# III

# Turbulence in Mature Financial Markets

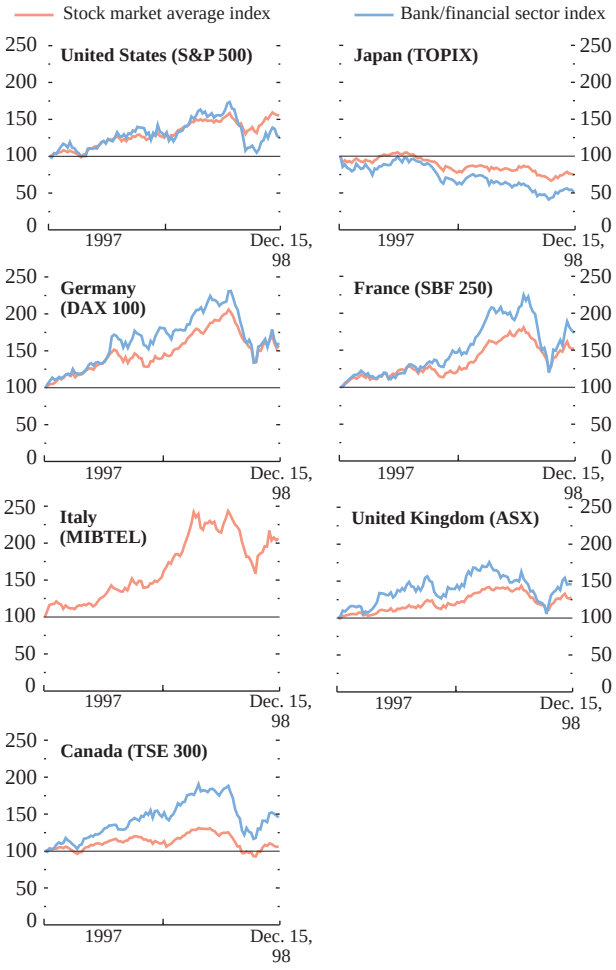
Until July 1998, the mature financial markets in the United States and Europe remained buoyant, largely avoiding significant negative spillovers from the Asian crisis despite some episodes of increased volatility, most notably in October 1997.[1] Government bond yields continued to decline, while equity prices recorded further strong gains, especially in continental Europe, where markets surged in a number of countries by 45–65 percent over end-1997 levels. Favorable economic developments, including very subdued inflation, solid domestic demand growth in most countries, and increased confidence in a successful launch of EMU contributed to this market buoyancy.[2] In addition, the mature financial markets were boosted by a "flight to quality" as investors shifted funds away from Asia and other emerging markets. Despite these generally favorable developments, however, there were some signs of a weakening in sentiment in the months leading up to July 1998. Major stock market indices in the United States and the United Kingdom continued to advance, but the gains were increasingly narrowly based, and market indices for "small cap" stocks began to weaken. Also, yield spreads on below-investment-grade bonds in the United States widened by about 90 basis points from their historic lows reached in mid-1997 prior to the Asian crisis.[3] Elsewhere, equity markets and the exchange rate weakened further in Japan, where domestic economic conditions continued to worsen, and also came under downward pressure in countries with strong trade links to Asia or heavy reliance on commodity exports (notably, Canada, Australia, New Zealand, and Norway).

Equity markets in the United States and Europe generally peaked in mid-July. While it is difficult to identify a particular event that triggered the initial downturn, several factors may have led investors to reassess

**Figure 3.1. Major Industrial Countries: Stock Market Price Indices[1]**

*(National currency; week ending January 2, 1997 = 100)*

Equity markets mostly peaked in mid-July before a sizable correction led by bank stocks; markets have since rebounded quite strongly, particularly in the United States.




Source: Bloomberg Financial Markets, LP.

[1]For United States, Standard & Poor's 500 Index; for Japan, Price Index of Tokyo Stock Exchange; for Germany, DAX 100 Index; for France, Société des Bourses Françaises 250 Index; for Italy, Milan Stock Exchange MIB Telematico Index; for United Kingdom, Financial Times Stock Exchange All-Share Index; and for Canada, Toronto Stock Exchange 300 Composite Index.

[1]For details, see the September 1998 *International Capital Markets* report, Chapter IV.

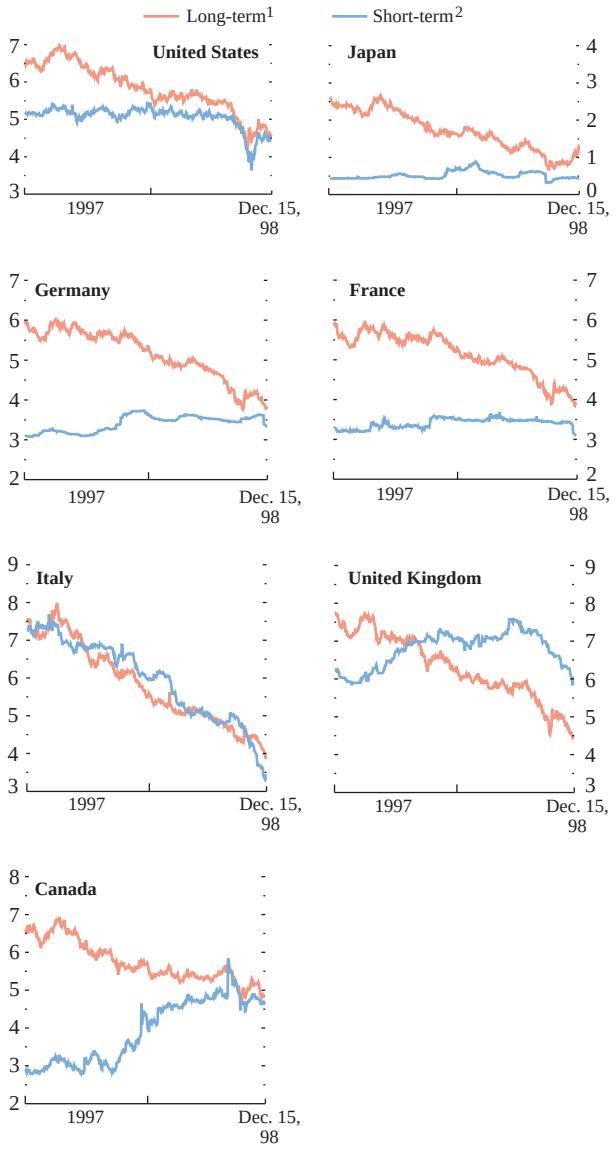
[2]Initial positive effects of the Asian crisis on economic activity in the United States and Europe, including declines in inflation and interest rates and an associated boost to real incomes, may have contributed to a perception that negative spillovers from the crisis would be relatively limited. In addition, market participants generally viewed the prospect of a moderate slowdown in the United States as beneficial in terms of reducing overheating risks.

[3]This widening coincided with a general weakening in U.S. corporate earnings growth and an increase in the number of corporate credit rating downgrades relative to upgrades.

### Figure 3.2. Major Industrial Countries: Nominal Interest Rates

*(Percent)*

The downward trend in bond yields accelerated in the wake of the Russian crisis, while short-term rates have also declined, reflecting cuts in official interest rates.




Sources: WEFA, Inc.; and Bloomberg Financial Markets, LP.

[1]Yields on government bonds with residual maturities of ten years or nearest.

[2]Three-month maturities: treasury bill rates for United States and United Kingdom; interbank rate for Germany, France, Italy, and Canada; and deposit rate for Japan.

the sustainability of historically high equity market valuations reached after a period of sustained and rapid price increases. First, the negative effects of the Asian crisis on output growth and corporate earnings were becoming more visible, particularly in the United States. In addition, it was increasingly apparent that the contraction in the Asian emerging market economies was much deeper than initially expected, and that prospects for early recovery in Japan had diminished. The deteriorating situation in Russia also contributed to concerns that the emerging market crisis might spread beyond Asia. Bank stocks were hit particularly hard, in part unwinding earlier sharp gains but also reflecting concerns about bank exposures to emerging markets (Figure 3.1, preceding page). In credit markets, spreads on lower-quality U.S. corporate bonds widened by a further 50 basis points in the first half of August, but there was only a modest widening in spreads on investment grade bonds.

## Recent Developments

The situation deteriorated rapidly in the second half of August as the devaluation and unilateral debt restructuring by Russia sparked a period of turmoil in mature markets that is virtually without precedent in the absence of a major inflationary or economic shock. Neither Russia's relative importance in the world economy nor the size of bank exposures to Russia[4] can fully explain the magnitude of the market movements that followed, including a broad-based reassessment of the risks associated with emerging market investments and a large-scale—partly involuntary—portfolio rebalancing across a range of global financial markets. In subsequent weeks, conditions in the mature financial markets deteriorated sharply. The equity market sell-off intensified, largely wiping out the gains recorded earlier in the year. In the United States, equity markets bottomed out in late August, roughly 20 percent below their highs, while European markets continued to decline through the first half of October, falling on average by about 35 percent. At the same time, the decline in government bond yields accelerated, taking yields to their lowest levels since at least the mid-1960s and in some cases since World War II, as investors increasingly sought to shift funds into the safest and most liquid assets (Figure 3.2). In the six-week period between mid-August and early October, for example, government bond yields fell by about 70 basis points in Germany, 110 basis points in the United Kingdom, and 120 basis points in the United States, implying price gains in the range of 6–11 percent for the benchmark seven- to ten-year bonds. Elsewhere in

[4]In 1997, Russia accounted for roughly 1½ percent of world GDP and 1.2 percent of world trade; BIS bank claims on Russia accounted for less than 1 percent of BIS total claims.

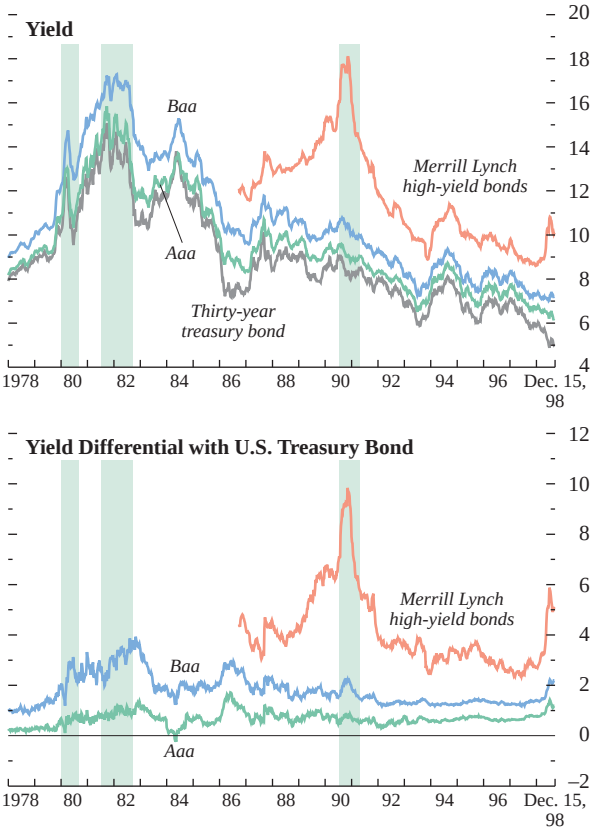
Europe, yield spreads over German rates widened to their highest levels of the year within the euro area, and even more dramatically outside the euro area, with spreads for Denmark and Sweden widening by 30–40 basis points in less than a month.

Corporate bond spreads also widened sharply, both relative to government bond yields and in terms of the spreads between high- and low-quality corporate bonds. Comprehensive data are most readily available for the United States, where the corporate bond market is relatively large and well developed (Figure 3.3). Yield spreads over U.S. treasury bonds for below-investment-grade bonds widened from about 375 basis points immediately before the Russian debt restructuring to almost 600 basis points by mid-October, the highest level since the collapse of the U.S. junk bond market at the beginning of the 1990s. For an average high-yield bond, this spread widening was equivalent to a loss of about 8 percent on the value of the bond, more than half the average loss recorded over a longer 4½ month period at the height of the market turmoil in 1990–91. Spreads for the highest rated (Aaa) investment-grade bonds also widened from about 90 basis points in early August to about 150 basis points in mid-October, while spreads for lower-rated (Baa) bonds rose from about 150 to 230 basis points, in both cases reaching levels that typically have been observed only during periods of recession. For the most part, the rise in spreads on higher-grade credits reflected the fall in treasury bond yields rather than a rise in actual borrowing costs. However, below investment grade, the spread widening was also associated with a sharp increase in nominal yields. The U.S. credit market may have been particularly vulnerable to a setback, given that prolonged periods of economic expansion such as that achieved by the United States in the 1990s often culminate in excessive borrowing and underpricing of risk.[5] However, corporate bond spreads also appear to have widened in some European markets, though time-series data on these spreads are much more limited. For example, spreads on AA euro sterling bonds over U.K. gilts widened from about 90 basis points to 130 basis points during the same period,[6] and spreads also widened for bonds issued by financial institutions in France and Germany. New debt issuance activity dropped off markedly, most notably in the high-yield market in the United States, where the volume of bonds issued in October fell to about $2 billion, compared with a monthly average of roughly $15 billion in the second quarter (Figure 3.4). A substantial though less pronounced

## Figure 3.3 United States: Yields on Corporate and Treasury Bonds[1]

*(Percent)*

In the wake of the Russian crisis, yield spreads on corporate bonds widened sharply to levels not seen since the early 1990s.




Sources: Board of Governors of the Federal Reserve System; Bloomberg Financial Markets, LP; and Merrill Lynch.

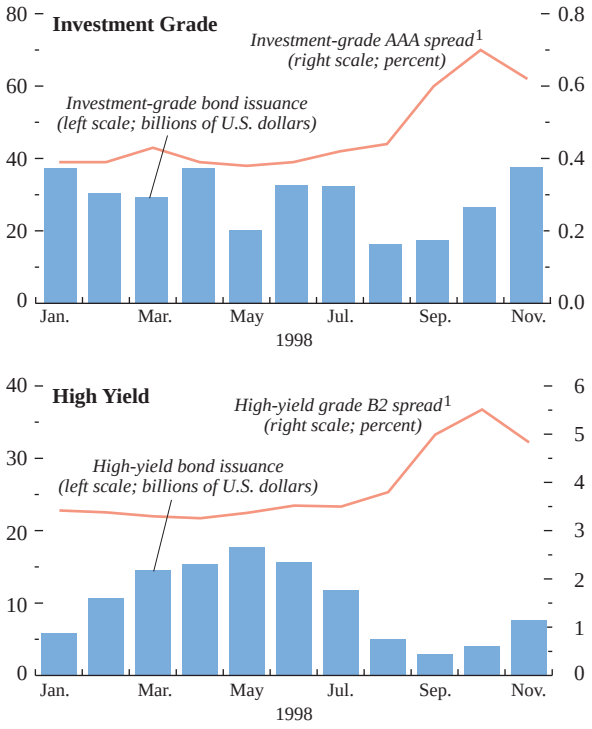
[1]Weekly data; the Moody's ratings of the corporate bonds are shown in the panels. Yields on thirty-year treasury bonds of constant maturities are used for the U.S. treasury bond. The shaded regions indicate recession periods.

[5]U.S. credit spreads had become unusually compressed in the past two years amid a marked acceleration in private indebtedness, much of it securitized and held off banks' balance sheets.

[6]Individual U.K. corporate bond spreads also widened significantly during the third quarter. See Bank of England, *Inflation Report* (London: November 1998), p. 6.

### Figure 3.4. United States: Corporate Bond Market

The widening in yield spreads was associated with a marked drop-off in new issuance activity, particularly for lower-quality bonds.




Source: Bloomberg Financial Markets, LP.

[1]Spread between yields on corporate bonds and ten-year U.S. government bonds. Monthly average of daily observations.

drop-off was observed in the issuance of U.S. investment-grade bonds, and there are reports that high-yield corporate bond issuance also slowed sharply in continental Europe.

