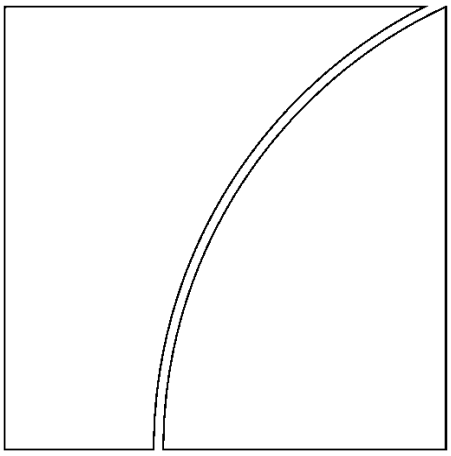
Committee on Payment and Settlement Systems



Strengthening repo clearing and settlement arrangements

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Foreword

During the recent financial crisis, some repo markets proved to be a less reliable source of funding liquidity than expected. In June 2009, the Committee on Payment and Settlement Systems (CPSS) therefore commissioned the Working Group on Repo Market Infrastructure to investigate the extent to which the clearing and settlement infrastructure for repos contributed to the instability evident in some repo markets. The Working Group was also asked to identify potential ways in which the repo clearing and settlement infrastructure could be improved.

This report first presents a comprehensive survey of the clearing and settlement arrangements for repos in selected CPSS member countries. In particular, it sheds light on the experience with these arrangements during the financial crisis. The analysis shows that repo clearing and settlement arrangements vary considerably across countries and markets.

Second, the report identifies several issues related to clearing and settlement arrangements for repos that have the potential to affect the resilience of repo markets (eg the risks related to the extension of significant amounts of intraday credits within some repo settlement arrangements; the lack of transparency of some repo infrastructure roles, responsibilities, practices and procedures; concerns regarding the protection against counterparty credit risk in repo transactions; and inadequate capabilities for liquidating repo collateral in the event of a cash borrower's default). Due to the substantial variety in repo clearing and settlement arrangements, the identified issues are not relevant to the same extent in each market. Finally, the report outlines options and measures through which these issues can be addressed.

The report concludes that it is worthwhile for the stakeholders in each market to review how the clearing and settlement arrangements for repos could be further strengthened. As a first step, the report suggests that the providers of such arrangements in each country should, jointly with market participants, regulators and the central bank, attempt to develop a common view on the relevance of the identified issues for their market. As a second step, each provider could then evaluate which measure or combination of measures would be best suited to address the relevant issues in its specific circumstances.

The CPSS is very grateful to the members of the Working Group and its chairman, Andy Sturm (Swiss National Bank), for their excellent work in preparing this report.

William C Dudley, Chairman
Committee on Payment and Settlement Systems

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Executive summary

During the recent financial crisis, repo markets proved to be a less reliable source of funding liquidity than expected in some countries. As part of the Financial Stability Board's (FSB) broader work stream "Strengthening the core financial infrastructures and markets", the Committee on Payment and Settlement Systems (CPSS) therefore commissioned a working group to investigate the extent to which the market infrastructure – ie the practices, procedures and systems used for clearing and settling repos and liquidating a defaulting cash borrower's collateral – added to the uncertainty in repo markets and whether there is room for improvement.

Based on a comprehensive survey of the clearing and settlement arrangements for repos in selected CPSS countries and, in particular, on the experience with these arrangements during the financial crisis, the Working Group identified seven issues related to the repo market infrastructure that have the potential to affect the resilience of repo markets: (1) the risks related to the extension of significant amounts of intraday credits within some repo settlement arrangements; (2) the lack of transparency of some repo infrastructure roles, responsibilities, practices and procedures; (3) concerns regarding protection against counterparty credit risk in repo transactions; (4) inadequate capabilities for liquidating repo collateral in the event of a cash borrower's default; (5) the inefficient use of (high-quality) collateral due to constraints within repo clearing and settlement arrangements; (6) procyclical effects of certain risk management practices; and (7) a lack of transparency in the repo market. The Working Group believes that appropriate measures on the level of repo clearing and settlement infrastructure can play a role in helping to address these issues, thereby contributing to more resilient repo markets. The seven issues and potential measures to address these issues are briefly summarised below.

First, the settlement procedures for repo transactions, and in particular for term repos, can give rise to the extension of significant amounts of intraday credit to the cash borrower, either by repo settlement infrastructures or by settlement banks supporting the repo infrastructure. This may create vulnerabilities not only for the institution extending intraday credit, but also for the repo counterparties. For instance, the cash borrower may become dependent on risk management decisions by the institution extending intraday credit, while the cash lender – to the extent that it holds temporarily a cash deposit with the settlement institution instead of securities collateral – may face heightened counterparty risk. Where relevant, an infrastructure settling repo transactions thus might review its practices and procedures to ensure that the arrangements allow for effective mitigation of the risks related to the extension of significant amounts of intraday credit.

Second, to the extent that repo clearing and settlement infrastructure roles, responsibilities, practices and procedures are not fully transparent, market participants may misperceive the credit and liquidity risks involved by entering into repo transactions. Moreover, particularly in times of market stress, uncertainty about the repo infrastructure roles, responsibilities, practices and procedures can give rise to concerns in using the infrastructure. Where relevant, repo clearing and settlement infrastructure facilities are thus encouraged to raise market participants' awareness of their roles, responsibilities, practices and procedures and to eliminate any related ambiguities.

Third, concerns regarding protection against counterparty credit risk in repo transactions can suddenly deter financial institutions from participating in repo markets, particularly in times of volatile collateral prices and heightened counterparty credit risk. Depending on the adequacy of their risk management, central counterparties (CCPs) can play an important role in helping financial institutions manage their counterparty risk in repo markets. Stakeholders in the repo market thus might evaluate carefully the benefits and limitations of introducing or promoting the wider use of a CCP for the repo market. In addition, other repo infrastructure facilities could evaluate whether and how they can assist participants in managing counterparty risk more effectively.

Fourth, in the event of a cash borrower's default, cash lenders must be entitled and operationally able to take possession of and liquidate the repo collateral. If cash lenders are not well prepared to do so they might withdraw from the market in times of heightened counterparty risk concerns. In markets cleared by a CCP, the CCP takes over the responsibility of liquidating collateral in the event of a cash borrower's default. In other markets, tri-party repo service providers could evaluate whether and how they can play a role in supporting their participants' preparations for collateral liquidation. Even if market participants are adequately prepared for liquidating collateral, they might still withdraw from the market if they fear that the liquidation of a substantial amount of collateral following the default of a large market participant creates the potential for fire sale conditions. While this report presents some suggestions as to how market infrastructure could help reduce the potential for fire sale conditions, it is acknowledged that this is essentially a collective action problem that requires coordinated action by market participants.

Fifth, constraints on the efficient and flexible use of collateral within repo clearing and settlement arrangements can complicate market participants' collateral management, hampering the development of liquid repo markets in normal times and affecting the resilience of repo markets in times of stress. The efficient and flexible use of collateral could be fostered by repo collateral substitution and re-use functionalities or, in the case that frictions are caused by fragmented infrastructure, by establishing efficient and secure linkages between clearing and settlement infrastructure that facilitate the transfer of collateral between different markets and countries.

Sixth, risk management practices that aggravate procyclical effects in repo markets can be detrimental to the resilience of repo markets in times of stress. To the extent that repo market infrastructures must manage their own credit and liquidity risks, they could consider adopting risk management practices that mitigate procyclical effects (eg by calibrating margins, haircuts and liquidation horizons to stressed market scenarios). This is particularly relevant for CCPs, but to some extent also for any other repo infrastructure that bears credit and liquidity risks.

Seventh, inadequate transparency as well as asymmetric information in repo markets can exacerbate the full or partial withdrawal of some repo market participants in times of heightened credit and liquidity risks. To enhance the transparency of repo markets, repo infrastructures are encouraged to consider reasonable requests – by market participants or authorities – to make available meaningful summary statistics on the repo market.

Finally, it needs to be stressed that repo clearing and settlement arrangements vary considerably across countries and markets, and hence not all of the identified issues are relevant to the same extent in each market. Nevertheless, the Working Group believes that it is worthwhile for the stakeholders in each market to review how the repo market infrastructure could be further strengthened. As a first step, the providers of repo market infrastructures in each country, jointly with market participants, regulators and the central bank, should attempt to develop a common view on the relevance of the identified issues for their market. Based on that, each repo market infrastructure could then evaluate which measure or combination of measures would be best suited to address the relevant issues in its specific circumstances.

