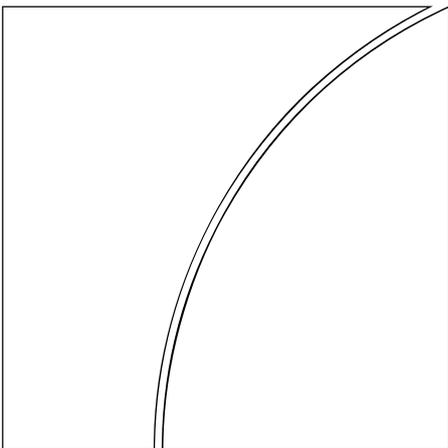


Committee on the Global Financial System



Collateral in wholesale financial markets: recent trends, risk management and market dynamics

Report prepared by the Committee on the Global Financial
System Working Group on Collateral

March 2001



BANK FOR INTERNATIONAL SETTLEMENTS

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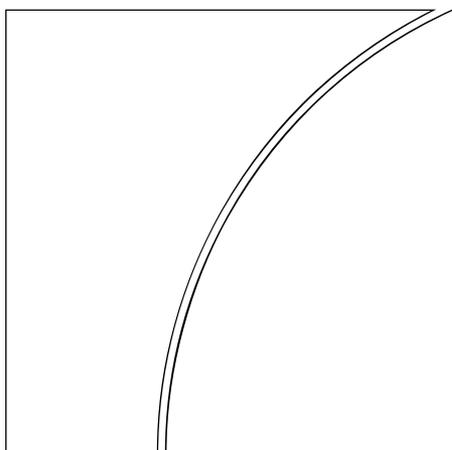
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Executive summary and principal conclusions

Purpose of study

The use of collateral has become one of the most important and widespread risk mitigation techniques in wholesale financial markets. Financial institutions extensively employ collateral in lending, in securities trading and derivatives markets and in payment and settlement systems. Central banks generally require collateral in their credit operations.

Over the last decade, the use of collateral in wholesale financial markets has grown rapidly. The collateral most commonly used and apparently preferred by market participants are instruments with inherently low credit and liquidity risks, namely government securities and cash. With the growth of collateral use so rapid, concern has been expressed that it could outstrip the growth of the effective supply of these preferred assets. Scarcity of collateral could increase the cost of financial transactions, slow or inhibit financial activity and potentially encourage greater reliance on more inefficient non-price rationing mechanisms, such as restricting access to markets.

These developments suggest two questions for exploration. The first is to what extent trends in the use of collateral and its supply have created or have the potential to create a relative scarcity of low-risk, liquid collateral and, if such scarcity emerges, how markets could adjust. The second is how such adjustment mechanisms and other changes in collateral usage might alter market dynamics and the risk management demands on financial institutions, particularly in stress periods.

Trends in the use of collateral and the potential for relative scarcity

Collateral-using activities have expanded rapidly in recent years, spurred by growth in securities and derivatives trading, the development of secured payment and settlement systems, and the expansion of financial activity worldwide. Increased attention to risk management has spurred the growth of financial transactions relying on collateral to manage large credit risks, such as those between dealers, or counterparty risks in complex market risk exposures. The increase in collateralised transactions has occurred while the supply of collateral with inherently low credit and liquidity risks has not kept pace. Securities markets continue to grow, but many major government bond markets are expanding only slowly or even contracting. The latter phenomenon was particularly evident in the United States in the second half of the 1990s.

Concerns about an increasing scarcity of low-risk, liquid collateral have been based on the expectation that demands for collateral would continue to expand faster than the stock of preferred forms of collateral. Over the last few years, the rate and direction of change in both the use and the supply of collateral with low issuer and liquidity risks has become more uncertain. The evolution of credit risk instruments and management techniques, such as securitisation, credit derivatives and portfolio models of credit risk, has the potential to affect both the use and the effective supply of collateral. New methods of managing payment and settlement risk could greatly influence the use of collateral. Changing patterns of issuance of securities could affect its supply. At present, however, market participants interviewed for this study found little evidence of scarcity, although they noted the rapid current and prospective growth of collateral needed to support payment and settlement activities, including access to intraday credit and new clearance and settlement mechanisms in some markets.

Slower growth of or an outright reduction in collateral with low issuer and liquidity risks has apparently elicited market responses and is likely to evoke further adjustments, the wide variety of which substantially allays the concern about a general scarcity. As relative prices adjust to a changed supply of preferred types of collateral, institutional investors would have an incentive to make more of the securities they hold available for securities lending; securitisation techniques could be applied to develop instruments with high credit quality and liquidity; and other issuers might be encouraged to enhance the transparency and market liquidity of their securities, thereby making them more attractive as collateral. Greater efficiency in collateral use, including perhaps the wider use of central counterparties, represents a further way to offset a scarcity of preferred collateral. In addition to the above effects, some types of demand for collateral are likely to be highly sensitive to its cost, limiting the extent to which any given shortfall of supply would tend to cause the price of collateral to rise.

Current issuance trends suggest that shortfalls of the stock of preferred collateral may eventually lead to appreciable substitution into collateral having relatively higher issuer and liquidity risk. In sum, the

market responses would change the risks associated with the use of collateral and would therefore have implications for risk management and market dynamics.

Issues for markets

While the risk-reducing effects of collateral are undisputed, its use may nevertheless generate undesired externalities. Collateral practices influence market behaviour, and the adjustment of collateral standards in stress periods may add to market disturbances. Case studies of market disturbances in which collateral arrangements have played a significant role suggest that risk management failures begin in normal times, often in the presence of high degrees of leverage by financial institutions. Risk management shortcomings and the distortions they introduce are especially problematic when a market disturbance spurs market participants to rush to correct their errors. Such a rush can greatly exacerbate a market disturbance once it begins by sharply changing the market access and liquidity needs of market participants who are not at the epicentre. If major market participants respond with a general tightening of collateral standards, systemic pressures are likely to be intensified. Widespread liquidation of collateral following defaults can similarly generate severe strains for both holders and providers of collateral. Under such conditions, margin calls are one of several mechanisms in financial markets that can add to selling pressure and an overshooting of prices. If prices move sharply enough, margin calls may force providers of collateral to sell assets on a large scale in order to meet margin requirements. The 1987 equity market crash followed this dynamic, and elements of it played a major role in the “global margin call” of 1998. The overshooting effect on prices may be amplified if the sell-off of assets provokes additional margin calls, forcing market participants to sell in an already falling market.

Given these dynamics, three areas of change in collateral practices are of special interest. The potential for increased use of collateral with higher issuer risks and/or lower liquidity than cash and government securities creates new risk management challenges for financial institutions and possible changes in market dynamics, especially under stress conditions. The linkages among markets are growing, but institutional, operational and legal differences across these linked markets persist, potentially becoming contributors of stress. Factors such as a lack of transparency or the presence of concentration may impede the ability of market participants to manage their credit exposures effectively across unsecured and collateralised markets.

Collateral other than government securities and cash

An expansion of the range of collateral to include instruments beyond government securities and cash introduces new risks that need to be managed carefully. Among them are (a) the price volatility of the collateral itself, particularly if it lacks liquidity; (b) possible negative correlation of changes in the value of the collateral with changes in the exposure being collateralised; and (c) possible positive correlation of changes in the value of the collateral with changes in the creditworthiness of the obligor. The use of more diverse forms of collateral places a greater onus on the methods used to value collateral, both at the outset and over the life of the exposure, and on the assessment of the liquidation value of the collateral in stressed markets. Identifying risk exposures in these dimensions often requires stress testing.

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The effects of institutional differences across markets

In normal times differences in the institutional features of markets – including legal and operational differences – provide a diversity of marketplaces to meet market participants’ needs and the opportunity for arbitrage across markets. Provision of collateral is one mechanism for arbitrage as well as an important linkage between markets. In situations of market stress, the linked markets may be subject to rapid and large price adjustments. Differences in market practices may result in an uneven pattern of adjustment across the markets, which may in turn cause severe liquidity distress and potentially insolvency. An example is the liquidity pressure caused by margin calls in one market segment that cannot be met by receiving cash from an offsetting position held in another market.

Given the trend toward closer integration of markets, market participants need to identify and analyse differences in the legal, operational and institutional features of an ever expanding array of markets. While differences across markets contribute to a diversity of interests and risk profiles for market participants and also may in some circumstances slow the spread of market distress from one marketplace to another, it seems worthwhile periodically to weigh these benefits against those that might flow from greater harmonisation of legal and operational differences. The balance between these two categories of benefits seems likely to change over time. Efforts along these lines are under way in both the private and the public sector.

Structural features of markets

Two structural features of financial markets seem particularly important, given the growth of collateral use. The first is the impact of an increasing use of collateral on unsecured creditors. Ceteris paribus, the provision of assets as collateral reduces the pool (and perhaps the quality) of assets available to a firm's general creditors in the event of its default. In practice, it is difficult to draw any specific conclusions regarding the extent to which unsecured creditors are disadvantaged, in large part because the ability to use collateral may expand the range of assets and the profit opportunities available to the firm providing collateral. But as a rule it seems likely that the impact on unsecured creditors depends on the extent to which those creditors have the necessary information and skills to assess how collateralisation affects the risks and rewards to which they are exposed, and the ability to adjust their exposures and terms and conditions accordingly.

One determinant of the ability of unsecured creditors to analyse and renegotiate their position is the degree of disclosure by financial market participants. Disclosure of collateral-related information on the extent to which assets are pledged and on the liquidity of a counterparty may be essential to the efficient functioning of the financial markets. Public disclosure of the first is generally limited and should be improved. Disclosure of the second in the private negotiation of trading agreements appears to have been improving since the events of 1998, but public disclosure is still limited.

The second structural feature, increasing concentration in collateralised markets, may affect how these markets perform in periods of market stress. Concentration in collateral markets is high and comparable to that found in other trading markets. In part, increasing concentration reflects the same forces that have over time narrowed the number of traders in most financial products, as well as the broad consolidation trend within the financial industry. Concentration in markets where collateral is used may amplify the market dynamics associated with the use of collateral in stress periods because difficulties at one of the few critical participants might put substantial pressures on counterparties and the markets for securities used as collateral.

Main report

Background and structure of the report

The use of collateral has become one of the most important and widespread risk mitigation techniques in global financial markets. Financial institutions extensively employ collateral in lending, in derivatives markets and in payment and settlement systems. Central banks require collateral in most of their refinancing and other credit operations.

The motivation for the Committee on the Global Financial System (CGFS) to analyse the role and the systemic implications of the growing use of collateral is twofold. First, the markets for collateral are undergoing fundamental changes. The use of collateral is increasing in areas of particular relevance for financial stability, namely wholesale trading markets, such as derivatives, and in payment and settlement systems. At the same time, the pool of available collateral is changing as many important government bond markets are characterised by slower growth – and even shrinkage – while issuance of fixed income securities by the private sector increases. Second, although the stabilising effects of collateralisation are widely acknowledged, the use of collateral and related market practices contributed to market disruptions in the summer and autumn of 1998.

Against this background, this report assesses recent trends and developments in the demand for and supply of collateral, with a special emphasis on possible adjustments to a relative scarcity of low-risk, liquid collateral and the role of collateral in influencing market price volatility and liquidity under stressful market conditions. The report addresses specific risks associated with the use of collateral and related risk management techniques and the impact of collateral on market dynamics and financial stability.

The report draws on a wide range of studies and surveys of the collateral markets produced in recent years.¹ The CGFS Working Group on Collateral compiled information on current central bank collateral practices, updated tables from recent studies, reviewed several case studies involving either the introduction of new forms of collateral or market disturbances that may have been associated with the use of collateral, and interviewed a small number of market participants on collateral practices. The Working Group also reviewed preliminary findings from ongoing studies by the Basel Committee on Banking Supervision touching on collateral management practices.

The *first chapter* deals with the main forces driving the demand for and supply of collateral. It summarises major trends in the private sector use of collateral and provides an overview of central bank collateral practices.

The *second chapter* addresses the private and social benefits and costs of the use of collateral and the role that collateral risk management and transparency play in exploiting the benefits of collateral as a risk mitigation technique.

The *third chapter* deals with the impact that collateral practices have on the performance of financial markets under stress. It reviews the role of collateral in past stress episodes, analyses the ways in which collateral practices affect market dynamics, and highlights key factors that may exacerbate market stress. Finally, it addresses the role of market linkages and concentration both in collateralised markets and in markets for assets serving as collateral.

The *fourth chapter* presents the report's conclusions.

¹ Several reports by Basel-based committees have dealt with issues related to collateral. The *Report on OTC derivatives: settlement procedures and counterparty risk management* (1998) by the Committee on the Global Financial System (CGFS) and the Committee on Payment and Settlement Systems (CPSS) coordinated a survey of OTC derivatives dealers' practices and analysed weaknesses in these practices from the point of view of counterparty risks. The report presented further analysis of the implications of reported delays in documenting and confirming transactions, the potential expansion of clearing houses and the rapidly expanding use of collateral. The main objectives of the CGFS report *Implications of repo markets for central banks* (1999) were to enhance central banks' understanding of their economic and monetary policy role and to identify measures to stimulate their development, soundness and efficiency. The CPSS and International Organization of Securities Commissions (IOSCO) report *Securities lending transactions: market development and implications* (1999) describes the participants in securities lending markets and the structure of typical transactions. The report suggests a series of sound practices, in particular in the area of collateral management.

1. The market for collateral: forces driving demand and supply

In general terms, collateral can be defined as an asset or a third-party commitment that is accepted by the collateral taker to secure an obligation of the collateral provider.² The primary function of collateral is to protect against a default of the counterparty. Collateral is broadly used by a variety of entities in different financial transactions: lenders in credit markets, including repo markets; one or both counterparties in derivatives transactions; central counterparty clearing houses; members of payment systems; and central banks for their open-market and other credit operations.

The objective of this chapter is to lay the groundwork for a detailed analysis of collateral risk management and the impact of collateral in periods of market stress in wholesale financial markets, covered in the later parts of the report. Section 1 summarises general trends in the demand for and supply of collateral. Section 2 discusses perspectives for the use of collateral and Section 3 addresses the collateral practices of central banks.

