

SENIOR SUPERVISORS GROUP

Observations on Risk Management Practices during the Recent Market Turbulence

March 6, 2008



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SENIOR SUPERVISORS GROUP

March 6, 2008

Mr. Mario Draghi, Chairman
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Dear Mr. Draghi:

On behalf of the Senior Supervisors Group, I am writing to convey a report that assesses which risk management practices worked well, and which did not, at a sample of major global financial services organizations during the recent period of market turmoil. This report, *Observations on Risk Management Practices during the Recent Market Turbulence*, summarizes the results of a review that we undertook this past autumn of firms' practices. It also reflects the results of a roundtable discussion that participating supervisory agencies held with industry representatives on February 19 at the Federal Reserve Bank of New York.

A few caveats are necessary when reviewing this report. First, while the analysis covered eleven of the largest banking and securities firms (and the roundtable included representatives of five additional firms), it did not cover the universe of all major firms active in the relevant markets. Second, the observations reflect supervisory judgments based primarily on detailed discussions with these firms, supplemented with information drawn from ongoing supervisory work. Finally and most importantly, the analysis was completed *prior to the conclusion* of the period of market turmoil.

Subject to these caveats, the report identifies a number of risk management practices that may be associated with negative or positive performance to date.

The predominant source of losses for firms in the survey through year-end 2007 was the firms' concentrated exposure to securitizations of U.S. subprime mortgage-related credit. In particular, some firms made strategic decisions to retain large exposures to super-senior tranches of collateralized debt obligations that far exceeded the firms' understanding of the risks inherent in such instruments, and failed to take appropriate steps to control or mitigate those risks. Such firms have taken major losses on these holdings, with substantial implications for their earnings performance and capital positions.

Another risk management challenge concerned firms' understanding and control over their potential balance sheet growth and liquidity needs. For example, some firms failed to price properly the risk that exposures to certain off-balance-sheet vehicles might need to be funded on the balance sheet precisely when it became difficult or expensive to raise such funds externally. Likewise, some firms found that they could not syndicate their holdings of leveraged loans because of reduced investor appetite for those assets and that they could not cancel their commitments to fund those loans. The resulting effects on the balance sheets of major firms from these sources have been substantial, although the impact on capital ratios has been significantly less than the effect from the write-downs on their exposures to securitizations of subprime mortgage-related credit.

Firms that avoided such problems demonstrated a comprehensive approach to viewing firm-wide exposures and risk, sharing quantitative and qualitative information more effectively across the firm and engaging in more effective dialogue across the management team. Senior managers in such firms also exercised critical judgment and discipline in how they valued its holdings of complex or potentially illiquid securities both before and after the onset of the

market turmoil. They had more adaptive (rather than static) risk measurement processes and systems that could rapidly alter underlying assumptions to reflect current circumstances; management also relied on a wide range of risk measures to gather more information and different perspectives on the same risk exposures and employed more effective stress testing with more use of scenario analysis.

In addition, management of better performing firms typically enforced more active controls over the consolidated organization's balance sheet, liquidity, and capital, often aligning treasury functions more closely with risk management processes, incorporating information from all businesses into global liquidity planning, including actual and contingent liquidity risk.

Using the observations of the report to set expectations, primary supervisors are critically evaluating the efforts of the individual firms they supervise to address weaknesses in risk management practices that emerged during the period of market turmoil. Each supervisor is ensuring that its firms are making appropriate changes in risk management practices, including addressing deficiencies in senior management oversight, in the use of risk measurement techniques, in stress testing, and in contingency funding planning.

Finally, our observations help to define an agenda for strengthening supervisory oversight of relevant areas. In particular, we have identified the following areas relevant to this agenda.

First, we will use the results of our review to support the efforts of the Basel Committee on Banking Supervision to strengthen the efficacy and robustness of the Basel II capital framework by:

- reviewing the framework to enhance the incentives for firms to develop more forward-looking approaches to risk measures (beyond capital measures) that fully incorporate expert judgment on exposures, limits, reserves, and capital; and
- ensuring that the framework sets sufficiently high standards for what constitutes risk transfer, increases capital charges for certain securitized assets and asset-backed commercial paper liquidity facilities, and provides sufficient scope for addressing implicit support and reputational risks.

Second, our observations support the need to strengthen the management of liquidity risk, and we will continue to work directly through the appropriate international forums (for example, the Basel Committee, International Organization of Securities Commissions, and the Joint Forum) on both planned and ongoing work in this regard.

Third, based on our shared observations from this review, individual national supervisors will review and strengthen, as appropriate, existing guidance on risk management practices, valuation practices, and the controls over both.

Fourth and finally, we will support efforts in the appropriate forums to address issues that may benefit from discussion among market participants, supervisors, and other key players (such as accountants). One such issue relates to the quality and timeliness of public disclosures made by financial services firms and the question whether improving disclosure practices would reduce uncertainty about the scale of potential losses associated with problematic exposures. Another may be to discuss the appropriate accounting and disclosure treatments of exposures to off-balance-sheet vehicles. A third may be to consider the challenges in managing incentive problems created by compensation practices.

We are simultaneously releasing the report publicly to inform the broader industry of the results of our review and to identify areas of practice where industry attention is necessary.

Sincerely,



William L. Rutledge
Chairman

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I. INTRODUCTION

After an extended period of ample financial market liquidity and generally low credit spreads in many economies, the sharp loss in the value of subprime mortgages and related mortgage-backed securities and the deterioration in investor appetite during the summer of 2007 led to broad and deep market distress. Because these and other innovative products had been created during the prior period of more benign market conditions, banks and securities firms had not observed how such products would behave during a significant market downturn and found their risk management practices tested to various degrees.

Asset-backed securities (ABS¹) in general and mortgage-backed securities (MBS) in particular experienced the greatest degree of stress in 2007. The loss in the value of subprime mortgages throughout the year led to growing uncertainty about the valuations of credit instruments such as collateralized debt obligations (CDOs) that often included such subprime mortgages in what investors and rating agencies had previously considered high-quality assets. Consequently, investors sought clarity about the quality of specific assets supporting investment securities and shunned those whose risk they could not easily assess. Their willingness to purchase similar securitized assets backed by mortgages waned as they realized the difficulties of assessing the quality of the underlying assets, as did their willingness to purchase other complex credit products, such as collateralized loan obligations (CLOs). Consequently, many types of credit instruments, such as MBS and other ABS, CDOs, CLOs, and asset-backed commercial paper (ABCP), became illiquid during this time, causing steep decreases in many secondary market prices and requiring corresponding markdowns in the valuations of firms' holdings of affected assets.

Early on in this period of market turbulence, our group—senior supervisors of such major financial services firms from France, Germany, Switzerland, the United Kingdom, and the United States²—convened to assess whether shortcomings in risk management may have contributed to the losses. More specifically, we sought to identify risk management practices that may have tended to work well, and those that may no

have, so that we could better evaluate whether changes in supervisory guidance and expectations are necessary.

To this end, we developed an extensive questionnaire covering senior management oversight and risk management performance across key dimensions. We shared the questionnaire with a sample of eleven global banking organizations and securities firms that are significant competitors in affected markets and that experienced a range of outcomes through the early months of the market turmoil. In November 2007, we met with senior management at the selected organizations to elicit their perspectives on how well or how poorly key elements of their corporate governance, business strategy, and risk management practices had worked up to that point in time. By analyzing the results of these systematic discussions and by using information otherwise available to principal supervisors, our senior supervisory group sought to determine the effectiveness of different risk management practices over the period of stress through the end of calendar year 2007. We then met with industry representatives on February 19, 2008, in New York to share our observations and seek comments on them.

This report outlines supervisors' observations on the risk management practices that may have enabled some firms to weather the financial market turmoil better than others through year-end 2007. Specifically, supervisors focused on practices related to the following:

- the role of **senior management oversight** in assessing and responding to the changing risk landscape;
- the effectiveness of **market and credit risk management practices** in understanding and managing the risks in retained or traded exposures as well as in counterparty exposures, in valuing complex and increasingly illiquid products, and in limiting or hedging exposures to credit and market risk, and
- the effectiveness of each firm's **liquidity risk management practices** in assessing its vulnerability to that risk in a stressed environment and taking appropriate action.

It should be emphasized that the observations in this report reflect our understanding of risk management practices at eleven major firms through our year-end 2007 review period. Our work does not represent a comprehensive review of the turmoil and all firms' experiences. As market events progress, other weaknesses may emerge, and our observations may not prove to be definitive or complete. Consequently, this report

¹A list of abbreviations used in this report appears in Appendix A.

²The seven supervisory agencies participating in this project are the French Banking Commission, the German Federal Financial Supervisory Authority, the Swiss Federal Banking Commission, the U.K. Financial Services Authority, and, in the United States, the Office of the Comptroller of the Currency, the Securities and Exchange Commission, and the Federal Reserve. The list of working group members appears in Appendix B.

should be viewed as an interim assessment of the key risk management practices that have affected major firms' ability to weather the current market turbulence.

II. SUMMARY OF KEY OBSERVATIONS AND CONCLUSIONS

The market distress that began in the second half of 2007 occurred after an extended period of ample financial market liquidity and generally low credit spreads. The banking organizations and securities firms in our sample entered the turmoil in relatively sound financial condition and generally with capital well above regulatory requirements. However, as a result of these events, many firms absorbed significant losses, and the prolonged disruption in market liquidity stressed most firms' liquidity and capital.