1. Introduction

In general, repo markets are seen by market participants as a safer and more reliable source of funding than uncollateralised money markets. During the recent financial crisis, however, repo markets proved to be a less reliable source of funding liquidity than expected in some countries. The Committee on Payment and Settlement Systems (CPSS) sought to investigate the extent to which the market infrastructure – ie the practices, procedures and systems used for clearing and settling repos and liquidating a defaulting cash borrower's collateral – added to the uncertainty in repo markets and whether there is room for improvement. For this purpose, the CPSS set up a working group (see Annex 4 for a list of the Working Group members). The Working Group's efforts form part of the Financial Stability Board's (FSB) broader work stream "Strengthening the core financial infrastructures and markets", which considers improvements to market infrastructures and measures to reduce the risk of contagion.

The Working Group was mandated (i) to take stock of the existing arrangements for clearing and settling repos in the CPSS countries, including measures taken by market participants and/or central banks during the crisis to restore the functioning of repo markets; (ii) to identify and analyse the strengths and weaknesses of various clearing and settlement arrangements currently in place; and (iii) to identify options for strengthening the repo clearing and settlement arrangements with a view to enhance the resilience of repo markets.

Reflecting the diversity of the repo clearing and settlement arrangements across markets, the Working Group adopted a functional approach and analysed all repo clearing and settlement services, irrespective of whether these services are provided by dedicated market infrastructures or commercial banks.

The Working Group focused its work on the clearing and settlement of cash-driven repos. The performance of repo markets within the broader financial system and policies on the availability of services from central banks to repo counterparties and to financial market infrastructures were outside the scope of the Working Group.

Related work

A number of previous CPSS reports have analysed the clearing and settlement of repo transactions. In July 1999, the CPSS together with IOSCO published the report *Securities lending transactions: market development and implications*, which covered certain aspects of repo transactions. The 1999 report describes the market structure, size, participants and the legal framework. It also analyses types of risks and risk management practices. In November 2001 and November 2004, respectively, the CPSS and IOSCO published *Recommendations for securities settlement systems* and *Recommendations for central counterparties*. Although these recommendations are often applied to clearing and settlement infrastructures for repos, they do not focus on the infrastructure's role for repo transactions per se. These recommendations are currently being reviewed by CPSS and IOSCO.

The Committee on the Global Financial System (CGFS) has also published several reports that have examined certain aspects of repos. In March 1999, the CGFS published the report on the *Implications of repo markets for central banks*, which proposes market practices to support the development of sound and efficient repo markets. Recently, a CGFS report published in March 2010 on *The role of margin requirements and haircuts in procyclicality* sets out six policy options, including some for consideration, which, if implemented, may help counter or reduce the procyclicality in secured lending and OTC derivatives markets. While not directly focusing on clearing and settlement infrastructures, the outlined policy options are also relevant for repo markets and their clearing and settlement arrangements.

In addition, initiatives have been undertaken by the private sector to enhance the resilience and efficiency of repo markets. In the United States, a Task Force on Tri-Party Repo Infrastructure was formed under the auspices of the Payments Risk Committee (PRC) to

develop a set of recommendations for mitigating risks related to tri-party repo transactions. Among others, the final report released in May 2010 includes specific recommendations for the repo clearing and settlement arrangements in the United States. In Europe, the International Capital Markets Association (ICMA) European Repo Council released in July 2010 a white paper on the operation of the European repo market, which discusses, among others, existing barriers to the efficient transfer of collateral cross-border and key features of efficiently interconnected clearing and settlement infrastructures. Another European forum bringing together market participants, infrastructure providers and the public sector is the Contact group on euro securities infrastructures (COGESI), chaired by the ECB. It addresses post-trade issues in euro financial markets, including collateral management and interoperability between clearing and settlement infrastructures.

Purpose and structure of this report

The purpose of this report is to identify options for strengthening the repo clearing and settlement arrangements with a view to enhancing the resilience of repo markets. The primary audience of this report thus comprises providers of repo clearing and settlement services, irrespective of whether they are dedicated market infrastructure providers or commercial banks. In addition, this report should be of interest to a broader audience, including repo market participants, regulators, and central banks.

The report is structured as follows. Chapter 2 provides an overview of repo clearing and settlement arrangements, covering the major repo markets in USD, EUR, JPY, GBP, CAD, CHF, SEK and HKD.[1] Chapter 3 evaluates the impact of the financial crisis on repo markets and compares the experience of different countries, and important features of repo clearing and settlement arrangements to identify issues that have the potential to affect the resilience of repo markets. Chapter 4 explores the issues identified in more detail and discusses various ways in which repo infrastructure providers might address these issues. The concluding Chapter 5 suggests that the relevant stakeholders in each repo market review how repo market infrastructure could be further strengthened.

[1] Countries and repo market currencies are not necessarily identical as in some countries repos are also entered in non-domestic currencies. Moreover, the tri-party repo service providers offer multi-currency collateral management services.

2. Overview of repo clearing and settlement arrangements

Focusing on the clearing and settlement arrangements for cash-driven repos, this chapter describes the life cycle of a repo transaction and reviews the clearing and settlement arrangements in selected CPSS countries.

Life cycle of a repo transaction and the role of market infrastructure

A repo transaction (short for repurchase agreement) is an agreement between two parties on the sale and subsequent repurchase of securities at an agreed price. In economic terms a repo transaction is equivalent to a loan secured by securities (collateral). In cash-driven repos, cash borrowers – usually banks and securities dealers – employ repo transactions to refinance their trading portfolios or to finance short- and mid-term cash needs, essentially as an alternative or complement to other financing sources such as unsecured loans and the issuance of short-term securities. Cash lenders are typically looking for a short-term investment opportunity for surplus cash incurring minimal counterparty and market risk. Cash lenders not only include banks, but in some repo markets also investment funds, asset management firms and – in a few cases – insurance companies.[2]

Repos can be distinguished according to the involvement of intermediaries between the cash lender and the cash borrower. In bilateral repos the cash lender and the cash borrower select the collateral, initiate the transfer of cash and securities and conduct collateral valuation. In tri-party repos, however, a third party (tri-party repo service provider) enters into a tripartite agreement with the two counterparties to the transaction. The tri-party repo service provider is responsible for the administration of the transaction, in particular the selection and valuation of collateral securities.[3] Both types of repos can be combined with CCP clearing.

A repo transaction goes through several processing steps from the point at which two parties agree to execute a repo transaction to the point where the transaction is completed with the settlement of the repurchase leg. This life cycle is different from a regular buy-sell securities transaction in three important respects: the management of collateral during the life of the repo transaction, the existence of – in general – two settlement processes (ie one for the purchase leg and one for the repurchase leg), and the potential need to liquidate collateral in the event of the cash borrower's default. Figure 1 illustrates the key steps in the repo life cycle, which are briefly described below. A more detailed description can be found in Annex 1 of this report.

Documentation: In most countries, the contractual basis for entering into repos consists of domestic and/or international master agreements between the cash lender and cash borrower. These contracts are complemented by clearing and settlement agreements between trading parties and key infrastructures, such as central counterparties and tri-party repo service providers.

Trade execution: Repo transactions are typically agreed bilaterally between cash lenders and borrowers, through electronic trading systems, phone or e-mail. Some inter-dealer trades are executed through inter-dealer brokers via electronic broker screens or phone. The

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[2] Closely related to cash-driven repos are so-called special repos, where the primary focus is on lending or borrowing specific securities rather than cash. In special repos, the cash plays the role of collateral, and the interest rate charged, which depends on the "specialness" of the security, is in general lower than in cash-driven repos. The clearing and settlement arrangements for special repos are often similar to cash-driven repo transactions.

[3] Another type of repos is hold-in-custody repos. They are characterised by the cash borrower retaining control of the securities and by serving simultaneously throughout the transaction not only as principal but also as the cash lender's custodial agent. The focus of this report is on bilateral and tri-party repos.