In September and early October, indications of heightened concern about liquidity and counterparty risk emerged in some of the world's deepest financial markets. As discussed further below, a key development was the news of difficulties in, and ultimately the near-failure of, a major U.S. hedge fund—Long-Term Capital Management (LTCM)—which had large highly leveraged positions across a broad range of markets, and substantial links with a range of U.S. and European financial institutions. Although a private rescue of LTCM, organized with the help of the New York Federal Reserve Bank, was announced on September 23, the market reverberations intensified in the ensuing weeks as previous positions were unwound and as concerns increased about the extent to which other financial institutions might be in trouble or face a need to unload assets into illiquid markets at distressed prices. In response to these developments, market volatility increased sharply, and there were some significant departures from normal pricing relationships among different asset classes.[7] In the U.S. treasury market, for example, the spread between the yield on "on-the-run" and "off-the-run" treasuries widened from less than 10 basis points to about 15 basis points in the wake of the Russian debt restructuring, and to a peak of over 35 basis points in mid-October, suggesting that investors were placing an unusually large premium on liquidity (Figure 3.5).[8] In terms of the value of the bonds, this spread widening was equivalent to a relative price movement of about 4 percentage points—a relatively large differential for bonds of similar duration and the same underlying credit risk. Spreads between yields in the Eurodollar market and on U.S. treasury bills for similar maturities also widened to historically high levels, as did spreads on fixed-for-floating interest rate swaps, pointing to heightened concerns about counterparty risk.

In exchange markets, the U.S. dollar continued to strengthen on a multilateral basis through mid-August, remaining relatively stable against major European currencies but rising further against the Japanese yen and currencies of the major commodity-exporting countries (Figure 3.6). As the emerging market crisis took on global dimensions, however, the dollar began to weaken amid increased concerns about the down-

[7]While the observed movements in market prices suggest problems of reduced liquidity and perhaps broader disruption of normal market functioning, reports of such problems remain largely anecdotal (see the next section).

[8]This particular comparison refers to the spread between the 25-year and the 30-year benchmark treasury, but a similar pattern was observed for other maturities. On-the-run securities are the latest issue of a particular maturity. Off-the-run securities are the previous issues of the same maturity.

side risks to U.S. growth and a shift in market expectations about the direction of U.S. monetary policy from modest tightening to significant easing.[9] These developments, combined with signs in Japan of greater progress with long-awaited bank reform[10] and additional moves there toward fiscal and monetary stimulus, significantly altered the balance of risks facing investors with yen-denominated exposures. The initial weakening of the dollar was relatively orderly; it fell by less than 10 percent against both the yen and the deutsche mark between mid-August and early October. However, the situation changed in the week beginning October 5 when the dollar fell by almost 15 percent against the yen in the space of 3 days, including the largest one-day movement in the yen/dollar rate since the collapse of the Bretton Woods system. This latter adjustment mainly reflected a sharp general appreciation of the yen: the dollar fell less than 2 percent against the deutsche mark over the same period (Figure 3.7). It also coincided with an unusually abrupt steepening of mature market yield curves outside Japan, as bond yields rose from their historic lows while short rates continued to fall. Over the same week, for example, the gap between three-month and ten-year rates widened by about 85 basis points in the United States, 50 basis points in Germany, and 60 basis points in the United Kingdom. The coincidence of such dramatic moves in the yen/dollar rate and in major credit markets is difficult to explain in terms of changing economic fundamentals alone, and appears to have reflected a large-scale unwinding of yen-denominated exposures—the "yen carry trade"—amplified by technical factors linked to stop-loss orders and dynamic hedging strategies (Box 3.1, page 43). These developments were a particularly visible manifestation of a global move by investors to close out open positions and reduce leverage in the wake of the heightened market turmoil.

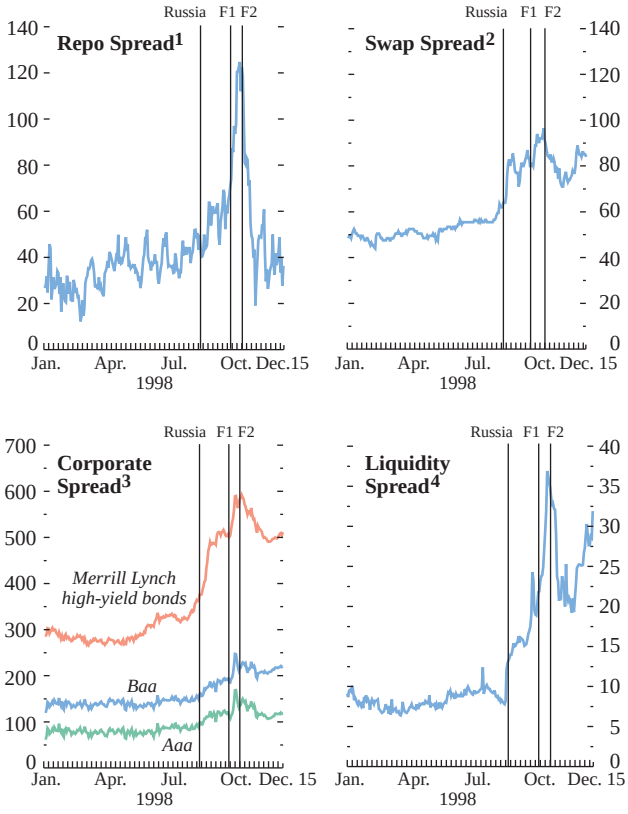
In response to these developments, the U.S. Federal Reserve Board moved to cut interest rates on three occasions beginning in late September. An initial cut of ¼ of 1 percentage point in the target federal funds rate was announced following the Federal Open Market Committee (FOMC) meeting on September 29 but failed to have any significant effect in calming markets; spreads continued to widen, equity markets fell further, and volatility continued to increase. Against this background, the Federal Reserve followed up on October 15 with ¼ of 1 percentage point cuts in both the federal funds target and the discount rate, a move that proved to be the key policy action that stemmed

[9]For example, the implied yield on the eight-month federal funds futures contract fell from about 5.6 percent in May and June, to 4.25 percent by mid-October, suggesting that market participants expected a sizable easing over the subsequent months.

[10]Recent developments in the Japanese financial system are discussed in Chapter I (Box 1.2).

**Figure 3.5. United States: Developments in Fixed-Income Securities Markets**
*(Basis points)*

Growing concerns about liquidity and counterparty risk were partially alleviated after the second cut in the Fed funds rate target in mid-October.




Source: Bloomberg Financial Markets, LP.

Note: The vertical lines represent the following: Russia = Russian debt moratorium (August 17); F1 = Federal Reserve interest rate cut (September 29); and F2 = Federal Reserve interest rate cut (October 15).

[1]Rate on three-month U.S. treasury repos minus yield on three-month U.S. treasury bill.

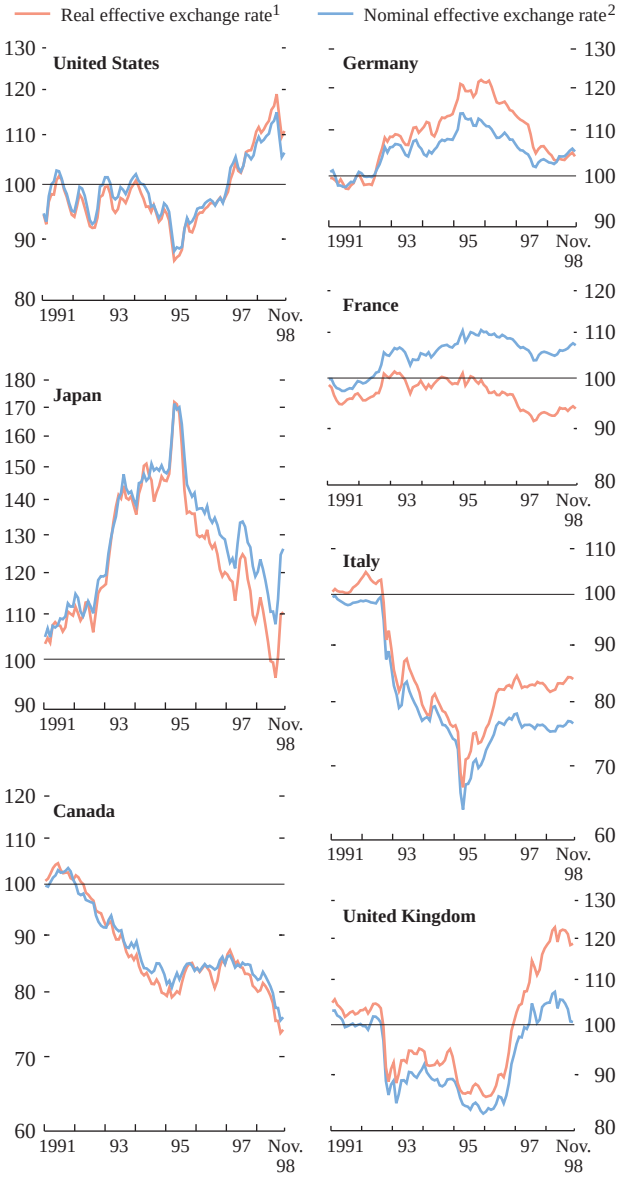
[2]Spread of fixed-rate leg of 10-year U.S. dollar interest rate swaps over yield on 10-year U.S. treasury bond.

[3]Spread over 30-year U.S. treasury bond.

[4]Spread of 25-year U.S. treasury bond over a 30-year on-the-run U.S. treasury bond.

**Figure 3.6. Major Industrial Countries: Effective Exchange Rates**
*(Logarithmic scale; 1990 = 100)*

The U.S. dollar continued to strengthen until mid-August, before a moderate decline associated in part with a sharp rebound in the yen.




[1]Defined in terms of relative normalized unit labor costs in manufacturing, as estimated by the IMF's Competitiveness Indicators System, using 1989–91 trade weights.
[2]Constructed using 1989–91 trade weights.

and ultimately reversed the deteriorating trend in market sentiment. The second easing was not particularly large, but the fact that it came so soon after the first rate cut and outside a regular FOMC meeting—the first such move since April 1994—sent a clear signal that the U.S. monetary authorities were prepared to move aggressively if needed to ensure normal market functioning. The Federal Reserve subsequently cut both the federal funds target and the discount rate by a further ¼ of 1 percentage point at the next FOMC meeting on November 17, noting that although financial market conditions had settled down materially since mid-October, unusual strains remained. Elsewhere, the Bank of Japan reduced the guideline for the uncollateralized call rate by 25 basis points to ¼ percent on September 9, and official interest rates have been reduced since late September in Australia, Canada, and Europe. While these moves have been motivated primarily by domestic considerations, they have also played a helpful role from a global perspective by contributing to the broad easing of monetary policy in the industrial countries.

Since mid-October, a significant degree of calm returned to financial markets. Indicators of reduced liquidity and heightened counterparty risk were substantially, though not completely, reversed (see Figure 3.5), and exchange rate volatility declined somewhat. Mature equity markets also rebounded, most dramatically in the United States, where the main indices more than regained their earlier losses by late November, before a moderate downward correction. Equity markets in Europe also strengthened, although they remain significantly below their earlier peaks. Sovereign yield spreads over German rates also generally narrowed within continental Europe, particularly in the euro area. In addition to the recent interest rate moves in the industrial countries, further steps in Japan to address the problems in the banking sector and to provide additional fiscal stimulus, and agreement on an economic program in Brazil, played important roles in the restoration of market confidence. In credit markets, spreads on U.S. corporate bonds narrowed by about 90 basis points in the high-yield market and by about 25 basis points on investment-grade bonds; corporate bond spreads also narrowed somewhat in the United Kingdom.

## Significance for Economic Activity

The significance for real economic activity of the recent turmoil in mature financial markets remains somewhat uncertain. In credit markets, although spreads have narrowed since mid-October, they remain well above pre-August levels and near levels that in the past have generally been associated with periods of markedly slower growth if not actual recession. By November, there were signs of a significant pickup in

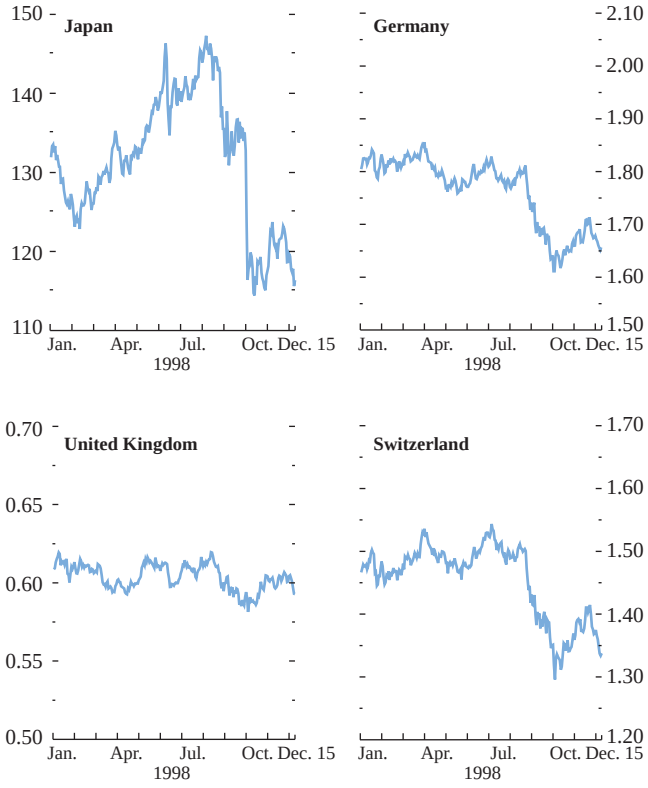
new debt issuance in the U.S. high-yield bond market, though volumes remained below their earlier levels. Some further recovery in volumes and narrowing of spreads can reasonably be expected as long as financial market conditions continue to stabilize and economic growth remains well sustained, but a return to the highly compressed credit spreads applying before the Russian crisis is probably neither likely nor desirable. It is worth noting that, except for low-grade credits, actual borrowing costs in mature markets do not appear to have increased significantly during the recent episode and may even have declined for many borrowers.

The risks for real activity will also depend in part on the impact of the turbulence in emerging and mature markets on mature banking systems. Available, but incomplete, balance-sheet data indicate that, as of mid-1998, banking system loan exposures to emerging markets amounted to about $536 billion in the euro area (9 percent of 1997 GDP),[11] $211 billion in Japan (5 percent of GDP), and roughly $120 billion in both the United Kingdom and the United States (9 percent and 1½ percent of GDP, respectively; Table 3.1).[12] These exposures already reflect a substantial pullback in net bank credit outstanding mainly to the Asian emerging market economies, since the beginning of the year. So far, a number of major financial institutions have announced significant profit declines as a result of their losses on emerging market investments and the recent turbulence more generally. For example, in the third quarter of 1998, profits of U.S. money-center banks declined to about half the level recorded a year earlier. However, bank rating agencies presently estimate that the turbulence has had a manageable impact on the mature banking systems, in part because the hardest-hit financial institutions were generally well capitalized going into the turbulence, were reasonably well provisioned (or had state guarantees) on much of their emerging market portfolios (and have in many cases increased provisioning further), and were fairly profitable in the early part of 1998.

The paucity of off-balance-sheet data makes it difficult to assess overall exposures and vulnerabilities, although in some instances these exposures may be relatively large. For example, one estimate suggests that total credit exposure (including off-balance-sheet positions) of foreign banks to Russia may have been 40 to 65 percent higher than on-balance-sheet exposure.[13] In addition, as the recent period of turbulence amply demonstrated, when emerging market financing and leveraged derivatives positions are unwound, the ma-

**Figure 3.7. Selected Countries: Bilateral U.S. Dollar Exchange Rates**
*(Currency units per U.S. dollar)*

In early October, the dollar weakened sharply against the yen but more modestly against other major currencies.




Source: Bloomberg Financial Markets, LP.

[11]Exposures for all European Union banking systems totaled about $676 billion (9 percent of GDP).

[12]These data include securities holdings.

[13]Off-balance-sheet exposures may increase or decrease total exposure. For example, counterparty risks increase exposure, since counterparties may default on positions; hedges decrease it, since they decrease the exposure to market risk.