The widespread retraction of interest among investors in purchasing various kinds of assets caused many major financial services firms to experience substantial write-downs and unexpected losses in their portfolios; some firms have subsequently had to raise new capital. Financial businesses such as those involved in the syndication to external investors of leveraged loans to corporate borrowers faced dwindling demand for their products and consequently losses as positions had to be marked down.

But the primary source of losses came from concentrated exposures that some major financial services organizations had to U.S. subprime mortgage-related credit, particularly in businesses involved in the warehousing, structuring, and trading of CDOs backed by such credits. Several firms found that their aggregate exposure to this risk was larger than they initially recognized. What drove most directly the absolute and relative dimensions of loss were the strategic decisions that some firms made to retain large exposures in super-senior tranches of CDOs that far exceeded the firms' appreciation of the risks inherent in such instruments. Firms did not recognize the possibility that losses on the underlying MBS could reach levels that could impair the value of even the super-senior tranches of collateralized debt obligations of asset-backed securities (ABS CDOs).

Many firms were more vulnerable to a prolonged disruption in market liquidity than they expected. Firms were

surprised by the nature and length of the market disruption and were forced to fund exposures that they had not anticipated in their contingency funding plans. This included retaining exposures in warehouse portfolios for significantly longer periods of time than expected when firms realized they were unable to find buyers for securities such as residential mortgage-backed securities (RMBS), ABS CDOs, and high-yield bond exposures. Firms likewise found that they could neither syndicate to external investors their leveraged loan commitments to corporate borrowers nor cancel their commitments to fund those loans despite material and adverse changes in the availability of funding from other investors in the market. Moreover, some firms were required to fund contractual commitments backstopping a range of off-balance-sheet financing vehicles that they had not anticipated they would have to fund themselves, such as ABCP conduits. In other cases, firms under no contractual obligations still provided voluntary support to these and other off-balance-sheet financing vehicles, including structured investment vehicles (SIVs), because of concerns about the potential damage to their reputations and to their future ability to sell investments in such vehicles if they failed to provide support during the period of market distress.

Nevertheless, during the turmoil, all firms were able to obtain adequate liquidity to fund their operations and, in certain cases, to bring additional assets onto their balance sheets that they had not planned to fund. However, all firms faced higher funding costs and, in most cases, did not have as much contingent funding liquidity as they would have liked.

While firms were neither universally effective nor ineffective across all relevant dimensions, our supervisory group identified actions and decisions that have tended to differentiate firms' performance during the period of market turbulence through year-end 2007. Some firms recognized the emerging additional risks and took deliberate actions to limit or mitigate them. Others recognized the additional risks but accepted them. Still other firms did not fully recognize the risks in time to mitigate them adequately. Many of our observations on risk management practices relate to the decisions that firms made to take, manage, measure, aggregate, and hedge (or not hedge) such exposures. In particular, we found important differences in firms' approaches to four firm-wide risk management practices and to three specific business lines.

A. Four Firm-Wide Risk Management Practices That Differentiated Performance

Firms that tended to deal more successfully with the ongoing market turmoil through year-end 2007 adopted a comprehensive view of their exposures. They used information developed across the firm to adjust their business strategy, risk management practices, and exposures promptly and proactively in response to changing market conditions.

1. *Effective firm-wide risk identification and analysis*

Through robust dialogue among members of the senior management team (including the chief executive officer, the chief risk officer, and others at that level), business line risk owners, and control functions, firms that performed well through year-end 2007 generally shared quantitative and qualitative information more effectively across the organization. Some firms were consequently able to identify the sources of significant risk as early as mid-2006; they had as much as a year to evaluate the magnitude of those risks and to implement plans to reduce exposures or hedge risks while it was still practical and not prohibitively expensive. Senior managers developed a firm-wide plan to reduce or hedge those exposures and did not rely on the hope that business lines would make decisions individually that would benefit the firm's exposures collectively.

In firms that experienced greater difficulties, business line and senior managers did not discuss promptly among themselves and with senior executives the firm's risks in light of evolving conditions in the marketplace. This left business areas to make some decisions in isolation regarding business growth and hedging, and some of those decisions increased, rather than mitigated, the exposure to risks.

2. *Consistent application of independent and rigorous valuation practices across the firm*

At firms that performed better in late 2007, management had established, before the turmoil began, rigorous internal processes requiring critical judgment and discipline in the valuation of holdings of complex or potentially illiquid securities. These firms were skeptical of rating agencies' assessments of complex structured credit securities and consequently had developed in-house expertise to conduct independent assessments of the credit quality of assets underlying the complex securities to help value their exposures appropriately. Finally, when they reached decisions on values,

they sought to use those values consistently across the firm, including for their own and their counterparties' positions. Subsequent to the onset of the turmoil, these firms were also more likely to test their valuation estimates by selling a small percentage of relevant assets to observe a price or by looking for other clues, such as disputes over the value of collateral, to assess the accuracy of their valuations of the same or similar assets.

In contrast, firms that faced more significant challenges in late 2007 generally had not established or made rigorous use of internal processes to challenge valuations. They continued to price the super-senior tranches of CDOs at or close to par despite observable deterioration in the performance of the underlying RMBS collateral and declining market liquidity. Management did not exercise sufficient discipline over the valuation process: those firms generally lacked relevant internal valuation models and sometimes relied too passively on external views of credit risk from rating agencies and pricing services to determine values for their exposures. Given that the firms surveyed for this review are major participants in credit markets, some firms' dependence on external assessments such as rating agencies' views of the risk inherent in these securities contrasts with more sophisticated internal processes they already maintain to assess credit risk in other business lines. Furthermore, when considering how the value of their exposures would behave in the future, they often continued to rely on estimates of asset correlation that reflected more favorable market conditions.

3. *Effective management of funding liquidity, capital, and the balance sheet*

The importance of maintaining a firm-wide perspective is similarly evident in differences in the enforcement of more active controls over the consolidated organization's balance sheet, liquidity, and capital positions. Those firms that avoided more significant problems through our year-end review period aligned treasury functions more closely with risk management processes, incorporating information from all businesses in global liquidity planning, including actual and contingent liquidity risk. These firms had created internal pricing mechanisms that provided incentives for individual business lines to control activities that might otherwise lead to significant balance sheet growth or unexpected reductions in capital. In particular, these firms had charged business lines appropriately for building contingent liquidity exposures to reflect the cost of obtaining liquidity in a more difficult market environment.

Moreover, better performing firms actively managed their contingent liquidity needs. For example, some firms avoided business lines such as CDO warehousing or SIVs because the perceived contingent liquidity risk outweighed the potential returns. When implementing their plans, these firms exhibited greater discipline in adhering to limits in the face of changing market conditions.

Firms that experienced greater problems tended to have weaker controls over their potential balance sheet growth and liquidity. Their treasury functions were not closely aligned with risk management processes and lacked complete access to flows of information across all businesses in the firm and an understanding of the changing contingent liquidity risk of new and existing businesses. In some cases, contingency funding plans were based on incomplete information because the firm did not consider properly the risk of certain exposures being added to the balance sheet or failed to price appropriately the usage of the balance sheet or of contingent liquidity needs such as those liquidity needs for SIVs and for syndicated leveraged loan deals. Accordingly, these firms failed to create incentives for business lines to manage such potential scenarios prudently.

4. Informative and responsive risk measurement and management reporting and practices

Firms that tended to avoid significant challenges through year-end 2007 typically had management information systems that assess risk positions using a number of tools that draw on differing underlying assumptions. Generally, management at the better performing firms had more adaptive (rather than static) risk measurement processes and systems that could rapidly alter underlying assumptions in risk measures to reflect current circumstances. They could quickly vary assumptions regarding characteristics such as asset correlations in risk measures and could customize forward-looking scenario analyses to incorporate management's best sense of changing market conditions.

Most importantly, managers at better performing firms relied on a wide range of measures of risk, sometimes including notional amounts of gross and net positions as well as profit and loss reporting, to gather more information and different perspectives on the same exposures. Many were able to integrate their measures of market risk and counterparty risk positions across businesses. Moreover, they effectively balanced the use of quantitative rigor with qualitative assessments. This blend of qualitative and quantitative analysis provided a high level of insight and consistent

communications to management about evolving conditions, enabling the firm to pursue opportunities as they emerged and, more importantly, to reduce exposures when risks outweighed expected rewards.

Firms that encountered more substantial challenges seemed more dependent on specific risk measures incorporating outdated (or inflexible) assumptions that management did not probe or challenge and that proved to be wrong. Some firms that lacked alternative perspectives on risk positions lost sight of how risk was evolving or could change in the future and what that might mean for the aggregate size of their gross versus net exposures. Some could not easily integrate market and counterparty risk positions across businesses, making it difficult to identify consolidated, firm-wide sensitivities and concentrations.

What follows is a review of firms' use of two particular sets of risk management tools during the period of market turbulence, namely value-at-risk (VaR) measures and stress testing.

First, VaR measures formed a key barometer for most firms in understanding their sensitivity to changes in market conditions. In the course of market events, most firms indicated that their VaR measures performed as expected, but many identified weaknesses in the assumptions and specifications underpinning their VaR measures. Some firms identified shortcomings in their assumptions about the scale of shocks or degree of market volatility they may face; how their holdings of (relatively new forms of) instruments may behave in comparison with more established debt products when shocks strike markets; or how the accuracy of their VaR measure is affected by the accuracy of price estimates for less liquid or illiquid securities. Nonetheless, some firms emphasized that the dependence on historical data makes it unlikely that a VaR-based measure could ever capture severe market shocks that exceed recent or historical experience, highlighting the importance of supplementing VaR with other views on risk.