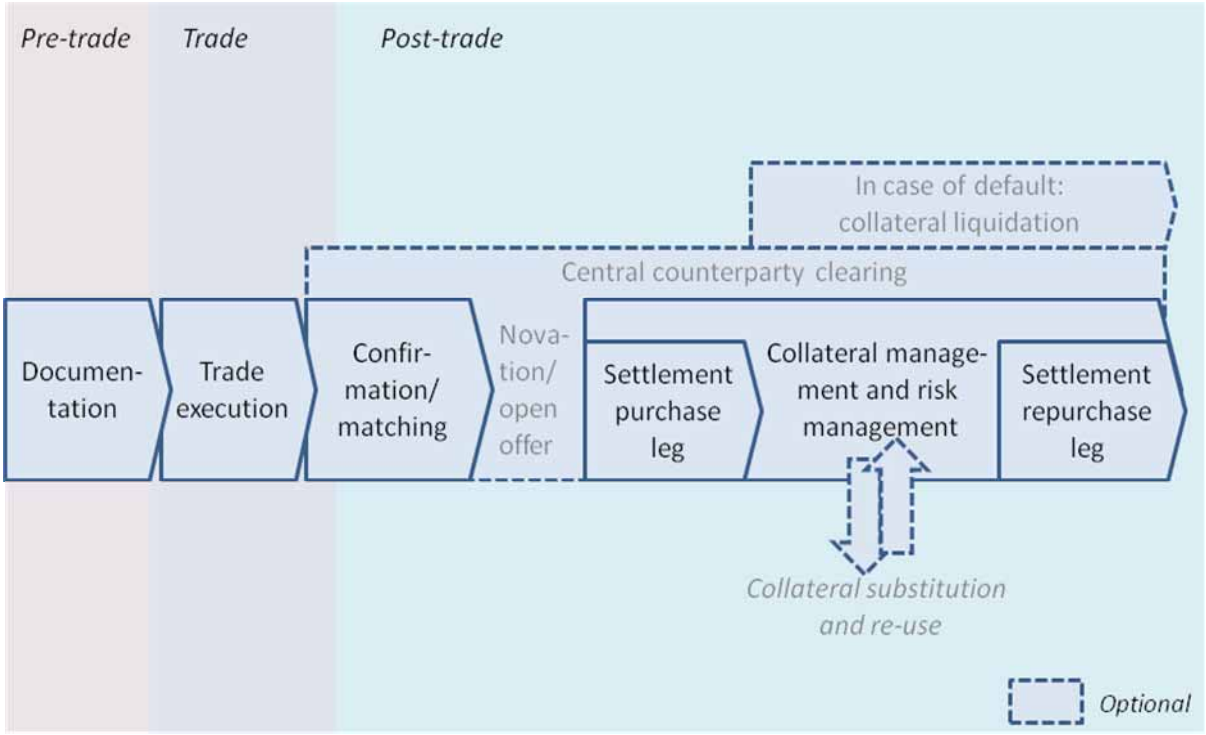
execution of repo transactions is less standardised and less often electronic compared to buy-sell securities transactions.

Confirmation/matching: Affirmation of the economic terms (also known as verifications) and confirmations are done over phone, fax, e-mail or on electronic platforms. Responsibility for entering the settlement instructions into the relevant settlement systems depends on the country and the trading venue. If trades are executed bilaterally over phone or e-mail, each trading party is usually responsible for entering instructions to the settlement system where they are matched. If trades are executed on an automated trading platform, responsibility can lie with the trading platform, which sends pre-matched instructions, or with the counterparties (similar to trading over the phone or e-mail).

Novation/open offer and central counterparty (CCP) clearing: Once a repo transaction has been confirmed and matched, a CCP may become the lender to the cash borrower and the borrower to the cash lender. This can be achieved through novation or open offer.[4] As in other financial markets, CCP clearing is an optional feature in repo markets. The benefits and limitations of CCPs in repo markets are discussed in Box 1 below.

Figure 1

Life cycle of a repo transaction



Settlement of purchase leg: On the value date, the purchase leg is settled in the same payment and securities settlement systems used for buy-sell transactions, sometimes complemented by specific repo modules, eg for the automated selection of collateral.

[4] In the case of novation, the agreement between the cash lender and cash borrower is replaced by two agreements, one between the cash lender and the CCP, the other between the cash borrower and the CCP. In the case of open offer, after the cash lender's and the cash borrower's offers are matched, the CCP automatically and immediately becomes interposed in that transaction, thus creating two separate agreements. At no stage does a direct agreement between the cash lender and the cash borrower exist.

Collateral management and risk management: After the settlement of the purchase leg, values must be assigned to collateral (by using trade data to conduct mark-to-market valuations of the collateral and to apply appropriate margins and haircuts[5]) and margin calls must be triggered if the collateral value falls below the loan value. These functions may be performed by the cash lender, a tri-party repo service provider on behalf of the cash lender, or by a CCP, depending on the type of repo. Collateral substitution allows the cash borrower to substitute collateral during the lifetime of a term repo in order to obtain the return of specific collateral. Collateral re-use allows the cash lender to use the received collateral for alternative purposes during the lifetime of the repo.

Settlement of repurchase leg: Upon termination of the repo, securities collateral is returned to the cash borrower and cash, including interest, is returned to the cash lender. For the settlement of the repurchase leg, counterparties rely on the same payment and securities settlement systems as for the purchase leg.

Collateral liquidation (in case of default): If the cash borrower defaults, the cash lender (including, where available, repo CCPs) will need to assume control over the collateral and liquidate it to cover its losses or refinance the collateral to obtain liquidity. The ability of the cash lender to assume control of and liquidate a potentially large collateral portfolio in a timely manner depends critically on clear and enforceable legal documentation[6] and its own operational capabilities.

Box 1

Benefits and limitations of CCPs in repo markets

When it comes to the benefits they yield and the limitations they face, CCPs for repo markets are comparable with those in other financial markets. From the perspective of individual repo counterparties, the benefits of a CCP in terms of risk management and efficiency will depend – among other factors – on its risk management framework including the financial resources available in case of participant default, on the standardisation of repo contracts, and on the ability to reduce open exposures from repos through legally effective netting between a CCP and each member generating multilateral netting benefits. Netting efficiency depends on market structure, and the number of participants and trading patterns. In addition, from a broader financial stability perspective, CCPs act as a firewall against the propagation of default shocks across major market participants, and they can mitigate procyclicality, enhance market transparency, facilitate collateral liquidation, and foster standardisation of repo terms and eligible collateral. For example, as discussed in the recent CGFS report on *The role of margin requirements and haircuts in procyclicality*, CCPs could impose minimum constant through-the-cycle margins and haircuts, preventing sudden and large one-off collateral calls that may severely affect the liquidity of an institution. A CCP might also be better equipped to administer the liquidation of a large portfolio compared to uncoordinated liquidation by individual counterparties. In case of a default, the CCP's standardised procedures would contribute to an orderly closeout of repos and collateral liquidation, hence mitigating contagion risk and spillover effects. In some markets, CCPs are also under evaluation as a possible instrument for providing anonymity, and hence for preventing stigmatisation effects in times of stress.

[5] Haircuts are expressed as a discount on collateral value, while margins are expressed as a mark-up on exposures.

[6] Enforceability will depend not only on contract law in the relevant jurisdictions, but also on the bankruptcy or insolvency law applicable to the cash borrower in the relevant jurisdictions. The ability of the insolvency authority to impose stays on collateral liquidation or impose losses on secured lenders is an important consideration. This report does not analyse these issues.

Box 1 (cont)

CCPs in repo markets face limitations that are comparable to those applying to CCPs in other financial markets, although some of these limitations might be particularly relevant for repo markets. First, CCPs concentrate counterparty risk and hence their failure could have system-wide consequences. It is therefore essential that CCPs are adequately regulated and comply with minimum requirements as outlined in the CPSS-IOSCO *Recommendations for central counterparties*. Second, a CCP's usefulness depends on the degree of standardisation of repo terms, which are often agreed bilaterally. Third, if repo market participants are typically on one side of the market, a CCP may not be able to significantly net down volumes and values. In this case, open positions in a repo CCP can be very large and could create substantial additional collateral requirements. Fourth, the capacity of a CCP to administer a participant's default depends critically on its operational capabilities and its ability to rapidly obtain liquidity to meet its assumed settlement obligations and to close out repos and liquidate collateral in an orderly manner. Given the often very large size of open positions by major repo market participants, the collateral amounts to be liquidated may be very high. Fifth, in some markets cash borrowers and lenders may include a variety of non-bank financial institutions and institutional investors. On the one hand, if these institutions have direct access, the CCP will face challenges with regard to risk monitoring and loss allocation. On the other hand, if direct access is not permitted, these institutions will have to rely on direct participants to access the CCP. Finally, given the role of the repo market as a key funding source for financial institutions, the suspension or exclusion of a participant by a CCP could severely affect the participant's funding ability. Hence, the exclusion of a major participant, even if it is in line with the CCP's rules and regulations, could conflict with broader financial stability objectives.

Repo clearing and settlement arrangements in selected CPSS countries

A cross-country comparison of clearing and settlement arrangements for repo transactions in selected CPSS countries reveals a few similarities and a number of differences, both minor and fundamental. The most important similarities and differences are outlined below. Annex 2 of this report contains a comprehensive cross-country comparison of repo infrastructure arrangements.