**Table 3.1. Claims of Banks in BIS-Reporting Countries on Selected Emerging Markets as of June 1998[1]**

*(Billions of U.S. dollars)*

| | All BIS-Reporting Countries | Japan | United Kingdom | United States | Euro Area[2] | France | Germany |
|---|---|---|---|---|---|---|---|
| **Asia** | **639.4** | **186.7** | **84.6** | **31.7** | **237.3** | **55.3** | **92.6** |
| China | 59.3 | 17.5 | 7.8 | 2.1 | 23.5 | 8.0 | 7.4 |
| Hong Kong SAR | 174.6 | 54.6 | 32.8 | 6.1 | 59.4 | 12.6 | 24.1 |
| Asian-5 | 210.3 | 74.3 | 15.1 | 16.6 | 98.9 | 20.0 | 26.9 |
| **Latin America** | **295.7** | **14.8** | **23.1** | **64.2** | **140.7** | **25.1** | **39.5** |
| Argentina | 60.2 | 1.7 | 5.2 | 10.2 | 34.3 | 5.2 | 7.5 |
| Brazil | 84.6 | 5.2 | 5.8 | 16.8 | 37.6 | 7.9 | 12.8 |
| Mexico | 62.9 | 4.4 | 5.7 | 16.7 | 24.9 | 6.1 | 6.1 |
| **Transition countries** | **133.4** | **4.1** | **3.9** | **12.4** | **92.4** | **11.1** | **52.5** |
| Russia | 75.9 | 1.0 | 1.8 | 7.8 | 51.5 | 6.7 | 31.3 |
| **Middle East** | **57.3** | **3.0** | **6.5** | **5.3** | **25.7** | **7.0** | **11.6** |
| **Africa** | **58.3** | **2.3** | **3.9** | **4.8** | **39.4** | **18.7** | **9.4** |
| **All emerging markets** | **1,184.0** | **210.9** | **122.0** | **118.4** | **535.5** | **117.2** | **205.6** |

Sources: BIS; and IMF staff calculations.

[1]On-balance-sheet claims, excluding claims on offshore centers (with the exception of Hong Kong SAR and Singapore, which are included in Asia).

[2]Because data are not reported for Greece and Portugal, data are for Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, and Spain.

ture markets that finance these positions are also affected. Even if the off-balance-sheet exposures of mature banking systems to emerging markets are relatively limited, therefore, they may still have significant consequences for the mature derivatives markets.

Looking ahead, the mature banking systems and the institutions within them face three risks that are particularly relevant to the outlook. First, in addition to the direct exposures described above, financial institutions have significant indirect exposures to emerging market risks, including to counterparties that take on emerging market risks, and to the mature securities markets themselves. As recent events have shown, mature markets can experience sizable turbulence directly related to developments in emerging markets. Second, there are concerns, as discussed further below, that risk management practices continue to lag developments in financial markets, increasing potential vulnerability to turbulence. Third, the fact that the credit cycles in some major countries are in a mature phase, with economies close to potential after several years of strong growth, suggests that banks could face a deterioration in credit quality on domestic exposures, including from a slowdown in economic activity.[14] Available data on bank lending volumes do not point to any broad-based curtailment of credit availability to date, outside Japan, in part because companies have been able to draw down existing bank credit lines as a substitute for reduced access to the corporate bond and commercial paper markets.[15] However, a Federal Reserve Board survey in November showed that U.S. bank lending practices had tightened significantly, reflecting increased concern about the economic outlook, and with the number of domestic respondents reporting tightened loan standards reaching the highest level since 1990. Some tightening of loan standards is probably a welcome development—indeed, in July 1998 the Federal Reserve expressed concern that standards had become too lax—but a substantial cutback in credit availability clearly would have negative implications for economic growth.

Equity market developments also are likely to have a significant bearing on near-term growth prospects—particularly in the United States, where equity price gains have been a major driving force behind the rapid growth in private consumption in recent years. For example, U.S. consumer confidence fell significantly from the record high reached in June, no doubt at least partly reflecting the downward correction in the stock market, before a partial recovery in November as the stock market rebounded; there have been indications of similar effects in some other countries. Given that equity prices have recovered rapidly since early October, it seems unlikely that the recent relatively short-lived

[14]One credit rating agency takes the view that the U.S. credit cycle has already peaked.

[15]Data for the United States indicate that bank lending growth accelerated in the period after late August, in part reflecting growth in commercial and industrial loans. Similar trends are evident in the United Kingdom.

### Box 3.1. Recent Dollar/Yen Exchange Rate Movements

One outstanding feature of foreign exchange market developments in the past few months was the sharp and unprecedentedly sudden appreciation of the yen vis-à-vis most major currencies in early October that ended the trend of yen depreciation since mid-1995. While the recent yen appreciation to some extent may have been warranted by fundamental forces (among them a reassessment of relative monetary policy stances), the timing and the speed of the exchange rate changes strongly suggest that short-term trading conditions (such as the large-scale unwinding of "yen-carry trades") and technical market factors (including repercussions from the expiration of barrier options) contributed significantly to the sharp dynamic adjustments in the yen/dollar market. This box describes these adjustments and the technical features that drove them.

With a brief interruption in mid-1997, the yen depreciated vis-à-vis the dollar by some 40 percent during the past three years and reached an eight-year low at ¥147.26 per dollar on August 11, 1998 (*see figure*). This long-running appreciation of the dollar was abruptly and sharply reversed in the wake of renewed turbulence in emerging markets. Of particular interest are the developments surrounding the unprecedented, sharp appreciation of the yen during October 6–9, 1998, when the yen appreciated 15 percent vis-à-vis the dollar. This episode was driven by a confluence of factors—some of a fundamental nature, others largely technical but generating positive feedback dynamics.

Various catalysts may have sparked an initial rally in the yen and the 6.2 percent surge in the Nikkei stock index on October 7, 1998. The new draft banking bill was submitted to parliament on that day; there was talk of an additional fiscal stimulus package; and the relative monetary policy stance in Japan, the United States, and Europe was reassessed in part based on the Bank of Japan (BOJ) balance sheet for September, which was interpreted by some market participants as casting doubts on previous hints of extensive monetary easing by the BOJ.

The initial spate of dollar selling, in the wake of some turbulence in U.S. markets and the cut in interest rates by the Federal Reserve, may have induced a change in sentiment that the dollar's long-standing strengthening vis-à-vis the yen had run its course. The impression of a turning point was reinforced by indications of a cascade of dollar selling by institutional investors, including hedge funds. Large financial institutions were reportedly unwinding their yen-carry trade positions,[1] as part of the process of international deleveraging. According to market participants, technical factors stemming from standard hedging procedures may have contributed to the sudden surge in the yen. In particular, the cancellation of complex options as the yen surged through several trigger levels and dealers' unwinding of hedges against these options, as well as the bunching of limit orders, created additional momentum that boosted demand for yen. Some temporary demand for yen appears to have originated from foreign investors who had short positions in Japanese stocks and decided to cover them ahead of new rules (effective October 23) that bar investors from selling borrowed stock in declining markets. Foreign exchange trading volume surged initially, but liquidity tightened up quickly (see figure) and contributed to large price discontinuities. In these circumstances, market participants took a cautious view, reflecting, among other factors, the very sharp increase in implied foreign exchange volatility.

The dollar eventually stabilized on October 9, 1998, reportedly after market participants began to think that the Federal Reserve was prepared to intervene in support of the dollar. But unlike in June, when a concerted intervention of the Federal Reserve and the BOJ was aimed at boosting the value of the yen, no central bank interventions are reported to have taken place between August and November 1998. In the following weeks, the yen/dollar rate weakened slightly, and liquidity returned to the foreign exchange market. Implied volatility remained high, however, as uncertainty about prospects for Japan and in particular its financial system lingered (see Chapter I, Box 1.2).

#### Yen-Carry Trade

Tempted by low borrowing costs in Japan, proprietary trading desks of major financial institutions and hedge funds, and even some corporations, had borrowed in yen to invest in U.S., European, and emerging market assets, thereby shorting the yen. The borrowing took various forms. Funds were either raised in the interbank market, through term repo agreements, or by issuing money market paper. Subsequently the funds were swapped for foreign currency or exchanged in the spot market. Owing to the interest rate differentials between Japan and, say, dollar assets and the appreciation of the dollar vis-à-vis the yen, these positions had been highly profitable during the past few years.

Japanese banks also exploited the yen-carry trade by accumulating open foreign asset positions. In the first three quarters of 1998, the net holdings of assets denominated in foreign currencies increased by about $44 billion, while the net holdings of yen-denominated assets abroad declined by $103 billion (see figure). Against the background of the yen depreciation, a shift toward a "long" position in foreign currencies became increasingly attractive to Japanese banks.

*(Box continues on next page.)*

[1]The yen-carry trade was discussed in detail in the September 1998 *International Capital Markets* report, p. 44; it is also explained below.

stock market correction alone will be sufficient to have a significant dampening effect on consumer spending. Indeed, with equity markets back in some cases to near their all-time highs, previous concerns about the sustainability of current market valuations have resurfaced (Box 3.2, page 48; and Figure 3.8), and the possibility of a more pronounced downward correction in equity prices remains an important risk.

## Box 3.1 *(concluded)*

### Currency Markets and Net Foreign Position of Japanese Banks


Sources: Bank of Japan; Bloomberg Financial Markets, LP; and Nikkei.
[1]Average daily turnover in January-June 1998 in the spot and swap markets was $14 billion and $17 billion, respectively.
[2]The underlying data are in yen (left scale); the U.S. dollar values (right scale) are computed at an exchange rate of 120 yen per U.S. dollar.

In exchange markets, the most notable by-product of the recent turmoil has been a substantial strengthening of the yen, which by late November was up roughly 20 percent in nominal effective terms from its August low. The multilateral value of the U.S. dollar weakened by about 6 percent over the same period, while that of the deutsche mark was little changed on balance, though it strengthened significantly against the dollar.

**Japan: Notional Amounts of Over-the-Counter (OTC) Derivatives Outstanding, End-June 1998**
*(Trillions of U.S. dollars)*

| | Grand Total | Of Which: 1 Year or Less | OTC Options | Of Which: 1 Year or Less |
|---|---|---|---|---|
| Foreign exchange contracts | 3.37 | 2.87 | 0.40 | 0.26 |
| With reporting dealers | 2.44 | 2.18 | 0.31 | 0.20 |
| With other financial institutions | 0.58 | 0.47 | 0.07 | 0.05 |
| With nonfinancial customers | 0.35 | 0.22 | 0.02 | 0.02 |
| Single-currency interest rate contracts | 9.54 | 5.27 | 0.89 | 0.25 |
| With reporting dealers | 7.54 | 4.42 | 0.53 | 0.14 |
| With other financial institutions | 1.41 | 0.72 | 0.23 | 0.08 |
| With nonfinancial customers | 0.59 | 0.13 | 0.13 | 0.03 |

Source: Bank of Japan, *Regular Derivatives Market Statistics in Japan* (Tokyo).

Worsening investment opportunities following the turbulence in some emerging markets, and corrections in mature markets during the summer of 1998, prompted a reversal of yen-carry trade positions. In addition to profit taking, the unwinding was also triggered by institutional investors, including hedge funds, that were confronted with margin calls on positions in other markets. Many institutions closed out carry trades because they faced a shortage of liquidity as banks increasingly cut credit lines to leveraged investors—as part of a global reevaluation of the willingness to take risks. Some margin calls on hedge funds might have dampened the yen appreciation as they triggered the sale of liquid yen assets to raise cash, which was subsequently converted into foreign currency.

Japanese institutions began to repatriate funds in light of rising funding costs—including an increasing "Japan premium" and higher rates on basis swaps (currency swaps)[2]—and reportedly deteriorating access to international interbank markets. In this situation, long dollar positions represented a potential source of vulnerability and contributed to unwinding pressures. These pressures were intensified by the need to overcome capital shortfalls on their half-year balance sheets (September 30) and as an increasing number of Japanese banks reconsidered the viability of their overseas business. Selling pressures on the dollar reportedly originated from Japanese investors pulling funds out of U.S. securities as those markets softened and the higher exchange rate volatility increased foreign-currency risk and made hedging more expensive.

### Technical Factors

Large dollar-yen movements were likely exacerbated by a series of technical factors, such as stop-loss orders and, more important, by the cancellations of barrier options[3] and the unwinding of associated hedging positions by dealers. Leverage and the hedging of yen positions can often be achieved more cheaply through derivatives. The volume of outstanding yen foreign exchange contracts had grown at end-June 1998 to $3.4 trillion, of which about $400 billion corresponded to options (*see table*). Although no official breakdown by type of options is available, market participants consider barrier options a popular instrument.

Knockout options (a special form of barrier options)[4] are widely used as a hedge of currency risk because they are less expensive than standard options. But knockout options provide protection only against moderate exchange rate changes and leave the investor unhedged against large currency movements, since as soon as the exchange rate breaches a certain level, the knockout option is canceled. A Japanese exporter, for example, might buy dollar knockout put options, which expire prematurely if the dollar exchange rate drops below a certain level, to protect against a (moderate) depreciation of the dollar. A drop of the dollar large enough to trigger the cancellation of the option would, however, expose the exporter to losses. In response, the exporter might be inclined to sell dollars into a falling market to cut his expected losses.

Additional feedback in a falling market may have originated from the dynamic hedging strategies commonly employed by dealers who sell knockout options. As the dollar exchange rate fell and knockout call options were canceled, dealers immediately sold the long dollar positions they held as a dynamic hedge for these options. The hedging of knockout put options typically involves more complex buying and selling of standard options as exchange rates vary. In a down market, standard put option values are bid up even higher by the dynamic hedging and expose dealers to significant losses. These reactions can contribute to an overshooting in the price (and implied volatility) of options.

[2]In a basis swap, a bank swaps principal and interest obligations on a yen liability for dollar principal and interest payments. This arrangement converts yen-denominated debt held by a Japanese bank into dollars and thus helps fund the bank's overseas activities. Basis swaps had offered Japanese banks an attractive source of foreign currency at a time when their credit ratings made it difficult to borrow abroad.

[3]Barrier options are options that either come into effect or are canceled if the price of the underlying asset crosses a stated level.

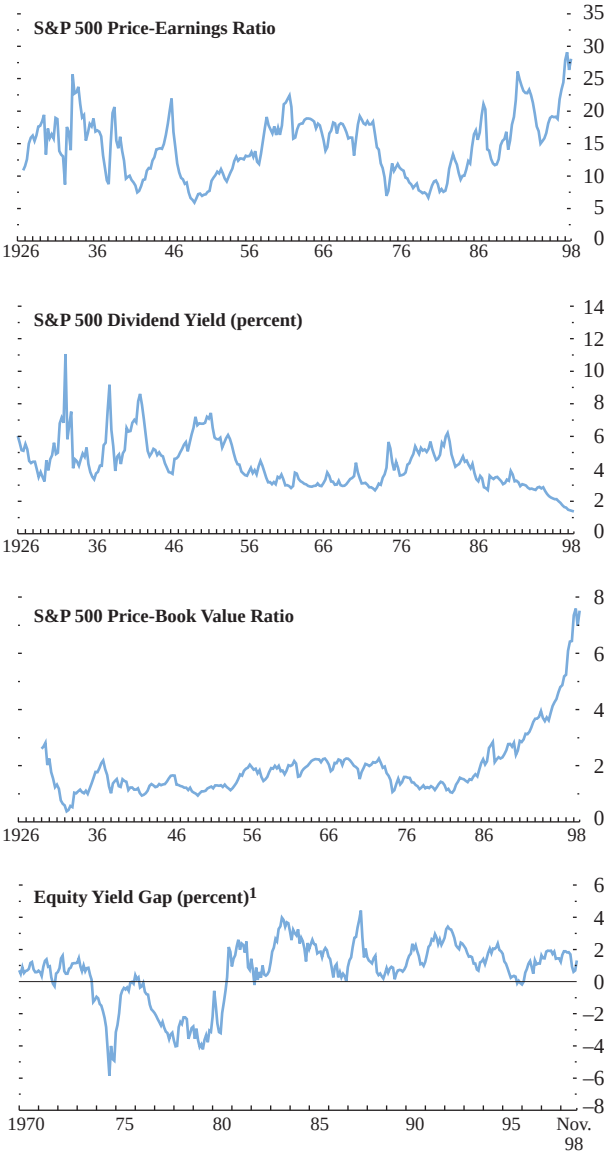
[4]Knockout options are barrier options that are canceled as the underlying asset price breaks through a specified level.