Second, with regard to stress testing and related scenario analyses, the firms surveyed experienced more divergent results. Some found that their stress tests or scenario analyses generally matched the movements in market prices, but others found that the actual shocks to credit spreads tended to be wider and longer lasting than their prior analyses had suggested. Many firms plan to refine their stress tests to alter, for example, their estimates about the economic benefits of diversification in stressed markets. While it should be emphasized that the goal of stress testing cannot be to anticipate the scale of every future shock, which would be an

unachievable expectation, some firms found it challenging before the recent turmoil to persuade senior management and business line management to help develop and pay sufficient attention to the results of forward-looking stress scenarios that assumed large price movements.

A common shortcoming in the implementation of both VaR measures and stress tests at some firms, and especially at those that experienced greater challenges, related to the failure to treat appropriately the basis risk between cash bonds and derivative instruments such as credit default swaps. Another issue was the use of proxy volatility data as a substitute for risk assessments of instruments that did not have a long price history of their own. For example, some firms that encountered more substantial challenges tended to assume that they could apply the low historical return volatility of corporate credits rated Aaa³ to super-senior tranches of CDOs, a more novel instrument that rating agencies had likewise rated Aaa. That assumption turned out to be wrong and increased those firms' exposure to basis risk. Furthermore, some firms placed too much reliance on the external credit ratings of structured products and did not challenge the resulting calculations of VaR (or static stress shocks calibrated from historical data series) that their risk measurement engines generated based on these ratings and related optimistic assumptions. As mentioned earlier, the dependence of these firms on rating agencies' assessments stands in marked contrast to the sophistication of their existing internal credit assessment processes in other business lines. Such firms failed to assess properly both correlation risks generally and basis risks and correlation risks specifically within particular asset classes.

B. Three Business Lines Where Varying Practices Differentiated Performance

In addition to noting differences in outcomes attributable to varying risk management practices that firms applied across their businesses, our supervisory group found that differences in risk appetite, business strategy, and risk management approaches in three particular business lines have led to considerable variability in firms' performance.

1. CDO structuring, warehousing, and trading businesses

The losses resulting from write-downs of positions in super-senior tranches of CDOs backed by subprime mortgages have

³The credit ratings notations used in this report reflect the scale used by Moody's Investors Service, a credit rating agency. The use of this scale is for illustrative purposes only.

accounted for a majority of the overall losses for major financial services firms active in this business during the second half of 2007. Affected firms sought to expand this business rapidly, generally with poor risk management practices.

In particular, the firms did not consider that the positions might be of poorer credit quality than the external credit rating indicated and that even senior tranches could lose considerable market value if the underlying collateral suffered losses (or was downgraded) or if market liquidity receded for these products. Such firms typically sustained significant losses because they retained the super-senior position of CDOs backed by subprime mortgages or other similar assets and treated them as "par" assets.

In addition, internal incentives were missing or inadequately calibrated to the true risk of the exposures to the super-senior tranches of CDOs. Poor internal controls for balance sheet usage, such as weaknesses in the application of internal pricing or limits, did not create adequate incentives to restrict or hedge the risks related to these positions in a timely fashion. Likewise, internal risk capital measures that relied too much on agency ratings underestimated the true price of the risk of such positions. Furthermore, we believe that traditional credit risk management disciplines such as conducting analyses of industry sectors and using limits were not in place in several cases.

2. Syndication of leveraged financing loans

Some firms worked aggressively to defend or expand market share in the syndication of leveraged financing loans, and many of those that later faced challenges in this business did not properly account for the price risk inherent in the syndicated leveraged lending pipelines. This oversight resulted in inadequate aggregate risk measures. Some firms did not consider the importance of marking pipeline positions to market, but rather treated them more like loans and valued them at or close to par. Given changes in the financial markets, some firms had to fund deals and postpone others. In contrast, several firms that scaled back activities in this business line as they saw underwriting standards deteriorate were able to avoid significant challenges.

3. Conduit and SIV business

Several firms did not properly recognize or control for the contingent liquidity risk in their conduit businesses or recognize the reputational risks associated with the SIV business. Many firms did not properly price for the correlated contingent liquidity risk in asset-backed conduits, an error that led to unexpected claims on the firms' own liquidity resources.

In some cases, firms concerned about risks to their reputations felt compelled to bring SIV assets on their balance sheets or to finance assets that they had expected to sell. Such decisions imposed substantial costs on the organizations and led to some further expansion of the firms' liquidity and capital needs. In addition, certain non-recourse financing products (such as leveraged total return swaps) created issues for certain firms because of the deterioration in the price and market liquidity of the assets underlying some of these products.

C. Supervisory Response

Our observations on risk management practices during the recent market turbulence have relevance both to the supervision of individual firms and to the agenda for strengthening supervisory oversight.

Using the observations of the report to set expectations, primary supervisors are critically evaluating the efforts of the individual firms they supervise to address weaknesses in risk management practices that emerged during the period of market turmoil. Each supervisor is ensuring that its firms are making appropriate changes in risk management practices, including addressing deficiencies in senior management oversight, in the use of risk measurement techniques, in stress testing, and in contingency funding planning.

Moreover, our observations help to define an agenda for strengthening supervisory oversight of relevant areas. In particular, we have identified the following areas relevant to this agenda.

First, we will use the results of our review to support the efforts of the Basel Committee on Banking Supervision to strengthen the efficacy and robustness of the Basel II capital framework by:

- reviewing the framework to enhance the incentives for firms to develop more forward-looking approaches to risk measures (beyond capital measures) that fully incorporate expert judgment on exposures, limits, reserves, and capital; and
- ensuring that the framework sets sufficiently high standards for what constitutes risk transfer, increases capital charges for certain securitized assets and ABCP liquidity facilities, and provides sufficient scope for addressing implicit support and reputational risks.

Second, our observations support the need to strengthen the management of liquidity risk, and we will continue to

work directly through the appropriate international forums (for example, the Basel Committee, International Organization of Securities Commissions, and the Joint Forum) on both planned and ongoing initiatives in this regard.

Third, based on our shared observations from this review, individual national supervisors will review and strengthen, as appropriate, existing guidance on risk management practices, valuation practices, and the controls over both.

Fourth and finally, we will support efforts in the appropriate forums to address issues that may benefit from discussion among market participants, supervisors, and other key players (such as accountants). One such issue relates to the quality and timeliness of public disclosures made by financial services firms and the question whether improving disclosure practices would reduce uncertainty about the scale of potential losses associated with problematic exposures. Another may be to discuss the appropriate accounting and disclosure treatments of exposures to off-balance-sheet vehicles. A third may be to consider the challenges in managing incentive problems created by compensation practices.

We offer below our detailed observations on the risk management practices—relating to senior management oversight, liquidity risk management, and credit and market risk management—that tended to differentiate firms' performance through year-end 2007.

III. SENIOR MANAGEMENT OVERSIGHT

Well-managed organizations rely on their leadership to articulate strategy, the range of outcomes that are acceptable to maintain and increase franchise value, and the structure through which organizations pursue their strategy and increase the firm's value as a going concern. Imbedded within these responsibilities is the task of determining in which businesses to engage and to what degree, and hence the kinds and levels of risks the firm will accept. The responsibilities necessarily include the task of creating an infrastructure to take on appropriate exposures that will achieve targeted returns and simultaneously to identify, measure, and manage the associated risks.

A firm's business/risk mix, the level of risk it accepts, and the management and control structure through which it operates reflect senior management's view of, and willingness to do business in, the market environment. During the recent market turbulence, the senior management of the firms in our

review differed both in their outlook for the broader business environment and in their willingness to accept the risks emerging in particular markets. In addition, some senior managers missed or underestimated the risks in products and markets that they exploited as sources of growth; these products and markets later became sources of weakness and material losses in the turmoil. But the outcomes varied, even among those firms that had leaders who understood and accepted the risks in products or markets that later proved to be problematic.

How senior management at various firms approached the current market turmoil appears to have differed in a number of important ways that help to explain firms' outcomes through year-end 2007. Four such differences in approaches included the following:

- the balance that each firm's senior management in general achieved between its desire to do business and its appetite for risk as reflected in the tone set for developing or enforcing controls on the resulting risks;
- the role that senior management in particular played in identifying and understanding material risks and acting on that understanding to mitigate excessive risks;
- the efforts that senior management undertook to surmount organizational structures that tended to delay, divert, or distort the flow of information up the management chain of the firm; and
- the breadth and depth of cross-disciplinary discussions and communication of insight into relevant risks across the firm.

A. The Balance between Risk Appetite and Risk Controls

An overarching difference is apparent in the balance that senior management achieved between expanding the firms' exposures in what turned out to be high-risk activities and fostering an appropriate risk management culture to administer those activities. Senior management at nearly all firms surveyed had allowed the businesses to increase their exposure to market risk, but some firms' senior management was far more assertive than others' in encouraging the increased risk taking. For example, firms that experienced material unexpected losses in relevant business lines typically appeared to have been under pressure over the short term either to expand the business aggressively, to a point beyond

the capacity of the relevant control infrastructure, or to defend a market leadership position. In some cases, concerns about the firm's reputation in the marketplace may have motivated aggressive managerial decisions in the months prior to the turmoil.

A further distinction among the firms was the degree to which senior management encouraged a firm-wide approach to risk management and the enhancement of control structures to keep pace with the growth of risk taking. In addition, it was critical for firms to have risk management functions that are not only independent, but also have sufficient authority within the organization.