In the countries analysed, clearing and settlement arrangements for repos are typically either integrated in the clearing and settlement of buy-sell securities transactions, or provided through special repo modules or segments of established buy-sell infrastructures (eg collateral management services, and reporting and notification on relevant custody events). No stand-alone, dedicated arrangements for clearing and settling repo transactions were identified. However, repo transactions often make up a significant share of the transaction values in those buy-sell infrastructures that handle repo transactions.

While repos in all countries thus clear and settle to a very large extent on the same infrastructure as regular buy-sell transactions, there are only a small number of additional similarities. First, all markets analysed have in common that repos settle in DVP mode, eliminating principal risk in the settlement of the purchase and repurchase legs of a repo transaction. Settlement in all markets is also facilitated by securities lending and borrowing services to minimise settlement fails. Another similarity is that in the event of a cash borrower's default, none of the markets have a dedicated collateral liquidation facility that could support or coordinate the liquidation of collateral across multiple counterparties. However, in markets cleared by a CCP, one could argue that the CCP de facto assumes the role of a dedicated collateral liquidation facility.

The repo clearing and settlement arrangements in the CPSS countries analysed exhibit an array of differences, reflecting to some extent the differences present in the buy-sell infrastructure in these countries. Some of the key functional differences include:

- ***Clearing:*** In the majority of the CPSS countries analysed, a CCP is available for clearing repos, but the scope and the share of CCP clearing varies considerably. In some countries they form an essential part of the repo infrastructure and are widely used, in other countries they are established but rarely used. Yet, in other countries repo CCPs are currently being introduced or evaluated. Where they are established, repo CCPs are part of a CCP that also clears other market segments, including buy-sell securities transactions.

- ***Settlement:*** Settlement arrangements vary along several dimensions. First, in some CPSS countries, repo transactions are settled in central bank money, while in other countries they are settled in commercial bank money. Second, the role and significance of intraday credit to expedite repo settlement varies considerably. Third, in some markets the settlement window for repos is separate and often shorter than the settlement window for buy-sell transactions, while in other markets the settlement of repo and buy-sell transactions overlap. Finally, while in all markets securities lending and borrowing services place limits on settlement fails, in some markets they are complemented by penalties and further incentives to settle on time.

- ***Collateral management:*** The management of repo collateral during the life of the repo transaction varies along three key dimensions – the collateral manager, the mechanism used for collateral substitution, and the ability of the cash lender to re-use collateral. First, collateral is managed directly by the cash lender (or its custodian bank) or by a third-party agent (eg a tri-party repo service provider or a tri-party collateral management service provider). The relevance of tri-party repo service providers to repo transactions varies significantly. While in some countries almost all repos are managed by a tri-party repo service provider (eg United States, Switzerland), such services do not exist at all in other countries (eg Sweden), or are of relatively low importance (eg in the euro area about 10% of repos are tri-party). Second, where available, substitution of collateral by the cash borrower during the term of the repo is achieved in different ways. In the United States and United Kingdom, term repo transactions are typically unwound daily allowing for the delivery of different securities at the end of the day when the (term) repo is re-settled. In tri-party repos in Europe, on the other hand, the tri-party repo service providers allow for continuous substitution of specific collateral over the life cycle of the repo transaction. In some other countries substitution of collateral by the cash borrower is not allowed. Finally, the scope for the cash lender to re-use collateral also varies. In some countries (eg Switzerland) full re-use is permitted, in other cases (eg the Euro GC Pooling segment of Eurex Repo) re-use is possible within the system, while in the United States – for tri-party repos and GCF repos – re-use is not permitted, or not possible by design.

- ***Risk management:*** In almost all markets, margins and haircuts are applied to the mark-to-market collateral value to provide a cushion against market fluctuations in collateral value. In some markets, they are specified bilaterally between the cash borrower and cash lender. In other cases, such as when trades are executed on electronic trading platforms, there may be a standard haircut or margin by collateral type applied to all repo transactions. In markets where a CCP is involved, the CCP effectively standardises the margins and haircuts as it becomes the counterparty to every cash borrower and every cash lender. In contrast, tri-party repo service providers typically only implement the margins and haircuts agreed upon by the counterparties.

- ***Degree of automation:*** A few of the markets analysed achieve full straight through processing from the trade execution on electronic platforms to the termination of the transaction by settling the repurchase leg. In other markets, one or several post-trading steps of the repo life cycle require manual interventions.

Besides these functional differences, the clearing and settlement arrangements in the analysed CPSS countries also vary according to institutional features such as the organisational structure, ownership and business model of repo infrastructure providers and access to these infrastructures. For example, in some countries repo infrastructures are organised as dedicated infrastructures or special-purpose banks, while in other countries the infrastructure for clearing and settling repos is part of a general purpose commercial bank. Moreover, in some countries, repo market counterparties have mainly direct access to market infrastructures, while in other countries tiering plays a larger role.

Against the backdrop of these cross-country differences in terms of repo clearing and settlement arrangements, the Working Group investigated to what extent specific features of these arrangements might enhance or compromise the resilience of the repo market, particularly in times of stress. In the next chapter, this issue is analysed in the light of the experience of the financial crisis.

3. Repo clearing and settlement arrangements in the light of the financial crisis

This chapter summarises the main developments in repo markets during the recent financial crisis and identifies the features of repo clearing and settlement arrangements in selected CPSS countries that might have affected the resilience of repo markets.[7] The features identified will be explored in more detail in Chapter 4.

General repo market developments

The performance of repo markets during the financial crisis has been analysed from various perspectives.[8] These studies conclude that in markets around the world the terms for secured lending, which includes cash-driven repo transactions, became progressively tighter for a range of asset types over the course of the crisis. With the exception of a few markets or market segments, the absolute volume of repos declined during the crisis.

The first phase of the financial crisis was marked by a considerable loss in counterparty confidence, which resulted in a shift from the unsecured to the secured money market. In all markets under consideration and for which relevant data is available it was observed that the relative importance of the repo market as a source of short-term refinancing increased. This corroborates the view that secured money markets tend to be a more reliable source of funding liquidity relative to unsecured money markets.

Nevertheless, especially in the second phase of the financial crisis, after the collapse of Lehman Brothers in September 2008, absolute outstanding values in the analysed repo markets declined.[9] There were, however, a few exceptions, where outstanding repo values actually increased. For example, the CCP-cleared German Eurex repo market, and in particular its EURO GC (General Collateral) pooling segment, increased. Sterling and euro repo volumes cleared by LCH.Clearnet Ltd also increased over the period, with volumes in October 2008 setting a record. Repo volumes cleared by FICC in the United States and LCH.Clearnet SA in France increased as well, and there are indications that in other European markets the reduction in outstanding repo values was less pronounced for CCP-cleared repos than for other repo segments.

The general decline in outstanding repo values can be attributed to a number of factors. Doubts about the creditworthiness of counterparties as well as legal and operational concerns regarding the ability to liquidate collateral in case of counterparty default became more pronounced. As a consequence, within most secured money markets cash lenders

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[7] More detailed information on repo markets during the crisis is provided in Annex 3 of this report, which outlines country- and market-specific developments such as changes to (i) repo market volumes and values; (ii) eligible collateral used in repo markets; (iii) repo maturities; (iv) repo margins and haircuts; (v) repo settlement fails; (vi) other notable changes or issues in repo markets during the crisis; and (vii) central bank actions taken with regard to the repo market.

[8] See, for example, CGFS Publications no 37, *The functioning and resilience of cross-border funding markets,* prepared by a joint Study Group of the CGFS and the Markets Committee, March 2010; and CGFS Publications no 36, *The role of margin requirements and haircuts in procyclicality*, March 2010. See also P Hördahl and M King, "Developments in repo markets during the financial turmoil"*, BIS Quarterly Review*, December 2008; and "Euro repo markets and the financial market turmoil", *ECB Monthly Bulletin*, February 2010.

[9] For example, the estimated outstanding values in the European repo market dropped from a peak in June 2007 of EUR 6,775 billion to a low in December 2008 of EUR 4,633 billion. Since December 2008, outstanding values have increased again to EUR 5,582 billion in December 2009 *(ICMA European Repo Market Survey December 2009).* The size of the US tri-party repo market declined from a peak of about USD 2.8 trillion in early 2008 to USD 1.7 trillion during the first quarter 2010 (Federal Reserve Bank of New York: *Tri-party repo infrastructure reform,* Federal Reserve Bank of New York, May 2010).

demanded shorter repo maturities and higher quality collateral (eg government securities). At times, counterparty credit risk concerns reached levels where some market participants were unwilling to lend even against high-quality collateral. The decline in outstanding volumes also reflected a general deleveraging by market participants and, as funding uncertainty increased, a widespread reluctance to lend cash. In several markets the decline in market activity was amplified by an increase in haircuts and margins and by cuts in credit lines and concentration limits. In addition, market participants' defensive behaviour triggered by the concerns and uncertainties about credit and liquidity risks might have been aggravated by a lack of transparency in some repo markets. Finally, in many markets, generous liquidity provision by central banks and low levels of interest rates also contributed to a decline in repo values.