1.1 Trends in the use of collateral in the wholesale financial markets

Uses of collateral

Financial institutions such as banks or securities dealers use collateral mainly in three areas of their wholesale activities. The first is in the cash market in the form of repo or reverse repo transactions.³ A repo is the sale and subsequent repurchase of securities at a specified date and price. As repos have a “cash leg” and a “securities leg”, collateral is an inherent part of such transactions. Repos are employed to finance and hedge dealer positions and to create short-term assets with low credit risk, underlining the either “cash-driven” or “security-driven” character of the transaction. The second area is the collateralisation of positions in derivatives markets. Here, the use of collateral reflects the wish to largely offset the counterparty risk associated with some or all of the transactions employed to manage market price risk via derivative contracts. Third, in payment and settlement systems, collateral is used to manage credit risk, but also to enhance liquidity. This is particularly evident in arrangements where real time gross settlement (RTGS) processes are used which require a high availability of liquidity throughout the day, provided through collateralised intraday credit.

In recent years, these collateral-using activities have expanded rapidly. Four important secular changes are responsible. The first is the general expansion of trading, which has increased transaction volumes and risk exposures, and therefore the need for risk mitigating techniques in cash and derivatives markets. The growth in trading activities has been accompanied by growth in payment and settlement activities. The second is the expansion of financial activity globally to include a broader range of participants, thereby introducing new types of counterparties and new or additional credit risks which collateral can help manage. The third is the widespread adoption of techniques to manage and reduce payment and settlement risk, seeking to balance access, liquidity, finality and credit considerations. These techniques have increased the use of collateral in payment and settlement systems. Finally, a greater sensitivity to risks following a series of market disturbances in the 1990s, especially the financial crisis in 1998, has given further impetus to the use of collateral as a risk mitigation technique. At the same time, it should be noted that collateral markets are in different stages of an evolutionary process. In the United States, where collateralisation of trading exposures has been a longstanding feature of securities markets, this process may be more advanced than in Europe, where repo markets have developed more recently.

Repo transactions have grown quickly since the 1980s. Major forces driving repo market growth have been improvements in the financial infrastructure, in the legal framework and in risk management techniques. Together, these have reduced transaction costs. The sharp expansion of government securities markets created large inventories of assets suitable as collateral. Additionally, repos were adopted or more actively used as monetary policy instruments by most central banks in industrial

² In this report, the terms “provider” and “giver” of collateral on the one hand and “receiver” and “taker” on the other are used synonymously.

³ Repos and reverse repos can be defined as one form of a broader group of transactions that comprise a temporary exchange of cash against securities (comprising repos, securities lending and sell-buyback transactions). Although the legal structure of these instruments differs, they are very similar in economic terms (see CPSS/IOSCO (1999)). In this report, repo (transaction) is employed as a generic term for all these transactions.

countries. In the United States, outstanding repos and reverse repos of securities dealers grew by an average 13.5% a year in the second half of the 1990s, amounting to US\$ 2,500 billion by mid-2000. In the euro area countries, the start of EMU caused a strong expansion of repo transactions, and cross-border activity has grown significantly. The market, however, still faces obstacles that to some extent hamper arbitrage across the currency area, such as differences in the legal and tax framework across countries and a lack of integration of market infrastructure. The repo market in the United Kingdom also experienced strong growth following the introduction of gilt repos in 1996, and after a period of somewhat slower growth there are tentative signs that growth has stepped up again. The size of the Japanese repo markets has increased sharply in recent years and the share of international transactions has grown, especially with the expansion of the Japanese government debt.

Table1
Repo market in selected countries¹

	Transactions with all counterparties								Transactions with non-MFIs ² only	
	US ³	FR ⁴	UK ⁵	JP ⁶	IT ⁷	DE ⁷	BE	SE ⁸	Euro area ⁹	NL ⁹
	USD	EUR ¹⁰	GBP	JPY	EUR ¹⁰	EUR	EUR	SKR	EUR	EUR
1990	777.8				11.0					
1995	1520.4	240.3		11079.8	77.3					
1996	1649.8	322.8		11945.5	85.2					
1997	2194.5	320.2	74.9	9979.5	87.4				211.0	
1998	2372.0	296.4	97.1	11516.5	93.3				183.9	
1999	2517.1	159.1	102.5	20798.6	122.5	81.2	111.7		155.3	
2000	2636.8	149.1	138.2	22661.0	163.7	137.8	97.7	400.0	186.2	6.2
in US dollars										
2000	2636.8	240.0 ⁷	206.0	197.2	137.8	119.6	90.9	42.2	173.3	5.8

¹ In billions; amounts outstanding at the end of the year; for 2000, latest available data; end-year exchange rates applied. Cross-country comparability of the figures is limited owing to differences in measurement concepts. ² MFIs are monetary financial institutions. ³ Repurchase and reverse repurchase agreements of US government security dealers. ⁴ Repurchase agreements of French government security dealers. ⁵ Gilt repo and sell/buy-backs; data refer to November. ⁶ Total amount outstanding in the bond repo market. ⁷ Repurchase agreements of domestic monetary financial institutions with other sectors. ⁸ Repurchase agreements on government bonds and mortgage securities; rough estimates. ⁹ Domestic repurchase agreements of monetary financial institutions. ¹⁰ For EUR, euro conversion rate applied also prior to 1999

With the development of derivatives markets in the mid 1970s, another important area for collateralisation emerged. Exposures in exchange-traded derivative transactions are typically fully collateralised within short timeframes by margin payments required by clearing houses. In over-the-counter (OTC) derivatives markets, collateralisation of exposures with cash and government securities has grown significantly but unsecured derivatives exposures still predominate. One factor behind this growth is the range of transactions where collateral is used; that range has broadened beyond "traditional" credit enhancement to a general means of managing counterparty risk.

Traditionally, most OTC market participants have had high credit ratings, and for them collateral use was not deemed necessary. Lower-rated participants, however, typically have had to post collateral when dealing with higher-rated counterparties. Concern over the credit quality of such counterparties has been a significant force driving market participants' entry into collateral arrangements. In the 1990s, however, it has become increasingly common for dealers (and some highly rated customers) to enter into collateral arrangements in order to control overall credit risks in their trading operations and use their capital (both economic and regulatory) more efficiently. Collateral can allow business activity

to expand when uncollateralised credit lines are exhausted. Moreover, market participants report that collateral is becoming increasingly common in international transactions and long-term derivatives contracts such as 30-year interest rate swaps. Transactions with non-bank financial intermediaries such as pension funds are frequently collateralised. In some cases, end users seek two-way collateral agreements in order to limit their credit exposure to financial institutions.

Another factor behind the increasing use of collateral in OTC derivatives transactions is that the European markets, where collateral has been less widely accepted than in the United States, have advanced rapidly in complexity (International Swap and Derivatives Association (ISDA) (1999)). Nevertheless, in Europe and Japan, the collateralisation of transactions in local markets and especially with end users still seems to be relatively less developed compared with US markets.

ISDA estimates the total value of collateral in circulation across the privately negotiated derivatives industry by end-1998 to be in the range of US\$ 175-200 billion (ISDA (2000)). This relates to a gross market value of OTC contracts outstanding of US\$ 3.2 trillion as of end-1998. For 1999, ISDA presumes that the amount of collateral pledged may well be larger.⁴

A third field where collateral is widely used is payment and settlement systems. In several countries, intraday credit for large-value RTGS systems is provided on a collateralised basis. In Europe, the role of collateral in the payment system has increased since the early 1990s when RTGS systems were set up in most countries. With the start of EMU and the introduction of TARGET, the euro RTGS system has been established on the basis whereby intraday credits have to be fully collateralised. In payment systems operating on a net basis with deferred settlement or on a hybrid basis, collateral is utilised in some G10 countries.⁵ Many settlement systems process cash and securities lending-related services that are collateralised.⁶

Sources of collateral

A very broad range of assets may in principle serve as collateral. In the markets where the desire for effective protection against credit risk is the predominant motivation for collateralisation, liquid assets without credit risk or with at most low credit risk are the preferred collateral. The range of securities accepted as collateral in derivatives markets is limited to government securities, traditionally mainly US Treasuries, but increasingly European and Japanese government securities. The use of cash⁷ as collateral in derivatives transactions has gained in importance since the end of 1999. While this was originally attributed to Y2K considerations, these cash positions, according to ISDA, remained in place through the first quarter of 2000. Although cash has to be reinvested (creating additional credit risk), the respective money market transactions may for many market participants be less complex and costly than the ongoing management of a portfolio of securities. In payment systems, government securities have been the primary form of collateral, followed by mortgage bonds and cash, although the range of assets accepted as collateral is broader in several countries, notably in the European Union. The greatest variety of collateral is used in the repo markets, partly reflecting the role that repo transactions play in the direct financing of securities holdings and in short-selling positions. Although government securities are the main underlying asset used in repo transactions in all major countries, mortgage-backed securities or Pfandbriefe are frequently used.⁸ In addition, more firms globally are beginning to accept equity as collateral for financing arrangements (CPSS/IOSCO (1999)). Transactions such as equity repos can reduce financing costs for dealers while offering cash lenders a higher interest rate if they are willing to take the added risk of equity compared to collateral with a lower risk profile.

⁴ This largely confirms the results of the survey of OTC derivatives dealers' practices presented in the CGFS-CPSS *Report on OTC derivatives: settlement procedures and counterparty risk management*. According to these results, dealers with the most advanced programmes collateralise transactions with between 10% and 30% of their counterparties (CGFS/CPSS (1998), p 22).

⁵ For a detailed cross-country comparison of payment systems, see CPSS (2000), pp 112 ff.

⁶ See CPSS/IOSCO (1999) for a detailed description.

⁷ In theory, cash is the perfect collateral. The assets traditionally used as collateral, such as government bills and bonds, exhibit characteristics that make them close substitutes for cash. In practice, cash collateral is provided in the form of bank deposits and is thereby subject to operational risks related to the transfer of these deposits or the risk that the depository institution defaults.

⁸ ISDA (1999) explicitly recommends more institutions consider widening the pool of acceptable collateral, for instance by including high-quality corporate debt.

Against the background of these uses of collateral, two broad trends in the supply of collateral are particularly important. On the one hand, securities markets – for fixed income instruments as well as for equities – continue to grow strongly worldwide, thereby increasing the pool of assets available as collateral. Debt securities outstanding issued by non-financial corporations, financial institutions and governments in G10 countries amounted to US\$ 25 trillion by mid-September 2000, reflecting an average annual growth rate of about 6% since 1994.

In contrast, the composition of this expanding pool of securities is changing significantly. The supply of government bonds, often seen as the preferred type of collateral, is increasing slowly, stagnating or even shrinking in major countries, with the notable exception of Japan. As a result, by end-September 2000 US government paper had a share of 29% of all bonds issued by US residents, compared to 44% in 1994. In the same period, the market share of government bonds has also fallen in several European countries, while it has increased by more than 10 percentage points in Japan. Corporate issues show the highest growth rates, although in many cases, including most continental European bond markets, starting from a very low level. Additionally, debt securities issued by financial institutions such as asset and mortgage-backed securities continue to be on the advance. Finally, there seems to be a general tendency towards longer maturities, although it remains an open question whether this reflects a secular trend or the current level of long-term interest rates, which in most countries is low by historical standards. Equity issuance has boomed recently, particularly in Europe.

These trends change the overall *risk profile* of the available pool of collateral. With a growing weight of private sector paper, credit risk becomes increasingly important compared to a world where government securities are predominant. Private issues tend to be smaller and more heterogeneous than those of the government. Additionally, there exist virtually no liquid derivatives markets for private sector fixed income securities. As a result, private issues are basically less liquid and more difficult to value and to hedge than government securities, as indicated by larger bid-ask spreads and higher price volatility. That said, an important distinction may be made between the highly rated issues of financial institutions, including asset-backed and mortgage-backed securities in the United States and in Europe, on the one side, and corporate bonds on the other. The risk profile of asset-backed and similar instruments may be seen as standing between those of government and corporate issues, as indicated by yield spreads and perceived levels of liquidity and credit risk. Finally, an increasing duration of bonds outstanding is associated with higher market price risk of collateral if these become part of collateral portfolios.

1.2 Perspectives

General trends

The future trends in the uses and sources of collateral depend on a broad range of factors that are interrelated and partly work in opposite directions. Recent trends suggest further – potentially quite significant – growth in the use of collateral.

Market participants' perceptions of the creditworthiness of counterparties and appetite for credit risk are two determinants of demand for collateral. Over time, increased competition in both the financial system and the real economy has tended to narrow profit margins and has contributed to a decline in the average creditworthiness of both bank and non-bank counterparties. Increased pressure on margins in the financial sector creates pressure to take more risk, which in turn has accommodated increased market access for a broader range of participants. To look ahead, it is uncertain whether credit risk in the financial and non-financial sectors will increase on average and whether such an increase would be of a permanent nature. For example, an offsetting factor to such a trend might be reductions in leverage in the corporate sector.

The willingness of market participants to bear credit risk may be affected by advances in credit risk management and transparency. The development of new techniques to assess the credit risk of individual counterparties and of portfolios of credit exposures is an example of important advances in credit risk management still gathering momentum. These advances may encourage and enable participants more actively to manage and mitigate the credit risk they incur. Similarly, work under way in the public and private sectors to enhance transparency and make information vital to a credit assessment more widely available represents another such initiative in this area.

Table 2:
Size, growth and structure of bond markets (domestic and international issues) ¹⁾

Country	Size ²⁾	Growth ^{3, 4)}				Structure ^{3, 5)}					
	Total	Total	Government	Fin.institut	Corp.	Government		Financial institutions		Corporations	
	March 2000	December 1994 – March 2000				Dec. 1993	March 2000	Dec. 1993	March 2000	Dec. 1993	March 2000
United States ⁶⁾	13524.1	9.3	1.5	15.5	10.3	43.6	27.5	36.6	51.5	19.8	20.9
Japan	5404.0	6.1	8.8	-1.5	2.4	63.3	74.1	20.1	12.6	16.6	13.3
Germany	2253.9	6.8	2.7	9.0	20.4	43.0	33.7	55.5	63.3	1.4	3.0
Canada	638.4	5.5	3.4	18.8	12.1	85.1	74.8	5.4	11.3	9.5	13.9
France	920.4	4.4	7.9	-1.5	11.6	41.1	50.5	48.5	33.8	10.3	15.7
United Kingdom	935.4	10.6	6.2	17.7	14.5	62.4	48.5	20.0	29.5	17.6	21.9
Italy	1306.1	7.4	5.5	13.0	31.2	82.6	73.8	16.4	22.4	1.1	3.7
Belgium	347.9	3.2	3.0	3.4	4.2	62.6	61.7	31.4	31.9	6.0	6.4
Luxembourg	13.4	35.0	-2.9	39.7	24.1	4.3	0.6	66.2	82.0	29.5	17.5
Netherlands	396.1	9.4	2.8	18.4	13.0	62.9	42.7	28.7	47.0	8.4	10.4
Sweden	271.8	3.1	6.7	-2.0	8.6	44.9	55.4	48.1	35.0	7.0	9.6
Switzerland	227.7	2.4	5.9	-0.4	8.8	16.6	20.6	68.9	58.1	14.5	21.3
Total	26239.1	7.8	4.8	11.3	9.0	51.9	43.6	33.0	40.3	15.1	16.2

¹⁾ International Bonds, international euro medium-term notes by nationality of issuer and domestic bonds. ²⁾ Total amounts outstanding, in billions of US dollar. ³⁾ In percentages.