An issue for a number of firms is whether compensation and other incentives have been sufficiently well designed to achieve an appropriate balance between risk appetite and risk controls, between short-run and longer run performance, and between individual or local business unit goals and firm-wide objectives. Many firms are assessing their overall financial performance for 2007 and, in light of their results, reevaluating their approaches to performance-driven compensation and other incentives going forward.

In addition, in some of the firms that felt most confident in their risk identification practices during the market turmoil and that avoided material unexpected losses through year-end 2007, senior managers promoted a continuous dialogue between business areas and risk management functions at the top of the firm on whether the firm was achieving an appropriate balance between its risk appetite and risk controls. These discussions became more active as the market turmoil intensified.

In contrast, senior management at some other firms that recorded relatively larger unexpected losses tended to champion the expansion of risk without commensurate focus on controls across the organization or at the business-line level. At these firms, senior management's drive to generate earnings was not accompanied by clear guidance on the tolerance for expanding exposures to risk. For example, balance sheet limits may have been freely exceeded rather than serving as a constraint to business lines. The focus on growth without an appropriate focus on controls resulted in a substantial accumulation of assets and contingent liquidity risk that was not well recognized. This pattern was particularly apparent in several significant business lines.

- For example, some firms did not fully appreciate the market risk of **CDO warehouse and packaging businesses** even as these businesses were expanding substantially. Some management teams believed that they would be able to sell at a favorable price whatever

credit instrument they structured. Consequently, as explained in more detail below, senior management and risk management at these firms did not challenge business lines' assumptions regarding the risks associated with the exposures retained on the firms' balance sheets, nor did they require that steps be taken to test the accuracy of valuations. Management did not anticipate the duration of the warehouse pipeline or require hedging of those exposures. They did not seek to limit these risks by reducing or hedging retained positions on a timely basis; some firms continued to underwrite or increase their exposures until the summer of 2007 despite an array of data indicating rising stress in the subprime mortgage market and worsening credit market conditions.

- In the **syndicated loan business**, some firms ignored limits on syndicated loans as covenants and market material adverse change (MAC) clauses increasingly fell away. Other firms, faced with the same information about evolving market conventions and weakening lender protections, reduced the volume and nature of transactions they were willing to finance. A number of firms in effect provided financial sponsors with out-of-the-money options as commitments made without market MAC clauses and with thin market flex terms⁴ were taken up in substantial volumes. The size of assets that were potentially being added to dealer firms' balance sheets challenged their prospective liquidity, capital, and balance sheet capacity and adversely affected asset quality. Effective firms were more likely to use prudent transfer pricing to account for contingent liquidity and balance sheet usage.
- Similarly, regarding **liquidity support for conduits**, a number of firms belatedly recognized that the out-of-the-money liquidity support options were being taken up in substantial numbers and the associated risks were not fully priced. Additionally, concerns about reputational damage drove some firms to provide unanticipated support to vehicles, including consolidating these positions onto their balance sheet, when no contractual support was required.

⁴Market flex terms are the prices and other terms that syndicators set for borrowers to sell the loans to outside investors.

B. Senior Management's Role in Understanding and Acting on Emerging Risks

A second difference noted by our supervisory group concerns the role that the firms' senior managers (including its chief executive officer, chief risk officer, and others) played in understanding the emerging risks and acting on that understanding to mitigate excessive risks.

The senior management teams at some of the firms that felt most comfortable with the risks they faced and that generally avoided significant unexpected losses had prior experience in capital markets. Consequently, the nature of market-related events over the summer of 2007 played to their experience and strength in assessing and responding to rapidly changing market developments and issues such as uncertainty in valuations. As risk issues were identified and brought to the attention of senior managers, executives in many of the firms that avoided significant losses championed robust and timely risk mitigation efforts, including executing hedges, deciding to write down exposures, and enhancing management information systems.

In contrast, some of the executive leaders at firms that recorded larger losses did not have the same degree of experience in capital markets and did not advocate quick, strong, and disciplined responses.

This observation does not imply that firms should select executive leaders on the basis of their experience in managing risk in trading businesses. Instead, it emphasizes the need for senior management teams as a whole to include people with expertise in a range of risks since the source of the next disruption is impossible to predict. Recent events suggest that firms are more likely to maintain a risk profile consistent with the board and senior management's tolerance for risk if they establish risk management committees that discuss all significant risk exposures across the firm, meet on a frequent basis, and include executive and senior leaders from key business lines and independent risk management and control functions—for example, the chief financial officer and senior managers from the legal function and operations areas—as equal partners.

The third and fourth areas where the varying approaches of firms' senior managers may help to explain differences in the firms' experiences relate to efforts to ensure that organizational structures did not delay, divert, or distort the flow of information upward or across the firm.

C. Timing and Quality of Information Flow up to Senior Management

In a period of quickly shifting market developments, the timely provision of accurate information to senior management was critical to a firm's ability to respond rapidly. Certainly difficult or complex issues must be analyzed and discussed vigorously at all levels of the institution. However, the highest level of management should be involved in decisions that may have significant implications, such as altering materially a consolidated organization's overarching strategy or balance sheet.

As for timing, senior managers at virtually all firms understood and were discussing changes in markets and risks by the first half of 2007. At some firms, however, managers escalated their concerns about emerging risks to senior managers in business and risk management functions (including the chief executive officer, chief risk officer, and others) as early as the summer of 2006. Accordingly, some firms gained up to a year to consider ways to investigate the risks and reduce or hedge their exposure to the highest risk assets while it was still practical and inexpensive to do so. Others lagged in discussing the emerging risks at the senior management level until 2007, when it was already becoming too difficult to address them.

The quality of information shared with senior management varied as well. 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. In contrast, some firms effectively removed organizational layers as events unfolded to provide senior managers with more direct channels of communication.

D. Breadth and Depth of Internal Communication across the Firm

Firms that understood quickly the kinds and scale of risks they faced and that generally avoided significant losses through year-end 2007 relied on information from many parts of their businesses and communicated that information both up to senior management and across businesses.

In contrast, the existence of organizational "silos" in the structures of some firms appeared to be detrimental to the firms' performance during the turmoil. Silos tended to compartmentalize information: in some cases, information gathered by one business line was not shared with other

business lines where the information would have been useful. This inadvertent diversion or withholding of key information left different business areas to make decisions in isolation and in ignorance of other areas' insights. For example, although some business line managers recognized that underwriting standards for some products were loosening, other business line managers did not; instead, they continued to add to the firms' warehouses assets whose credit quality was likely deteriorating.

In some other firms, however, the treasury function served as a central point between silos and was integrated more closely in the firm-wide risk management process. This structure improved decision making, with positive implications for a firm's consolidated balance sheet, capital position, and liquidity needs. In particular, some firms had well-developed linkages between the control functions (as well as treasury) and the businesses. At firms that avoided significant losses, risk management had independence and authority but also considerable direct interaction with senior business managers and was not viewed as remote from the businesses. While the independence of risk management functions was not cited as an issue at the firms visited for this review, the degree to which risk management functions interacted with business line management was lower at firms that experienced greater difficulties during the turmoil.

Some firms defined and discussed risk broadly across business lines. Those firms ensured that relevant insights from one business were used to scale the firm's strategy and risk appetite in other businesses. For example, some firms that avoided significant losses sought insights from consumer and financing businesses and used their understanding of changes in default rates on the underlying assets to scale the risk in the CDO warehouse businesses. Similarly, some firms that avoided significant losses cited a degree of integration among the liquidity, credit, market, and finance control structures that was lacking at other firms.

Senior managers at firms that experienced more significant unexpected losses tolerated a more segregated approach to internal communications about risk management. This behavior may have contributed to the lack of awareness among managers of the risks they faced and the resulting losses. Several firms that were challenged by market events acknowledged the need to improve their integration of credit and market risk management with accounting and financial control functions. Some firms lacked an effective forum in which senior business managers and risk managers could meet to discuss emerging issues frequently; some lacked even the commitment to open such dialogue.

How firms approached particular categories of risk—especially liquidity, market, and credit risk—provides further insight into practices that differentiated firms’ experiences through year-end 2007.

IV. LIQUIDITY RISK MANAGEMENT

While most firms entered the period of turmoil in relatively sound financial condition with apparently sufficient liquidity, the nature, depth, and duration of the market’s loss of liquidity were so severe that strains developed. As investors’ interest in purchasing some classes of assets fell sharply, firms’ willingness to extend credit and liquidity to others softened because they wished to retain liquidity for their own needs and because they became more uncertain about their counterparties’ possible exposure to losses.

The level of contingent liquidity reserves held by individual institutions varies as a function of a range of factors, including business model, degree of centralization, geographic dispersion, local market structure, regulatory jurisdiction, and relevant deposit insurance scheme. For example, securities firms may choose to hold more excess liquidity than banks because they lack the stable funding source of insured retail deposits. In addition, firms use a variety of processes and measures to establish the minimum level of liquidity reserves they believe they must hold. These processes could include behavioral models with complex inputs and underlying calculations, spreadsheets listing sources and uses of funds, or simple measures and ratios. While initially capital and liquidity positions were relatively strong, certain firms’ resources were somewhat strained by previously planned acquisitions at the time that, or just before, the turmoil unfolded.

However, many institutions found that during the turmoil their liquidity reserves were not as large as they would have liked. Most experienced higher borrowing rates and were unable to obtain funding in amounts or maturities at or close to historical norms. Moreover, the market turmoil has lasted longer than most firms anticipated in their contingency plans.