The role of repo clearing and settlement arrangements

Not all repo markets were affected to the same degree by the financial crisis, and a few market segments actually experienced volume growth or a shift to longer transaction maturities. The Working Group thus compared different country experiences during the financial crisis and important features of clearing and settlement arrangements to identify issues that have the potential to affect the resilience of repo markets. However, the comparison is complicated by two factors. First, besides the particular clearing and settlement arrangements, there are a number of other environmental factors that differed markedly in the analysed markets (eg the level of counterparty risk or the leverage of repo market participants at the beginning of the financial crisis). It is thus difficult – if not impossible – to rigorously determine how far the differences in market resilience can be attributed to clearing and settlement arrangements. Second, even if one could control for the impact of these environmental factors, clearing and settlement arrangements typically differ along many dimensions, making it difficult to attribute differences in market resilience to individual features of clearing and settlement arrangements. These difficulties notwithstanding, the Working Group believes to have identified the following five clearing and settlement related features that have played a role during the financial crisis.

The extension of significant amounts of intraday credit in some markets – either by the repo infrastructure providers themselves or by settlement banks supporting the repo infrastructure – created vulnerabilities for the repo infrastructure and repo market counterparties. For instance, the extension of intraday credit in the repo market in the United States is the direct result of the clearing banks' practice of unwinding all maturing and non-maturing repos at the start of the processing day (usually in the early morning), and not recreating (or rewinding) non-maturing repos and settling new repos until near the close of the processing day, usually in the late afternoon. The practice of daily unwinds of non-maturing (term) repos can be due to market conventions, inadequate processing capabilities of infrastructures and/or for daily substitution of collateral. The issue of intraday credit extensions is further explored in Section 4.1 in the next chapter.

There are indications that in some countries not all stakeholders were fully aware of the risks that market participants and repo infrastructure providers incurred. Insufficient transparency regarding the role(s) and responsibilities of repo infrastructure providers can lead to misperceptions of the credit and liquidity risk in repo transactions, including the risk involved in using the repo clearing and settlement arrangements. Insufficient transparency can also give rise to a lack of confidence in using the infrastructure, particularly in times of market stress. Infrastructure providers which are part of an entity also engaging in commercial banking or securities trading activities seem to be particularly prone to such situations, as participants might not be able to clearly distinguish between their various relationships with such entities. The issue of transparency about the roles and responsibilities of repo service providers is further explored in Section 4.2.

As counterparty risk increased during the financial crisis, there is evidence that many cash lenders withdrew from the market, either in full or partially, since they considered that repo

collateral no longer provided effective protection against counterparty credit risk. However, as discussed above, this behaviour was generally not observed in markets or market segments that were cleared by a repo CCP. To the extent that counterparty exposures and counterparty risk are reduced by CCP clearing, a robust CCP can increase the resilience of repo markets in times of stress, when counterparty risk concerns are high. The issue of effective protection against counterparty credit risk in repo transactions is further explored in Section 4.3.

At least in some markets, a complementary factor explaining the withdrawal of market participants from the repo market during the financial crisis is that not all cash lenders were adequately prepared to take control of and liquidate repo collateral in the event of a counterparty default. Concerns about collateral liquidation thus might have led to an inordinate decline in repo market activity when counterparty risk concerns were high. Again, in repo markets cleared by a CCP, this factor seems to have been less of a concern, as the CCP assumes de facto the role of a dedicated collateral liquidation facility, which liquidates collateral in the event of a cash borrower's default.[10] The issue of collateral liquidation is further explored in Section 4.4.

Especially in stressed market conditions, when there is a flight to (scarce) high-quality collateral, constraints on the efficient use of high-quality collateral in repo clearing and settlement arrangements can affect the resilience of repo markets. Arrangements that contribute to the efficient use of collateral exist in several markets. For instance, in Germany (Euro GC pooling segment), collateral previously received in interbank repos can be re-used to access liquidity from the central bank. Both in Germany and Switzerland, collateral eligibility criteria and valuation rules in the interbank repo market are aligned with central bank eligibility criteria, and operational procedures are closely integrated. Moreover, market infrastructures with a network of linkages to securities markets (eg Clearstream Banking Luxembourg, Euroclear Bank, SIX SIS) allow for the centralisation and the flexible delivery of foreign collateral (eg in tri-party repo arrangements), which increases the amount of high-quality collateral available in these markets. For example, in Switzerland, the share of foreign currency denominated collateral delivered in interbank repo transactions increased from roughly 50% before the crisis to 85% in December 2009, with the quality of the collateral delivered remaining unaltered. This example shows that a flexible delivery of foreign collateral and hence a wide range of high-quality collateral can support the functioning and resilience of the repo market. The issue of efficient use of collateral is further explored in Section 4.5.

In addition, the Working Group believes that the providers of repo infrastructures can be in a good position to help address two other more general issues that can affect the resilience of repo markets, namely procyclicality and inadequate transparency in repo markets. These issues are further explored in Sections 4.6 and 4.7. Finally, the Working Group has identified three issues – access to repo clearing and settlement services, governance, and financial risk management – which might be particularly complex and demanding for those infrastructure providers that are part of an entity also providing commercial banking services. These considerations are discussed in Section 4.8.

[10] The default of Lehman Brothers in September 2008 highlighted the importance to CCPs of adequate risk management and default procedures. For instance, in one country, it took the CCP several days to liquidate the collateral after the failure of Lehman Brothers.

4. Options for strengthening repo clearing and settlement arrangements

The Working Group has identified seven issues or concerns that are particularly relevant for or specific to the clearing and settlement of repo transactions. While not all issues are relevant to the same extent in each market, each has the potential to affect the resilience of repo markets. This chapter explores the seven issues in more detail and proposes some ways in which repo clearing and settlement infrastructures might address these issues.

The proposed options for repo clearing and settlement infrastructures aim to further the stability and resilience of the financial system in normal times and in particular during times of stress, while preserving the financial system's efficiency, flexibility and capacity for innovation. A robust set of arrangements for clearing and settling repo transactions contributes to financial stability by facilitating an efficient and resilient repo market, even in times of stress, so that (i) banks, securities dealers and other financial institutions can obtain short-term collateralised funding, and (ii) cash-rich financial institutions have a useful, liquid and low-counterparty risk investment instrument in which to place short-term funds. It needs to be stressed, however, that repo clearing and settlement arrangements cannot fix all potential issues in repo markets and need to be complemented by additional measures, particularly in contractual design, market participants' risk management and the specification of eligible collateral for repo transactions.

Due to the diversity of institutional arrangements in repo clearing and settlement, the Working Group adopted a functional approach. The proposed options are thus directed to all arrangements used by market participants for clearing or settling repos (including centralised collateral management services), irrespective of whether these services are provided by dedicated market infrastructures or commercial banks (eg the clearing banks in the United States). In addition, the Working Group has identified three issues which might be particularly complex and demanding for infrastructure providers that are part of an entity also providing commercial banking services. These issues – namely access to repo clearing and settlement services, governance, and financial risk management – are outlined in Section 4.8 of this chapter.

4.1 Effective mitigation of risks related to intraday credit extensions

Significant values of intraday credit can be extended by repo settlement infrastructures (eg in the United States), or by settlement banks supporting the repo infrastructure (eg in the United Kingdom[11]). Large credit extensions can be occasioned by the operational design of the repo infrastructure. For example, significant amounts of credit can be extended in systems where the repo infrastructure unwinds all or a large portion of non-maturing term repos at the start of the processing day (usually in the early morning), and only recreates (or rewinds) non-maturing repos near the close of the processing day (usually in the late afternoon).[12] The unwinding of non-maturing term repo transactions intraday gives a cash

[11] But note that in the United Kingdom, the Bank of England provides intraday liquidity through self-collateralising repos (SCRs) which enable CREST settlement banks to repo their SCR-enabled CREST members' eligible securities in return for sterling liquidity to help the settlement bank fund CREST members' purchase of those securities.