As discussed above, the sharp rise in the yen appears to have been at least partly attributable to the sudden unwinding of large short yen positions, amplified by technical factors, and it remains to be seen to what extent the current yen/dollar alignment will persist as the impact of these essentially one-off factors begins to fade.

At a more fundamental level, however, the yen's rise also appears to have reflected expectations of ad-

### Figure 3.8. United States: Equity Market Performance

With the latest rebound in U.S. equity prices, several indicators of market valuation have moved further away from their long-term averages; however the yield gap vis-à-vis treasury bonds remains below recent peaks, reflecting the decline in government bond yields.




Sources: Board of Governors of the Federal Reserve System; Bloomberg Financial Markets, LP; WEFA, Inc.; and Standard and Poor's.

[1]Difference between the yield on long-term government bonds and the inverse of the price-earnings ratio.

ditional policy steps to boost growth in Japan and of slower growth in the United States, which would imply a narrowing of the current large divergences in relative cyclical positions. So far, there is little evidence of such narrowing in the economic data, however, and the recent abrupt strengthening of the yen could be damaging to prospects for recovery in Japan at a time when domestic private sector demand remains very weak. Indeed, as discussed in Chapter IV, the appreciation of the yen is one of the factors behind the further downward revision in the 1999 staff forecast for Japan. From a global perspective, however, a moderate realignment of the yen/dollar rate also carries several potential benefits. First, by introducing a greater element of uncertainty about the future direction of exchange rates, it has probably reduced the incentives for investors to take on large short-yen exposures that may have contributed to the emergence of exchange market strains and asset price bubbles elsewhere in the global financial system over the past two years. Second, it has helped to alleviate downward pressures on the currencies of other emerging market economies in Asia and elsewhere—particularly those with explicit or implicit links to the U.S. dollar—and thus has provided scope for these economies to pursue somewhat easier monetary policies. Particularly in the current environment where global deflationary pressures remain relatively strong, such cautious monetary easing is generally helpful in terms of reducing the risks of a more pronounced slowdown in world growth. Third, it has provided additional scope for the Japanese authorities to pursue an aggressively expansionary monetary policy aimed at boosting domestic demand and easing strains in the financial sector. Nonetheless, a further significant strengthening of the yen or weakening of the dollar in the short term would also carry risks, in terms of both the prospects for economic recovery in Japan and the scope for further interest rate cuts in the United States.

## Systemic Aspects of Mature Market Turbulence

Recapping some of what has already been discussed, the turbulent dynamics in mature markets had been preceded by a steady buildup of prices in the mature equity and bond markets during the years and months preceding the Russian crisis in mid-August 1998. The long-standing rise in asset values was supported by several important developments in the mid-to-late 1990s—including the widespread reduction in inflation rates in the world economy; the continued noninflationary expansion in the United States, and the belief by some that the U.S. economy had entered a new, high-productivity growth age; continued flows of funds into U.S. and other mature equity and bond markets; and the relatively successful convergence

process toward EMU. All of these developments continued through the early summer, amid earlier warning signs that many advanced country equity markets, not just in the United States, were reaching record and perhaps unsustainable levels. In addition, as early as mid-1997, differences in the cost of borrowing between high- and low-risk borrowers began to narrow to the point where several advanced country central banks sounded warnings that credit spreads were reaching relatively low levels and that lending standards had been relaxed in some countries beyond a reasonable level.

In mid-July 1998, equity markets in the advanced countries began to decline somewhat on reports of poor corporate earnings and concerns about a slowdown in U.S. economic growth. At the same time, some mature markets—notably the U.S. fixed-income markets—began experiencing a widening of interest rate spreads between low- and high-quality borrowers, in part the result of concerns over growth prospects and what this might imply for the ability of higher-risk debtors to service obligations in the future and in part the result of the continued flight to quality and liquidity (and away from Asian emerging markets). This relatively small widening of interest rate spreads between low- and high-quality fixed-income securities was then followed by a more dramatic widening of spreads, and subsequently by a period of severe turbulence in mature and international financial markets, triggered, and driven, by several related events—including the Russian unilateral restructuring of GKOs (ruble-denominated discount instruments); the immediate partial closing out, and deleveraging, of positions in other emerging markets; and later in mid-September the near collapse of a highly leveraged hedge fund, LTCM.

Dynamic adjustments in other emerging markets related to the Russian crisis necessarily entailed some adjustments in the mature markets as well, reflecting the important role of these markets in financing and leveraging investments in Russia and in other emerging markets. But it would normally be expected that such adjustments would occur relatively smoothly and without the kind of severe financial turbulence that occurred in September and October 1998 in some of the deepest and most liquid markets in the world. By definition, deep and liquid markets, such as those in the United States, might have been expected to be able to absorb the after-effects of what were relatively moderate shocks with relatively limited price and liquidity effects.

However, the financial turbulence in the mature markets appeared out of proportion to the events that triggered it. The events surrounding the Russian unilateral debt restructuring led to large investment and trading losses and changed market perceptions of default and convertibility risk, which together affected the balance of risks and returns in international portfolios. Because of the new financial calculus that resulted, the internationally active financial institutions and other asset managers appear to have engaged in a wholesale reassessment and repricing of financial risk, which was accompanied by a rebalancing and deleveraging of international portfolios in a short period of time, accented by risk avoidance, market illiquidity, and extreme price movements.

As a result, and contrary to what would normally be expected, the mature markets subsequently experienced dramatic, and in some cases unprecedented, price and liquidity adjustments that cut across mature equity, fixed-income, currency, and derivative markets and caused some of them to become illiquid, and at times to seize up temporarily; liquidity spreads reached record highs.[16] Despite the apparent concentration of mature market turbulence in U.S. financial markets and the focus of attention on some newsworthy U.S. financial institutions, internationally active European and Japanese financial institutions were involved in similar leveraged risk taking, in some cases on a very large scale, and, as of end-November 1998, appear to be undergoing a similar process of risk reassessment and rebalancing. The negative impact on asset values during the most turbulent subperiod—between mid-September and mid-October—was sufficiently severe that it triggered fears of significant negative spillover effects on world economic growth.

The severe nature of the mature market turbulence raises several issues about private risk and portfolio management, banking supervision, financial market surveillance, the management of systemic risk, and the operation of the international financial system. The remainder of this section examines several features of international financial markets that provide an understanding of why there was a reassessment of risks and rebalancing of mature market portfolios in the period from mid-August through mid-October 1998. These features include the following: (1) the unilateral debt restructuring in Russia challenged underlying assumptions of investors in mature markets about sovereign risk and potential international financial support; (2) mature markets financed a significant share of emerging market exposures; (3) a large number of diverse financial institutions, not just hedge funds, had

[16]The turbulence was also affected by a number of features of the structural transformations that have occurred in financial markets during the past 10–15 years, some of which contributed to, and magnified the effects of, the turbulence, and some of which moderated the turbulence and its impact. These features include the expanded opportunities for unbundling and repackaging components of financial risk, and advances in trading and portfolio management techniques (stop-loss orders, portfolio insurance, dynamic hedging) afforded by advances in information and computer technologies; the evolution of commercial and investment banks into financial conglomerates with global reach; and the growing importance of institutional investors (insurance companies, pension funds, hedge funds). For analyses of some of these changes see "Globalization of Finance and Financial Risk," Annex 5 of the September 1998 *International Capital Markets* report.

## Box 3.2. What Is the Implied Future Earnings Growth Rate that Would Justify Current Equity Prices in the United States?

Since its peak in July 1998, the U.S. stock market has experienced a significant correction and then a rebound. The Standard & Poor's 500 index fell some 19 percent from peak (July 17) to trough (October 8). The S&P 500 index has since rebounded by about 24 percent (having reached a new high on November 27). The correction was triggered in part by reports of lower corporate earnings and reevaluations of earnings expectations. At the same time, long-term bond yields declined markedly. A key question is: At present levels of interest rates, what is the implied growth rate of future nominal earnings that would justify equity prices in early December as the present value of discounted future earnings? The answer provided by the analysis below is that, assuming an unchanged risk premium, the implied nominal earnings growth rate (7½ percent) is about the same as in late 1997, when the S&P 500 index was significantly lower than in early December 1998. The decline in long-term interest rates thus makes the 20½ percent higher S&P 500 consistent with unchanged expected earnings growth. The analysis supports the view that current equity valuations are unsustainably high, especially in light of the relatively late stage of the U.S. business cycle, by showing that the implied earnings growth rate adjusted for inflationary expectations is at a post–World War II peak.

### *Calculation of Implied Earnings Growth Rates*

The relationship between equity prices and the implied growth of future nominal earnings can be derived from the hypothesis that the current equity price, $P_t$, is equal to the discounted present value of future earnings, $E_{t+j}$ ($j \geq 1$), with discount factor $\rho_t$.

$$P_t = \sum_{j=1}^{\infty} \left(\frac{1}{1+\rho_t}\right)^j E_{t+j}. \qquad (1)$$

Assuming that future earnings grow at a constant rate, $g_t$, such that $E_{t+j+1} = (1 + g_t)E_{t+j}$, equation (1) becomes:

$$P_t = E_t \sum_{j=1}^{\infty} \left(\frac{1+g_t}{1+\rho_t}\right)^j. \qquad (2)$$

This implies the following relationship between the current price earnings ratio, $(P_t/E_t)$, the discount factor, and the future earnings growth rate:

$$\frac{P_t}{E_t} = \left(\frac{1+g_t}{\rho_t - g_t}\right). \qquad (3)$$

Given a suitable discount factor, equation (3) can be solved for the implied earnings growth rate, $g_t$. The discount factor, $\rho_t$, is equal to $(r_t + e)$, where $r_t$ denotes the 30-year U.S. treasury bond yield and $e$ is a constant equity risk premium (assumed to be 6 percentage points).[1]

### *Assessment*

The S&P 500 price index on December 2, 1998, although 20½ percent higher than at the beginning of the year, is underpinned by about the same earnings expectations as at the end of 1997 (*see figure*). The drop in long-term interest rates (by about 90 basis points) can, according to this approach, almost fully explain the gains in the S&P 500. Had interest rates not fallen but remained at their end-1997 levels, the implied earnings growth rate as of early December would be consistent with the S&P 500 being 235 points (20¼ percent) lower. Alternatively, to support current equity prices at end-1997 interest rates, the implied earnings growth would need to be about 90 basis points higher indefinitely into the future (*see figure*).[2]

From a historical perspective, implied earnings growth rates[3]—at about the same level as in the 1980s—can be considered high (see the bottom panel of the figure). The implied earnings growth rates, $g_t$, may not provide the best comparison of equity valuations over a long time horizon because they depend in part on the discount factor, $\rho_t$, and thus on the bond yield, $r_t$ , (see equation (3)). Bond yields are influenced by many factors that may distort intertemporal comparisons and are sensitive to market participants' inflationary expectations. A measure of implied earnings growth independent of expected inflation is the ratio of the (gross) nominal earnings growth rate to the (gross) nominal bond yield, which can be approximated by the spread between the earnings growth rate and the bond yield. This spread was at an all-time high in November 1998 (see bottom panel of the figure), raising questions about the sustainability of current high equity valuations.

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[1]R. Mehra and E. C. Prescott, "The Equity Premium: A Puzzle," *Journal of Monetary Economics*, Vol. 15, (1985), pp. 145–61, and J. Y. Campbell, A. W. Lo, and A. C. MacKinlay, *The Econometrics of Financial Markets* (Princeton, New Jersey: Princeton University Press, 1997), find a risk premium of about 6 percentage points. An 8 percent risk premium (instead of 6 percent) would shift the level of the earnings growth path plotted in the figure up by approximately 2 percentage points. Thus, the choice of the risk premium would not affect the comparisons of earnings growth between end-1997 and November 1998 so long as the risk premium did not change over this interval of time.

[2]Consider the following scenario that telescopes the needed changes in earnings into 1999. Assume that in 2000 and thereafter the paths for interest rates and earnings revert back to the paths implied at the end of 1997; in this case earnings would need to be about 5½ times larger in 1999 than in 1998 in order to justify the S&P 500 level in early December.

[3]Owing to data limitations, the historical implied earnings growth rates for 1954–98 were derived based on the 10-year U.S. treasury bond yield, rather than the 30-year bond yield.

similar risk exposures and became vulnerable to a continued widening of interest rate spreads; (4) risk management models did not prevent the buildup, and modern portfolio management exacerbated the unwinding, of the preponderance of credit risk convergence plays; and (5) a disorderly unwinding and deleveraging, if it

**United States: Earnings Growth and Share Prices**


Sources: Bloomberg Financial Markets, LP; Haver Analytics; and IMF staff calculations.

had been allowed to continue to build momentum, would have posed systemic risks in international financial markets.

Although these features provide some understanding of why the mature market adjustments occurred, taken together they do not provide an understanding of why the recent mature market turbulence was so extreme. The turbulence was extreme enough that it was judged to have posed threats to internationally active financial institutions, and potential systemic problems in the mature and international financial markets. The apparent under-estimation of the extent to which these vulnerabilities and risks had accumulated raises a number of systemic concerns, which are raised briefly in the third and final subsection.

## Why Did the Russian Crisis Create More Mature Market Turbulence than the Asian Crises?

The depth and scale of the recent financial market turbulence certainly cannot be explained by the potential direct impact of the unilateral debt restructuring in Russia. First, the value that could be lost from an outright default was relatively small, and only one-third of it was held by nonresident investors. Second, interest rates on Russian GKOs in the period leading up to the unilateral restructuring were high relative to the cost of borrowing by other emerging market sovereign credits. This suggests that investors were aware of the risks of lending to Russia, as reflected in the significantly higher returns that were necessary to compensate for the higher perceived risks. Indeed, financial markets should have realized that the economic and financial problems faced by Russia were significantly more protracted than in many other emerging markets. Finally, Russia was perceived as unique among emerging markets in one significant regard: long-standing political and foreign policy considerations implied to many investors that Russia might continue to receive the funds it required from the international community to finance the required adjustments. In effect, Russia was perceived as "too big to fail." Overall, these factors suggest that it is not obvious why the Russian unilateral restructuring would trigger a wholesale exit from emerging markets and a period of unprecedented turbulence in mature and international markets.

Nevertheless, for market participants the Russian unilateral restructuring seems to have been a defining event. The restructuring appears to have challenged fundamental assumptions about emerging market finance—widely held by the major financial institutions and priced into all but the safest investments—perhaps including a presumption that countries would not unilaterally restructure sovereign debt obligations. In the event, and regardless of the subjective reasons, the Russian crisis drove risk managers and investors to question the validity of their assumptions and the balance of financial risks in their international portfolios made up of investments in both emerging and mature markets.

Accordingly, risk reassessments implied that many portfolios might be riskier than risk management models had previously indicated, and that even mature market portfolios with even relatively low-risk combinations of emerging and mature market investments might be riskier than perceived before August 17. In addition to affecting emerging markets, developments in mid-to-late August, including the unwinding of mature market financing, led to a further widening of interest rate spreads between relatively low-quality advanced country fixed-income securities (such as asset-backed securities and low-grade corporate bonds) and very high-quality government (U.S. and German) debt securities, as the general flight to quality proceeded.

Unlike the Asian crises, the Russian financial problems triggered mature market turbulence because of differences in the nature of the shock. The Russian crisis was a unilateral restructuring of sovereign debt—a traded financial market instrument—that in a mark-to-market environment would immediately trigger the unwinding of leveraged positions by large, internationally active, financial institutions. In the Asian crisis, by contrast, the bulk of the financial contracts that immediately became at risk consisted of (nontradable) interbank loans. In addition, Russia's unilateral restructuring was a sudden and defining event, whereas the Asian crises developed more slowly in several stages. But the Asian crises, of course, contributed to the recent turbulence by already reducing appetites for risk. Another difference is that the Russian crisis occurred amid greater concerns about the health of the U.S. economy and the sustainability of the valuation of U.S., and other mature, equity markets.