⁴⁾ Annualised rate. ⁵⁾ Share in total amounts outstanding. ⁶⁾ State Agency debt assigned to financial institutions.

Another factor affecting the use of collateral is the availability and cost of substitutes, such as securitisation or, increasingly, credit derivatives.⁹ The regulatory treatment of various credit risk mitigation techniques (in particular, the extent of the reduction in capital charges for each technique) may be one factor affecting their costs. The Basel Committee on Banking Supervision is seeking to align the relative regulatory costs of different risk mitigation techniques, including collateralisation, with the extent of risk mitigation as it revises the Basel Capital Accord for banks (Basel Committee on Banking Supervision (2001)). Other relative costs include differences in the effective financing costs or investment returns produced by using such risk mitigation techniques, as well as the operational costs, legal certainty and flexibility of these alternative means to enhance credit.

Changes in the infrastructure supporting the financial markets are another determinant of the use of collateral, although the size and direction of the impact on collateral use is not obvious. Large market participants are actively considering ways to reduce settlement exposures and economise on the liquidity and collateral needed to support clearing and settlement mechanisms. Improvements in securities settlement systems and the tendency to harmonise portions of the legal framework across countries, especially for netting, open up the possibility of greater cross-border use of collateral, reducing the burden on domestic markets where collateral is scarce. Interest has increased in expanding the role of central counterparty clearing houses in markets that now clear either slowly or on a bilateral basis.¹⁰ The essential element of a central counterparty (CCP) is that it replaces the original counterparties in a trade and becomes the single counterparty for each market participant, thereby taking over each participant's counterparty risks and allowing for netting of collateralised positions. The most ambitious plans envision the eventual complete integration of existing central counterparties to allow substantial cross-market netting and margining.

The impact of the introduction of a CCP on collateral usage is difficult to predict. Its introduction to a previously uncollateralised market, such as the cash market for equities or bonds, clearly increases the level of collateral needed to support the settlement of trading activities in that market. To cover presettlement (replacement cost) risk, CCPs require the collateralisation of the positions of their members during the period between trading and settlement, whereas, in the absence of a CCP, market participants do not generally collateralise their positions during this period. CCPs are, however, also increasingly being introduced for markets, such as the repo or swaps markets, in which counterparties previously collateralised exposures on a bilateral basis. The introduction of multilateral netting could markedly reduce the amount of collateral used by participants in those markets.

Many participants believe that consolidation amongst the largest CCPs will reduce the amount of collateral used by CCPs, given the greater scope for exposure netting and, specifically, the ability to offset margin requirements for closely correlated positions previously held in separate CCPs. If so, further integration of CCPs would be expected to reduce collateral requirements in clearing markets. Mergers would also allow a single net margin call across all the markets cleared, yielding potentially significant reductions in back office and settlement procedures and costs.

However, concentrating risk within a smaller number of CCPs would increase the systemic importance of each one and the potential impact of its failure. The consolidation process therefore serves to highlight the crucial importance of effective risk management by CCPs, and is of great interest to central banks and regulators.

Consolidation among financial institutions through mergers could work in the same direction as consolidation at the level of providers of financial market infrastructure. Whilst over time consolidation should not significantly affect risk appetite, in the short term it could bring about reductions in aggregate levels of exposure as both merged companies and their counterparties seek to minimise increases in absolute levels of exposure to individual counterparties. The resulting impact on collateral needs is difficult to predict. Consolidation might reduce the need for collateral, given potentially lower overall levels of exposure. A counterargument is that consolidation might increase the demand for collateral to manage counterparty exposure among the largest firms or to accommodate new market participants that are sufficiently large to enter wholesale markets such as those for many OTC derivative instruments.

⁹ Credit derivatives are a means for reallocating credit risk. They could act as a substitute for collateral at least in those areas where pure risk mitigation is the motivation for the use of collateral (rather than objectives such as hedging or financing of positions or liquidity enhancement).

¹⁰ The increasing use of central counterparties is also addressed in the context of the emergence of electronic and alternative trading systems in a report by the CGFS Working Group on Electronic Trading (2001).

Use of collateral by CCP operations

The global trend to mitigate counterparty and other risks arising in financial transactions has been one factor behind extending central clearing functions to OTC outright and repo transactions, both in the United States and in the European Union, in recent years. In such arrangements, the CCP replaces the original counterparties in a trade and becomes the single counterparty, thereby assuming all direct counterparty risks. The growth of CCP arrangements reflects a number of factors: multilateral netting of exposures enables regulatory capital savings and balance sheet expansion; settlement netting permits significant reductions in operating costs; and the removal of counterparty exposure facilitates the increasing use of anonymous electronic trading systems.

The CCP's ability to control the risks it incurs is vital to the soundness of the markets it serves. As a first means of doing so, CCPs usually apply stringent regulatory and financial criteria to their counterparties, with clearing membership being subject to a number of selection criteria, including capital and/or minimum credit rating requirements. In some cases, they may also require from clearing members a sizeable direct provision of capital/reserves.

But the principal means by which CCPs manage risks taken over from participants is by taking collateral. Clearing members are required to deposit various forms of collateral as margin against positions held with the clearing house to protect the CCP from adverse market movements and counterparty default. CCPs generally require clearing members to deposit *initial margin* to reflect potential exposure arising from the position and end-of-day or, in fast moving markets, intraday *variation margin* to reflect actual daily price movements. Margin provides a first line of protection against loss if a clearing member defaults, in accordance with the "defaulter pays" principle. If the margin were to be insufficient to cover any shortfalls that emerge in liquidating the defaulting members' positions, other forms of protection for the CCP exist. These include default funds to which all members contribute (in accordance with the "survivor pays" principle), external insurance, recourse to the equity capital of the clearing house, or ultimately in some cases a guarantee from the shareholder(s).

The most common forms of collateral accepted for margin purposes are cash and high quality government securities, although selected equities may be acceptable against certain positions. Although cash is traditionally the most common collateral utilised, provision of government bonds is increasing, in part due to the extension of CCP arrangements to government bond cash and repo markets. Government securities provided may be relatively illiquid issues (larger haircuts may be applied to account for this) as members may choose to save their "best" collateral for circumstances where no other is acceptable. In practice, collateral deposited with the CCP will generally be greater than the total margin requirement at any one time, since members tend to deposit excess collateral to minimise additional margin calls.

Multilateral netting of offsetting transactions is one of the main benefits of the interposition of CCPs, since it allows market participants to set off their mutual obligations, leaving just a single obligation to the CCP for every netted trade. As a result, the need for liquidity and regulatory capital can be significantly reduced. In markets which were previously collateralised only on a bilateral basis, collateral requirements can also be significantly reduced. To increase still further the netting benefits to members, the netting arrangement may be extended to include a range of financial instruments with the same underlying asset, for example outright and repo transactions. To this end, a number of clearing houses are in the process of integrating their CCP services for outright and repo trades. Beyond the benefits of netting, the integration of cash and repo trades into a single clearing and netting system may facilitate the introduction of straight-through processing and so allow significant reductions in back office and settlement costs and operational risks.

Clearing houses are in some circumstances prepared to recognise robust statistical and economic correlations among changes in the value of different financial instruments that reduce the margin needed to protect the CCP when a counterparty has offsetting positions in different instruments. Whilst these clearing houses stress the need for caution in recognising correlations, some allow such *margin offsets*, for example between derivatives contracts and related cash and repo instruments, allowing clearing members to economise still further on their collateral requirements. Such efficiencies could also be obtained through margin-offsetting arrangements between clearing houses acting in different markets if appropriate information-sharing and management controls were in place. More generally, the extension of CCP services to cover a range of – even uncorrelated – instruments allows for efficiencies through cross-margining arrangements. Members are able to pool margin held against different positions, allowing a single net margin call across all the markets cleared.

How scarce has preferred collateral become and what is the outlook?

In the light of the recent reduction in many governments' budget deficits or moves into surplus on the one side, and the increasing use of collateral on the other, questions have arisen about the potential for the growing demand for collateral, especially collateral with low issuer and liquidity risk, to outstrip the supply. Evidently, markets have already begun to adjust to changing conditions, both on the supply and the demand side, with increased efforts by some large corporate and non-bank financial issuers to enhance the liquidity of their issues and to economise on collateral through netting arrangements or CCPs. Interviews with market participants suggest that to date signs of scarcities

have yet to emerge but that the current and potential growth of collateral use in payment and settlement systems bears the potential for demand pressures in some markets.

Generally, markets could address scarcity in several complementary ways. The expected initial response is that the relative price of preferred collateral would rise. This price adjustment would be reflected in a scarcity premium in the cash market for the respective instrument – namely the government bond market – as well as in the rate on securities lending transactions.

A higher relative price for collateral may be a reason for streamlining the use of collateral and lead to a substitution into other types of credit enhancement or credit management transactions with profiles similar to collateralisation (eg through the use of credit derivatives). The extent of such substitution will depend on the price sensitivity of the demand for collateralisation and the availability of attractively priced alternatives. Another effect of higher prices for preferred collateral might be to make counterparties more willing to take collateral with more credit or market risk, adjusting as necessary the terms of the collateral agreement to compensate for the additional risk and any extra cost of managing the collateral.

In addition, higher prices create incentives to increase the supply of preferred collateral. In this respect, it is important that the overall supply of collateral depends on two factors: first, the amount of an asset that is assessed by market participants as being suitable to serve as collateral (*“potential supply”*) and, second, the effectiveness in the use of this stock of collateral, as affected by market practices and infrastructure (*“effective supply”*).

The *potential* supply is largely exogenous to the use of an asset as collateral. It mainly reflects factors such as the fiscal position of the government or the financing needs of the private sector. Higher prices for securities with particular risk characteristics nevertheless may, at the margin, encourage issuers of preferred forms of collateral (ie governments) to increase the supply of such securities.

Perhaps more significantly, scarcity of preferred forms of collateral may also increase the demand for close substitutes, such as the debt of highly rated banks and other private firms, bidding down the interest rates such firms would need to pay. Lower financing rates would allow these firms to expand their activities, making it more attractive for them to expand their issuance of debt. Moreover, demand for such securities could potentially be further enhanced by improvements in their liquidity, the transparency of the market in which they are issued and traded, and the availability of hedging instruments. The ongoing (and prospective) efforts of highly rated private issuers to create liquid and more transparent markets for their paper may not only be relevant with respect to the “benchmark” status of such issues, but also with respect to their acceptance as collateral.

Another adjustment mechanism is to increase the supply of instruments with characteristics similar to preferred collateral. One important avenue is the securitisation of non-marketable assets or marketable assets with higher credit risk. In the United States, and more recently in Europe, for example, the issuance of highly rated asset-backed commercial paper has been growing as the demand for high-grade commercial paper has outstripped supply.

Beyond that, market participants could try to counter rising costs by making more efficient use of the existing stock of assets that serve as collateral and so increase the effective supply. Higher returns on securities loans could encourage institutional investors holding securities to make them available for securities lending (subject to regulatory or legal constraints). Arranging a securities lending agreement involves a one-time fixed cost which institutional investors would be more willing to incur if returns rise. Greater use of on-delivery or rehypothecation¹¹ of collateral increases the velocity of the existing stock of collateral securities. Rehypothecation is not currently permissible in a number of jurisdictions, including in most EU member states, although the forthcoming Collateral Directive is likely to recognise its validity within the European Union.

And, as noted above, the increasing use of, and potential integration between, CCPs may also free up collateral currently held in clearing houses and potentially enhance the efficiency with which collateral is used. But the net impact on collateral usage is not clear and any integration of settlement processes brings its own costs and risks. At a bilateral level, efforts to develop new master agreements that integrate several existing master agreements from several markets may also lead to some

¹¹ The legal terminology depends on whether the holder of collateral has a security interest in the collateral (“rehypothecation”) or a legal title (“on-delivery”).

opportunities for increased collateral efficiency. The increasing cross-border use of collateral may also mitigate regional shortages of collateral.

These market responses to changing supply conditions could considerably alter the risk profile of collateralised markets. Broadening the range of assets could reduce the average liquidity and credit quality of the *overall* stock of collateral. Making more efficient use of existing collateral could avoid this but heighten operational risks (for instance those associated with the tracing and recalling of on-delivered collateral – which could also generate new counterparty exposures) and legal risks (for example those arising from netting arrangements). Such developments would, in turn, change the demands on risk management. So, while it is not clear from today's perspective whether the growing use of collateral will outpace an increase in effective supply, future demand is likely to meet a changed risk profile of available collateral.

One area where continued strong growth in the use of collateral is evident is payment and settlement systems. In those systems, the need to use high-quality collateral to obtain intraday liquidity (particularly in systems where settlement takes place across accounts at a central bank) or to manage credit and liquidity exposures (as in many net settlement systems) imposes costs on direct and indirect users. Values passing through these systems are large and continuously growing. Moreover, the introduction of RTGS systems in most developed markets and the expanding use of central bank money in real-time securities settlement systems increase the uses for which high-quality collateral is needed.

Market participants and market infrastructure providers are responding to those challenges in a number of ways. Optimisation processes, and the creation of single “pools” of liquidity available to meet users' payment, settlement and foreign exchange needs, maximise the efficiency with which available collateral is used. Automation of settlement processes facilitates the giving and taking of eligible collateral. Users are encouraged, both through education and through the agreement of formal or informal rules governing the receipt and disposition of liquidity (such as throughput guidelines), to strive to make optimal use of available collateral.