Finally, some firms faced unexpected challenges obtaining U.S. dollar funding. The reduction in the availability of dollar-denominated funding reflected an increase in counterparty credit risk. Firms faced uncertainty about the

scale of positions held and losses taken by counterparties seeking dollar funding, and some firms felt that significant demand for dollar funding was indicative of increased risk. Regarding cross-border intra-group funding needs, most firms were not of the view that local regulatory restrictions trapping liquidity in specific affiliates presented significant problems. Some firms did cite limitations in the United States attributable to Section 23A of the Federal Reserve Act, which limits certain transactions with affiliates. Others indicated that long positions in some legal entities denominated in certain major currencies could not be used to cover U.S. dollar funding needs at other legal entities during the turmoil.

Firms that managed their funding liquidity needs more successfully through year-end 2007 encouraged individual business lines to assess and communicate their likely needs for funding to the treasury function and to price those internal claims on liquidity appropriately in light of actual market conditions.

A. Planning and Managing Internal Pricing for Contingent Events

Those treasurers that were *ex ante* more effective in identifying and managing funding liquidity risk had been in close and regular contact with business lines and understood the potential contingent liquidity risk of existing and new products across their firms. However, other firms’ assessments of, and planning for, contingent liquidity risk were not sufficient or comprehensive.

Of particular importance, it emerged that firms that experienced the most significant challenges in meeting their funding liquidity needs were those that, before the turmoil began, had not priced contingent liquidity internally or externally to reflect the *ex post* assessment of the nature and risk profile of these liabilities. For example, some firms’ internal transfer pricing systems did not assess business lines for building contingent liquidity exposure. During the interviews, several firms noted that going forward they plan to increase internal and external pricing for liquidity, including contingent liquidity.

Furthermore, prior to the events of the summer of 2007, many firms had not included assumptions about the need to fund certain off-balance-sheet obligations in their contingency funding planning. Some of these liquidity obligations were contractual, but treasurers were neither monitoring the risks nor incorporating them into their processes for managing

liquidity risk. Other liquidity obligations were not contractual but were nevertheless fulfilled in order to protect the reputation of the businesses. Firms' liquidity management plans generally did not account for the increased absence of market MAC clauses and narrower flex pricing in their syndicated lending business—changes in business practice that materially altered the contingent funding risk of these positions.

B. Funding Liquidity Management during the Stress Event

During the crisis, effective funding managers were able to monitor and manage their funding liquidity positions using quantitative and qualitative information and to make decisions quickly based on rapidly changing market information. Experienced judgment to deal with the unexpected nature of the crisis was critical to the adequate management of liquidity risk. For example, early in the market turmoil, senior management at some firms decided to build up liquidity reserves in anticipation of increased funding needs.

The flexibility of firms' funding liquidity management tools in responding to unanticipated and evolving market conditions was also critical. Some firms employ behavioral tools to model their contingent liquidity risk; these models build in assumptions based on preselected stress scenarios that were not appropriate for recent market conditions. During the crisis, several firms that employ these types of tools switched to more flexible tools that lack built-in assumptions and that could help firms more easily understand the impact of current market conditions on their liquidity positions.

C. Contingency Funding Plans

Many of the observations our supervisory group has made regarding firms' contingency funding plans are common to all firms. Although the processes and analyses that firms used in their contingency funding plans varied somewhat in effectiveness, nearly all firms' plans failed to anticipate fully the severity and nature of recent market stresses in a number of ways. Indeed, almost all firms mentioned that they intend to make improvements to their contingency plans based on their recent experiences. In many cases, the challenges that firms have faced demonstrate the limits on the types of events addressed in their contingency plans.

In late 2007, firms faced stresses that were not anticipated or prepared for in their contingency funding plans. Many firms had assumed that the most stressful scenario they would face would be a firm-specific credit event. Even those that used market-wide stress scenarios in their contingency funding plans did not fully foresee the nature or extent of the market disruption. Four ways in which firms' plans did not anticipate the depth of the market turmoil are described below.

- Many firms had not expected that asset market liquidity would be impaired and had assumed that secured funding would always be available during a stress event; in fact, many secured funding markets such as asset-backed commercial paper (ABCP) and the U.S. mortgage dollar roll market⁵ were unavailable in late 2007.
- Most firms had not assumed that the size of their balance sheet would increase during a stress event. In fact, many firms have recently been faced with growing balance sheets: some needed to hold underwriting commitments on their balance sheets longer than anticipated; others purchased assets to support sponsored ABCP conduits or affiliated asset management funds.
- Most firms had not expected difficulty in obtaining funding in major currencies. Some firms in Europe found it more difficult to obtain dollar funding, particularly in term maturities, due to the strain in the foreign exchange swap market. At the height of the uncertainty surrounding the extent of firms' structured credit exposures, participants in the foreign exchange swap market began to differentiate firms based on the perceived exposure, on peer groupings or jurisdictions, as well as on specific "names" of firms. This affected the cost and availability of liquidity in adverse market conditions, and some firms that were dependent on cross-currency funding may not have sufficiently factored the potential change in market liquidity into their contingency plans.
- Firms had not planned for a funding disruption lasting as long as the current one.

⁵In the dollar roll market, an institution sells a security (usually a mortgage-backed pass-through security) for immediate delivery and agrees to repurchase a substantially identical security (but not the same security) on a future date at a specified price.

Furthermore, many of the stresses that had been outlined in firms' contingency funding plans have not been relevant for recent events. For example, many major banking organizations expected that some retail deposit run-off would occur during a stress event; however, retail deposits generally have been stable or slightly higher over recent months in the major banks surveyed for this exercise.

Because many firms used the stress scenarios in their contingency funding plans to determine the size and composition of their contingent liquidity reserves, these reserves may not have been as robust as anticipated in some firms. For example, reserves held in the form of mortgage-backed securities were not easily monetized to obtain liquidity. Moreover, several of the firms surveyed cited the need to hold more liquidity in the holding company in the future.

Regardless of whether firms had employed firm-specific or market-wide scenarios, their contingency funding plans generally assumed severe stress events and were not designed to address conditions in which they would need to make business decisions to maintain their reputation and position in the market. For example, firms did not anticipate the need to support entities for which they were not contractually obligated to do so, such as money market funds or SIVs. Firms had also not anticipated the need to deal with intense media coverage or to incorporate reputation risk considerations into funding decisions. Furthermore, firms had not fully anticipated the need to balance funding liquidity management needs with the desire to maintain business relationships with customers. For example, one firm noted that it needed to continue providing funding for certain customers in order to protect the business relationship.

V. CREDIT AND MARKET RISK MANAGEMENT

In addition to managing difficulties arising from receding market liquidity, firms have faced significant additional challenges in actively managing credit and market risk as liquidity in many instruments diminished sharply. Those firms that were the most successful through year-end 2007 in dealing with the turmoil challenged their internal assumptions about the valuation and the behavior of products and markets by applying a wide range of credit and market risk measures and tools; equally important, they used judgment as well as these more quantitative techniques in deciding how to respond to market developments.

A. Valuation Practices Relevant to Risk Management

In our discussions with firms, we identified major shortcomings in the valuation practices of some firms that bear directly on risk management. The valuation process is central to risk management, particularly for over-the-counter derivatives. In this report, we use the term "valuation" to refer to the efforts a firm undertakes to verify the prices it has assigned to certain holdings for its books and records. The goal of verifying prices is to estimate the price at which the firm could sell or transfer a financial instrument in a normal market transaction today. This price may reflect either an outright sale of the position to a buyer or the cost of hedging the position. Firms use a variety of techniques for estimating this price, including, for example, relying on prices obtained in observed trades; interpolating or extrapolating a price from observed trades of similar products; modeling cash flows; or relying on risk-neutral pricing models.

Actions prior to the Market Turmoil

Our supervisory group noted that some firms had established robust price verification processes prior to the onset of the turmoil, and, using those tools, were more sensitive to the potential for their exposures to certain complex assets to fall in value. They adopted a more active approach to verifying their sense of valuations using internal resources, often in a coordinated, centralized fashion. The few firms that used valuation models for exposures to super-senior tranches related to subprime mortgages prior to the third quarter of 2007 were able to begin to consider at an early enough stage countermeasures such as the sale of positions or the purchase of hedges. Such firms were thus generally successful in avoiding significant unexpected write-downs in those portfolios.

Firms that adopted more active approaches to valuation typically devoted considerable resources to establishing specialized product financial control staff able to perform a fundamental analysis of the underlying positions. Some firms also enforced discipline internally in marking their assets to their estimated prices. This discipline was evident, for example, in the use of consistent marks across both proprietary positions and financed counterparty positions. Such firms furthermore factored position size (to account for the market impact of immediate sales of such size) and the dispersion of observed prices into their valuation marks.

Other firms, however, had not created robust internal processes prior to the turmoil to verify or challenge their

business units' own estimates of the value of their holdings. For example, some firms that retained super-senior tranches of ABS CDOs, which rarely traded, benchmarked those instruments to spreads realized on primary market transactions. The use of information from primary market transactions may have given false comfort about the true value of retained positions in the absence of secondary market trading. In addition, some firms tended to rely too heavily on rating agencies' assessments that complex securities such as CDOs were equivalent to the highest quality assets and consequently continued to value them at par for too long into the period of market turmoil.

Actions during the Market Turmoil

Once the turmoil began, taking action to avoid losses from a write-down of CDO positions had, as noted above, become prohibitively expensive. Instead, firms faced the challenge of understanding at an early stage what the scale of loss would be.

Those firms that had active valuation approaches sought clues about the accuracy of their valuations through various actions, such as the following:

- When faced with a difficulty in establishing valuations, some of these firms would require the trading desk to sell a sufficient portion of the exposure to observe an actual market price. These sales served to establish marks that were often conservative, but the firm still needed to judge whether market activity was sufficient to obtain a reliable price quotation for marking an entire book of that exposure.
- Similarly, some of these firms monitored disputes over the market value of collateral posted by counterparties to help mark their own holdings of the same or similar securities. Business management brought valuation disputes from the back office to the attention of senior managers, often at an early stage.