Ultimately, the Russian unilateral debt restructuring triggered an abrupt, post-Asian-crisis flight from a wide range of emerging financial markets, a sharp widening of emerging market interest rate spreads to 1,700 basis points, and a drying up of liquidity in international capital markets. The related flights to quality and liquidity in international capital markets set off a process of deleveraging of financial transactions and virulent turbulence in mature financial markets that rapidly and sharply affected many investors and a wide range of mature financial markets.

## Mature Markets Financed and Leveraged Emerging Market Investments

At least some of the immediate impact on mature markets of the unilateral debt restructuring in Russia reflected the fact that a significant share of financing for Russian and other emerging market investments had been arranged and leveraged in the mature markets, in particular U.S. financial markets. For example, some investors had purchased Russian GKOs, on margin, through investment banks that had funded the purchases with short-term repurchase agreements and commercial paper in U.S. markets. Other Russian and emerging market securities purchases had been funded in Japan and swapped into local currencies or dollars. Accordingly, the initial unwinding of financing for emerging market positions, hedges, and leverage meant that mature market positions related to these investments also had to be unwound or hedged, because the Russian restructuring triggered margin calls and led to a widespread increase in margin requirements. Because many of the investments that needed to be unwound were highly leveraged, the downward price adjustments were unusually sharp in a wide range of markets. The leveraging of investments magnifies returns when asset prices are appreciating, but it also magnifies losses, and requires the expenditure of scarce capital to meet margin calls, when adverse price movements occur, thereby forcing market participants to liquidate positions as rapidly as possible. Thus, the simultaneous presence of a high degree of leverage in a wide range of interconnected markets forced a large number of investors simultaneously to sell assets into declining markets. This contributed to the rapid speed and heightened intensity of the downward price pressures and adjustments in September and October 1998 (Box 3.3).

The widening of spreads and liquidity pressures that immediately followed the Russian crisis and the flight from emerging markets destroyed value in fixed-income positions that had been predicated on the perception that "credit risk" spreads between low-quality (mortgage-backed securities and corporate debt, for example) and high-quality (sovereign) borrowers in the advanced countries had widened beyond sustainable levels because of the "Asian contagion." These so-called credit-risk "convergence plays" (not to be confused with EMU currency and interest rate convergence plays) were widely held. They were made up of financial positions in advanced country fixed-income markets in which the investor would simultaneously be "long" in relatively high-risk debt securities (such as U.S., German, and Danish asset-backed and corporate securities)—expecting their value to appreciate—and "short" in sovereign debt instruments of similar currency denomination and maturity (such as U.S., German, and Danish government bonds)—expecting their value to depreciate. The plays were calculated gambles that, once Asian contagion dissipated, credit spreads would narrow to more normal (historically consistent) levels and would be associated with the expected price movements. Instead of narrowing, however, credit risk spreads widened further. Depending on how the transactions were financed, these adverse price movements were associated with further margin calls, liquidations, and hedging, leading to further significant demands on the shrinking pool of liquidity. This led

### Box 3.3. Leverage

Leverage is the magnification of the rate of return (positive or negative) on a position or investment beyond the rate obtained by a direct investment of own funds in the cash market. It is defined as the ratio of assets to equity. Leverage is achieved by increasing the investment through either outright borrowing or derivative instruments. In the former case, a loan (including repurchase agreements) is used to supplement the equity investment, which is expected to have a rate of return higher than the interest rate on the loan. Instead of cash, the loan could consist of a security (as in short-selling operations). In the latter case, derivative positions (such as futures and options) allow the investor to earn the return on the notional amount underlying the contract by committing a small portion of equity in the form of initial margin or option premium payments.[1] To measure precisely the use of leverage by a firm, one needs to know all of the firm's positions. This is frequently not possible because activities such as repurchase agreements and derivatives take place off the balance sheet and are therefore not observable to an outsider.

Leverage is of concern because of two effects. By definition it creates and enhances the risk of default by market participants; furthermore, rapid deleveraging—the unwinding of leveraged positions—can cause major disruptions in financial markets by exaggerating market movements.[2] If the rate of return on an investment to which borrowed funds have been committed turns out to be less than expected, the investor's equity may very quickly diminish and become insufficient to cover the loans. In response to an adverse price movement, a leveraged position will be closed faster by an investor (with a given loss tolerance) than if it were not leveraged. The larger the leverage, the smaller is the needed price change to trigger an unwinding of the position. The need to quickly unwind large positions in response to margin calls following exogenous price movements can magnify these movements in a destabilizing manner. That is, a "long" leveraged position will be sold as a result of an exogenous price decline, thus contributing to the price movement even further. Conversely, a "short" position needs to be covered in a rising market by buying the security, therefore contributing to upward price pressure. While any (unleveraged) position would require similar actions, leveraged positions may increase volatility more rapidly.

If there are many similar leveraged positions, if there is a single large position, or if the underlying market is not very liquid, rapid deleveraging can create price disconnects (large price moves resulting from temporarily one-sided markets). These price movements in a mark-to-market environment will trigger margin calls or cause other investors to reevaluate their positions. This, in turn, will force the liquidation of more leveraged positions, resulting in a knock-on effect, which can send ripples through diverse financial markets spawned by leveraged positions.

Some institutional investors, such as hedge funds, employ leverage in various ways, aimed at designing strategies to bet on developments in many different markets by committing as little of their own equity as possible. The following hypothetical scenario illustrates how an institution can lever up its equity several times. It also shows how seemingly exogenous events can cause this strategy to unravel, magnifying the turbulence in financial markets (*see figure*). The example is inspired by, but does not necessar-

*(Box continues on next page.)*

[1]The degree of leverage for a futures contract can be defined as the ratio of the notional value (assets) to the margin posted (equity). The degree of leverage for an option contract can be defined as the delta times the underlying price, times the notional value, divided by the option premium.

[2]Leverage also has benefits not only to participants but to the system as a whole. It can be usefully employed to hedge an existing commitment in a cost-saving manner. It also facilitates speculation, which is necessary for the efficient functioning of markets and enhances liquidity. Furthermore, commercial banks are by their nature highly leveraged without necessarily building up leveraged positions as described in this box.

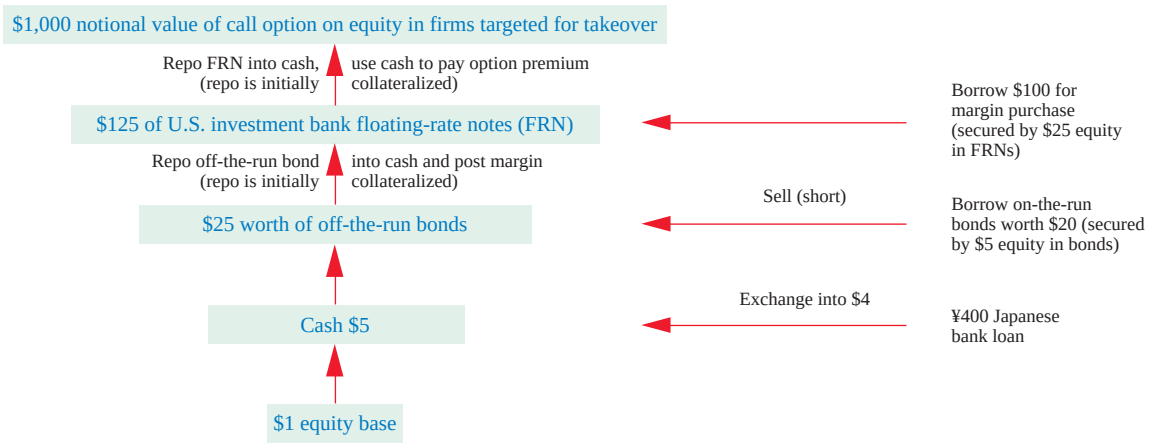
to even wider spreads in some markets as more positions were liquidated to make margin calls in other markets.

This adjustment process ultimately posed potential systemic risks because of its impact on market liquidity and dynamics. Market liquidity dried up temporarily even in the deepest and most liquid markets as risks were repriced and positions deleveraged. Anecdotal evidence suggests that this occurred in the U.S. treasury securities markets (in both August and September), the U.S. repo market (in October), and the yen/dollar market (during October 7–9). The drying up of liquidity had a visible impact on prices and flows, and there were repeated instances when concerns about liquidity were heightened, with markets becoming one-sided until prices declined enough to bring buyers back into the fray. There also appears to have been unusual concern about counterparty risk in collateralized markets, although this can be explained by the uncertainty surrounding the turbulence, most notably around the time of the near collapse of LTCM and in the early weeks of the unwinding of LTCM's positions. It was not clear how far asset prices needed to fall, or how badly counterparties' balance sheets had been damaged by the turbulence.

The potential for these dynamics to have systemic consequences was especially visible in U.S. dollar markets, the center of gravity for much of the portfolio rebalancing and deleveraging. Moreover, the dollar is the principal financial vehicle for international financial transactions and for managing liquidity, engineering leverage, and speculation. As noted in previous *International Capital Markets* reports, financial institutions and markets in the United

**Box 3.3 *(concluded)***

**Hypothetical Example of Leverage**




ily accurately reflect, positions alleged to have been taken by Long-Term Capital Management (LTCM). It is by no means unique; similar leveraged positions might also be taken by many hedge funds and investment banks alike.

The first layer involves an outright loan, using a small amount of equity to secure a yen-denominated loan in order to take advantage of the interest differential between Japan and the United States. The proceeds from the loan are exchanged into U.S. dollars and used as collateral to short-sell on-the-run government bonds.[3] The proceeds from this sale finance the purchase of off-the-run government bonds in the expectation that the yield spread between the two bond types would narrow. In the third layer of leverage, the fund would then use its long position in off-the-run government bonds as collateral to borrow funds under a repurchase agreement.[4] The pro-

[3]On-the-run securities are the latest issue of a particular maturity. Usually they are the most actively traded issues for a particular maturity. Off-the-run securities are the previous issues of the same maturity. For example, in October 1998 the on-the-run 30-year treasury bond matures in August 2028; the most recent off-the-run 30-year treasury bond matures in November 2027.

[4]The lender of cash in a repo may also demand a "haircut" (margin payment) to limit his credit exposure resulting from a decline in the price of the collateral. This margin payment would reduce leverage. While stock margins are 50 percent and exchange-traded futures margins are between 2 and 8 percent, haircuts on repos are between 1 and 2 percent. Hedge funds are often able to negotiate a zero margin. Without any cushion to accommodate fluctuations, a 4 percent price movement (see the text) on a few trillion dollars of assets serving as collateral in a repo would cause massive margin calls and result in a major market movement.

States have played the critical role of international financial intermediary. Some have interpreted this role as bestowing benefit on the U.S. economy: developments between August and October suggest that there are also significant costs and risks. However, although U.S. markets were most visibly affected by the turbulence, other mature financial systems were also at risk if the disorderly unwinding had continued to escalate.

The resulting dynamics experienced in the mature markets—in particular, dollar financial markets and yen/dollar currency markets—reflected the very high degree of leverage that accumulated in these markets through the late summer 1998. This high degree of leverage itself reflected the relatively low margin requirements on over-the-counter derivative transactions and the increasingly accepted practice of very low, or zero, "haircuts" on repo transactions. These and other features of modern finance may have increased the vulnerability of the involved markets, and the investors trading in them, to the kind of selling pressures, liquidity needs, rapid price adjustments, and illiquidity that ultimately occurred. These features and market dynamics ultimately exposed the international financial system to unexpected and unwarranted risks.

## A Large Number of Diverse Financial Institutions, Not Just Hedge Funds, Drove the Turbulence: An Asian Lesson Revisited

Partly because of the near collapse of LTCM and the publicity it attracted, there has been a tendency to exaggerate the role that hedge funds played in the ma-

ceeds of the repo could be invested in floating-rate notes (FRNs) issued by U.S. investment banks, earning a higher return than would be paid under the repo. The investor could lend these FRN securities back to the investment bank from which it had bought them through another repo agreement. As is common under repo agreements, the investor would continue to earn the floating-rate coupon on the FRN, which by assumption is higher than the rate the investor has to pay for the repo. Furthermore, the last repo frees up cash that can in turn be used for another investment, facilitating the increase in leverage through a derivative instrument. For example, the fund could buy a call option on equity of firms targeted for a takeover, which represents the fourth layer of leverage.[5]

At each stage of this strategy the assets of the institution are increased without committing further equity, leveraging up its equity base through a series of investments on margins, short sales, repurchase agreements, and derivative securities. It allows the firm to bet on yen depreciation, narrowing U.S. treasury yield spreads, rising U.S. investment bank FRN prices, and rising equity prices of takeover targets. Furthermore, some of these activities are not recorded on the firm's balance sheet. The initial loans and U.S. treasury positions will be booked on the balance sheet. However, the repos and the derivative transaction will facilitate off-balance-sheet activity.

[5]Balance sheet leverage is limited by two factors: underlying equity and requirements to hold capital against the assets created from the equity, which limits the number of times equity can be lent out. Leverage accumulated through off-balance-sheet derivative contracts is limited by the amount of margin payments counterparties require. If there is no margin payment, leverage can be unlimited.

The investment strategy illustrated in this example would have unraveled after the Russian debt restructuring when the flight to quality and liquidity widened the yield spread between on-the-run and off-the-run U.S. treasury bonds, and the turbulence and losses dampened prospects for the U.S. investment banking industry. The widening of the liquidity spread not only implied a loss on the second leg of the transaction, owing to relative price movements, but also triggered a margin call on the first repo as the value of off-the-run bonds serving as collateral was reduced. This meant the fund would not only have to buy on-the-run bonds when their price was rising to cover its short position, but also to sell off-the-run bonds in a falling market to meet the margin call. Similarly, the FRN securities in the second repurchase agreement dropped in price and would therefore also trigger a margin call. To raise the cash needed to meet the margin calls, the investor would likely sell the FRNs in the rapidly declining market. As rumors spread that a financial institution was in a liquidity crisis, counterparties would raise the "maintenance" margin to the level of the initial margin to ensure that the loss in value of collateral would not expose counterparties to credit risk. This in turn would accelerate the unwinding of leveraged positions, causing even sharper price movements. The FRN market seized up completely at the beginning of October. Similarly, the bond market experienced significant turbulence in the period of October 7–9, around the time that much of this deleveraging may have been going on. Furthermore, the continuous appreciation of the yen prior to October would have squeezed the fund on the first leg of the transaction, triggering a rush into yen to repay the initial loan, which is consistent with the observed sharp yen appreciation in the first week of October. This illustrative scenario shows how leveraged positions may have amplified the exogenous price movement triggered by the Russian crisis and spread the turbulance to other markets.

ture market turbulence. Within the large universe of 3,000 hedge funds, LTCM was a unique institution (Box 3.4). Like other bond arbitrage operations, its strategy was to profit from small price discrepancies in the safest securities markets in the world, a strategy pursued by other hedge funds and other financial institutions. LTCM was unique, however, in the way that it tried to magnify the value of seemingly low-risk, low-profit gambles by taking very high-volume and highly leveraged positions to a greater extent than most other hedge funds. It was viewed in the markets as having a large appetite for risk. Single LTCM trades would involve large positions (for example, one trade of $10 million worth of U.S. treasury securities) financed on 10 percent (or smaller) margin, in order to profit from interest rate spread changes of 1 or 2 basis points. By employing this strategy—high leveraging, with supposedly low-risk and low-return investments—a small profit from each trade potentially would be magnified, and the same trade would be repeated over and over again. Few hedge funds employed the scale of leverage that LTCM assembled.[17] In the end, both the leverage and the positions ultimately destroyed LTCM.

Although LTCM was the best-known loser from the kind of low-profit-margin, fixed-income position taking that became exposed to a widening of credit risk and liquidity spreads, other, much larger institutions took similar positions, in some cases with consider-

[17]See Barry Eichengreen, Donald Mathieson, and others, *Hedge Funds and Financial Market Dynamics*, Occasional Paper 166 (Washington: IMF, 1998).