1.3 Central bank use of collateral

Central banks' collateral practices

Central banks are important, although in most countries not dominant, participants in collateral markets. Central banks use collateral actively in credit operations to protect against counterparty risk and as a means to achieve “neutrality” towards all banks. On these grounds, taking collateral is often required by law. All major central banks normally require collateral in the context of their credit operations for monetary policy purposes (see Table 3). Repos or other forms of collateralised operations typically serve a double purpose. First, they are used to supply or absorb liquidity. Second, in some cases the interest rates at which collateralised operations are conducted are meant to have a signalling effect as to the stance of monetary policy. Most central banks also demand collateral in the context of intraday credit for payment and securities settlement system purposes. This is notably the case of the European Union central banks, which requires full collateralisation of intraday credit granted in the context of the TARGET system. The Bank of Japan has introduced a similar system in 2001. By contrast, the Federal Reserve does not generally require collateral for intraday credit under Fedwire, instead assessing charges against daylight overdrafts. A third area where central banks may engage in collateralised transactions is the management of foreign reserves.

The type of collateral accepted by central banks in their operations varies significantly. As a rule, central banks accept only low-risk collateral in their monetary and payment operations, in line with the general objective of insulating the central bank from loss in the conduct of its operations. However, while some central banks (such as those in the Eurosystem) accept a very wide range of collateral, some other central banks (for example the Federal Reserve) accept only a comparatively narrow list of assets as collateral in open market operations.

The range of collateral accepted by central banks reflects, generally speaking, whether they conduct operations directly in the interbank market or conduct specific refinancing operations. For central banks operating directly in the interbank repo market, there usually exists an active, liquid market for assets accepted as collateral. An example of a central bank directly active in the interbank money market is the Federal Reserve. The Federal Reserve conducts open market operations with US government securities and obligations that are direct obligations of, or fully guaranteed as to principal and interest by, an agency of the United States. For all these assets, there exists an active and liquid interbank repo market.

Table 3 Central bank collateral practices in G-10 countries ¹

	Canada	Euro-12	Japan	Sweden	Switzerland	UK	USA
1. Open market operations involving collateral							
Type	Buy/sell back	Repo, buy/sell back, pledge.	Various instruments used, mainly buy/sell back and securities borrowing	Buy/sell back	Repo	Repo.	Repo
In use since	1953	1999	1986 (buy/sell back) 1997 (securities borrowing)	1994	April 1998	Since 1997 in open market operations.	1920s
Objective							
Liquidity management: Supply, Absorption	S, A	S, A	S, A	S	S, A	S, rarely A	S, A
Interest rate signalling	No	Yes	No	Yes	No	Yes	No
Outstanding amount as a percentage of total monetary base (Sept. 2000)	2.4%	49%	12.5%	45%	60%	50%	2.5%
Frequency of use	2 per day as nee	Weekly (MRO) ²⁾ Monthly (LTRO)	As needed	Weekly	As needed	Up to 4 times per day	As needed.
Maturity of repos	1 day	14 days (MRO) 3 months (LTRO)	Typically 1 week to 3 months (max. 6 months)	1 week	O/N – 6 months; average maturity about 2 weeks	Main operations - Around 14 days Any remaining residual – O/N	O/N to 90 days
Underlying assets ³⁾	G, M	G, S, M, C	G, M, C depending on instrument used	G, M	G, S, M, C	G, S	G, M
Type of counterparties	Banks, securities firms	Banks	Banks, securities firms, money market dealers	Banks, securities firms	Banks	Regulated financial institutions which meet functional criteria	Banks, securities dealers
Number of potential counterparties	12	2,500	Depending on instrument, between 34 and 47	209	45	No limit, providing fulfil criteria	29
Tender system	Fixed rate	Fixed rate/Multiple rate tender, with min. bid rate	Multiple rate	Fixed rate	Fixed rate	Fixed rate	Multiple rate

¹ Excluding own reserve management practices. ² MRO stands for main refinancing operation, LTRO stands for longer-term refinancing operation. ³ Government securities, Supranationals, Mortgage/asset backed, Corporates and/or other (including bank bills or non marketable bank loans).

	Canada	Euro-12	Japan	Sweden	Switzerland	UK	USA
Disclosure							
Before tender: amount	Max amount	No	Yes	No	No	Max. amount	No
Before tender: information on rate(s)	Yes	Fixed rate/Multiple rate tender Min. bid rate	No	Yes	Yes	Yes	No
Tender result: bid and/or allotted amount	No	Yes	Yes	Yes	No	Yes	Yes
Tender result: information on rate(s)	-	Yes	Yes	-	-	-	Yes
Managing practices							
Mark to market	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Margin call	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial haircut	Yes	Yes	Yes	Yes	No	Yes	Yes
2. Other forms of credit involving collateral							
Type	Advances	Marginal lending facility	Loans with collateral	Marginal lending facility	Lombard credit facility	No ⁴⁾	Discount window
In use since	1935	1999	1887 (modified in 1949 as it stands)	Collateralised since 1994	1907	-	1920s
Underlying assets (see footnote 3)	G	G, S, M, C	G, S, M, C	G,M (from 1.1.2001 also S, C)	G, S, M, C	-	G, M, C
Intraday credit: requirement of collateral	Yes	Yes	Yes	Yes	Yes	Yes	No
<i>If yes:</i>							
In use since	1999	1999	Beginning 2001	1994	October 1999	1996	-
Underlying assets (see footnote 3)	G, M	G, S, M, C	G, S, M, C	G,M (from 1.1.2001 also S, C)	G, S, M, C	G, S, C	-
3. Memo item							
Outstanding amount of collateral held in monetary policy operations and intraday credit (period average, Q3 2000) ⁵⁾	CAD 4 bln (USD 3 bln)	EUR 680 bln (USD 590 bln)	JPY 37,167 bln (USD 344 bln)	SEK 97 bln (USD 10 bln)	CHF 20 bln (USD 12 bln)	GBP 29 bln (USD 43 bln)	USD 542 billion

⁴⁾ The Bank of England's discretionary Settlement Bank Late Repo Facility may serve a similar purpose to some of the facilities listed by other countries, but is part of the Bank's open market operations.

⁵⁾ For EMU countries with pool-pledging systems, the figure includes the amount of collateral pledged, not necessarily in use. USA: collateral held includes assets resulting from outright transactions. In parentheses, USD equivalent at the exchange rate of end-September 2000.

For central banks conducting specific refinancing operations, it is not a binding operational constraint that there exist a liquid repo market for assets eligible as collateral. A good illustration of this approach is the one used by the Eurosystem where the main refinancing operations are conducted through specific procedures, notably in the form of regular tenders, employing different collateralisation techniques such as repo and pool pledging. In this respect, the Eurosystem accepts a wide range of instruments as collateral. Potentially, all high-quality assets available in the balance sheet of counterparties (marketable or not) such as debt securities, bank loans and equities, may be deemed eligible by the Eurosystem after assessment against common eligibility criteria.

Central banks vary in whether the same assets are accepted for all credit facilities or if different types of collateral are used for different types of operations. The Eurosystem provides an illustration of the first case. It accepts the same type of collateral for both its open market operations and its marginal lending (standing) facility, as well as for intraday credit for payment system purposes. By contrast, the Federal Reserve accepts a wider range of assets at its discount window than in its open market operations. The Bank of Japan also accepts different types of assets for different types of facilities. Medium- and long-term government bonds are suitable as assets for borrowing securities against cash collateral (JGB repos), while for repurchase agreements the Bank of Japan accepts commercial paper issued by non-financial companies and short-term government bills. In addition to these monetary operation instruments,¹² the Bank of Japan is entitled to provide loans to financial institutions, against which it accepts as collateral a broad range of assets.¹³

The impact of central banks' collateral policies on financial markets

Central banks' collateral choices may affect the use of collateral between private counterparties via different channels. In principle, they directly affect the balance between the supply of and the demand for collateral and hence the price of collateral. In most countries, however, the impact is modest since central bank operations are small relative to the market. In addition, central banks' collateral practices may influence the preferences of the private sector with respect to the range of assets used as collateral. Eligible assets may be valuable to financial institutions as a prerequisite for obtaining credit from the central bank. Ceteris paribus, banks may prefer holding eligible collateral rather than non-eligible collateral on their balance sheet, which implies that the investor base for the former may be potentially wider than that for non-eligible collateral.

In practice, the overall impact that central bank practices have on private sector behaviour seems to be rather limited. Consistent and sustainable effects on the price of collateral would require that market participants have unlimited opportunities for arbitrage in collateral instruments, ie they should at all times be able to bring any amount of collateral to the central bank. This is in practice not normally the case. Central banks typically only intervene at specific intervals, and for fixed amounts. The experience of the Eurosystem, which accepts a wide range of assets at the same price, is that while counterparties effectively "arbitrage" the cost of collateral for monetary policy operations, differences in the prices of different types of collateral remain. The experience in the United States and in Canada during the Y2K period provides some additional evidence on this issue. Both the Federal Reserve and the Bank of Canada expanded the list of collateral accepted in certain operations around the century date change, and in both cases the impact on the portfolio and the price of collateral pledged was rather limited. Likewise, the Bank of England has expanded quite significantly the range of collateral it accepts in its operations, without observing any significant changes in the price of newly eligible assets. This leads to the tentative conclusion that even though a central bank collateral policy may have an effect on the collateral market, this effect is – at best – muted.

¹³ This facility is, however, no longer used for monetary policy operations.

2. Risk management and the benefits and costs of using collateral

To better understand the role of collateral in risk management and in periods of market stress, it is necessary to understand the rationale for its use and how collateral agreements can be tailored to manage risks.

Sections 1 and 2 examine the private benefits and costs of the use of collateral and the role that collateral risk management techniques play in exploiting the benefits of collateral usage. Section 3 addresses the challenges that a changing risk profile of collateral poses to risk management. Sections 4 and 5 discuss the social benefits and costs of collateralisation and the role of transparency with respect to collateral use.

2.1 Private benefits and costs

For the *receiver of collateral*, the benefit of taking collateral is the reduction of credit risk. This risk mitigation theoretically occurs through three channels, with the first being by far the most important in practice. First, collateral reduces the possible loss in the event of counterparty default. The credit exposure is effectively reduced by the liquidation value of the collateral, even if the liquidation value turns out to be less than expected. Second, collateral reduces the likelihood of default; the giving of collateral should give the provider an incentive to incur a lower level of risk than would otherwise be the case (the “*incentive effect*”).¹⁴ The more collateral pledged, the more the provider has to lose in the event of failure – similar to a deductible in insurance contracts. Hence, his incentive to avoid default increases with the amount of collateral pledged if there is an effective bankruptcy process and creditors can effectively gain control over the assets. Finally, in theory collateral requirements enable debtors to signal their creditworthiness and so overcome problems of asymmetric information which would otherwise result in their access to credit being rationed (the “*signalling effect*”). Relatively safe debtors can indicate their good quality by providing more collateral than risky debtors are willing to provide. That would of course imply that collateral tends to be provided by less risky borrowers, whereas in financial markets the opposite is usually true. A more realistic assumption may be that lenders can assess the riskiness of borrowers reasonably accurately despite information asymmetries, but that the reduction of loss given default and incentive effects of collateral arrangements for many collateral providers are sufficiently powerful to reduce the effective cost of credit significantly below the rates lenders would require to extend unsecured credit.

Since collateral mitigates the credit risk for the receiver of collateral, it can also serve as a (partial) substitute for an assessment of creditworthiness and the monitoring of counterparties. This reduces transaction costs, making collateral especially attractive in markets with infrequent interaction with a wide variety of counterparties. These advantages are obvious in payment systems or organised derivatives markets, where exposures may change rapidly and counterparties may not be well known in advance. By reducing credit risk, collateral also sometimes lowers regulatory costs. Under capital adequacy standards, for instance, many collateralised positions in the wholesale financial markets qualify for a lower capital requirement under current and prospective capital standards.

It should be noted, however, that the use of collateral does not generally eliminate credit risk. First, unless initial margins are very large relative to the volatility of the position being collateralised, unsecured credit risk can emerge in the period between an increase in credit risk exposure and the time when collateral is posted and reconciled (Basel Committee on Banking Supervision (1999), Financial Stability Forum (1999)).

Second, it appears doubtful whether the provision of collateral actually reduces the probability of a default occurring very much. It may even increase the probability of default, by imposing liquidity risks on the giver of collateral (see below). Third, the collateral itself may be subject to credit risk. If, for example, the taker of collateral accepts a bank bond as collateral for an interbank loan, in the event of a general banking crisis, not only could the borrower default, but in that environment bank bonds would be considered more risky and their value would decline. The effectiveness of the protection provided by collateral therefore depends on the issuer of the collateral and its vulnerability to the kind of shocks likely to bring about default in the underlying exposure. In addition, the collateral taker

¹⁴ On the use of collateral as an incentive and screening device, see Coco, Guiseppe (2000).

assumes other risks embedded in the asset used as collateral, ie market price risk and liquidity risk as well as operational and legal risks.¹⁵

The costs involved in transferring and holding collateral comprise operational and legal costs, for example the costs of putting together the proper documentation for a collateral pledge and of managing the collateral. The magnitude of these costs tends to increase with the riskiness of the asset used as collateral. If cash is pledged, there is little need for a revaluation of the collateral over time; however, other assets may require frequent revaluation, monitoring of the pool of collateral for concentrations and periodic stress testing of the collateral portfolio. The net benefit of the collateral depends on the size of these costs compared to the reduction in credit risk achieved by collateralisation.

From the *collateral giver's* point of view, the risk-reducing effect of collateral implies more favourable financing conditions (price effect) and/or broader or deeper access to markets (*quantity effect*). Price effects are observable: interest rates on collateralised credit are generally lower than interest rates on unsecured credits. In the US money market, interest rates on collateralised three-month funds were on average about 20 basis points lower than those on uncollateralised transactions (Chart 1). The spread between collateralised and uncollateralised borrowing substantially exceeded this level in the aftermath of the autumn 1998 turbulence and the period around the Y2K date change, indicating that the pricing of collateralised credit is sensitive to market tensions. This could occur for several reasons: because the demand for collateralised credit increased, because the demand for the assets used as collateral increased, and because suppliers of collateralised credit reduced the amount of credit they were willing to supply. The Y2K episode also had a significant impact on spreads between collateralised and uncollateralised rates in Europe. A similar pattern could be observed in Japan, although it was not as pronounced as in the United States.