Other firms discounted these techniques and, in some cases, used valuations biased toward par values that they did not actively challenge, even in the latter half of 2007; these valuations may have been questionable and may not have fully reflected the downside risk.

Shortcomings in valuation practices were exacerbated by several market realities.

1. Market liquidity premia embedded within pricing

Driven by an abundance of liquidity from 2002 to mid-2007, spreads on credit products and structured finance products tightened to historically low levels. The events of the second half of 2007 might suggest that these tight spread levels reflected technical factors and did not adequately reflect the market, credit, and liquidity risk characteristics of those assets. Market liquidity for certain products dried up, notably for certain types of ABS, CDOs, ABCP, and leveraged loans. In the absence of any trading, price discovery proved virtually impossible. In the primary and secondary markets for other products, liquidity did not dry up but did recede substantially, even in instances when there was no prima facie evidence that the asset quality had deteriorated (for example, highly rated short-dated ABS backed by student-loan receivables). It became clear that market participants were demanding a liquidity premium for buying assets. In previous stress events, there was evidence that liquidity premia had emerged for certain types of assets, but in the current turmoil, the premia seem to have been more significant, more broadly based, and more persistent. This change in the nature and duration of the premia contributes to the valuation challenge.

2. Ongoing refinements to models

Many firms are constantly developing and refining their models, which often results in a large increase in write-downs when an updated model is used for pricing. As the complexity of a model is tied to the size and nature of exposure (for example, CDOs), the models tend to be complex and dissimilar across the firms. However, the industry appears to be converging on the use of common loss estimates for the underlying mortgages; some firms have begun using information drawn from indices such as the ABX series, which comprises credit default swaps on subprime mortgages, to help estimate losses in the underlying mortgages.

3. Uncertainty in the performance of subprime assets

Finally, uncertainty about the ultimate performance of the underlying mortgage pools—and the need to incorporate new information about the performance of these pools as it becomes available—means that valuations will continue to be subject to considerable volatility for the foreseeable future.

While major valuation problems clearly existed for several other important classes of exposure, firms did not report difficulty in marking the value of the leveraged finance pipeline. Several firms did state that their past practice had

been to recognize valuation changes only after closing. However, those firms indicated that they had recently altered their practices to recognize changes in the value of the pipeline beginning upon commitment.

B. Use of a Range of Risk Measures

Most firms that avoided significant unexpected losses used a wide range of risk measures to discuss and challenge views on credit and market risk broadly across different business lines in a disciplined fashion. Some firms gave particularly thorough consideration to the interplay of the market sensitivities of derivative exposures (the “greeks”), notional limits, value-at-risk, static single-factor stress tests, and historical and forward-looking scenario analysis in a way that the other firms did not. These firms tended to use processes and measures that could be adjusted to reflect new circumstances, and they understood the limitations of individual risk measures. We note below eight key differences in the use and specification of risk measures through year-end 2007.

1. Use of multiple tools

Firms that avoided significant unexpected losses tended to use many or all of these tools cited above, and at least some of the tools were meant to provide different views of risk. In contrast, firms that experienced more significant problems were too dependent on a single methodology, or a limited set of tools, or they relied on inflexible applications that could not be adjusted to crisis conditions or that were flawed. This second group of firms tended to apply a “mechanical” risk management approach, accepting the estimates of their primary risk systems without challenges based on other tools and expert judgment.

2. Consideration of notional measures

In light of some firms’ uncertainty about the accuracy of assumptions underlying their risk measures during the current period of turbulence, several firms cited the usefulness of revisiting simple notional limits to highlight potential concentrations of risk. These measures are devoid of assumptions and give management a simpler perspective on the potential scale of the risks.

In contrast, other firms cited difficulties that arose from their dependency on net measures of risk or measures of risk that rely on certain assumptions about correlation, market liquidity, and other factors that may not be true in a given

event. Some, but not all, firms that recorded more significant unexpected losses lost sight of the aggregate size of their exposures. For example, several firms said that their risk measures assigned zero net risk to negative basis trades. In this type of trade, an investor holds a long position in a corporate bond combined with purchased credit protection on the bond in the form of a credit default swap (CDS). The investor engaging in a negative basis trade earns the spread between the two when the CDS cost is lower than the yield received on the bond. The assessment of zero risk was based on an assumption that the correlation between bond prices and CDS prices would follow historical relationships. Such an assumption, however, ignores the fact that the market liquidity risk in unwinding the position can cause a historical price relationship to break down when the volume of trades made on that position is large.

3. Use of Value-at-Risk

VaR measures were a key indicator for most firms seeking to understand their sensitivity to changes in market conditions. While most firms reported that their VaR systems generally worked as expected across all businesses, many firms identified weaknesses in their particular implementation of VaR and cited plans to change their VaR methodology. Nevertheless, firms indicated that VaR, as a backward-looking measure of risk dependent on historical data, may never fully capture severe shocks that exceed recent or historical norms.

For example, some firms’ initial assessment of the true potential losses they faced were likely skewed downward by their VaR measures’ underlying assumptions and a dependence on historical data from more benign periods. Firms suggested that VaR calculations based on new market data were anywhere from about 10 percent to at least 200 percent higher compared with VaR calculations conducted using data sets reflecting earlier, and more favorable, market conditions. The increase in most firms’ VaR calculations ranged from 30 percent to 80 percent.

Firms reported between two and sixteen back-testing exceptions during the third quarter of 2007 alone. Most of these exceptions were generated by much higher market volatility and realized asset price correlation than the historical data series implied.

As a consequence, many firms are planning to change the volatility estimates in their VaR methodologies to make them more sensitive to volatility spikes. To this end, firms may use shorter horizon price histories or give greater weight to more recent observations, and they may update the volatility estimates more frequently (for example, on a daily basis).

Some firms used VaR systems calibrated to minimum regulatory guidelines or standards. This design made the VaR estimates less meaningful to the firms' actual businesses. One firm underscored the value of a low VaR threshold (95 percent instead of 99 percent) coupled with a dynamic volatility model as an early warning tool. The low threshold would be crossed more often and thus could serve as a signal to prompt management queries and efforts to uncover anomalies that could reveal unrecognized risks.

Firms that plan to update volatility parameters in their VaR systems more frequently believe that this change will provide management with timely signals of the altered risk of a position. These firms see the change in the VaR as an indicator that senior management can use to probe the firm's risk profile. One firm, however, found that the most recent data for one risk class had lower volatility and expressed the view that judgment was required in the choice of historical window for capturing the relevant volatility input. A number of firms described the value of using multiple measures of risk to make use of all available information, such as using volatility estimates from the very recent past as well as estimates drawn from a long historical interval. The former would provide early warning signals of changes in current market conditions while the latter would provide the perspective of stressful episodes in the past.

In addition, in some instances firms did not get clear signals about the effectiveness of risk measurement from their VaR back-testing processes. Most firms attributed profit- and loss-related VaR exceptions to the sharp increases in realized volatility, a result that was to be expected in light of the severity of the market turmoil and the optimistic volatility assumptions in many firms' VaR models. As discussed below, valuation issues caused some back-test VaR exceptions, such as the "lumpy" recognition of losses as positions migrated from market-price-based to model-based valuations. At some firms, this problem may have been exacerbated by a failure to test the valuation of illiquid or rarely traded products with actual trade prices; this allowed stale prices to impair valuations and risk assessments and led to large all-at-once revaluations when the market liquidity risk discount in the product was discovered.

4. *Quality of price data sets and volatility estimates*

Difficulties in marking-to-market complex or illiquid assets like CDO tranches had cascading effects on the accuracy of VaR measures. Firms that avoided significant losses generally had a disciplined approach for marking exposures to market values and used these marks more consistently in the time series data that fed into the volatility estimates in their VaR calculations. This, in turn, made their VaR calculations much

more sensitive to evolving risks than those of institutions that marked illiquid positions at par and failed to test their valuations against trade prices. The ability to capture evolving market conditions in risk measures can provide early warning indicators that prompt management to review a firm's risk profile. Perhaps as important, and separate from estimating volatility, the practice of testing valuations of illiquid products against actual trade prices revealed valuation anomalies that were an early warning signal to risk managers about valuation model errors and changing market conditions.

5. *Basis risk*

Among the risks that were missed or misestimated was basis risk or correlation risk within an asset class, as well as correlation risk more broadly. Most firms' VaR measures did not properly capture the basis risk between cash bonds and credit default swaps (or the basis risk that exists between bonds and loans). This weakness, in which the behavior of derivative instruments was assumed incorrectly to be closely related to the behavior of bonds, led to inconsistencies in the risk measures but was not a direct cause of material observed losses to date. Some profit and loss volatility not predicted by VaR models and some losses were attributable to the basis risk in hedge positions that was not captured in VaR models. Consequently, some firms are reconsidering what should be treated as a true hedge for risk management objectives, as discussed below.