[12] For instance, in the United States, when non-maturing term repos are unwound or broken at the beginning of the day, the securities used as repo collateral are temporarily transferred back to the securities dealers and the cash borrowed by the securities dealers is temporarily returned to the lenders. By debiting the securities dealers' accounts for large amounts when returning cash to the lenders, the securities dealers' accounts go into overdraft. The overdrafts are in essence credit extensions made by the clearing banks. In addition, as a result of receiving cash in exchange for collateral, the cash lenders temporarily hold deposits with the clearing banks, not securities.

borrower the flexibility to substitute securities used as collateral and, at the same time, it is simpler operationally than processing substitutions of collateral individually as needed during the day.[13] A cash borrower that is a securities dealer and actively trading a portfolio will need some, or possibly many, of the securities locked up as collateral in repo transactions in order to deliver them during the day and meet settlement obligations. Similarly, a securities dealer will receive securities during the day that it would like to use as repo collateral. Unwinding term repos early in the day and recreating them late in the day simplifies the daily substitution of securities used as collateral, which expedites settlement of buy-sell transactions and gives securities dealers more opportunities to obtain repo financing for their constantly changing inventory. Cash lenders also benefit because cash borrowers are more willing to engage in term repos in exchange for higher interest rates, provided that the specific securities used as collateral can change daily.

Large credit extensions can also be the product of a repo infrastructure settling maturing repos early in the day and not settling new repos until late in the day.[14] This practice, like the unwinding of non-maturing term repos, affords more flexibility to cash borrowers, while being simple for the infrastructure to execute. The settlement of maturing repos in the morning allows dealers to use securities serving as repo collateral to meet settlement obligations throughout the day and before the maturing repos are rolled over or paid down with cash obtained from other sources. In addition, the settlement of new repos in the evening allows a dealer a better chance of obtaining repo financing for securities it receives during the afternoon. Benefits accrue to the cash lenders too, as they have more opportunities to find a short-term investment for any surplus cash that becomes available late in the day.

In addition to the large value of intraday credits highlighted above, the indiscriminate unwinding of repos and the settlement of new repos late in the day can also lead to further risks. First, the sizeable extensions of intraday credit make a repo cash borrower vulnerable to risk management decisions by the lender, be it the infrastructure or a settlement bank supporting the infrastructure. Any abrupt change in the infrastructure's or a settlement bank's policies and practices can have consequential impacts on a repo market participant when the amount of intraday credit extended is large and alternative sources of credit are unavailable. Second, the unwinding of repos early in the day means that the cash lender holds a cash deposit intraday instead of securities collateral. Holding an unsecured cash deposit intraday implies counterparty risk, which the cash lender was trying to avoid in the first place by entering into a repo. If repo market participants become concerned about the financial condition of the institution where they hold their deposits intraday, they may avoid engaging in repos. Third, the unwinding of term repos increases overall settlement volumes, potentially leading to higher settlement risks. Finally, the late re-winding of repos may run counter to efforts to achieve early finality of repo settlement during the day.

Options for repo clearing and settlement infrastructures

Where relevant, an infrastructure settling repo transactions might review its practices and procedures to find ways to reduce intraday credit extensions and ensure that the risks related to remaining intraday credits are effectively mitigated. Infrastructures have a number of

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[13] While some repo infrastructures have the capability to substitute collateral intraday, doing so either takes away some flexibility in the use of collateral by cash borrowers or requires substantial IT investments and processing capabilities if the substitutions are made rapidly and in large numbers.

[14] For instance, in the United States, when maturing repos are settled in the morning, the securities used as repo collateral are transferred back to the securities dealers and the cash borrowed by the securities dealers is returned to the lenders. By debiting the securities dealers' accounts for additional amounts, the securities dealers' accounts with the clearing banks go into overdraft. And by receiving cash in exchange for collateral, the cash lenders temporarily hold deposits with the clearing banks, not securities, even if they will be entering into new overnight or term repo transactions that same day.

options available to establish effective risk controls, with the most reliable approach judged to be a combination of collateralising and limiting credit extensions. A decision to introduce new procedures or additional risk controls should, however, be made judiciously and take into consideration all relevant factors and interests, including the volume and value of repo settlements, concentrations in the market, the reliance of financial institutions on repo financing, the quality of the securities used as collateral, the ability to re-use collateral, and the efficiency of the infrastructure.

The practice of unwinding all or the bulk of repo transactions early in the day is already under review in the United Kingdom and the United States. In the United Kingdom, Euroclear UK & Ireland is currently reviewing its delivery by value (DBV) service – which provides a method of settling term repo instructions as a series of overnight instructions – by incorporating a term DBV functionality including some automated ability to substitute collateral (CREST also provides a term repo product, but most repo activity appears to be undertaken via DBVs). In the United States, the PRC Task Force on Tri-Party Repo Infrastructure is exploring options for the overhaul of clearing bank settlement procedures, including changing the time of day at which maturing repos and new repos are settled, and implementing a facility for automated collateral substitution. In its final report, the PRC Task Force on Tri-Party Repo Infrastructure recommends implementing "operational enhancements to achieve the 'practical elimination' of intraday credit by the Clearing Banks".

4.2 Transparency of repo clearing and settlement infrastructure roles, responsibilities, practices and procedures

The inadequate transparency of repo clearing and settlement infrastructure roles, responsibilities, practices and procedures can lead to misperceptions of the credit and liquidity risk involved in using the repo infrastructure. It can also undermine confidence in using the infrastructure, particularly in times of market stress.

The presence of an agent in a tri-party repo introduces the potential for ambiguities that do not exist with respect to bilateral repos or buy-sell transactions involving the same securities. In particular, the roles and responsibilities of the tri-party repo service provider can become blurred if, for example, following the unwinding of repos the tri-party agent extends intraday credit or overnight securities loans to the cash borrower.[15]

Additional ambiguity about services, rights and responsibilities can arise if the repo clearing and settlement infrastructure is part of an entity also providing commercial banking services. In particular, market participants may raise the question of how confidential information gained through the provision of infrastructure services or other banking services could be used.

Options for repo clearing and settlement infrastructures

To make infrastructure arrangements as transparent for repo transactions as they are for buy-sell transactions, repo clearing and settlement infrastructures might raise market participants' awareness of and reduce ambiguity surrounding their roles, responsibilities,

[15] In the United States, the PRC Task Force on Tri-Party Repo Infrastructure noted in its December 2009 *Progress Report* that market participants assumed that clearing banks would continue to extend intraday credit, although in reality clearing banks had the right not to do so. There was no detailed description within repo and tri-party documentation regarding the circumstances in which the clearing banks would exercise their right to refuse to engage in the morning unwind process (thereby leaving the dealer credit exposures with repo investors) or when clearing banks would require dealers to post more collateral to the clearing banks itself. In other markets where tri-party repo service providers are widely used, uncertainty seemed to have been centred to some extent around the rights, responsibilities and procedures of the tri-party repo service providers in case of a default of a repo counterparty.

practices and procedures, including the infrastructure's methods and data sources for valuation of the collateral provided to the infrastructure (as principal or as agent). Transparency allows participants to correctly assess the potential for credit losses and liquidity pressures resulting from repo transactions, including the pre-settlement and settlement risks stemming from the use of the repo clearing and settlement infrastructure. This is particularly important for tri-party repo service providers, whose rights and responsibilities (eg in risk management or in the case of a default) have not in all cases been entirely clear to the market.

However, it must be emphasised that while market infrastructures should make relevant information available, their participants are also responsible for ensuring that they are adequately informed and – if necessary – for demanding additional transparency from the market infrastructures they are using.

Transparency is particularly critical where infrastructures are part of an entity also providing commercial banking services. In this case, transparency on roles and responsibilities might also encompass how the infrastructure internally shares information and how it ensures that confidential information gained through the provision of infrastructure or other banking services is not misused. This would address potential concerns of market participants that confidential information may be used by an infrastructure to the disadvantage of its participants.

4.3 Effective protection against counterparty credit risk[16]

Insufficient protection against counterparty credit risk in a repo transaction, whether actual or perceived, can swiftly deter financial institutions from participating in repo markets. This is the case particularly in times of volatile collateral prices and heightened counterparty credit risk. Concerns can arise due to uncertainty about the value and liquidity of collateral or inadequate margins and haircuts. Also, anecdotal evidence suggests that during the financial crisis some repo market participants were reluctant to lend to a counterparty below a certain credit quality, irrespective of the collateral provided. This might be related to a lack of transparency about default procedures and related rights, responsibilities and processes. Uncertainty about legal risks in repo transactions and about the speed and ease of liquidating collateral and related liquidity risks might also have contributed to this situation (see also Section 4.4). Hence, the financial crisis highlighted that in secured transactions too participants are concerned with the credit quality of their counterparty, irrespective of the quality of the collateral received.