Quantity effects are less easily observed. In wholesale financial markets, collateral often enables a market participant to have access to credit or to financial markets that would be limited or entirely unavailable to that participant without collateral. The extent to which access expands with collateral is difficult to measure. Many wholesale financial markets, such as the international interbank markets and the OTC derivatives markets, can be characterised during calm or non-crisis periods by "modest or little differentiation in the price of credit but the use of informal, normally stable credit lines to borrowers."¹⁶ The limited differentiation in market rates with respect to the quality of counterparties points to rationing. The willingness to transfer collateral enhances a market participant's credit standing and allows him to increase his trading volume.

Accordingly, the opportunity and other costs incurred in providing collateral might be interpreted as a mixture of purchasing an extension of business and negotiating a reduction in the risk premium. This implies that even a low-risk borrower might have to bear the additional collateral cost as the price to be paid for broader market access. The provision of collateral also implies risks for the giver of collateral. The provider of collateral has credit exposure with respect to the taker, because collateral may, depending on the legal circumstances, not be recoverable if the taker defaults. The giver also incurs ongoing liabilities (to provide margin) to the taker, which impose liquidity risks. This mutual character of risks associated with collateral may be particularly relevant in transactions where exposures may quickly change from positive to negative and vice versa, particularly in derivatives markets.

2.2 Risk management and the realisation of private benefits in collateral agreements

In wholesale financial markets, credit risk mitigation through the use of collateral involves the receiver of collateral substituting other risks, including market price, liquidity, operational and legal risks, for some, but not generally all, of the counterparty risk. The extent to which creditors achieve their objective of reducing loss in the event of debtor default depends upon how they manage both the underlying credit risk through the collateral agreement and the substitute risks. The taking of collateral has therefore to be accompanied by continuous risk management by the collateral taker.

¹⁵ The exact distribution of risks between collateral giver and collateral taker will depend on the specifics of the collateral agreement.

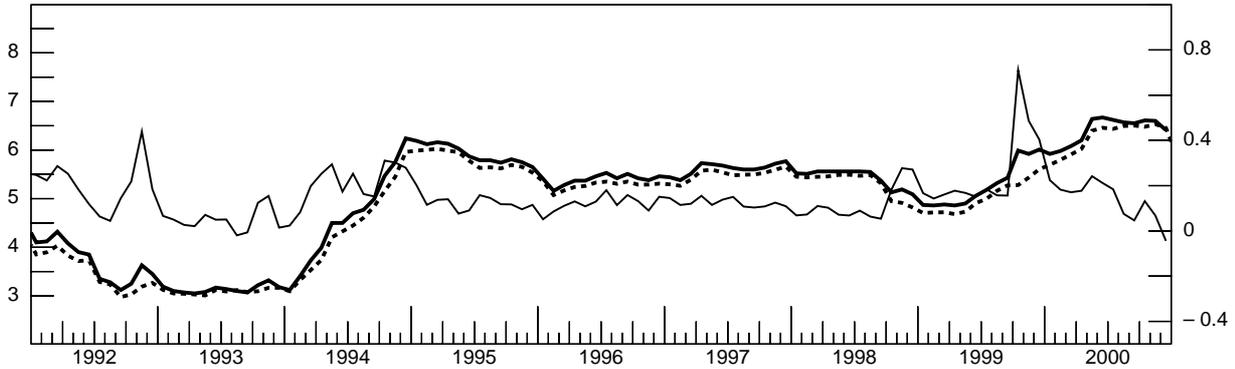
¹⁶ Bernard, Henri and Joseph Bisignano, "Information, liquidity and risk in the international interbank market: implicit guarantees and private credit market failure", *BIS Working Papers*, No 86, March 2000.

Three-month rates; repo and international interbank market ¹

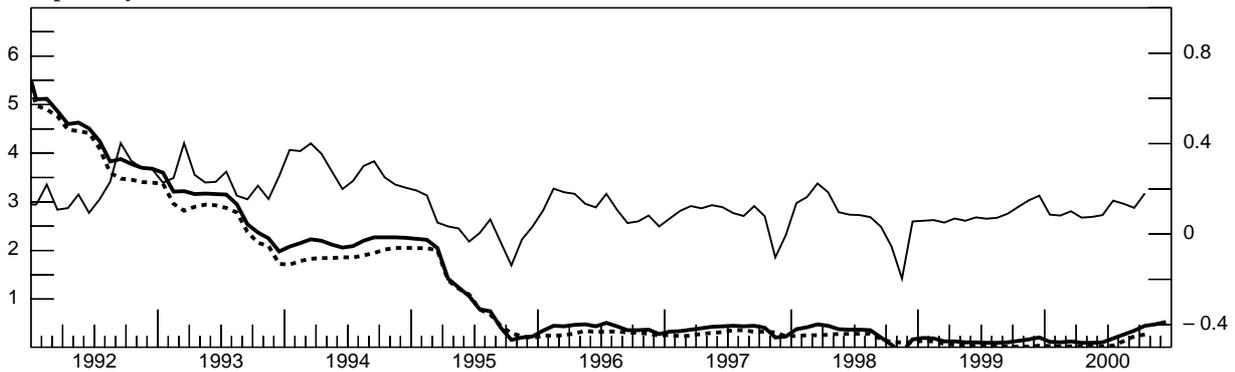
In percentages and percentage points

— Three-month international interbank rate (lhs)
 - - - Three-month repo rate (lhs)
 — Spread (rhs) ²

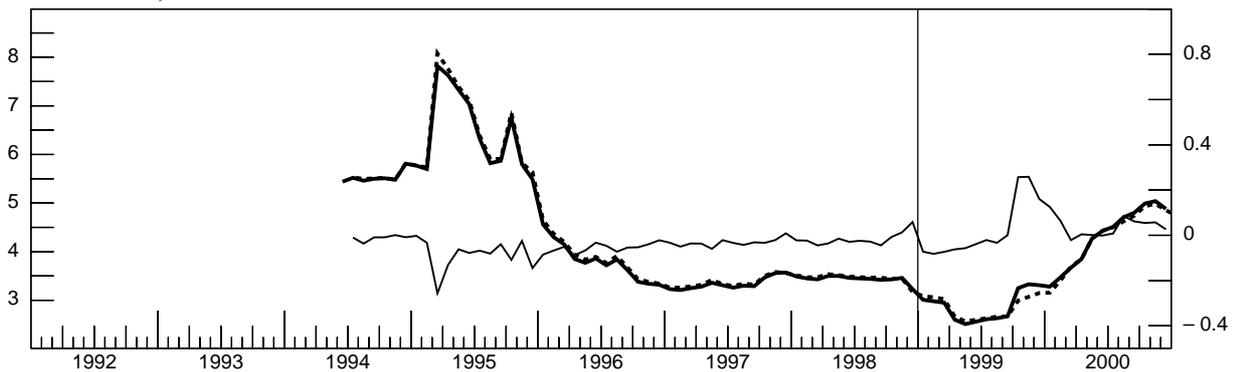
US dollar



Japanese yen



French franc, euro ³



¹ Monthly averages. ² Three-month international interbank rate less three-month repo rate. ³ Since 1999, repo and international interbank rate for the euro.

Sources: Bloomberg, Standard and Poor's DRI; BIS; national data .

Risks associated with the collateral management process

Collateral management practices are employed to mitigate the risk that, in the event of the counterparty's default, the proceeds from liquidating the collateral will fail to fully cover the receiver's exposure from the underlying transaction. The potential for loss given counterparty default, called the effective exposure in this report, generally exceeds the simple exposure calculations often used (market value of the underlying exposure minus the value of collateral) and depends on three sets of factors.

First, the effective exposure depends on the *value of the collateralised position*, which in wholesale market transactions will generally change over time. Some changes, such as the accrual of interest, are generally quite small on a day-to-day basis and usually known in advance with certainty. Other changes, such as the daily fluctuations in the market value of derivatives transactions, are essentially random and can be quite substantial. For example, derivative positions typically have zero market value when they are established. As these positions are subsequently marked to market, they appreciate or depreciate in value depending on the paths taken by underlying asset prices. Similarly, balances in payment systems are typically also subject to large and uncertain changes.

Second, the *value of the collateral itself* will in most cases change over time. Again, some incremental changes may be known in advance, such as interest accrued on cash collateral. But non-cash collateral is also subject to market price fluctuations, and its value can change over time in a less predictable way. Price volatility tends to be lowest in short-term instruments and in large government bond markets, where liquidity is high and issuer risk is low. Other fixed income securities are generally subject to higher price volatility, even in calm periods. In addition, price volatility itself changes over time, and the volatility relationships between instruments can vary substantially over time.

Third, the *effective exposure period* depends on the time needed to complete the operational steps of the risk management process from a change in the value of the underlying position to the corresponding verification of posting of margin or liquidation of the collateral position. This extended period gives rise to the possibility of quite significant changes in the value of both the underlying position and the collateral, especially if default occurs and the collateral needs to be liquidated. The effective exposure period can be substantial. ISDA has calculated that even with daily revaluation the effective exposure period is not less than 10 days (ISDA (1999)). This implies that large actual exposures can result not only from unusually large shifts in prices, but even from a cumulation of several relatively small price movements.

The effective exposure will also reflect *any correlation of price movements in the collateralised position and in the collateral*. Positive correlation between the two can provide a kind of automatic cushion against an increase in exposure if both prices follow broadly the same pattern; negative correlation between the two may increase exposure and thus credit risk. *Correlation of changes in the creditworthiness of the collateral provider and in the value of collateral* can also affect the effective exposure. The use of securities closely related to the counterparty's business as collateral can produce such a substantial correlation. This is the situation of some undiversified hedge funds that rely heavily on repo financing of their securities holdings. In such circumstances, declining collateral values may intensify liquidity pressures when the fund's creditworthiness is jeopardised by trading losses. High correlation can arise with other types of collateral. The use of unaffiliated bank bonds to secure exposure to an individual bank counterparty could pose similar problems, since changes in the value of the collateral would reflect in part changes in the creditworthiness of the overall banking sector, and thus, indirectly, that of the borrowing bank.

Managing collateral risks

A fundamental decision for a financial institution operating in the wholesale financial markets is the extent of unsecured credit exposure the institution is willing to assume. The design of collateral agreements, which can have great flexibility, represents in part the tailoring of the extent of unsecured exposure the institution is willing to accept. The design, especially of the margining and haircut process, also has implications for the risk that the unsecured exposure significantly exceeds expectations.

In order to reduce the risk of unsecured exposure, the receiver of collateral can demand a "buffer". This can basically be done in two different ways, which can be used in combination. One technique is margining. A trading agreement can require excess collateral at the time the contract is initiated, reflecting the potential size of the effective exposure over the life of the contract. This is normally described as an *initial margin*, ie an up-front provision of collateral. Most collateral management agreements also involve payment of *variation margin*. This means that, during the life of the contract,

the difference in exposure and/or collateral value that accrues between two valuation dates is paid in cash or some accepted collateral. Margin is frequently used when exposures may change rapidly, particularly in derivatives markets. The other technique to create a cushion against risks is to apply a discount when calculating the value of the collateral, and hence to require an excess of collateral for a given exposure. The percentage by which the value is reduced is referred to as a *haircut*. Theoretically, the size of the initial margin should be determined from the potential future changes in the value of the exposure, while the size of the haircut should be determined from the potential change in the value of the collateral. So for the same exposure, the haircut could differ depending on the collateral held. The calculation of initial margins and haircuts can clearly affect the demand for instruments used as collateral since higher margins or larger haircuts increase the amount of collateral needed for a given exposure. For the provider of collateral, this ties up a larger portion of a firm's assets and reduces its ability to supply collateral for other purposes.

If unsecured credit exposure is meant to be largely eliminated, the buffer should cover the *potential effective exposure*, ie the potential change in the market value of the position minus the change in the market value of collateral over the exposure period. As noted above, the potential effective exposure is determined by the volatility of the underlying position and the asset used as collateral, as well as the time needed to recognise a default and realise the value of the collateral.¹⁷ When deciding on the buffer size, it is also important to take into consideration the potential difference between market value and *liquidation value*. Unless there is unlimited liquidity in a particular asset, there is a risk that the collateral cannot be liquidated without a decline in the market value of collateral, especially in a distress situation. This risk is of course greater the larger the position is in relation to the normal turnover in the asset – an issue particularly relevant if relatively illiquid securities are accepted as collateral.

The amount of unsecured exposure will also reflect limitations in the obligations of the counterparty to deliver additional collateral. Often, derivatives collateral agreements include a *threshold amount* reflecting the degree of open credit exposure acceptable between the two counterparties. Furthermore, standard collateral agreements often establish a *minimum transfer amount*, in order to avoid transferring small margin amounts. In evaluating the size of any buffer, the calculation can take account of these minimum amounts. Finally, the collateral agreement may or may not give the collateral taker the right to *on-deliver* the collateral, ie use it for any other purpose, such as to fulfil the collateral taker's own margin requirements. The ability to reuse received collateral is dependent on the legislation in the relevant jurisdiction(s) as well as the collateral agreement.

Issues of basic risk management were highlighted in the aftermath of the autumn 1998 distress among highly leveraged institutions (HLIs). Among other findings in the January 1999 Basel Committee report on highly leveraged institutions, it was reported that few financial institutions accurately assessed the degree of unsecured credit risk inherent in the margining set out in their trading agreements. Recent interviews with market participants and ISDA surveys suggest that potential future exposures are being more carefully measured; work is proceeding to estimate the exposure in a liquidation scenario; and stricter limits, including earlier triggers for winding down exposure, are being incorporated in agreements. Furthermore, the effective exposure period has been shortened by speeding up dispute resolution procedures and shortening delivery periods for collateral (for example same day settlement for cash collateral).

The range of current practices used to manage collateral risk seems to vary significantly over the different categories of risk. According to ISDA (2000), about half of the large market participants surveyed review issuer risk, the composition of the collateral portfolio and the risk in payment and settlement systems. Somewhat fewer incorporate collateral considerations into their liquidity risk management (43%), and the smallest proportion of survey participants (29%) monitors correlation risk on an ongoing basis.

¹⁷ The volatility could be calculated for the actual exposure period or calculated from daily volatilities, by multiplying them by the square root of the exposure period. An alternative approach to developing the potential exposure is to choose a relatively high probability value from the empirical distribution of price changes over a time horizon matching the effective exposure period.