For example, several firms misestimated basis risk in their approaches to managing the CDO warehousing and packaging business and significantly underestimated the risk of the super-senior positions they retained as a result. The practice at some firms of valuing super-senior tranches of subprime CDOs at or close to par value and assuming that their risk profile could be approximated using the historical corporate Aaa spread volatility as a proxy failed to recognize these instruments' asymmetric sensitivity to underlying risk (in contrast to an unstructured corporate bond of the same rating). The first loss protection built into the securitization structure created an asymmetric exposure to losses in the underlying assets, so that the senior tranche became more sensitive to default rates as credit quality deteriorated. As volatility spiked up and credit spreads widened, the increasing sensitivity of the instrument to underlying risk led to accelerating mark-to-market losses. In general, the construction of CDOs tends to make them more sensitive to systematic shocks. In contrast, highly rated corporate debt issuances tend to be more sensitive to "idiosyncratic" risk, or risks associated with characteristics specific to the corporation that issued the debt.

6. *Design and integration of market risk measurement tools*

With regard to market risk measurement tools, some firms that avoided significant losses appear to use both “conditional” and “unconditional” measures of market risk to provide information and limit risk. Dynamic volatility models for VaR are examples of conditional measures, which are more sensitive than unconditional measures to short-term changes in market risk; scenario analysis is an example of an unconditional measure. Firms that avoided significant losses have additional risk measures that reflect differences in assumed levels of correlations between market variables in benign versus stressed market conditions. Still, most firms surveyed expressed a desire to increase the sensitivity of their VaR models and other measures of risk to shorter term changes in the market environment.

7. *Integration of exposures across risk types*

Firms that avoided significant losses appear to have a better ability to integrate exposures across businesses for both market and counterparty risk management. Other firms did not appear to have sufficient abilities to identify consolidated, firm-wide, single-factor stress sensitivities and concentrations.

8. *Use of profit and loss reporting as a signal of emerging stress*

Successful firms had in place granular profit and loss reporting systems, which were often used in conjunction with risk management tools subject to regular senior management review, and those systems may have provided additional insight into signs of stress. One firm noted the need to implement more granular reporting. An additional feature of a successful firm’s approach to VaR was the active use of the VaR process to alert management to the need to uncover and probe anomalies in profit and loss and VaR that could provide early warnings of stress or other unrecognized risks.

C. Stress Testing and Scenario Analysis

In recent years, the industry as a whole has acknowledged the importance of developing and using forward-looking scenarios and stress tests to explore known and unknown risks, including how exposures may change in light of unexpected changes or shocks to the business environment. Most firms in the survey have indeed sought to supplement measures of

current exposure with more forward-looking measures of their risk; the firms surveyed used a wide variety of techniques. These included static single-factor changes to market variables calibrated to extreme moves in historical data series, historically based scenarios, and forward-looking scenarios (collectively, “stress tests”).

Some firms found that the size of price movements in their static shock simulations and/or credit scenarios generally matched the observed market movements, while others found the actual widening of credit spreads to be larger and of longer duration than assumed. At some firms, a particular challenge to risk managers was obtaining senior management and business line acceptance of stress tests—in particular, the hypothetical forward-looking scenarios—which seemed extreme to some senior managers. Many managers recognize that stress tests themselves should be dynamic—such that they consider new scenarios as business conditions evolve—yet still be stable enough to provide firms with a useful gauge for monitoring the evolution of their risk profile over time. In light of recent events, most firms in the survey found problems in certain features of their stress tests or with the stress tests of particular products, and many firms indicated that they planned to make specific changes in the design and implementation of stress tests.

1. *Risk identification and modeling issues*

Many firms expressed a desire to build a higher level of detail into their stress test models and systems. Some firms are revising their stress tests to reduce correlation benefits among exposures and to impose larger credit spread shocks. To help risk managers discover exposures overlooked by high-level aggregated risk measures, some firms mentioned the value of exposure measures based on both gross and net positions.

Many modeling issues that affected firms’ VaR measures also affected their stress tests and, in particular, tests involving static single-factor shocks. As in their VaR tests, some firms used price histories associated with corporate issuers rated Aaa as proxies for stress price movements in those new products that did not have sufficiently long data histories of their own. Firms that used single-factor stress tests calibrated to historical data significantly underestimated the risk of super-senior subprime CDO positions. Several firms that experienced losses used VaR and static single-factor stress tests calibrated using the same historical data series. As a result, the stress tests provided no new information.

One firm observed that the level of detail necessary to model the risks in securitization properly is considerable.

Simple measures of the sensitivity of super-senior subprime CDO tranches to the Aaa spread were not sufficient to capture the credit risk in the product without detailed knowledge of the CDO's composition. Two problems in the rating and treatment of these products became apparent. First, the senior tranches were rated at or equivalent to an Aaa credit risk despite the deteriorating credit standards at origination. Second, on the basis of this Aaa rating, some firms used the historical returns volatility of other securities rated Aaa as a proxy for the price risk of senior subprime exposure, even though these super-senior tranches represented new securities for which firms had little historical performance data.

Many firms' stress measures did not properly capture the basis risk between cash bond and credit default swaps, although, as noted earlier, this shortcoming does not seem to have led to significant losses. Some firms failed to capture syndicated loan pipelines and unfunded loan commitments in their firm-wide stress tests. Some firms used single-factor shocks calibrated to shorter holding periods than were revealed to be appropriate in light of the loss of market liquidity. At one firm, the relatively short duration of the stress shock was based on an unrealistic assumption that positions could be reduced within that interval.

2. Senior management involvement in stress testing and scenario analysis

Senior management involvement was important to the effective use of stress tests, especially macro scenarios, as risk management tools. Senior management's endorsement of stress testing as a guide in decision-making was seen as particularly valuable when the tests revealed vulnerabilities that firms found costly to address (in terms of hedging costs or forgone business). Less successful firms had difficulty getting senior management and business-line management to embrace the use of forward-looking scenarios with large underlying price movements and to participate in the development and use of such tools. According to some risk managers, the larger the shock imposed, the less plausible the stress tests or scenarios in the eyes of business area and senior management.

3. Links between scenarios and business practices

Several firms emphasized the need to improve the applicability of forward-looking scenario analysis to the business practices of the firm. Knowledge of how business areas made money helped risk managers identify relevant stress scenarios or

provide warning when the assumptions underlying single-factor stress tests were inaccurate measures of risk. Similarly, some managers have stressed the importance of considering how market shocks appear to counterparties. A number of firms mentioned the constant need to review scenarios and to develop new ones at both the firm and desk levels. System flexibility was cited as crucial, although some firms may not have had sufficiently flexible systems to handle customized scenarios and stress tests.

D. Hedging of Market and Credit Risks

Firms that avoided significant losses reduced risk through active and early decisions to reduce or exit businesses that were likely to be affected by the changing environment. Such decisions were generally made well before the events started to unfold. As an additional tool to reduce risk, all firms sought to hedge their exposures to market risk and counterparty credit risk.

While all firms surveyed used some form of hedging as a means to reduce exposure to market risk, they experienced varying degrees of success in using them. Some firms hedged the risk of a decline in the market value of their holdings of subprime-related assets (for example, RMBS, ABS, CDOs) or leveraged loans by selling short credit indices and associated tranches. Firms faced the following key challenges in adopting an effective market risk hedge:

- For a hedge to produce the desired effect, it had to be put in place well in advance of the adverse market reactions, at a time when pricing was still relatively advantageous; this window closed in the second quarter of 2007. Firms that tried to hedge their exposure too late found the price of the protection prohibitive.
- The available credit index instruments introduced significant basis risk. This basis risk—that is, the risk inherent in the imperfect correlation between the underlying cash position and the hedge instrument (derivative)—weakened the effectiveness of the hedging strategy. In some instances, this led to losses on both the cash position and hedge, particularly for firms that sought to hedge relatively late.
- Because limited numbers of hedging instruments existed, many market participants relied on the same credit indices as hedges. The resulting strong demand

for short positions, coinciding with the erosion of asset market liquidity, led to a further widening in price differences between cash and derivative positions for technical reasons. These developments amplified the basis risk and further diminished the effectiveness of the hedge (by creating a “crowded hedge”).

Other firms entered into credit derivative contracts with monoline financial guarantors to hedge a portion of their retained super-senior CDO positions.

- Firms that sought to offset the risk of these positions by purchasing protection from financial guarantors were subject to a “wrong-way” counterparty credit exposure because the financial capacity of these counterparties to perform on their contracts is correlated with the value of the underlying positions being hedged.

Firms that avoided substantial losses made the decision to implement hedges based on their consolidated risk positions across businesses and in light of a wide range of available qualitative and quantitative risk information. Some of these firms coordinated the short positions through active “macro overlay” positions approved by senior management in dialogue with the business owners and risk control staff. By contrast, firms that did not maintain a consolidated perspective on risk and instead left hedging decisions to the business lines generally found their hedging strategies to be less effective, as different traders or business lines relied on the same hedge in an uncoordinated manner.

It should be noted that the use of a “macro” overlay hedge represents a step away from the view that a firm consists of a set of decentralized business lines and a step toward a view that senior management has a responsibility to orchestrate efforts to offset consolidated risks at the top of the firm. However, some managers cautioned against drawing too strong of a conclusion from the success of some of the macro hedges in use in this one recent period. Others noted that implementing a macro overlay hedge at the top of the firm introduces an element of moral hazard, lessening the accountability of individual business lines for the risks they create.

One final observation regarding hedging practices is that firms that hedged their exposures effectively also insisted that warehouse businesses capture the implicit cost of hedging market risk in their performance measures or required warehouse sponsors to assume a greater portion of the market risk. These stipulations raised the level of discipline in the business of warehousing assets.

As a result of the lessons learned during the recent financial turmoil, risk managers at several firms are rethinking their

market risk hedging practices. Among the issues under consideration are the degree of acceptable basis risk and its measurement, the absolute notional size of hedges and underlying positions, and the likely performance of hedges during severe market movements.