Counterparty risk concerns can be addressed to some extent by the use of CCPs that take over the counterparty risk in a repo transaction and become the cash lender to every cash borrower and the cash borrower to every cash lender. The effectiveness of a CCP in mitigating counterparty risk will depend on its own robustness and the scope for multilateral netting, which can reduce the open exposures from repos. In turn, netting efficiency will depend on market structure, participant numbers, the trading patterns of participants, and whether the CCP also clears outright transactions in the underlying repo securities.

The CCP-cleared German Eurex Repo market, and especially its Euro GC Pooling segment, as well as the CCP-cleared GC repo segments in France, the United Kingdom and the United States (cleared by LCH.Clearnet SA, LCH.Clearnet Ltd and FICC, respectively), were

[16] This section focuses on the counterparty risk taken by the cash lender. However, if the repo is over-collateralised (eg through margins or haircuts), the cash borrower in a repo can also face counterparty risk. CCPs can reduce these exposures for the cash borrower. In addition, Euroclear Bank, for example, offers a service that aims to reduce unsecured exposures by allowing the transfer of an initial margin to a dedicated account opened in the name of Euroclear Bank, instead of transferring it to the cash lender.

the only repo markets that saw an increase in outstanding values during the financial crisis. In other European markets, there are indications that the reduction in outstanding repo values was less pronounced for CCP-cleared repos than for other repo segments.

Options for repo clearing and settlement infrastructures

Repo clearing and settlement infrastructures can play different roles in mitigating counterparty risk. In particular, stakeholders in the repo market might evaluate carefully and comprehensively the benefits and limitations of introducing or promoting the wider use of a CCP for the repo market (for a discussion of the benefits, limitations and some particularities of CCPs in repo markets, see Box 1 in Chapter 2).

If a CCP is considered appropriate, it can help reduce market participants' level of counterparty credit risk. Provided that the CCP has a strong and transparent risk management framework, has sufficient financial resources and is adequately regulated, it becomes a financially robust counterparty for CCP-eligible transactions. This reduces the probability that elevated counterparty credit concerns would lead market participants to cease trading, thereby restricting access to funding.

Irrespective of the presence of a CCP, repo infrastructures might evaluate whether and how they can assist participants in managing counterparty risk more effectively. For instance, potential measures might be geared towards reducing market participants' uncertainty surrounding exposures at various points during the life cycle of the repo transaction (see also Section 4.2), assisting market participants in determining and implementing the methodology for collateral eligibility and valuation, or supporting their participants' preparations for collateral liquidation (see also Section 4.4).

4.4 Adequate capabilities for collateral liquidation

If the liquidation of repo collateral following the default of a cash borrower does not proceed smoothly, the needs or expectations of the cash lenders will not be met. For cash lenders to quickly recover the full amount of the loan, they must be entitled and operationally able to take possession of repo collateral soon after a default. In addition, cash lenders must be able to execute the liquidation of repo collateral successfully. This means that the process must be administered so that the transfer and the sale of the securities are timely, efficient (not excessively costly or hampered by errors), and effective in obtaining a good sale price. For this to occur, certain steps must be taken in advance: the cash lender in a repo must establish brokerage agreements, draw up and sign contracts, and assign staff to the various tasks. Experience from the financial crisis has shown that in a few repo markets even some significant cash lenders, especially non-banks, were unready to take control of and liquidate repo collateral.

The liquidation of repo collateral could also go awry because a substantial amount of collateral would need to be liquidated following the default by a large financial institution that is a heavy user of cash-driven repos. The liquidation of a sizeable amount of collateral creates the potential for a fire sale or panic selling, which could initiate or amplify a significant sudden fall in securities prices. A fire sale can be precipitated by regulations, internal risk management practices, fear of reputational damage, or other factors that compel cash lenders (collateral takers) to sell quickly and without regard to market conditions. The potential for a fire sale is a function of the liquidity and depth of the markets for the securities serving as repo collateral, which may be impaired by stress in the financial system. The potential for a fire sale is also a function of the sources of liquidity available to the cash lender, which are chiefly same-day market transactions and pre-arranged liquidity lines from commercial banks. They could also include central bank liquidity facilities for which the cash lender would be eligible.

Options for repo clearing and settlement infrastructures[17]

Tri-party repo service providers and potentially also CSDs could evaluate whether and how they might play a role in supporting their participants' preparations for taking possession of and liquidating collateral. Some options are outlined below, though their feasibility will need to be investigated in the context of each market and market infrastructure. In particular, it must be acknowledged that most CSDs might not be in a position to discriminate between regular buy-sell transactions and repo transactions.

First, to facilitate immediate access to repo collateral, market infrastructures could offer cash lenders real-time reporting facilities on the securities received as collateral. Moreover, market infrastructures could help to raise market participants' awareness about the necessary steps in taking possession of and liquidating collateral and potential difficulties which might be faced during these processes (this could be particularly relevant for smaller or less experienced repo market participants). Going further, market infrastructures could help draft sample checklists and procedures, which would allow their participants to evaluate and potentially enhance their own preparations. Finally, tri-party repo service providers could provide facilities and services which would directly support the liquidation of collateral. This could include, for example, the provision of advisors to its participants, who would monitor the transfer of collateral and assist in liquidating collateral on behalf of participants.

Alternatively, repo transactions could be cleared by a CCP, transferring the responsibility of liquidating collateral from market participants to the CCP.[18] If CCPs are better prepared to take possession of and liquidate collateral than some market participants, the introduction of a CCP or their wider use can increase the likelihood that collateral can be liquidated in an orderly manner. However, as a CCP concentrates exposures in the repo markets, it could potentially face the liquidation of very large collateral amounts. Hence, the CCP should put great emphasis on ensuring that it is well prepared for such a liquidation.

Reducing the probability of a fire sale is in essence a collective action problem for the cash lenders in a repo market.[19] To address the threat of fire sale conditions, regulatory authorities, market participants and repo infrastructures could evaluate the impact, risks and the feasibility of some of the options available to repo clearing and settlement infrastructures in particular and repo markets in general. One option for consideration could be that a CSD or tri-party repo service provider, provided that it is within its capacity to do so, imposes on behalf of market participants various restrictions or requirements as a preventive measure. For example, it could place limits on the aggregate value of repo contracts for individual counterparties, or eligibility requirements for the securities used as collateral. Restrictive measures of this type, however, have their pros and cons, and in any case, may only serve to divert short-term lending from repo transactions to other segments of the money market. A second option could be the introduction or promotion of the wider use of a CCP, though it depends on the circumstances whether a CCP would be in a better position to avoid fire sale conditions. To the extent that central clearing brings about multilateral netting benefits, the overall amounts of collateral to be liquidated by the CCP will be lower. Moreover, a CCP can monitor the collateral delivered by its counterparties and potentially set collateral-specific

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[17] With respect to preparations for liquidating collateral and avoiding or dealing with fire sale conditions, bank supervisors and market regulators should also inquire into the readiness of banks and non-bank financial institutions to liquidate repo collateral from a defaulting counterparty. This measure is, however, not directed towards market infrastructures and therefore not detailed further.

[18] However, should the CCP reserve the right to reallocate the collateral back to the surviving participants under certain circumstances (eg if there are no adequate prices for the securities it has taken possession of), the onus to liquidate collateral could fall back on the CCP's participants.

[19] Measures to be considered for preventing fire sale conditions by individual market participants or by market authorities are not covered here.

concentration limits. However, the probability of fire sale conditions will also be affected by the CCP's time horizon for liquidating collateral, which would depend on – among other factors – the availability of pre-arranged sources of liquidity and the employment of derivative instruments to hedge credit and market risks. It is thus not clear whether a CCP can be more patient than other market participants. A third option for solving the collective action problem would be for market participants to come together and form a facility that is dedicated to liquidating repo collateral after a default. This special purpose entity would be a new type of market infrastructure.[20]

4.5 Efficient use of collateral

The efficient and flexible use of collateral facilitates market participants' collateral management and can contribute to the development of liquid and smoothly functioning repo markets in normal times. In addition, the efficient and flexible use of collateral can also enhance the resilience of repo markets in times of stress, when repo markets typically experience a shift towards high-quality collateral (eg government securities).[21] In these circumstances, clearing and settlement infrastructures that allow cash lenders and borrowers to adapt to changing collateral requirements can contribute to preserving market liquidity.

The CPSS report on *Cross-border collateral arrangements* published in 2006 investigated the arrangements for transferring collateral across borders and currency areas.[22] It was noted that internationally active banks may face mismatches between the location of their liquidity needs and the collateral they hold. This was attributed among other factors to inefficient or missing linkages between some market infrastructures. Hence, market participants might face difficulties in adapting to changing collateral requirements. Fragmented infrastructures can also negatively influence the availability of certain and timely information on the settlement status of repo transactions.