2.3 Risk management and a changing risk profile of collateral

Risk managers will ideally seek to hold collateral that moves in line with the value of the exposure and that holds – or even increases – its value in the event that credit concerns arise. Cash and government bonds tend to be preferred precisely because their value is often largely uncorrelated with the value of the credit exposure and generally uncorrelated with the creditworthiness of the counterparty. Moreover, these assets can be expected to provide additional protection in stress periods, when demand for the most liquid and risk-free assets tends to increase and prices of these assets rise. This implies that requirements for risk management are lowest when a relatively stable exposure is collateralised with a low-risk asset, for example a short-term repo transaction collateralised with a government security of a highly creditworthy country.

Broadening the range of assets used as collateral to include securities such as corporate bonds or equities makes it more difficult to assess the net exposure after taking collateral. Price volatility of the collateral may be high and variable, and low liquidity may adversely affect its liquidation value in a way that is hard to predict. If, moreover, such assets are used to collateralise positions in markets with similar risk characteristics (for example equities being used to collateralise positions in equity derivatives), assessing the nature of correlation between the position and the collateral introduces additional complexity.

Against this background, both the collateralisation of positions subject to pronounced price fluctuations (such as OTC derivatives positions) and the use of riskier collateral require an adjustment of risk management techniques. This adjustment would begin with a careful analysis of the volatilities of and correlations between changes in the value of the collateralised position on one side and changes in the value of the collateral and in the counterparty's creditworthiness on the other. The analysis would include stress testing to determine the amount of unsecured exposure which could arise under large market price moves and conditions of market distress.

Collateral risk management can basically address these higher risks in three ways that may be employed in a complementary manner. One is to increase the buffer for higher potential exposures due to higher volatility and/or lower market liquidity of the collateral, namely to demand *deeper haircuts*. Besides providing the collateral taker with additional credit protection, larger haircuts would raise the cost of using lower-quality collateral to collateral givers and thus tend to offset its attractiveness relative to more expensive higher-quality collateral. A second approach would be to limit undesired correlations of the collateralised position or the creditworthiness of the borrower and the collateral. This could be achieved by taking collateral that moves in line with the value of the collateralised position and/or by relying on the prompt adjustment of underlying exposures or collateral portfolios (or exposures) when market conditions change. Both approaches are, however, sensitive to unexpected changes in market conditions and unusual price behaviour. In addition, portfolio adjustment takes time and may become increasingly difficult in stress periods, leaving the collateral taker with substantial risks.

A third method to control potential exposures is to reduce the exposure period. This could be achieved by adjustments in market conventions and improvements in market infrastructure, particularly more frequent and timely margin calls, lower threshold and minimum transfer amounts, and operational efficiencies in the issuing of margin calls and in the posting and reconciliation of collateral. More frequent collateral transfers add to operational costs and risks and place a greater burden on the efficiency of financial market infrastructure. But the alternative – high margins and thresholds and infrequent margin calls – can cause discontinuity in the demand for collateral, with a large market move leading to occasional calls for large amounts of collateral, sharp changes in liquidity needs and potentially slow recognition of counterparty liquidity difficulties.

The existence and use of more sophisticated collateral management techniques has repercussions both on the markets where positions are collateralised and on the markets for the assets used as collateral themselves. More sophisticated systems tend to increase the barrier to entry to collateralised trading markets, especially for dealers. Market participants report that this kind of separation is already observable, favouring a trend towards a two-tier market. In such a market, some large institutions gravitate towards performing an agency role in collateral management for other market participants, in addition to managing their own margining and collateral.

2.4 Social benefits and costs

Benefits

The net private benefits of collateral lead directly to *social benefits*. As suggested above, collateralisation mitigates the problem of asymmetric information which leads to credit rationing. Moreover, by separating credit risk from other financial risks, it generally tends to complete markets as contracts can be tailored more closely to the preferences of market participants. As a result, collateralising transactions in money markets and OTC derivative transactions should – as discussed above – result in financial entities gaining broader access to these markets, which may have further positive effects on the functioning of the market as a whole, by enhancing competition and fostering deep and liquid markets.

Reducing individual counterparty risk may also enhance the overall stability of the financial system. Because many interbank markets do not discriminate effectively in their pricing between higher- and lower-risk counterparties, these markets are prone to credit rationing and to an abrupt retreat of lenders, particularly in times of market stress. After the Asian and Russian crises in 1997 and 1998, for example, the credit limits and internal risk capital assigned to counterparties and countries perceived as higher-risk were abruptly and substantially lowered. The sudden retreat of lenders contributes to the spread of an initial shock across markets. The credit protection provided by collateral and frequent margining may somewhat moderate the tendency of credit and liquidity flows in wholesale financial markets to seize up under stress, especially if such markets are not at the epicentre of the initial shock. For example, repo markets and exchange-traded futures markets are often relatively resilient and subject to limited credit rationing in periods of market turbulence.

Finally, by reducing information costs, the use of collateral promotes the development of sound payment and settlement systems and clearing mechanisms in markets, such as the derivatives markets, where exposures and counterparties often change rapidly. By facilitating the clearance and settlement of transactions, the use of collateral also adds to market liquidity.

The beneficial impact of collateral on the stability of the financial system depends, however, on sound risk management practices. The advantages of collateralisation are lost if, for example, liquidity risk and leverage are not properly controlled and lead to the social cost of more market instability.

Costs

While the risk-reducing effects of collateral are undisputed, there may nevertheless be some undesirable externalities resulting from its widespread use. Aside from the general concern that collateral risk could be inadequately managed, two specific concerns arise. The first is that increasing collateral use can adversely affect the position of unsecured creditors. The second is that collateral can contribute to pressures that threaten the integrity of financial markets in times of stress. Discussion of the latter issue is deferred to Chapter 3.

Impact on unsecured creditors

The use of collateral mitigates credit risk for the taker of collateral, but it does not eliminate credit risk from the financial system. Collateral affects the risk borne by the collateral giver and its unsecured creditors. For example, in the simplest case, assets are pledged to collateralise *existing positions* (for example turning uncollateralised interbank borrowings into repos). In doing so, the collateral is removed from the pool of assets available to the provider to cover other obligations. Moreover, since in wholesale financial markets generally only the highest-quality assets are used as collateral, the average quality of the provider's remaining assets will decline. In sum, the provision of collateral leaves the provider's unsecured creditors with claims covered by fewer, less liquid and riskier assets.

If, however, the pledging of collateral supports an *expansion* of business activity, the previously existing assets are still potentially available to cover obligations against the unsecured creditors, provided the expansion of activity generates sufficient income to service the additional (collateralised) debt and earn a market rate of return on equity supporting the business expansion. However, whether even profitable uses of collateralised credit improve the prospects of uncollateralised creditors depends on the extent to which the borrower adjusts the extended balance sheet by augmenting its capital position. *Ceteris paribus*, an expansion of balance sheets through collateralised borrowing without an increase in capital implies greater leverage and thus increased risk.

Great care needs to be exercised, however, when generalising the result of this static analysis. The use of collateral in many cases may not only affect the amount of outstanding debt and the assets of the debtor, but also reflect changes in its business mix and thus income earning capacity. If

collateralisation allows for an expansion of activities in new, profitable areas, the returns to unsecured creditors may even be improved. Some of the particular uses of collateralisation reflect underlying changes in the operation of the financial system, including the relative importance of trading and capital markets to banks and to bank profitability. That large banks generally have shifted their activities towards more trading and capital markets suggests that these more collateral-intensive activities may have resulted in higher profitability and lower risk, or at least a higher return, to creditors.

Whatever the net effect on unsecured creditors, their risk/return profile has changed. Unsecured creditors need to be able to adjust their credit exposures, or the return generated by those exposures, to reflect any adverse change in the claim they hold. When facing a lower return in the event of a default and/or a higher risk of default, rational investors will, *ceteris paribus*, reduce exposures or demand a higher return. Debtholders, especially long-term debtholders, seek to anticipate such problems and incorporate into the debt contract an adjustment mechanism that is activated in the event of an adverse change. But to do so, they need to be able to understand fully the risks of their position, initially and as it develops over time. If unsecured creditors are unaware of the change of their position and/or are not able to react rationally by adjusting exposures or prices accordingly, they are unambiguously disadvantaged, the more so if they are dealing with institutions operating with high leverage. Moreover, the efficiency of resource allocation may have declined: the fact that creditors act on the basis of partial information implies inefficiency and, potentially, risk to the system as a whole (although transparency and asymmetric information are, of course, much wider issues).

Retail depositors or investors have traditionally been viewed as having limited ability to conduct such sophisticated credit risk assessments.¹⁸ The social benefits associated with providing unsophisticated depositors with a degree of protection, both to maintain confidence in the banking system and to reflect information and bargaining asymmetries, are already reflected in the deposit and investor protection arrangements which many jurisdictions operate.

Unsecured creditors in the wholesale market also face information and exposure adjustment difficulties. Adjusting exposures appears to be particularly difficult for holders of long-term claims, who generally are not able to revise contract terms after the inception of the debt contract. Unsecured and all other creditors are disadvantaged all the more if some collateralised lenders (who may well include the borrower's largest, and potentially most influential, counterparties) rely on collateral rather than effectively monitoring the creditworthiness of the borrower, and thus fail to detect imprudence or growing strain on the borrower and an increase in the risk of default. Finally, unsecured and even some secured creditors of a distressed counterparty may be disadvantaged if one or more secured creditors demands or holds on to substantial excess collateral, as has occurred in recent episodes of market and borrower distress. This secured creditor behaviour can exacerbate liquidity strains and increase the risk of default.

Improving the transparency of markets is perhaps the most powerful way to address problems of information and exposure adjustment for wholesale market participants. Enhancements to debt or derivatives contracts to reflect the potential for collateral-related changes in counterparty asset quality may be another outcome of increased experience with collateral arrangements in the wholesale markets.

2.5 Risk management and transparency

Market discipline is an important and necessary feature of well functioning financial markets, and if investors are to be able to assess risks and rewards and make suitably informed decisions, certain information is necessary, including that relating to the use of collateral. Such information could enhance market discipline in two broad ways: first, by encouraging a better understanding of the implications of collateral usage for an individual firm's risk profile and, second, by facilitating a better understanding of market dynamics. The boundary between what information should be viewed as proprietary and what should be available for public disclosure is an issue that is receiving renewed attention following the financial market disruptions that began with the Asian crisis in 1997. While the debate on public disclosure is beyond the scope of this paper, the growing use of collateral and the

¹⁸ As the assessment of the impact of collateralisation requires information and sophistication, retail investors and depositors are likely to be particularly disadvantaged. This raises the question of how changing boundaries between retail and wholesale markets might affect the position of unsecured creditors in the future.

ways in which collateral usage can transform the exposures of an institution and its counterparties suggest a need for more disclosure relating to collateral in order to allow participants to better understand an institution's risk profile and the implications for market dynamics. Objections to disclosure may carry less force in the area of collateral usage than in other fields because collateral disclosure need not reveal sensitive proprietary information about, for example, trading positions.

Information related to counterparty risk

A range of information relating to *institutions' provision and receipt of collateral* might potentially be made available through public disclosure in order to facilitate the assessment of credit and liquidity risk by counterparties. Disclosure of the proportion of each institution's balance sheet which has been provided as collateral and how much is held as collateral should in principle enable counterparties (and in particular unsecured creditors) better to assess the risk of default and the likely recovery in the event of a default. Disclosure of the replacement value of collateralised exposures and potential future credit exposure (potential change in replacement value) relative to margin levels would likewise better enable counterparties to assess risk. Of these two, the first is perhaps the most straightforward to justify and the most important to implement as public disclosure of assets provided and received as collateral is still inconsistent across large financial institutions. The latter raises far wider issues to do with the valuation and disclosure of financial positions and risk, which are being considered in other contexts.¹⁹

Useful collateral-related information regarding *exposure to cash liquidity/funding risk* would include (i) the vulnerability of an institution's liquidity position to margin calls (for example stress tests or other dynamic or statistical measures such as cash-flow-at-risk,²⁰ or static measures such as the percentage of positions that are subject to margin calls), and (ii) the effect of encumbered assets on the institution's liquidity profile. Again, such disclosures raise wider issues – for example agreement on a uniform means of calculation and the practicalities of disclosure.

While little of this information is publicly disclosed, the quantity and usefulness of information provided to creditors in trading relationships appears to have improved since autumn 1998. Some dealers have begun to link the amount of information provided by counterparties to the size of initial margins and other terms of their agreements.

Information related to market dynamics

For market participants, an understanding of the characteristics and dynamics of the markets for securities that are accepted as collateral is important for risk management decisions. For instance, the appropriateness of margin levels for collateralised exposures depends in part on the price volatility of the collateral, which will, in turn, reflect in part the size and liquidity of the market for those securities. Information about such markets is therefore important for institutions that use collateral to manage their credit exposures. Central banks also have an interest in this information since the securities that are generally accepted as collateral in the capital markets often play a key role in the conduct of monetary policy. In addition, for central banks and other authorities with a role in maintaining financial stability, an understanding of the dynamics of collateralised markets and their interaction with the rest of the capital markets would be important for assessing the severity and significance of market turmoil.

Timely and complete information on market prices and market size improves price transparency and, by reducing uncertainty about collateral values, encourages more efficient, effective use of collateral. Full price information (that is, a time series of prices, especially if related transactions volume were available) would help risk managers determine appropriate margin levels on collateral. Transparency both contributes to the management of risk and may improve the efficiency with which collateral is used. Greater uncertainty about the level and volatility of the value of collateral should cause a compensating increase in the level of margin. Market size information that could be useful would include (i) the stock of outstanding securities and aggregate amounts pledged as collateral, (ii) the size

¹⁹ A multidisciplinary task force under the joint auspices of the Basel Committee on Banking Supervision, the Committee on the Global Financial System, the International Association of Insurance Supervisors and the International Organisation of Securities Commissions is currently considering issues related to enhanced disclosure by financial firms.

²⁰ Cash-flow-at-risk (CFaR) is a measure similar to value-at-risk (VaR), except that instead of estimating the vulnerability of market value to changes in market prices, it measures the vulnerability of cash flows to changes in market prices. It is an estimate of the effect of price volatility on cash flows resulting from variation margin or other collateral demands, and the settlement of maturing contracts.

of the effective collateral pool (for example information about securities lending programmes, stripping and reconstitution) and (iii) comparable turnover volumes and outstanding values of repo activity. The difficulties that the Working Group faced in putting together complete and comparable data on market size and activity for this report underline the scope for improvement in this area.