E. Credit Underwriting and Reporting

While risk measures and hedging techniques address exposures that firms have already assumed, firms also stressed the importance of understanding the quality of new credits that their businesses originated or purchased from others. Competition in underwriting new credits weakened the standards that some firms applied. This was evident in both the underwriting of residential mortgages and leveraged loans.

With regard to the leveraged loan market, several firms commented on the absence of covenants and market MAC clauses. These firms felt that they had knowingly given financial sponsors an option without appropriate compensation. In addition, firms acknowledged that leverage levels had increased and that structural features beneficial to weaker borrowers, such as payment-in-kind/toggle features that permit borrowers to delay cash payment on coupons, had become more prevalent. This weakening of lending terms caused some firms to curtail their activity; subsequently, some managers recommended the reintroduction of stricter limits on the use of facilities that lack covenants related to material changes in market conditions.

Firms also noted that mortgage underwriting standards had deteriorated. An increasing portion of mortgages was being underwritten without verifying the borrower’s source of income for repayment (“stated income” loans). In addition, mortgages were often underwritten based upon initial “teaser” rates rather than a rate consistent with bearing the obligation to maturity. Undeclared and undocumented second liens also served to increase borrowers’ payments relative to their income and decreased borrowers’ equity position in the home.

With regard to the CDO warehousing business, some firms cited the need for better controls over indirectly sourced credits. Some firms relied too heavily on agency ratings in the CDO warehousing and packaging business and did not pay sufficient attention to internal assessment and the quality of the underlying assets. Some firms acknowledged that investors were likewise too dependent on rating agencies for assessments of the risk inherent in certain exposures or relied too heavily on assumptions regarding diversification benefits that turned out to be inaccurate.

When firms conducted their own due diligence for lending businesses, they were generally comfortable with the credit risk. However, they did not anticipate the price risk.

F. Counterparty Risk Measurement and Management

Most firms indicated few problems in reporting and understanding counterparty risk as a result of the recent market events. In general, firms reported satisfaction with their estimates of potential exposure and the modeling of events through stress tests related to counterparty credit risk, though they cited some of the same weaknesses they noted in market risk measurement. Managers stated that their firms' risk management systems and personnel were generally able to produce complete and accurate accounts of firm-wide risk exposures to particular counterparties daily with a lag of one business day. Many firms emphasized the importance of constantly reviewing and improving credit risk and counterparty credit risk reporting and measurement systems and the need to avoid concentrations.

With regard to daily risk management decisions, firms differed in their response to increased market volatility: several firms noted the need to raise initial margins, while others appeared to have been comfortable with levels established before market events. Overall, the number of counterparties closed out of positions because of their inability to meet variation margin payments appears to have been relatively small. All firms emphasized the importance of valuation to margining processes. Generally, management teams indicated that the number of disputes with counterparties was not material through year-end 2007. Several firms cited the signaling value of disputes in assessing the conservatism of their own and their counterparties' marks.

Monoline Insurers

While most managers indicated during their conversations with our supervisory group in late 2007 that their firms' exposures to counterparty credit risk were less problematic than their exposures to market risk, some cited concerns about material direct and indirect exposures to financial guarantors and, in particular, monoline insurers—firms that underwrite a single form of insurance (credit protection in this instance). A direct exposure arises when an investor purchases derivatives (including credit default swaps) from a financial guarantor

against the default of an underlying issuer, makes loans to the guarantor, or makes an equity investment in the guarantor. An indirect exposure to a financial guarantor arises from an investor's purchase of securities whose performance is guaranteed by a financial guarantor. Subsequent to our meetings, these concerns have become more widespread and pronounced across the industry, with many firms' exposures continuing to grow through year-end 2007.

Traditionally, financial guarantors had insured the performance of high-quality municipal bonds. Firms often have indirect exposures to financial guarantors through their tender-option bond and variable-rate demand note programs and through holdings of wrapped securities. In recent years, financial guarantors have become more active in insuring exposures to structured credits; most recently, they have begun selling credit default protection through credit derivatives on CDOs, including insuring securities that incorporate subprime mortgages. Dealer firms often bought protection against retained senior and super-senior tranches of CDOs. Purchasing this protection added a direct exposure on top of the existing indirect exposures to the financial guarantor. Additionally, since the financial guarantor was often more vulnerable to securities that included subprime mortgages than the firm seeking protection, the creditworthiness of the financial guarantor was correlated with the valuation of the exposures on which protection was purchased (an example of "wrong-way" counterparty risk).

Many firms take into consideration the credit quality of a financial counterparty when valuing derivative transactions. Firms make fair value adjustments to the carrying value of derivative contracts to adjust for the counterparty's creditworthiness. Some firms have relied on their internal or external agency credit ratings of the counterparty to calculate these credit valuation adjustments, while other firms adjust valuations on the basis of market factors. As the markets' perception of the creditworthiness of certain financial guarantors has diverged from the assigned agency rating, several firms have adjusted their valuation practice for these counterparties by basing their reserves on changes in market prices of credit default swap contracts to the counterparty. As a result, some firms have written down the value of purchased protection from these counterparties.

The rapid growth of current exposures, in excess of prior estimates of potential future exposure, highlights the reliance of measures of potential future exposure on historical volatility measures and illustrates the need to augment these measures with other approaches, such as scenario analysis or stress testing. In turn, such scenarios or stress tests should be designed

to consider the vulnerabilities of hedges (that is, the credit quality of counterparties providing them), as in the case of hedges purchased from, or referencing, financial guarantors.

Many firms drew comfort from having monitored their net exposures to CDOs and similar products by purchasing credit protection from financial guarantors. However, the growth in concentrations of financial guarantor counterparty risk highlights the need for firms to monitor gross counterparty risks, as well as net market risks. Moreover, the prevailing materiality of firms' exposures to financial guarantors at present indicates that firms should carefully monitor and stress-test the build up of "wrong-way" counterparty risk, especially when the counterparty, such as a monoline insurer, has not posted collateral.

CONCLUDING COMMENTS

The almost unprecedented nature, depth, and duration of the current market turmoil have raised major challenges for nearly all significant participants in financial markets. In this environment, participants face increasing pressure to understand the risks they face, to measure and assess such risks appropriately, and to take the necessary steps to reduce, hedge, or otherwise manage such risk exposures. This report has examined the risk management practices that tended to differentiate outcomes of several global banking organizations and securities firms—all active competitors in the financial markets currently experiencing stress—with a view toward identifying the practices that tended to work well and those that did not through the end of 2007.

Our work has consequently proved useful in clarifying for principal supervisors the areas in need of improvement in the

infrastructure, processes, and practices of some firms. As acknowledged throughout this report, a number of firms had already identified, or were beginning to identify, at least some of the deficiencies we cite in their own assessments, and many were already developing plans to address those weaknesses. The relevant supervisors are monitoring and assessing these and other remedial efforts to improve the quality of individual firms' risk management in light of the recent turmoil. Moreover, we will support continued collaboration on related efforts to revise relevant supervisory guidance, expectations, and policy through the appropriate coordinating bodies, such as the Basel Committee on Banking Supervision, the International Organization of Securities Commissions, and the Joint Forum. Finally, we note that efforts to address some of the most complex topics ahead may benefit in due course from broader discussions among supervisors, market participants, and others.

While we have sought to highlight examples of risk measurement and management practices that have tended to be associated with better or weaker performance during the current market turmoil, we recognize the contributions of other factors to business outcomes as well. A host of other considerations specific to each firm, such as its business strategy and risk appetite, influences the balance a firm seeks between risks and rewards. We recognize, moreover, that the turmoil continues in some markets at the time of this writing and that new areas of weakness may emerge in the near future not identified or anticipated in our review. As market events continue to unfold, supervisors and the financial industry may identify other issues that deserve broader investigation. We welcome continued dialogue with industry representatives, market observers, and other public authorities on these and other shared concerns.

APPENDIX A: ABBREVIATIONS USED IN THIS REPORT

ABCP	Asset-backed commercial paper
ABS	Asset-backed securities
ABS CDO	Collateralized debt obligation of asset-backed securities
CDO	Collateralized debt obligation
CDS	Credit default swap
CLO	Collateralized loan obligation
MAC	Material adverse change
MBS	Mortgage-backed securities
RMBS	Residential mortgage-backed securities
SIV	Structured investment vehicle
VaR	Value-at-risk

APPENDIX B: MEMBERS OF THE SENIOR SUPERVISORS GROUP

FRANCE

Banking Commission

Didier Elbaum
Alain Laurin
Guy Levy-Rueff
Frederick Visnovsky

GERMANY

Federal Financial Supervisory Authority

Sabine Lautenschläger-Peiter
Peter Lutz

SWITZERLAND

Swiss Federal Banking Commission

Tim Frech
Roland Goetschmann
Thomas Hirschi
Daniel Sigrist

UNITED KINGDOM

Financial Services Authority

Stan Bereza
Nicholas Newland
Andrea Pack

UNITED STATES

Board of Governors of the Federal Reserve System

Deborah P. Bailey
Roger T. Cole
Jon D. Greenlee
Steven M. Roberts

Federal Reserve Bank of New York

Arthur G. Angulo
Brian L. Peters
William L. Rutledge (*Chairman*)

Office of the Comptroller of the Currency

Kathryn E. Dick
Douglas W. Roeder
Scott N. Waterhouse

Securities and Exchange Commission

Matthew J. Eichner
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Secretariat

F. Christopher Calabia, Kathryn B. Chen, John E. Kambhu, Wilma Sabado, and Til Schuermann, all of the Federal Reserve Bank of New York