. In fast-moving markets, employees need flexibility.

But, as suggested, that same flexibility makes it possible for unobserved pockets of risk to emerge. And when such risks manifest themselves, it is not clear that they represent a risk management failure. Although risk management could have ensured that these risks were not taken, the firm and its shareholders would have been worse off. And even ignoring its effects on flexibility and innovation, improvements in risk monitoring are expensive enough that, at some point, they cease to be cost-effective.
To come up with useful assessments of risk, then, risk managers must look at longer horizons and take a comprehensive view of their risks. For example, one-year horizons are widely used as measures of firm-wide risk in enterprise-wide risk management (ERM) programs. Most financial institutions that focus on one-year measures of firm-wide risk aim for credit ratings that imply an extremely small yearly probability of default—say, 0.03%.

But such approaches are not sufficient. A high target credit rating effectively means that the firm tries to avoid default in all but the most extreme circumstances. When a firm aims for an AA credit rating, it effectively chooses a probability of defaulting of roughly one in 1,000 in the coming year. But since crises are more likely than that, management needs to understand the implications of its decisions in the event of a crisis and have a strategy to respond to it.

Risk models, as we have already seen, are generally not designed to capture risks associated with crises and help companies manage them. The models use historical data and, particularly when using risk measures such as VaR, are most precise for horizons that are numbered in days; and when using such short horizons, crises appear to be highly improbably events. But, when the horizon expands to years and even decades, the probability of a crisis becomes material.

And at least for purposes of evaluating the consequences of financial crises and planning for them, an extension of the horizon of risk management models is likely to be valuable for at least two reasons: First, as illustrated dramatically by events since the summer of 2007, financial crises can involve the abrupt withdrawal of liquidity from the markets. The absence of liquidity means that firms are stuck with positions they did not expect to hold. Positions whose risk was evaluated over a single day suddenly become positions that must be held for weeks or months. Second, during crisis periods, companies will repeatedly experience losses that exceed their daily VaRs, substantially weakening their own capital positions. And for these reasons, even firms whose trading is guided mainly by daily VaR should consider complementing their use with longer-term measures.
Financial crises also involve complicated linkages and interactions among risks and institutions. Statistical risk models typically take returns to be “exogenous” to the firm and ignore risk concentrations across institutions. But if such an approach is appropriate for many institutions, it will not work for others that, because of their size or degree of connectedness, can affect prices and volumes in certain markets.

Further, large institutions facing distress can be exposed to “predatory” trading—that is, trades made by others that have the effect of compounding the losses from such large, illiquid positions. An example is a situation where traders from other institutions benefit from selling and pushing prices down with the aim of bringing about a fire sale (and buying back their positions). As one firm experiences large losses, it may drag down prices for other institutions and make funding more costly for all of them. Typical risk management models do not account for such possibilities, leading to a significant underestimation of the risk of positions in the event of a crisis.

There is little hope for statistical risk models that rely on historical data to capture such complicated effects. And rather than attempting to introduce greater complexity and realism into their models, risk managers should consider complementing their reliance on models with tools such as scenario analysis to investigate how crises unfold, how the firm will be affected by them, and how it should best respond to them. With the help of such scenarios, top management can anticipate the threat posed by extreme events to the franchise value of their institutions and develop strategies for limiting and responding to such events.

But contrary to some current practice, scenario analysis must be informed by economic and financial analysis. Scenario analysis cannot succeed unless top management believes that the scenarios considered represent serious threats to the institution itself.
CONCLUSION

Recent economic difficulties have convinced some observers that there are major, perhaps irremediable, flaws in risk management, and that such flaws were important contributors to the crisis. This paper demonstrates the need to distinguish between flawed assessments by risk managers and corporate risk-taking decisions that, although resulting in losses, were fundamentally reasonable at the time they were made. To help in making this distinction, the paper also identifies a number of different ways that risk management can fail. In addition to choosing the wrong risk metrics and otherwise mismeasuring risks, risk managers can fail to communicate their risk assessments effectively and otherwise provide effective guidance to top management and boards. And once top management has used that information to determine the firm’s risk appetite and strategy, risk management can also fail to monitor risks appropriately and maintain the firm’s targeted risk positions.

But if risk management has been mistakenly identified as the culprit in many cases, there is no question that risk management practice can be improved by taking into account the lessons from financial crises past and present. Such crises have occurred with enough frequency that crisis conditions can be modeled, at least to some extent. And when models reach their limits of usefulness, institutions should consider using scenario planning that assesses the implications of crises for their financial health and survival. Rather than relying on past data, scenario planning must use economic analysis to evaluate the expected impact of sudden illiquidity and the associated feedback effects that are common in financial crises. Nevertheless, to serve as an effective part of a firm’s strategy, scenario planning and the analysis that comes out of it must be deeply rooted in a firm’s culture as well as the strategic thinking of top management.
ENDNOTES


4 Derivatives are financial instruments whose payoffs depend on the value of something else.

5 For a discussion of some of the issues concerning mark-to-market accounting that accounts for possible feedback effects, see Guillaume Plantin, Haresh Sapra, and Hyun Song Shin, “Marking to Market: Panacea or Pandora’s Box?” 2008, Journal of Accounting Research 46, 435–460.
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