Information about market size, the effective collateral pool and turnover volumes is particularly important in assessing the quality of securities that may in time come to be widely accepted as collateral, such as asset-backed, corporate and emerging market securities. Legal complexities, heterogeneity of clearing and settlement structures, and diversity of market practices in these markets represent additional dimensions of information necessary to evaluate the use of these securities for collateral purposes.

3. Collateral, market dynamics and behaviour under stress

The purpose of collateral is to mitigate credit risk. By insulating individual market participants from idiosyncratic shocks, collateral dampens the spread of those shocks. However, the turbulence that hit financial markets worldwide between August and October 1998 forced market participants and observers to re-examine how markets function under stress and the way in which the use of collateral influences market dynamics. Prevailing practices for managing credit risk, including those related to collateral, played an important part both in laying the groundwork for the crisis and in propagating market dislocations once they were under way. The potentially disturbing effects of collateral deserve particular attention as the composition of the stock of assets that can serve as collateral changes and the use of collateral increases in large, fast-moving markets such as the OTC derivatives markets.

This chapter addresses the interaction between collateral and market dynamics. The first section provides an outline of the issues by briefly reviewing the role of collateral in past episodes of market stress or the failure of individual institutions. The subsequent sections then take up these aspects in more detail. Section 2 discusses the role that collateral may play in allowing excessive leverage to build up. Section 3 analyses shortcomings in collateral risk management and their impact on market dynamics. Section 4 deals with the way collateralisation can affect linkages in otherwise discrete markets. Section 5 discusses issues related to market structure.

3.1 Collateral in stress periods – a review

The financial market events in autumn 1998

The effective default by Russia and the devaluation of the rouble in August 1998 resulted in sizeable losses for some investors and triggered a re-examination of credit risks by market participants. The outcome can be characterised as a global flight to liquidity, spurred by a global "margin call" (CGFS (1999a)). As this term suggests, collateral-related dynamics played a key role in these developments. Some of the positions affected were leveraged through collateralised financing arrangements, including securities lending, repurchase agreements and margin accounts at futures exchanges, which required positions to be marked to market daily. Many financial market participants incurred losses, reduced the scale of their operations and trimmed their risk exposures, in response to pressures from increasingly cautious counterparties and their own need to preserve capital in an environment of heightened uncertainty and reduced tolerance for bearing risk. At the same time, collateral requirements were increased in many parts of the markets because of heightened concerns about counterparty credit risks.

As a result of these and other factors, liquidity in many markets declined sharply, with bid-ask spreads widening and large transactions becoming more difficult to complete. Demand for the most liquid benchmark securities was further increased by the need for certain market participants to provide top-quality collateral as well as by investors stepping in to benefit from an expected further decline in bond yields in the light of ongoing concern about global deflation. Conditions in world financial markets deteriorated further following revelations in early September of the magnitude of losses at a major hedge fund, Long-Term Capital Management (LTCM).

Issues

The 1998 crisis made clear that potential exposures of collateralised positions and losses that can result from the need to liquidate them can lead to substantial unsecured credit risk (Basel Committee

on Banking Supervision (1999)). The crisis underscored the need for institutions to recognise the linkages among leverage, market risk, funding arrangements, collateral practices and asset market liquidity, both in normal times and in periods of distress, and to incorporate these linkages in their risk management assessments (Counterparty Risk Management Policy Group (1999)). Effective counterparty risk management involves the regular sharing of information about market, liquidity and funding risks between trading counterparties of all types in the wholesale financial markets.

From the viewpoint of collateralisation, three market shortcomings that contributed to the severity of the 1998 crisis are particularly relevant. First, collateralisation facilitated excessive leveraging of positions in the runup to the crisis. Second, market participants relied too heavily on the ability of collateral and daily margining to all but eliminate credit risk and overlooked the potential for swift moves in exposures when large price changes occurred; belated recognition of this oversight triggered a tightening of collateral standards which contributed substantially to liquidity pressures. Third, a high concentration of market activity, including in some markets for instruments used as collateral, accentuated the propagation of shocks across markets.

Failure of the Granite funds, 1994

The Granite funds pursued a strategy based on arbitrage in mortgage-backed securities (MBS). US MBSs are highly sensitive to interest rate changes, as their price also reflects the value of the prepayment option included in the underlying mortgages. Granite's stated "arbitrage" strategy was essentially to invest both in MBSs that would rise in value as interest rates rose and in MBSs that would fall in value for the same interest rate change. The gains would reflect Granite's superior ability to select securities, amplified by leverage.

In early 1994, the Federal Reserve initiated a series of tightening actions. Long-term interest rates rose quickly, with prices of MBSs hit particularly hard. Granite's positions, which at that time were more directional than arbitrage-oriented in nature, deteriorated sharply in value. The dealers began making margin calls, generally in conjunction with rolling over Granite's mortgage-backed and associated collateral positions. That changed a few weeks later, when one major dealer made a large margin call during the life of a repo transaction. As positions deteriorated further, Granite faced a wave of margin calls. Many of Granite's counterparties had not been monitoring their credit exposure and suddenly realised that they were undermargined. Granite's positions with several dealers were overcollateralised, and many of these dealers were reluctant to let Granite liquidate individual excess collateral positions. These dealers were counting on the benefits of netting across positions to limit losses in liquidating the full pool of collateral, and in some cases the dealers also found that they could not easily unwind trades to get back securities they themselves had used in repo operations. The collapse came when the dealers began liquidating Granite's positions to satisfy margin calls, especially since markets for MBSs turned out to be very illiquid. Granite funds sought protection under Chapter 11 of the US Bankruptcy Code in April 1994.

Issues

With respect to collateral, the demise of the Granite funds highlights three issues. The first is that inappropriate risk management – counterparties reportedly had valued positions and collateral carelessly and too infrequently – and a subsequent abrupt tightening of standards in the light of a crisis exacerbated distress. The second is that sharp changes in valuation can occur when securities used as collateral trade in markets with abruptly changing liquidity. The third is that credit relationships unravel rapidly when the collateral is highly correlated with the creditworthiness of the counterparty.

Aftermath of the US equity market crash, 1987

The 23% decline in US stock prices on 19th October 1987 led to very high demands for liquidity by brokers and investors. The origin of the stock market break was in the heavy selling associated with "portfolio insurance" used by large holders of equity portfolios, but the severe selling in the cash, futures and options markets led to dislocations across the markets that reflected collateral dynamics. These dislocations occurred as liquidity strains and credit concerns were escalating because of the break in stock market values and uncertainty about the solvency of many market participants. In addition, worries that failure to settle the huge volume of transactions could lead to further liquidity strains and cascading settlement problems added to the atmosphere of tension and near chaos.

Collateral issues contributed to liquidity problems and settlement concerns mounted because different margining practices were employed across the cash, futures and options equity markets. With price changes of normal magnitudes, a dealer or other market participant with offsetting positions in the cash and futures markets could easily manage the mismatch in cash flows arising from the daily

margin calls in the futures market and the margining that occurs in the cash market, where the only rule involves initial margin. With the huge drop in prices in October 1987, however, intraday and end-of-day margin calls became very large, triggering substantial, unanticipated cash needs. The inability to liquify gains in one market to meet margin calls in another created enormous liquidity strains.

Issues

Although collateral per se did not play an important role in creating market stress, the 1987 episode does offer a clear example of the role of collateral in propagating market disruptions in rapid and unexpected ways. The forced sale of positions in order to meet margin calls contributed to excessive selling and an overshooting of prices (“a run on the market”). Moreover, differences in collateral-related risk management practices in different segments (cash, futures and options) within a single equity market proved to be a major source of liquidity strain and led to dislocation in the price mechanism.

Summary of issues

These case studies illustrate generally how disturbances are more likely to develop and propagate when market participants have underestimated risks and misjudged their capacity to bear shocks through capital and liquidity. Moreover, the effort to correct these misjudgements often contributes to or even triggers disorderly markets. Among the lessons derived from these three episodes is that how financial institutions collateralise their exposures and manage the collateral is not just important for the individual firm’s protection, but can also have important implications for the behaviour of markets.

3.2 Collateral and leverage

High leverage – in general terms, the ratio of risk exposure to capital – has proved to be a major contributor to disruptions in financial markets, and it played a particularly prominent role in the autumn 1998 crisis. The concerns that leverage raises from the perspective of systemic stability are twofold. First, more highly leveraged institutions are, other things being equal, more exposed in the event of losses arising from credit, market and other risks than other firms with the same positions but more capital available to absorb the losses. Thus, an increase in leverage by definition reflects an increase in the overall risk exposure of a financial firm relative to capital, and thus an increase in the counterparty risk of all firms with exposures to the financial firm. Second, high leverage creates liquidity demand which can be difficult to manage since leverage amplifies swings in the value of a collateralised portfolio. Liquidity shortfalls may force firms to close out positions rapidly, with potentially disruptive effects on financial markets. If a leveraged firm defaults, the effects of unwinding leveraged positions fall on its creditors, potentially affecting their solvency.²¹

In the wholesale financial markets, collateral usage is often intended to increase counterparty access to markets and is thus more likely to facilitate the build-up of leverage in financial firms for two reasons.²² First, it provides borrowers with a ready means of expanding risk positions and balance sheets. For example, counterparties are able to finance asset holdings with borrowings collateralised with the assets purchased (the repo markets provide securities dealers with a ready means of financing holdings). If initial margin is very low or nil, there is substantial latitude to expand collateralised borrowing by many multiples. The willingness of banks and securities firms to grant credit with no initial margins to a wide range of counterparties, especially in the mid- to late 1990s, contributed to the leveraging that was a prominent feature through much of the decade. Moreover, the use of collateralisation to facilitate transactions in derivatives or involving embedded options allows firms to leverage their risk exposure substantially when positions in those instruments are not subject to sound margining.

Second, collateral can introduce a “monitoring gap”, with lenders having less incentive to monitor, or take account of, the actual leverage of the counterparty, believing (wrongly) that collateral is a substitute for monitoring borrower creditworthiness. Experience has suggested that poor monitoring

²¹ For a more detailed discussion of these effects, see Financial Stability Forum (2000).

²² It might be argued that the use of collateral could limit excessive leverage to some extent. For example, the finite size of the pool of assets eligible as collateral should in principle limit the ability to build up risk positions in wholesale financial markets. And the incentive effect mentioned above should encourage borrowers to manage the risks they incur effectively in order to minimise the risk of their own default.

practices allow borrowers to build up excessively risky, highly leveraged positions. Even when creditors are vigilant, leverage may be difficult to recognise because there are no agreed approaches to measuring it beyond overly simple asset-to-capital ratios. It has been proposed that leverage be analysed in conjunction with risk and liquidity, but practical methodologies have yet to be agreed (Counterparty Risk Management Policy Group (1999)).

The “monitoring gap” may be hazardous for the collateral taker and for the financial system as a whole if leverage allows individual market participants to take positions large enough to cause market disruptions if they have to be unwound. The distinguishing features of problems with HLIs in 1998 were the scale of some hedge funds’ activities, the size of positions in certain markets and the extent of leverage. Many HLIs were able to leverage themselves through repos with commercial and investment banks at unusually good financing conditions, with haircuts near zero.

The precarious liquidity situation of many HLIs in 1998 further underscored the need to take into account a counterparty’s liquidity risk management strategy, since the extent of liquidity risk exposure is a key factor in the counterparty’s ability to withstand severe market disturbances. This was especially true for HLIs making use of two-way collateral agreements, because often the HLIs relied on margin payments from counterparties for a large portion of the liquidity needed to meet margin calls on other positions.

Individual counterparties are generally the only reliable source of detailed information on the full extent of their own leverage. Recent efforts to strengthen counterparty risk management have focused on improving the flow of information on risk management, including market and liquidity risk between counterparties. For both the collateral giver and the collateral taker to understand and properly assess the nature and size of the risks they incur, appropriate risk management processes must be in place on both sides, including stress tests. Market participants are therefore paying closer attention to how their counterparties approach risk management, for example by reviewing sample risk reports and the output of their counterparties’ stress testing.

3.3 Risk management and market dynamics

Section 3.2 touched on one way in which inadequate monitoring of collateralised positions can place both lenders and the markets in which they operate at risk. Any such inadequacies may, however, only become evident when exposures from collateralised transactions and the perceived risk of loss become sufficiently sizeable to attract management attention. By this stage, tensions in financial markets may well already have begun to build up, augmented perhaps by the actual and/or prospective default of one or more large counterparties.

The difficulties of many HLIs in 1998 were a good example. The deficiencies of collateral in mitigating credit risk became evident during the 1998 crisis (President’s Working Group on Financial Markets (1999)). Collateral was demanded to cover current exposure (replacement cost) without sufficient consideration of the likely size and duration of the potential exposure under adverse market conditions, and excessively high threshold amounts and delays in the timeliness of settlement were tolerated. As a result, the securities firms and banks that were HLI counterparties were exposed to rapid increases in their uncollateralised exposure when market conditions turned turbulent.

Once aware of these shortcomings, market participants’ usual response is to adjust risk management standards abruptly by, among other things, demanding higher margins or deeper haircuts. Margin calls to some HLIs, for example, reflected not only the deterioration of their positions, but also more rigid credit arrangements and requirements to collateralise potential exposures (President’s Working Group on Financial Markets (1999)). Similarly, as the difficulties of the Granite funds became widely apparent, counterparties felt compelled to tighten collateral standards. Margin requirements were increased in some markets during the 1987 equity market break. A tightening of collateral standards may *contribute* to market disturbances by, at the extreme, triggering the default of counterparties unable to meet those standards. In very turbulent conditions, a sudden, general tightening of collateral standards by major market participants may create or increase systemic tensions.

The primary means by which collateral contributes to market dynamics is through the effects of calls for additional margin by the takers of collateral. Margin calls may force providers of collateral to liquidate positions in order to acquire the necessary assets. The sale of assets in order to meet margin requirements may cause disturbances in the underlying market for those assets. The impact will reflect the size of these transactions relative to the underlying market and the market’s customary liquidity. If positions are large, forced liquidations following margin calls may significantly reduce or dry up liquidity in the underlying market. As happened in autumn 1998, the reduction in liquidity can be triggered by the mere prospect of widespread liquidation of positions, and liquidity strains can appear in markets

otherwise viewed as being among the most liquid.²³ Indeed, the need to raise cash may often force market participants to liquidate their more liquid positions, often benchmarks or at least bellwethers for large segments of the financial markets, and this can exacerbate (at the margin) negative market psychology.