### Box 3.4. The Near Collapse and Rescue of Long-Term Capital Management

Long-Term Capital Management (LTCM) manages an investment fund[1]—a hedge fund—that attempts to profit from (often small) discrepancies in the relative value of government bonds, fixed-income derivatives, equities and equity derivatives primarily in the U.S., Japanese, and European markets. The fund also invests in a few markets outside the G-7 countries. LTCM's traders are legendary for being the best and brightest technicians in the hedge fund community, and the firm is reported to have recorded total returns, after fees, of 43 percent in 1995, 41 percent in 1996, and 17 percent in 1997.[2]

In the week of September 21—amid market rumors about LTCM and some of its major creditors and counterparties, and concerns over potential liquidity problems in financial markets—the Federal Reserve Bank of New York (FRBNY) helped to organize and coordinate a $3.6 billion private rescue of LTCM by a consortium of 14 major international financial institutions. All of these institutions are either counterparties, creditors, or investors of the hedge fund. According to press reports and FRBNY press statements at the time, the rescue was seen as necessary for two reasons: LTCM's financial condition had deteriorated to the point where it might not be able to make either loan repayments or margin calls on its highly leveraged positions in U.S., Japanese, and European bond markets, and might require either recapitalization or liquidation; and immediate closure of LTCM would have worsened the financial condition of some already weakened international financial institutions and could have triggered a massive simultaneous sale of LTCM's collateral (securities) by creditor institutions. This would have further strained the stability of the world's major bond markets, creating the potential for debilitating and widespread spillovers and contagion, including in emerging markets.

#### *What Brought LTCM to the Brink of Collapse?*

LTCM specializes in fixed-income and equity convergence strategies, taking complex and leveraged positions in order to profit from (often small) discrepancies in the relative price of bonds, swaps, options, and similarly in the relative price of equities and their derivative instruments. The bulk of LTCM's investments are convergence trades in U.S., Japanese, and European bond markets—essentially gambles that interest rate spreads had widened beyond a sustainable level and would narrow and return to more normal spreads. These transactions typically have horizons of 6 to 24 months. These so-called convergence trades are based on the judgment, probably supported by asset-pricing models, that markets have been undervaluing relatively risky bonds (mortgage-backed securities, for example) and overvaluing low-risk bonds (G-7 government securities).[3] LTCM purchased or borrowed large volumes of relatively risky bonds and sold short G-7 government bonds. These positions were leveraged using borrowed funds from internationally active commercial and investment banks. At the beginning of 1998, on capital of just $4.8 billion, LTCM managed balance sheet positions totaling about $120 billion, implying a leverage ratio of 25-times-capital. At the same time, LTCM was managing total gross notional off-balance-sheet derivative contracts amounting to about $1.3 trillion. These leverage ratios and off-balance-sheet transactions did not change significantly in the months leading up to the August 1998 crisis.

LTCM's trading book was "long" in relatively illiquid, low-quality securities (mortgage-backed securities, advanced country junk bonds) and "short" in liquid, high-quality securities (U.S. treasuries and other G-7 sovereign credits). It was also short volatility in the main equity markets. Contrary to LTCM's judgment, interest-rate spreads widened throughout most of 1998 in most of the theaters of its operations—earlier in the year, as the intensification of the financial crises in Asia encouraged a flight to quality in the G-7 government securities markets and, later in the year, as the Russian involuntary restructuring of GKOs (ruble-denominated discount instruments) led to an even greater widening of credit spreads.[4] Similarly, implied volatilities reached all-time

[1]The fund is Long-Term Capital Portfolio.

[2]By comparison, the return to the S&P 500 was 34 percent in 1995, 20 percent in 1996, and 34 percent in 1997.

[3]Bankers familiar with LTCM's portfolio suggested that LTCM engaged in a lot of transactions involving total return swaps, which allow investors to profit or to lose from price movements on securities without actually purchasing them. For example, for an obligatory financing charge, LTCM would borrow asset-backed securities and receive both interest and capital gains or losses. The securities would have to be returned and the finance charge paid regardless of the value of the securities. LTCM's expectation was that they would lock in relatively high interest payments and at the same time receive capital gains as the value of these securities rose as the markets' assessment returned to normal.

[4]In 1997, LTCM is reported to have borrowed aggressively, and on relatively favorable terms, to increase its exposure and leverage as spreads widened, presumably on the strong belief in its technical judgment that spreads would ultimately narrow and that it would be able to manage its growing exposure.

able leverage.[18] These institutions included internationally active commercial and investment banks, brokers and dealers, and other institutional investors. While LTCM was alleged to have had $80 billion dol-

[18]According to an analysis by Salomon Smith Barney, balance sheet data indicate that investment banks are highly leveraged institutions. Gross leverage ratios (ratio of gross assets to equity) for the top firms range between 25 and 35, while net leverage ratios (ratio of gross assets excluding matched-book financing to equity) range between 10 and 20. These ratios exclude off-balance-sheet activities.

highs. During these flights to quality, liquidity dried up in the high-yield (high-risk) sectors of U.S., Japanese, and European bond markets, driving spreads even higher. Because of the illiquidity of its positions, and difficult market conditions, LTCM was unable to reduce the size of its positions and strategies. The losses associated with this divergence of spreads and increased volatilities reduced the hedge fund's equity (net asset value) from $4.8 billion in January 1998 to $2.3 billion in August. This resulted in an increase of leverage to 50-times-capital on its balance sheet positions alone.

In a September 2 letter to investors, LTCM informed investors that the value of the fund was down 44 percent in August and 52 percent for the year. LTCM also reported that losses occurred in a wide variety of strategies, distributed approximately 82 percent to relative value trades and 18 percent to directional trades; only 16 percent of losses were attributed to emerging market investments. On average, spreads continued to diverge in September. Through Friday, September 18, LTCM was meeting margin calls, in part by drawing on a long-standing $580 million credit facility headed by Chase Manhattan Corporation.

After it was determined that LTCM's financial condition had deteriorated to the point where it might not be able to service its debt obligations and make margin calls during the week, the FRBNY organized a meeting of LTCM creditors and counterparties and began helping to coordinate a private consortium to rescue LTCM. As of Tuesday, September 23, LTCM's equity position stood at just $600 million and was supporting balance sheet positions in excess of $100 billion, implying balance sheet leverage of 167 times capital; the hedge fund's losses on its highly leveraged positions (but not necessarily on the securities that it was holding) had wiped out 90 percent of its equity.

### *Why Was LTCM Rescued?*

At some point—probably culminating on Sunday, September 20, when staff at the FRBNY and the U.S. Treasury visited LTCM headquarters in Greenwich, Connecticut—the assessment was made that the potential for market disruption supported facilitating a private-sector solution, given the similarity of position taking by other large internationally active financial institutions and the large number of other institutions (including brokers and dealers) that held large inventories of securities across the credit spectrum. It was known by the banks and U.S. authorities that LTCM's exposure was large enough, and cut across a sufficient number of important markets, that if the fund were forced into a sudden and disorderly liquidation, markets around the globe could be disrupted as LTCM's illiquid securities were dumped at prices well below face value. The further widening of spreads and dramatic price dynamics that might have accompanied an immediate closing out and deleveraging of LTCM's positions would have entailed a simultaneous and massive trading of a large volume of securities by the large international financial institutions in New York, Japan, and Europe, posing risks of systemic proportions. The process could have led to many technical insolvencies. Given the number of institutions involved in these transactions, even a small probability of this occurring posed the serious systemic risk broadly encompassing financial markets.

The threat of a massive "fire sale" of LTCM's collateral did exist. Repurchase and reverse repurchase agreements are governed by a provision of the bankruptcy law that would have allowed LTCM's creditors to sell immediately the collateral that secured repos and swaps used extensively by LTCM if it were allowed to fail. With LTCM's large balance sheet exposures and additional large off-balance-sheet positions, a bankruptcy filing could have touched off a simultaneous and potentially destabilizing effort by all creditors to buy and sell the securities that were backing these huge repo and swap positions, at a time when markets were already strained and jittery. In the days before the rescue was arranged, the $1 trillion U.S. repo market was showing strains on market rumors and concerns about the credit quality of some leading investment banks. A liquidation of collateral would have had repercussions in the underlying repo and swap markets themselves—in New York, Japan, and Europe. There was growing evidence that liquidity in these important funding markets was drying up, and the mounting nervousness might have encouraged the FRBNY to arrange the rescue in order to avoid a panic and the potential for systemic problems. The private rescue by creditors was orchestrated, in part, to allow for a more orderly unwinding of positions and to remove the potential for a rapid draining of liquidity in the world's major securities markets, and the systemic risks that such an event might entail.

Most if not all of the credit supplied to LTCM by the major financial institutions was fully collateralized with high-grade paper, in most cases U.S. treasury securities (probably some of it off-the-run issues). Never-

*(Box continues on next page.)*

lars in balance-sheet arbitrage positions in U.S. treasury security markets, commercial banks alone were estimated to have had $3 trillion in similar exposures. The widespread position taking, the complexity of the layers of derivative and leveraged spot market transactions, and the relatively closed circle of counterparties created a potentially unsustainable balance and distribution of financial risks. The confluence of these institutions' positions led to a situation in which a rapid unwinding of LTCM's portfolios in fixed-income and equity markets might have meant not only that direct creditors and counterparts could have had

**Box 3.4 *(concluded)***

theless, potential losses on bank loans to LTCM might have resulted from adverse movements in the market values of this collateral were LTCM to default. There was also concern that many of the world's largest internationally active institutions stood to lose from a massive sell-off of positions and the liquidity problems it might create. But the predominant consideration seems to have been that a very large number and variety of financial institutions could have been affected by such a wave of selling and repricing. This could have disrupted financial markets around the world. One way to contain the potential systemic risk was to organize a private consortium of LTCM's main creditors and counterparties, in part to engineer a more orderly process of unwinding and deleveraging, but also to internalize many of the risks. The pooling and internalization of risk was possible because the consortium included many, if not all, of the financial institutions that would necessarily have been involved in the closing out and deleveraging of positions in the markets, because they are the major market makers, dealers, brokers, and counterparties. An additional benefit might be that some share of the transactions could be netted within the consortium, and others could be closed out and deleveraged within the consortium rather than in the markets, which would help to reduce selling pressures in the major markets. Alternative solutions could have been found with similar benefits. For example, a single buyer might have been found for LTCM, and there was at least one such interested party. In the short time available for finding solutions, however, such alternatives were not agreed by LTCM's partners and potential buyers.

The rescue of LTCM can be seen as an out-of-court bankruptcy-type reorganization of LTCM in which its major creditors have become its new owners in charge of every aspect of the business, with the objective of salvaging as much value from the wreckage as they can. With the benefit of hindsight, it is safe to conclude that the outright failure of LTCM would have posed significant risks of systemic problems in international financial markets, and that it was necessary to restructure LTCM. A more rapid and disorderly unwinding of LTCM's very large and highly leveraged fixed-income positions and related positions of other institutions could have triggered an even more destructive forced deleveraging in U.S., German, and Japanese fixed-income markets and in the major currency markets. This would have necessarily included equally disruptive selling pressures in the associated derivative markets, where the volume and notional value of transactions are several multiples of the volume and face value of the underlying securities. One can only speculate how much worse the market turbulence would have been had LTCM been allowed to collapse.

Two counter arguments against the Federal Reserve System's involvement in facilitating the private rescue of LTCM have been suggested. First, it has been argued, because LTCM was not subject to the Federal Reserve's supervisory and regulatory jurisdiction, it was inappropriate for the Federal Reserve to risk its reputation and goodwill. Second, the involvement of the central bank in facilitating the private rescue might entail moral hazard for institutions not ordinarily regulated or supervised by the central bank, or for institutions that ordinarily take on high leverage in their activities. Moral hazard clearly is a concern with any central bank or other official interventions in individual financial institutions. Because no public funds were necessary in rescuing LTCM, the moral hazard implications of this particular intervention would be limited to the signals implicit in the Federal Reserve's involvement. It is not possible to evaluate objectively the potential costs of these signals against the benefits of the Federal Reserve's involvement.

***Who Are LTCM's New Owners?***

A total of $3.625 billion was injected as equity into LTCM by 14 international financial institutions, many of them creditors: 11 institutions took equity stakes of $300 million (Banker's Trust, Barclays, Chase Manhattan, Credit Suisse First Boston, Deutsche Bank, J.P. Morgan, Goldman Sachs, Merrill Lynch, Morgan Stanley Dean Witter, Travelers, and Union Bank of Switzerland); 2 institutions took a $125 million stake (Société Générale, Lehman Brothers); and 1 institution took a stake of $100 million (Paribas).[5]

The new owners together own 90 percent of LTCM's equity for a period of three years (the remaining 10 percent is held by the original partners) and have the option to obtain 50 percent of the management company for a nominal fee of $1. Most new investors are reported to be hoping to be bought out before then. The terms of the agreement provide the private consortium with full authority over the investment strategy, capitalization structure, credit and market risk management, compensation, and all other significant decisions.

[5]Among the new owners, Union Bank of Switzerland had already announced the writing down of its original equity stake in LTCM of $685 million.

difficulties collecting on their contracts, but also that the wide array of other institutions holding similar positions could have been adversely affected by sharp price movements.

Some of the proprietary trading operations of commercial and investment banks rival in scale the operations of large hedge funds and at times may have more risky proprietary trading books than many hedge funds. In addition to taking positions on their own account, the globally active commercial and investment banks may encourage clients to take similar positions, and so the volumes of trades and capital these institu-

tions place are larger than their proprietary positions, and than the positions taken by hedge funds.[19] Much of this investment and trading activity takes place in the relatively safe fixed-income markets in the advanced countries.

Nevertheless, the hedge funds together have enough capital and are sufficiently highly leveraged to have a noticeable impact on market liquidity when they withdraw from markets during turbulence: they often are the first to exit a market, but they also often are the first to reenter.[20] However, it is doubtful that any single hedge fund, or small group of hedge funds, alone could pose a risk of systemic problems. Rather it was the simultaneous and interrelated involvement of a large number of players, including both hedge funds and many internationally active commercial and investment banks, that recently raised the potential for such risks.

## Why Did Risk Management Models Not Prevent the Buildup of Positions and Leverage?

The ultimate impact of the turbulence on bank balance sheets and profitability, and on the financial condition of other financiers and investors, raises questions about why so many sophisticated institutions may have engaged in similar positions. A key issue is: Why did risk management technologies (models, stress tests, and scenario analyses) and internal operational control mechanisms apparently not warn risk managers and top management about the growing vulnerabilities?

Modern risk management models are designed (and are used along with stress testing) to measure and assess the riskiness of portfolios on the basis of assumptions about the likelihood of outcomes that might put a firm's capital at risk and ultimately risk its solvency. Value-at-risk (VaR) models are one way of achieving this objective.[21] One problem with relying on these techniques is that they may provide a false sense of precision, in part because the output of models depends on inputs that depend on human judgment. Faulty assumptions—about the probability of adverse events, the structure of markets, cross-market price correlations, and within stress tests and scenario analyses—might have impaired the usefulness of models. The models also assume that market liquidity will be sufficient to allow positions to be closed out without extremely large price changes or market disorder. Moreover, because they usually rely on historical relationships between price movements in many markets, the models can break down during times of unusual stress and turbulence, particularly when structural breaks occur in cross-market relationships. Such structural shifts, even if temporary, may imply dramatic shifts in risk in portfolios, and call for a rapid portfolio rebalancing. Even asset managers who only employed normal principles of portfolio diversification might have called for reductions in emerging market and similar risk exposures and for increases in low-risk or risk-free assets (Box 3.5). If many investors adjust large portfolios simultaneously in the same direction, market liquidity would tend to be adversely affected.

High-tech computer-driven portfolio management techniques, such as portfolio insurance[22] and dynamic hedging,[23] are supposed to have helped firms to minimize their losses and maximize their gains when these techniques worked, but they probably also exacerbated large volumes of sell orders flowing into declining markets where buyers and sellers were uncertain about who owned what risks and how they should be priced. Risk components that in normal circumstances would have remained isolated became blurred, and liquidity and counterparty risk considerations came to the fore as key concerns. At a time when there already may have been heightened concern about credit, market, and settlement risks, market participants appear to have intensified their focus on whether securities could be liquidated quickly if necessary (liquidity risk) regardless of the quality of the paper. It is this kind of blurring of risks, the intermittent, absolute focus on market liquidity, and the almost automatic nature of some position-unwinding and liquidity-seeking trades that could explain unusual developments in some market segments. One such example is the sharp rise in the premium on off-the-run over on-the-run U.S. treasury securities, which increased to more than 35 basis points in at least one segment of the market (possibly when LTCM was liquidating its long position in off-the-run U.S. treasuries).

## Threat of Systemic Problems: Accelerated Deleveraging and Widening of Spreads Surrounding the Near Collapse of LTCM

By late August 1998 the initial widening of credit risk spreads likely contributed to pressures on the port-

[19]Hedge funds obtain most of their operational financing from, and place their trades with, the large commercial and investment banks. The banks are seen by hedge funds as "front-running" the hedge funds' own position taking. Because of this front-running behavior, many hedge funds see commercial and investment banks as a threat to their returns. This is one of the reasons why hedge funds are so secretive about their positions and use complex trading strategies and tactics.

[20]See the 1997 *International Capital Markets* report.

[21]VaR models measure how much of the firm's capital could be lost because of swings in the value of its portfolio.

[22]Portfolio insurance is a technique that changes a portfolio's market exposure systematically in reaction to prior market movements, with the objective of avoiding large losses and securing as much participation as possible in favorable market movements.

[23]Dynamic hedging is a position-risk management technique in which option-like return patterns are replicated by adjusting portfolio positions to offset the impact of a price change in the underlying market on the value of an options position (the "delta"). Dynamic hedging relies on liquid, continuous markets with low transaction costs.

### Box 3.5. Risk Management: Progress and Problems

The most familiar risk management model is the value-at-risk (VaR) model.[1] The VaR model measures how much of the firm's capital could be lost owing to swings in the value of its portfolio, given a host of assumptions about correlations among security prices, the way that security prices move over time, and so forth. More technically, the VaR model estimates the loss on the firm's portfolio that should be exceeded with no more than a certain probability, given a model for changes in the prices of all the assets in the portfolio. For example, a firm's VaR might indicate that its losses over the coming week should exceed $10 million with no more than 5 percent probability.[2] Financial institutions base VaR calculations on historical data, and some also use stress tests, in which scenarios are simulated. Regardless of the methodology, if the potential loss is too large, the firm might rebalance, or hedge, part of its portfolio to reduce the value at risk. Some financial institutions also allocate capital on the basis of results of VaR and similar models.

Prevailing risk management practices focus on market risk, for which modeling is advanced and has reached a reasonable level of performance. Modeling of market risk entails formal models of the behavior of the prices of the assets making up the portfolio. A simple VaR model might assume that changes in the value of each asset in the portfolio are normally distributed and independent across time, with correlations and variances that change slowly. Such models would also tend to assume that the structure of markets is relatively simple and stable; for example, that the relationship between stock and bond prices is simple and does not change sign or magnitude, or that the complex relationship of a derivative security to its underlying security can be well approximated by a simpler relationship.

However, models of market risk have, over time, revealed weaknesses, owing primarily to their heavy reliance on historical data and relationships. Such analysis tends to understate the likelihood of extreme events and often involves the assumption that the processes generating market prices are stable. Recent events have underscored that rare, "fat-tailed" events can occur more frequently than expected, that correlations can increase and change sign suddenly, and that volatility can increase sharply without warning. Moreover, it is also presumed that market liquidity will be maintained so that positions can be closed out when necessary without adverse price declines.

Significant gaps also remain in the modeling of other types of risk, particularly credit and liquidity risks.[3] Credit risk modeling is still in its infancy, in part because credit risk is difficult to model: defaults are rare, and the risk of default evolves over time in a complicated fashion. However, the bulk of risk on balance sheets consists of credit risk; indeed, credit losses have been the key source of financial distress.

Even less advanced is the modeling of liquidity risk—the risk that transactions cannot be executed without

[1]For further discussion of recent advances in risk management, see the September 1998 *International Capital Markets* report, Annex V.

[2]Philippe Jorion, *Value at Risk* (New York: McGraw-Hill, 1997) provides technical details of risk management models.

[3]Other types of risk—which for the most part remain to be quantitatively addressed—include legal and operational risks; see Jorion, *Value at Risk.*

folios of the major financial institutions and LTCM, and the rebalancing and deleveraging of mature market portfolios accelerated. Although the Russian unilateral restructuring might have been perceived as a significant event for traders in New York, London, and Frankfurt, an important wake-up call for mature market position takers occurred in early September, when LTCM announced that 52 percent of its capital had been spent on margin calls, only 16 percent of which were related to emerging market investments (see Box 3.4). This apparently triggered rounds of speculation, selling, and counterparty concerns in the international markets. At that time, LTCM also had engaged in fund raising to try to increase capital to sustain its convergence plays long enough for interest rate spreads to converge.

Fears in the markets that many other institutions might be holding similar positions created substantial uncertainty about counterparty risk and generated rumors, which probably contributed to heightened market turbulence even after LTCM's rescue by a private consortium of its creditors and counterparties had been agreed. In the week beginning October 5, while the consortium was beginning to unwind and sell off LTCM's complex positions, there were several waves of turbulence (especially during October 7–9). The yen/dollar market, in particular, experienced extreme turbulence as the financing of global investments from Japan was abruptly unwound and the dollar fell sharply against the yen. As discussed earlier (see Box 3.1), this unprecedented yen/dollar adjustment was partly the result of the unwinding of the "carry-trade," in which investors around the world borrowed yen cheaply, swapped into other currencies (probably mostly dollars), and then purchased assets with higher returns in a wide range of countries and markets, including U.S. government securities. Much of the liquidity-driven (and large volumes of) trading that accompanied the further widening of spreads, the dramatic depreciation of the dollar, rumors of failing financial institutions, and other uncertainty-creating events was probably partly driven by the actual unwinding and deleveraging of positions by the consortium on behalf of LTCM and by consortium members.

unsettling markets. Liquidity risk may have been the most significant type of risk in the recent turbulence, since a lack of liquidity may have been responsible for some of the price disconnects that occurred.[4] Liquidity risk can make risk management extraordinarily difficult. For example, firms that take positions under the assumption that the positions can be unwound smoothly if events turn against them sustain larger-than-expected losses when they attempt to unwind in illiquid markets.

There are likewise significant gaps in the modeling of the nexus of market, credit, and liquidity risks, gaps that came into sharp focus during the Asian crises and in the aftermath of the Russian devaluation and moratorium.[5] For example, in the recent turbulence, market risk itself gave rise to credit and liquidity risks. In some cases, firms that had significant paper gains vis-à-vis emerging market counterparties were unable to collect these gains as counterparties went bankrupt: while market risk had moved in banks' favor, counterparty risk had moved just as strongly against them. Similar problems arose when large market moves sharply reduced the value of collateral. In other instances, large market moves created selling pressures, which in turn impaired market liquidity and gave rise to liquidity risk.

These problems—the unstable nature of market risk, the difficulty of modeling credit and liquidity risk, and the highly complex relationship between them—also undercut attempts to hedge. Banks that hedged the ruble exposure in GKOs (ruble-denominated discount instruments) through forward contracts with Russian banks faced losses on both the GKOs and hedges. Also, during the recent market stresses, assets that usually were uncorrelated or negatively correlated, and hence offered diversification or hedging, declined together as liquidity evaporated.

Successful risk management requires human judgment, including a balanced (lack of) respect for statistical models built on historical data. Another human factor is the interaction between the risk management and business functions in banks; sometimes, the dictates of risk models are overridden by business units in pursuit of, for example, a strategic relationship.[6] Indeed, within financial institutions there is a tension between taking risk during market upturns and managing the risk from market downturns.

There are two lessons for risk management from the market turbulence of the past summer and fall. First, risk management should promote a conservative and comprehensive approach to risk; a piecemeal approach clearly can miss significant risks and the interactions among them. Second, in risk management as in other areas, complex, formal models can complement but cannot fully substitute for judgment and experience.

[4]There is also a different type of liquidity risk (the ability to roll over funding). See Jorion, *Value at Risk*.

[5]For an approach to modeling both market and credit risk, see Theodore M. Barnhill, Jr., and William F. Maxwell, "Modeling Correlated Interest Rate and Credit Risk" (unpublished; Washington: George Washington University and Georgetown University, October 1998).

[6]See Bank for International Settlements, "On the Use of Information and Risk Management by International Banks: Report of a Working Group Established by the Euro-Currency Standing Committee of the Central Banks of the Group of Ten Countries" (Basle, October 1998).

Some trading was also likely to have been generated by the uncertainty over whether the emerging market contagion would spread to Latin America, in particular Brazil. It was not until after the U.S. Federal Reserve's second interest rate cut on October 15 that market pressures began to ease.

It is uncertain how much more deleveraging will occur in the period ahead. The manner in which markets adjusted; the apparent price disconnects in usually deep and liquid, but temporarily thin, markets; the panic-driven rumors; and other aspects of the turbulence strongly suggest that the unwinding that had to be accomplished to reach more comfortable risk levels was unusually large relative to underlying balance sheet positions. However, given the limited availability of transaction data, and the infrequency and incompleteness of the reporting of derivatives market transactions, it is not possible to assess the degree of leverage remaining in the system that might create further turbulent dynamics in the future. Considering that the process of deleveraging that followed the bond market turbulence in early 1994 took some eight months to complete, and that the price and flow adjustments at their nadir in the more recent episode were in many respects unprecedented—in particular the massive shifts out of relatively risky and illiquid assets—it would seem that the process of deleveraging may still have some distance to go, although presumably not with the extreme tensions that developed in September and early October.

While the preceding analysis provides some understanding of why the Russian crisis and some features present in mature markets might lead to a reassessment of risks and rebalancing of emerging and mature market portfolios, this understanding is not entirely reassuring. In particular, the associated surprisingly large flights to safety and liquidity, the rapid drying up of liquidity in international capital markets, and turbulence in a wide range of mature markets—defined at times by price disconnects and near seizures in some markets—all appear to have been out of proportion to the factors that triggered them. Thus, the overriding concern is not that the reassessments and portfolio adjustments occurred; instead, it is that they

were so violent and widespread that they might have posed systemic risks for world financial markets and significant downside risks to the world economic outlook.

## Shortcomings in Risk Management and Implications for Prudential Regulation and Supervision

As has been suggested, deficiencies in both private and systemic risk management probably contributed to the recent financial market turbulence. In private markets, a large number of diverse market participants were apparently surprised by sharp adverse price movements in asset markets, and this suggests that they engaged in excessive risk taking, excessive leverage, and ultimately an unsustainable structure of financial positions.[24] In addition, they may have paid insufficient attention to the interplay of market and credit risk. This confluence of mistakes might have created an accident waiting to happen. On the public side, although public systemic risk management in the period September–November 1998 alleviated the threat of a systemic problem in international markets, at least two lines of defense—banking supervision and market surveillance—that would ordinarily safeguard against the buildup of such a threat did not appear to provide sufficient warnings.

### Weaknesses in Private Risk Management

Financial systems have several lines of defense against systemic problems. The first are the risk management systems and internal management control mechanisms of private financial institutions that are designed to prevent them from taking excessive risks that could ultimately threaten their capital position and viability. In view of the extent of losses suffered by a number of large institutions, the degree of surprise associated with those losses, and the reaction of equity prices for these institutions, risk management systems appear to have not worked very well for a large number of diverse and systemically important financial institutions, including many of the internationally active commercial and investment banks, proprietary trading desks, market makers, broker/dealers, and foreign-exchange traders/dealers. Bank loan books had already become somewhat weakened by the Asian crises and were eroded further by the Russian crisis in August 1998. The profitability of trading books was also affected by the emerging market turbulence through the Asian and Russian crises, which induced a shift to advanced country fixed-income markets and the currency markets, and most notably the yen/dollar market. Many players appear to have been involved in convergence plays, in part because yield curve plays were not lucrative given the compression of the term structure.

The evidence suggests that many market participants did not adequately anticipate or understand the risks that were realized in the period mid-August through mid-October 1998. Several systemically important internationally active financial institutions appear to have made similar, if not the same, misjudgments in their risk assessments, risk management, and investment strategies. This suggests that management command and control systems now used by these financial institutions may be flawed, and raises concerns about the adequacy of risk and portfolio management systems and operational controls within some international financial institutions. The systems now in use apparently have not adequately incorporated some of the lessons of the 1994–95 Mexican crisis—some mistakes appear to have been repeated in the 1997 Asian crises—and some deeper-seated problems surfaced in the recent management of advanced country portfolios during the most recent turbulence. During the Mexican crisis, some investors made significant paper gains on their trading books by shorting the peso with Mexican entities, but they could not collect their sizable gains because the Mexican counterparty did not survive the peso devaluation. In the most recent turbulence, similar mistakes appear to have been made. Internationally active banks extended credit to LTCM and also were counterparties to some of LTCM's transactions without adequately understanding the size, complexity, and riskiness of LTCM's balance sheet and off-balance-sheet positions. As is now known, some creditors held many of the same positions as LTCM. At least some of the turbulence in 1998 probably could have been avoided if a more integrated approach to market and credit risk management and position taking had been the normal practice when the positions were being taken weeks, months, and years ago. This also was a lesson apparently not learned during the Asian crises. Greater diligence in credit risk assessment and oversight of credits to LTCM and other hedge funds also might have diminished the extent to which their exposures made creditor and counterparty institutions vulnerable to this kind of turbulence.

Risk management models and modern techniques of portfolio management typically presume that positions can be closed out in orderly, liquid, continuous markets, with low transaction costs. These conditions are unlikely to be present during times of stress and turbulence. Similarly, although market risk assessment and management appear to have reached a sophisticated level, and have met with some success in containing private risk in normal markets, such systems can break down in times of stress and turbu-

[24]During the past two years, central banks have voiced concerns about credit standards, the relaxation of loan covenants, and compressed interest rate spreads.

lence, when market correlations suddenly shift. In addition, the near collapse of LTCM, and the potential counterparty risk its failure posed, can be seen as a warning sign that some banks may not be devoting sufficient attention to credit risk assessment and management. Moreover, previous crises, and now the mature market turbulence, strongly suggest that sophisticated financial institutions with diverse ranges of semi-independent operations have not yet found a fully satisfactory way to assess the level of consolidated risks at the institutional level, and in particular do not yet fully incorporate (into their position taking, financing, and leverage) an adequate understanding of the impact of market risk events on credit risk assessments. Finally, the recent turbulence in the mature markets indicates that liquidity risk is an important area that also may not be sufficiently well understood.

It is tempting to blame the shortcomings in the application of modern quantitative approaches to risk assessment, risk management, and portfolio management to failures in the risk management technologies and systems themselves. The technical details of models, the sensitivities to assumptions, including the assumed probabilities of adverse events in stress testing, and the excessive risk tolerance limits may all be part of the problem. But an equally important shortcoming may be the element of human judgment required to implement these technologies and systems and to assess the economic and financial environment. Also relevant are the incentives within these organizations to maximize short-term gains and individual bonuses, at times at the expense of the firm's overall risk exposure and longer-term profit. In this regard, greater diligence, especially surrounding creditor and counterparty relationships between the major financial institutions and the hedge fund LTCM, was probably called for.

The recent turbulence also appears to have extended beyond the aggregation of the individual responses to margin calls and the need to unwind, deleverage, and hedge positions as protection against the adverse consequences of owning assets in declining markets. In particular, the impact of the simultaneous rush of many investors to close out positions and deleverage seemed to have been magnified by the inability of international financial markets to absorb the first round of the Russian unilateral restructuring. The process of adjustment seems to have taken on a life of its own through the structure of linkages between the relatively small circle of counterparties; the high, and perhaps excessive, degree of short-term competitive pressures; the complex manner in which the positions were originally financed, leveraged, and hedged; and the diversity of mature markets, currency denominations, and maturity structures that facilitated these transactions. In short, there also seemed to be systemic components that contributed to the virulence of the mature market turbulence that few, if any, participants fully anticipated. Accordingly, the market turbulence, and the issues raised by it, also need to be examined at the systemic level.