Similarly, liquidation of collateral positions in the event of default can generate further pressures for collateral takers and providers by creating downward pressures on the price of collateral assets. Collateral takers may find that liquidation values are lower than expected, resulting in unforeseen exposures to the defaulter. The dealer counterparties of the many banks, corporations and HLIs caught up in the 1998 market disturbances certainly failed to appreciate the difficulties involved in liquidating collateral and rebalancing their portfolios under such stressful market conditions. For non-defaulting collateral providers, who may face fresh calls for margin, such market moves resulting from widespread asset sales or concerns over default risk will generate further liquidity pressures. The dynamics will depend on the circumstances, but the potential exists for the emergence of vicious circles in which falling asset prices generate liquidity pressures and defaults, in turn generating asset sales and new price declines.

The risk management parameters that most directly affect how collateralised markets respond to stress are those that determine the kind and the amount of additional collateral demanded in stress periods, namely the size of margins and haircuts, the manner of their adjustment, valuation techniques and the range of assets accepted as collateral. These are considered more carefully in the following sections.

Initial margin and variation margin

The revaluation and remarking of collateralised positions requires counterparties with positions rapidly moving out of the money to come up with collateral at short notice, which may in turn force them to liquidate other positions. It could be argued that imposing high initial margin requirements could reduce the scope for frequent margin calls to generate instability. But margin calls, when made, would be larger and more likely to generate liquidity pressures for providers of collateral. Higher initial margins would also increase the up-front cost of collateralised transactions, potentially discouraging transactions that might otherwise have taken place, and reducing market efficiency. And even with high initial margins frequent revaluation and monitoring of counterparties would be necessary.

Whilst a thorough assessment of market participants' behaviour in stress periods is a precondition for an appropriate balance between initial and variation margin, best practice is increasingly for firms active in collateralised markets to revalue and remargin positions frequently, if necessary intraday. Other things being equal, this would tend to point to lower levels of initial margin being required. If so, it is important that any reductions in initial margin requirements reflect a realistic assessment of the risk management capabilities of both giver and taker, and of the likely impact of a shock to market liquidity more generally. Once again, takers of collateral will need to reflect the fact that the effective exposure period can be as much as 10 days when calculating the need for margins.

Many agreements tie initial margin to the credit rating of the counterparty or some other measure(s) of financial condition.²⁴ This may mean that an event which casts doubt on the credit quality of a large number of counterparties could lead to a spontaneous widespread increase in the demand for collateral and hence pressure on the markets for liquid securities. This is another channel through which increased credit risk can lead to increased liquidity risk in stressful conditions.

Haircuts

As with margin, a choice exists between taking deeper haircuts at the outset to protect against any sharp market movement, or being prepared to adjust haircuts occasionally to reflect changed

²³ In the event of systemic problems in the banking sector, it may be important to distinguish between government bonds and debt securities perceived as close substitutes in "quiet" times, such as asset-backed paper issued by highly rated banks or other financial institutions. As difficulties in the banking system are in many cases the result of a sharp price decline in the real estate market, the latter securities might suffer not just from the difficulties in the financial sector, but also from a fall in the value of the underlying assets. As a result, the prices of such securities might be hit particularly hard.

²⁴ An adjustment of haircut standards has to be assessed against the practices before the adjustment. Before the autumn 1998 turbulence, trading agreements between banks and security firms and highly leveraged counterparties often defined trigger points for additional collateral in a rather generous way. Many agreements, for example, contained triggers such as a 50% decline in net asset value over 12 months.

perceptions of asset volatility as market conditions change and to remargin exposures accordingly. While deeper haircuts would tie up more assets and make collateral more expensive, frequent adjustment of haircuts could impose significant strain on collateral givers in distress periods. Whatever haircuts are agreed, it is important that they take into account a thorough assessment of the value of the collateral in all conditions, including the potential liquidation value of the collateral, arrived at through a process of rigorous stress testing. Stress testing of counterparty risk exposures forms a routine part of the management of a credit portfolio.

Range of assets accepted as collateral

The type of collateral held will affect the extent to which receivers of collateral are exposed to price and liquidity risk. Takers of cash collateral face no such risks. Holders of government bonds may find markets less liquid than normal in times of high market volatility but are unlikely to experience sustained difficulties selling their collateral, particularly if the disturbances result in a more general flight to quality. (The greater uncertainty associated with a shock tends to shift the desired portfolios of lenders towards low-risk and liquid assets. Past episodes of market turbulence confirm that the prices of highly liquid assets without issuer risk increased while other assets suffered price declines.)

When collateral has substantial credit and market risks, both receivers and providers faced heightened risks under adverse market conditions. Receivers of less liquid forms of collateral such as some corporate securities may find their collateral more difficult to sell, should the need arise. For providers, a flight to quality would make it more expensive to collateralise positions with lower-quality assets since price falls in such collateral could result in calls for additional collateral, which could in turn force market participants to liquidate their positions into a falling market. The effect of this could be exacerbated if, over the course of the business cycle, creditors had reduced the spreads and eased the terms of collateral arrangements to riskier borrowers and now sought to restore them to normal or even more restrictive levels.

Summary

Takers of collateral, particularly collateral subject to liquidity and/or credit risk, have learned that they need to take great care in assessing the potential exposure to be collateralised, and the amount of collateral required to generate the required degree of protection. A careful assessment process distinguishes between the collateral needed to protect against the default of an individual counterparty in normal times and a default at a time of more general economic or financial stress – when the probability of failure may be elevated. Such an assessment also distinguishes carefully between the performance of different types of collateral, including any differences which arise from correlations between the value of certain types of collateral and underlying exposures. Stress testing should be carried out to ensure that margins and haircuts are sufficient to compensate adequately for the possibility of price declines in lower-quality collateral. The primary concern with the use of collateral assets with more credit and market risk is that margining/haircutting will not be adequate to cover both the observed volatilities for collateralised positions and the market price dynamics that can stem from the liquidity and correlation pressures likely to arise in these markets under adverse conditions.

3.4 Collateral and market linkages

The use of collateral may not only affect the counterparties involved in collateralised transactions or the markets for the asset serving as collateral, but may also help to spread volatility between markets or create tensions across the financial system. The spread of volatility results from market linkages that collateral creates or strengthens.

One example of such a linkage is when shocks affecting the underlying market for collateral assets directly affect the collateralised markets, by generating margin calls and other liquidity pressures in the latter markets. Such linkages may be exacerbated when the value of the collateral and that of the exposure are closely correlated (for example when government bonds are used to collateralise interest rate swap market exposures), since shocks to collateral values may occur at the same time that levels of exposure in the collateralised markets are increasing, generating pressures to post additional margin. Of course, one has to keep in mind that such markets are generally interlinked even in the absence of collateral, and that the dampening effect of collateral on credit exposure can reduce the danger of contagion by reducing the need for portfolios to be drastically adjusted in response to a shock.

Another example of a linkage (which, as noted above, arose during the US equity market crash in 1987) is when *uneven collateral practices* exist across different market segments or within the same

market, creating a “wedge” between or within segments. If a long OTC interest rate swap position with one counterparty is collateralised and the corresponding short position with another remains uncollateralised, a price shock would be followed by asymmetric cash flows. This may cause liquidity pressures if the long position has to be covered by additional collateral, while no corresponding collateral can be expected from the short position.

The problem of uneven collateral treatment goes beyond margining practices and is important in the context of increasing integration in domestic and international financial markets. Many other features can create a wedge between markets: regulatory capital treatment or other regulatory barriers, legal certainty about the enforceability of claims on collateral and certainty about the amount of presettlement credit exposure, among others. Specifics of collateral agreements such as the timing of margin payments, events of default, cure periods and dispute resolution procedures create additional wedges. To some extent, these differences are the product of diversity in marketplaces, one positive outcome of which is to allow market participants to tailor their risk profile and their risk management process to their own needs. Such differences across markets may even form barriers that slow the spread of market disturbances. But they can also *exacerbate* market distress, by creating liquidity pressure and price dislocations, as occurred in the 1987 equity market crash. The balance of costs and benefits should be reviewed periodically and efforts are currently in train in both the private and public sector to reconsider that balance.

In the trading markets, market participants are indicating their interest in reducing these differences, as they develop cross-market netting agreements that reduce credit exposures and seek to develop central counterparties that are active within multiple markets. Increasingly efficient and integrated markets and payment and settlement systems help to reduce wedges between markets, but in so doing, they provide many channels through which such shocks could be propagated.

3.5 Market structure issues

The effect that collateral has in situations of market stress, and in particular the speed with which a shock is transmitted to a broad range of market participants, also depends on structural factors such as the degree of concentration in the markets where collateral is used.

Available evidence suggests that concentration is relatively high in these markets. Repos seem to be traded by a concentrated group of dealers in several countries (particularly in smaller countries, apparently; for example, there are only four dealers in Sweden, while the five largest participants in Switzerland have a 78% share of the interbank repo market). The main dealers and end users are banks (for example, in Germany 85% of transactions take place between banks, while in France three major banks account for 32% of daily turnover in government securities repos), although no clear patterns emerge.²⁵

The high degree of concentration in collateralised markets reflects increasing concentration in financial markets in general and the trend towards consolidation in the financial sector in particular. For example, activity in OTC derivatives markets is highly concentrated among major financial institutions (International Monetary Fund (2000)) and this is also mirrored in the use of collateral. Collateralised markets may nevertheless be even more concentrated than others, perhaps because of barriers to entry or scale effects linked to information technology, learning costs, which prevent smaller financial firms from using collateral, or the cost to new, smaller entrants of holding generally accepted assets. Additionally, the relatively large ticket size in collateralised transactions is beyond the reach of many smaller firms.

The concentration in the markets where collateral is used may amplify the dynamics that collateral can create or contribute to turbulent markets. Difficulties at one of the few big players might put substantial pressures on the markets for securities used as collateral because of both general counterparty caution and the resulting reduction in activity at the relevant dealer. Information passes quickly in such

²⁵ With respect to the trend in concentration, data for the Belgian market indicate that (i) over time, concentration in the repo market has increased, with the share of the six largest banks in total outstanding amounts climbing from 44% as of end-1992 to 90% as of end-1999. Across instruments, concentration in repos (90% as of end-1999) is significantly higher than concentration in other, ie unsecured instruments. These facts seem to counter the idea that a “club” of large players dominating a market would not have the incentive to collateralise its internal transactions.

markets and additional pressures could emerge very quickly should a change in sentiment lead to a tightening of collateral standards by one or a few major market participants.²⁶

Another issue is the impact that different types of financial infrastructure have on market behaviour in stress periods. An interesting question in this context is whether centrally cleared markets, with a single central counterparty, would respond differently to disturbances than bilateral markets. In principle, the central counterparty should have access to more complete information on the state of the market and be in a better position to judge the consequences of its actions and, perhaps, take a longer-term view of what those actions should be. Similar questions could in principle arise in cases where a single institution provides tripartite repo services to a wide range of collateral market participants. Whether that would succeed in avoiding pressures to any significant degree is difficult to determine ex ante, but is an interesting area for further work.

4. Conclusions

The uses of collateral and the supply of assets that can serve as collateral are likely to continue to evolve over the coming years. Greater focus on the mitigation of credit risk, together with broader participation in the financial markets, especially with the growing acceptance of advanced financial technologies, is likely to increase the use of collateral. The area where current and prospective growth seems strongest is in the collateralisation of intraday credit and settlement exposures in payment and settlement systems. Higher demand for collateral in the wholesale financial markets has already begun to meet a changing pool of collateral in several major countries, with a declining share of government securities and an increasing share of private sector paper. Financial markets can adjust to a changing composition in several ways. As prices for different classes of collateral adjust, incentives could emerge to securitise assets and create other low-risk, liquid alternatives, to accept a broader range of assets as collateral or to improve the efficiency with which the existing stock of assets is used, for example through greater use of netting and central counterparties.

Taking collateral mitigates credit risk, but also generates risks related to the asset used as collateral and its management. Appropriate credit risk management through the design of the collateral agreements and sound collateral risk management are therefore preconditions for fully achieving the credit risk mitigation and business-generating benefits of collateralisation. The importance of risk management also implies that changes in the uses and sources of collateral will require corresponding adjustments to the practices associated with the use of collateral. Broadening the range of assets used as collateral implies that the receiver of collateral faces higher price volatility and possibly also greater correlation with the collateralised position or with the counterparty's creditworthiness, which requires careful risk management.

Transparency of both the use and balance sheet impact of collateralisation at the individual firm level and at the level of markets is a key prerequisite for effective risk management practices. Transparency is an important mitigant of the potentially negative impact of collateralisation on unsecured creditors. The ability of unsecured creditors to protect their position ultimately depends on their ability to assess and monitor the impact of collateralisation on the balance of risk and reward they face and to adjust exposures and/or returns accordingly.

Widespread use of collateral can affect the dynamics of markets, especially under stress. To limit the possibility of collateral risk management practices exacerbating market disturbances, counterparties can take many actions. Sound initial and ongoing evaluation of both collateral and counterparty is vital and should include comprehensive stress testing of secured and unsecured exposures, potential correlations between changes in collateralised exposure and in the value of the collateral itself, and an assessment of how market distress is likely to affect the liquidity and creditworthiness of major counterparties. Collateral risk management practices should reflect the full range of liquidation scenarios, ideally including plausible but extreme market conditions. This full and ongoing assessment

²⁶ In order to facilitate some risk management and operational aspects in collateral arrangements, some institutions offer tripartite services. The intermediary acts as an agent for both the collateral provider and the collateral receiver, evaluating and valuing collateral and managing the settlement of cash and securities. The agent may also manage revaluation, remarking and substitution of collateral, and sometimes select the securities to be used as collateral.

of the likely performance of the collateral should be implemented within an integrated risk management framework including the full involvement of top management.

The outsourcing of collateral risk management to central counterparties may help to overcome some problems, for example by reducing exposures through netting arrangements or perhaps by entrusting a single, better informed, entity with the management and if necessary liquidation of collateral. But a heavy reliance on central counterparties may, on the other hand, also raise questions regarding, for example, the concentration of a wide range of risks within a single entity providing a key market service, and the potential for contagion across markets as market exposures are combined for settlement. These and other issues, for instance those relating to the interaction between collateralisation and market dynamics or to the possible role of collateralised markets in spurring further concentration, are complex issues that require further study.

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