## Public Systemic Risk Management

An important line of defense against systemic problems is financial supervision and regulation. Modern financial institutions are complex organizations, and the risks taken by them may not always be fully understood by those who manage them. How, then, can supervisors be expected to make informed judgments about whether institutions are financially sound? Finding operational answers to this difficult question for the industrial countries of North America, Europe, and Japan, of a form that can be applied with reasonable consistency for a wide range of internationally active commercial banks, is the continuing task of the Group of Ten (G-10) banking supervisors under the auspices of the Basle Committee on Banking Supervision. The established approach, which relies on quantitative rules, such as the Basle capital ratio, has proved useful in providing enhanced discipline for risk taking by covered institutions—although there have been instances where the rules have apparently not been rigorously applied. However, it is also widely recognized (Box 3.6) that the established Basle approach has significant deficiencies, especially in the area of off-balance sheet activities, which are of substantial and growing importance for most, large, internationally active commercial banks.[25] This has led the Basle Committee to consider alternative approaches that would supplement present rules with supervisory assessments of the adequacy of risk management systems and systems of operational controls (see Box 3.6). In this regard, the recent experience suggesting significant deficiencies in the performance of risk management and operational control systems in at least some systemically important institutions clearly raises important concerns upon which the Basle Committee and others interested in effective bank supervision will need to reflect.

It is not evident that any system of supervision or surveillance could have identified these problems as they were actually developing. Nevertheless, it seems plausible that some of the excessive risk taking and leveraging could have been avoided if home national supervisors, and those responsible for market surveillance, knew more about the buildup of both balance sheet and off-balance-sheet positions, leverage, and both the aggregate amount and distribution of risk taking in national and international markets. For example, LTCM was known, and even advertised, to have a

[25]These deficiencies have been discussed in previous IMF *International Capital Markets* reports.

### Box 3.6. Supervisory Reforms Relating to Risk Management[1]

Structural changes in financial markets have encouraged international bank supervisors and the Basle Committee on Banking Supervision to shift gradually from "rules-based" to "risk-focused" methods of supervision, particularly in setting capital requirements for market and credit risks. Despite some progress in the treatment of market risk, recent events have exposed shortcomings in the treatment of credit risk, as laid out in the 1988 Basle Accord. These shortcomings are primarily in three areas: the distortions arising from risk weights, including on interbank claims and sovereign debt of OECD countries; the disregard of the effects of the business and credit cycles on credit risk; and the neglect of the broader operating environment for banks in emerging markets. Measures to address such shortcomings are under discussion by members of the Basle Committee and other international groupings of financial supervisors.

Encouraged by the rapid changes in the structure of financial markets and perceived shortcomings of past approaches, supervisors are gradually changing emphasis, focusing less on static concepts of risk and more on the systems and procedures that firms use to measure and manage risk. Leading the way within this new paradigm have been supervisory changes to capital requirements relating to market risk. The Basle Committee's 1996 guidelines on capital requirements for market risk, which became applicable and mandatory for internationally active banks on January 1, 1998, represent a watershed in the regulatory treatment of capital. The new requirements allow banks to use their own internal models for the determination of market risk capital. While only a few countries have banks with models that pass muster, their sanctioned use has raised issues about the role of regulatory capital more generally.

Notwithstanding this recent progress, three shortcomings remain in the regulatory treatment of credit risk. First, distortionary effects of the capital accord arise from the arbitrary manner in which the risk weights are assigned. For instance, under the 1988 Basle Accord, short-term claims on banks from any country carry a relatively low (20 percent) risk weight, leading to a lower cost of borrowing in the interbank market and a heavier reliance on interbank funding.[2] Also, the accord assigns a zero risk weight to instruments issued or guaranteed by OECD governments. It has been suggested by some Basle Committee members that the OECD designation has served as a "stamp of approval" and has encouraged banks to steer funds to OECD emerging markets rather than to non-OECD countries with equivalent or lower sovereign risks.

The second shortcoming is the arbitrary and unchanging 8 percent minimum capital assigned to risk-weighted assets. The constancy of this capital requirement over the business and credit cycles is viewed by some as unnecessary and undesirable. An alternative is to require banks to hold a higher ratio of capital to risk-weighted assets during the cycle's upswing, for two reasons. First, some cushion above the 8 percent minimum would be in place when the business cycle turns down. Although capital may be above the required minimum at the peak of the cycle, the additional buffer may not be sufficient in light of the increased risk. Second, at the peak of the cycle, the riskiness of banks' assets may be well above the average for the cycle, but the 8 percent minimum does not adjust upward as the cycle matures to take account of the increase in risk. Indeed, the risk of a sharp downturn in asset quality is probably highest at the peak of the business cycle, but current capital standards do not account for this dynamic. There is also a well-documented "credit cycle" in most countries, with banks moving down the credit curve as the cycle expands, taking on more and more risk. To the extent that the credit cycle tends to coincide with the business cycle, as it likely does, this would tend to augment the risk of a sharp downturn in asset quality during the mature phase of the business cycle. A minimum capital requirement that acknowledged these dynamics in credit risk and varied with risk over the business cycle would help to accommodate these risks.

[1]This box draws heavily on the September 1998 *International Capital Markets* report, Chapter V.

[2]See Box 5.8 in *International Capital Markets*, September 1998, for the accord's current risk-weighting scheme for on-balance-sheet assets.

large appetite for risk.[26] If the institutions that provided credit to facilitate LTCM's position taking and leverage had been encouraged to come to the judgment that LTCM was an excessively risky counterparty, then LTCM might not have gone as far as it did in taking risk. Likewise, had LTCM's counterparties not been so exposed to high-risk positions with as many high-risk players, the buildup would have been more limited.

Another line of defense against systemic problems is financial market surveillance. For example, the U.S. Federal Reserve's involvement in the markets means that it has continuous access to market intelligence and information. Moreover, to fulfill its mandate to ensure U.S. financial system stability, it has over the years de-

[26]LTCM's original prospectus warned investors that "it is expected that the Portfolio Company will generally be very highly leveraged, and that such leverage will generally be higher than that of other typically leveraged investment funds" and that "returns are anticipated to be volatile, especially on a monthly and quarterly basis."

A third shortcoming is the neglect of the banking system's larger operating environment. The 8 percent minimum was set with the industrial countries' banking systems in mind. The accord's adoption by many developing countries, where economic business cycles have larger swings and the operating environment for banks is much riskier, means that these banking systems are less protected than those in industrial countries. These problems argue for a more flexible approach toward capital requirements for credit risk in which a broader view about risk is incorporated.

Members of the Basle Committee recognize such deficiencies and are discussing the merits of a possible revision to risk weights. Members' suggested revisions to the capital accord include promoting better implementation, altering risk weights to better reflect actual risk, and incorporating portfolio-based risk models along the lines of capital requirements for market risk. U.S. Federal Reserve Board Chairman Alan Greenspan has advocated an increase in the risk weight on short-term interbank claims, which would raise the cost of borrowing, discourage excessive use of interbank funding, and encourage securitization of short-term claims. Other suggestions have included additional requirements that would need to be met before a zero risk weight could be applied to OECD sovereign debt, such as transparency and disclosure about the financial sector and implementation of the Basle Core Principles. The International Swaps and Derivatives Association (ISDA) has promoted a mixed approach involving the current accord, a modified version of the current accord, and a portfolio-modeling approach to capital requirements. Despite the pressures to move on the topic, the Basle Committee is likely to maintain its consensus-oriented deliberateness.

A reevaluation of the role of capital is also under way within the International Organization of Securities Commissions (IOSCO) and many of the securities commissions it represents. In the former regime, capital protected securities firms against unexpected liquidity shortages, allowing them to meet daily settlement flows and initiate an orderly windup if necessary. As banks and securities firms become increasingly involved in similar products and business activities, it has become less clear whether the different motives for capital requirements for the two types of firms still make sense. Level playing fields and regulatory arbitrage mean that capital requirements for banks and securities firms are unlikely to be far different for long.

Since market risk is the dominant risk faced by securities firms, capital requirements for market risk are likely to be a significant part of any unified approach. For example, the U.S. Securities and Exchange Commission (SEC) is already trying to determine how best to gain experience with the use of VaR models in the determination of capital requirements. In the United Kingdom, the Securities and Futures Authority (SFA), to be merged into the Financial Services Authority, has released a consultative paper outlining the impact of the introduction of the European single currency on its regulatory capital regime. The SFA is using this opportunity to revisit a number of issues.

While credit risk capital requirements are beeing debated, supervisory guidance dealing with operational and other risks is also being considered by both the Basle Committee and IOSCO. Recognizing that operational failures are the most common cause of financial institution failures, the two organizations are promoting operational controls and guidelines. Previous guidance issued by the Basle Committee has covered internal controls associated with specific areas of banks' activities, while the recent document, "Framework for the Evaluation of Internal Control Systems,"[3] provides a framework for a complete evaluation of internal controls for all on- and off-balance-sheet activities. The IOSCO initiative, "Risk Management and Control Guidance for Securities Firms and their Supervisors," combines risk management and operational controls as part of a larger goal of managing all types of risk—market, credit, legal, operational, and liquidity—noting that risks can come from both internal (for example, insufficient internal controls) and external sources (for example, sharp price changes). The principles of good risk management and control systems are intended as benchmarks against which firms and supervisors in each jurisdiction can judge the adequacy of their control systems.

[3]Basle Committee on Banking Supervision, "Framework for the Evaluation of Internal Control Systems" (Basle, January 1998).

veloped sophisticated research and surveillance functions, which include aspects of banking supervision as well. Given the turbulence that occurred, and its statutory mandate for ensuring financial stability, the Federal Reserve reached the judgment that it needed to facilitate a private rescue of LTCM as well as reduce the cost of liquidity. Together these measures fenced in an important aspect of the ongoing turbulence—by internalizing some of the unwinding of the positions of LTCM and the other financial institutions that had similar positions—and eased liquidity pressures in the markets when such action was most needed. The final cut in mid-November probably was taken, in part, as insurance against a relapse.

Probably no system of market surveillance, in particular of the U.S. financial system, could have accurately foreseen what unfolded during the turbulence in September and October. However, the bouts of turbulence, illiquidity, price disconnects, and other features of the sharp dynamics strongly suggest that the turbulence that erupted in the aftermath of the flight from emerging markets in mid-1998 may have been partly

the result of pressures that accumulated over a long period of time—in particular, during the long "bull" runs in fixed-income markets. The potential risks associated with these developments—which could have been triggered by some event that threatened the positions held by the large and diverse group of financial institutions—clearly should have received greater attention. Moreover, disclosure requirements for the unregulated hedge funds are limited, and so their activities are not transparent to all stakeholders. Indeed, market behavior during the summer and fall suggest that there may not be sufficient disclosure and transparency for even the most sophisticated players to know enough about the credit and counterparty risks they are taking.

Another observation is that public systemic risk management did not become proactive about the potential accumulation of financial vulnerabilities and disturbances until some of their adverse consequences were becoming painfully apparent. Warning signs were present almost two years ago when some central banks suggested that equity valuations were beginning to look unsustainable (irrational exuberance), credit risk spreads were unusually narrow and compressed, and loan covenants and nonfinancial terms were being relaxed. With the benefit of hindsight, it is possible to suggest that absent from these concerns were warnings that the degree of (off-balance-sheet) leverage was potentially becoming excessive, that credit extension to high-risk enterprises (hedge funds) was widespread and also possibly excessive, and that there was an excessive amount of position taking on the faith that mature market credit risk spreads would narrow once the "Asian contagion" dissipated. This suggests that there should be a more heightened awareness about potential financial vulnerabilities and disruptions when they are least expected—when economic and financial conditions are favorable and, in particular, when expansions in economies are reaching a mature stage. It is at the top of business and credit cycles as credit risk spreads narrow, when there are strong incentives to improve asset returns through leverage, and when bank capital appears ample.

* * *

The difficulties encountered in September and October 1998 suggest that financial markets can be adversely affected by the manner in which individual financial institutions react to market pressures, stress, and turbulence, particularly when many of them hold similar highly leveraged positions. Mistakes appear to have been made by systemically important, internationally active financial institutions, and it appears that management command and control systems should be reassessed to better cope with the risks inherent in modern financial markets. It is a necessary first step to enhance disclosure of the financial activities of financial institutions, particularly the least regulated among them. This can enhance the ability of both private and public sector stakeholders to assess financial risks and to understand where the risks reside. The widespread application of private risk management systems, which could benefit from greater disclosure, also should be reassessed in light of recent experience. These systems appear to have not incorporated some lessons from the Mexican and Asian crises, which could have aided institutions in avoiding vulnerabilities exposed by the most recent bout of turbulence in mature markets. Because many of the involved institutions are part of their national financial safety nets, supervisors and regulators need to be closely involved in this reassessment.

In addition to the adverse developments related directly to behavior of individual financial institutions, the mature market turbulence also seemed to have reflected features of the international financial system, including the highly integrated and complex nature of financial position taking, institutions, and markets, and in particular the linkages of financial positions across national and international markets. These linkages derive in part from basic elements of financial transactions, such as the need or desire to finance, leverage, hedge, and risk-manage diversified portfolios of claims. The linkages themselves, the dramatic nature of the position unwinding and deleveraging, and the severe price dynamics and illiquidity in the interconnected markets together revealed the possibility of significant problems in how the international financial system—composed of the interconnected national and international financial markets—performs in the presence of heightened financial vulnerability, stress, and ultimately excessive turbulence. Particularly disturbing is the revelation that otherwise deep and liquid mature (dollar-based) and international (yen/dollar) markets experienced difficulties in absorbing what appeared initially to be relatively moderate shocks.

The feedback effects of the growing market tensions, illiquidity, and rapid market dynamics intensified pressures on market participants to shed risk and acquire liquidity rapidly, which apparently impaired the ability of the mature financial markets to smoothly and efficiently facilitate the closing out and deleveraging of positions and exposures. Distinctions between credit, market, liquidity, and operational risks apparently became blurred as replenishing liquidity became the driving force behind risk assessment, asset pricing, and portfolio rebalancing. Ex ante, few would have expected this to occur in deep and liquid financial markets. This suggests that private risk models and their underlying principles of risk management and portfolio management have a tendency during periods of stress and turbulence to accelerate dynamics in declining markets, which in this most recent episode led to a temporary drying up of liquidity in even the most liquid markets.

The role of banking supervisors and those responsible for market surveillance in warning about the accumulation of increasing levels of risk and leverage in the mature markets is also an issue of concern. The argument often heard in the aftermath of the Asian crisis was that no one could see through the opaque financial structures and markets. Yet the markets and institutions that experienced the turbulence this summer and fall are the most open and transparent in the world. Why then were potential dangers not more accurately perceived at an earlier stage?

The features of the international financial system revealed by the turbulence in the period mid-August through mid-October 1998 suggest that neither private market participants nor the institutions in charge of prudential supervision and market surveillance have a full understanding of the ever-changing nature, structure, and dynamics of the rapidly changing international financial institutions and markets.[27] This, of course, is not an entirely new problem, and it is not a problem that possesses a complete and final solution. Rather, the difficulties revealed by recent financial market turbulence testify to the urgency of continuing efforts, in the private and public sectors, to improve the performance and enhance the stability of the international financial system.

[27]U.S. Federal Reserve Board Chairman Alan Greenspan made this observation in his remarks, "Risk Management in the Global Financial System," before the Annual Financial Markets Conference of the Federal Reserve Bank of Atlanta, in Miami, Florida, on February 27, 1998. In referring to the dramatic changes that have occurred in what was characterized as "the global financial system," Chairman Greenspan observed, "We do not as yet fully understand the new system's dynamics. We are learning fast, and need to update and modify our institutions and practices to reduce the risks inherent in the new regime."