In the euro area, where market infrastructures are relatively fragmented, the national central banks and the ECB are actively engaged in various projects (eg T2S, CCBM2), which will deliver integrated and efficient market infrastructures for the euro area financial market and for Eurosystem counterparties. This is complemented by industry efforts (eg the European Repo Council[23]) and other official initiatives (eg COGESI[24]).

Flexibility in managing collateral can also be enhanced by the option of substituting and re-using collateral. While all the markets analysed offer some collateral substitution or re-use

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[20] Another idea for forestalling a fire sale is to call on a CCP for buy-sell transactions to assist after a default, even if it is not serving as a CCP for repo transactions. A portion of the collateral in the possession of repo cash lenders after a default could be used by a CCP to meet buy-sell settlement obligations it had assumed from the defaulting participant. By taking repo collateral and delivering it to its counterparties, a CCP would reduce the amount of collateral that would need to be sold into the market.

[21] For example, in CGFS Publications no 37, *The functioning and resilience of cross-border funding markets,* March 2010, it was noted that in the United States tri-party repo market during the financial crisis a significant portion of the securities normally financed through the repo markets were largely rejected by lenders. Collateral was largely confined to securities eligible in Federal Reserve open market operations.

[22] While the analysis in that report was primarily focused on efficient collateralisation of intraday borrowings from central banks, the main implications are also valid for collateral in repo markets.

[23] See European Repo Council, *The operation of the European repo market, the role of short-selling, the problem of settlement failures and the need for reform of the market infrastructure,* July 2010.

[24] The COGESI (Contact group on euro securities infrastructures) addresses issues and developments which are relevant for the euro securities settlement industry and which are of common interest for the Eurosystem, market infrastructures and market participants. The COGESI, which is chaired by the ECB, consists of representatives of the Eurosystem and representatives of commercial banks, securities settlement systems and clearing houses mainly from the euro area.

functionalities, their availability can be restricted or their use operationally cumbersome. Also, in some markets, substitution or re-use is only achieved by measures which in turn imply the extension of significant amounts of intraday credits or the increase in settlement risks (eg by daily unwinds).

Options for repo clearing and settlement infrastructures

While all linkages between infrastructures involve certain risks that need to be properly evaluated and managed, it needs to be acknowledged that efficient and secure linkages between clearing and settlement infrastructures can facilitate the transfer of collateral between different markets and countries, mitigating the inefficiencies caused by fragmented infrastructure. Linkages are relevant in particular for market participants active at international level and in various markets, which are cleared and settled at different locations.

The implementation of efficient linkages between clearing and settlement infrastructures could enhance the capacity of market participants to deal with unexpected collateral needs and collateral mismatches and therefore enhance repo market resilience. Therefore, if market participants demonstrate that efficient linkages would materially facilitate collateral management and the settlement of repo transactions, repo infrastructures could evaluate the potential benefits and costs of establishing such linkages.

The 2006 CPSS report on *Cross-border collateral arrangements* also proposed increased transparency regarding payments and collateral movements, eg in the form of real-time information on the current status of individual payments, collateral holdings and transfers. This would reduce uncertainty regarding repo settlement and collateralisation processes and would allow market participants to use existing collateral more efficiently.

Repo clearing and settlement infrastructures might also evaluate whether substitution and re-use of collateral could facilitate a more flexible use of collateral in repo markets. This could increase the liquidity and resilience of the repo market, and reduce the bias towards overnight or short-term repo. In particular, the possibility of re-using collateral for re-financing with the central bank can enhance the resilience of repo markets. This is the case in the Eurex Repo GC Pooling Segment and in the Swiss repo market, where cash lenders can re-use collateral received in interbank repo transactions for re-financing with the central bank. In these two countries, collateral eligibility criteria for the interbank repo market and central bank operations are to a large degree identical. This extends the cash lenders' liquidity buffer and enhances their willingness to lend cash during times of stress.

As substitution and re-use can be achieved in different ways, repo infrastructures should consider the potential implications in terms of settlement risk or intraday liquidity needs. Also, there are limits to combining substitution and re-use of collateral in the same market.

4.6 Mitigating procyclical effects of risk management practices

A recent CGFS report observes that a sharp tightening of the terms for secured lending, including cash-driven repos, occurred as financial market conditions deteriorated during the financial crisis.[25] This tightening contributed to a contraction in the supply of short-term credit to financial institutions, which in turn intensified liquidity pressures. To mitigate such fluctuations in the availability of liquidity, the report proposes that margins and haircuts on secured lending transactions be calibrated to conditions in stressed financial markets.

In repo markets cleared by a CCP, the CCP must manage the credit and liquidity risks it assumes. A CCP has several means available to manage the risks it bears. Foremost among

[25] See CGFS Publications no 36, *The role of margin requirements and haircuts in procyclicality*, March 2010.

these means are the imposition of margin requirements or haircuts, as well as restrictions on the range of securities that may be used as collateral. An unanticipated substantial increase in its margins or haircuts, or a tightening of a CCP's collateral eligibility criteria could reduce liquidity in repo markets.

Tri-party repo service providers, CSDs, settlement banks, or custodian banks settling repo transactions might also bear credit and liquidity risk, particularly if they extend credit intraday in order to expedite the settlement process. To manage such risks, these entities may impose haircuts on or apply margins to securities used to collateralise intraday credit. During the financial crisis, some tri-party repo service providers were compelled to impose higher haircuts on collateral in order to protect themselves against the credit exposures they bore intraday during settlement. Sudden increases in haircuts and margins could reduce liquidity in repo markets, particularly if there is insufficient transparency on the practices and rules for revising or adjusting haircuts and margins.

Options for repo clearing and settlement infrastructures

There are various ways in which repo clearing and settlement infrastructures can mitigate procyclical effects in repo markets. For instance, it would be useful for participants to understand clearly the processes and models that a repo infrastructure or a settlement bank uses to set margins and haircuts. If the factors serving as inputs to the model can be tracked, participants would be capable of anticipating the timing and size of changes in margins and haircuts, which would allow cash borrowers to prepare for potential near-term liquidity pressures. Disseminating this information would be part of a broader effort to foster the transparency of the repo clearing and settlement infrastructure practices and procedures (see Section 4.2) and of the repo market in general (see Section 4.7).

Repo clearing and settlement infrastructures could also avoid making large discrete changes to the relevant risk management parameters. In addition, any change should be made in a transparent way and with sufficient lead time to allow participants in the repo infrastructure to adjust accordingly.

In addition, focusing on the role of CCPs, the CGFS report recommends considering the prudential impacts and practical implications of imposing, through CCPs, minimum constant through-the-cycle margins and haircuts. To the extent that other repo infrastructures also bear credit and liquidity risks, the Working Group believes that this consideration is relevant not only to CCPs but to repo infrastructures more generally.

4.7 Transparency of the repo market

The defensive behaviour of repo market participants during the financial crisis was driven by the perception of a sharp increase in the credit and liquidity risks inherent in cash-driven repo transactions. A lack of transparency in the repo market is believed to have been a factor contributing to this defensive behaviour. As a general rule, insufficient or asymmetric information in financial markets triggers an overreaction. In this regard, the industry-led PRC Task Force on Tri-Party Repo Infrastructure in the United States cites poor transparency as an area of concern. More specifically, it identifies as problematic the sparse quantitative information that is available on the repo market's size, composition, and structure. In addition, a CGFS study group identifies greater market transparency as one of the reasons to promote the use of centralised clearing infrastructures for repo transactions.[26]

Summary statistics describing the repo market can be derived from either responses to surveys of market participants or data supplied by repo clearing and settlement

[26] See CGFS Publications no 36, *The role of margin requirements and haircuts in procyclicality*, March 2010.

infrastructures. In Europe, a periodic disclosure to support transparency in the cash-driven repo market has already been implemented by the International Capital Market Association (ICMA). It conducts semi-annual surveys of financial institutions and disseminates a profile of the repo market in Europe. In addition, the ECB, in cooperation with the Eurosystem's national central banks, regularly conducts a Euro Money Market Survey, which covers the secured lending market, including repo transactions. In Japan, statistics are collected by market associations, and the Bank of Japan has conducted surveys on money markets including repos. On the part of repo infrastructures, some repo CCPs, including Eurex and the Fixed Income Clearing Corporation, provide information on market indicators such as aggregate value and interest rate for the transactions they clear.[27]

Whether to base repo market statistics on survey results or data collected by infrastructures is an open matter. There are, however, two clear arguments in favour of infrastructures as the data source: (i) summary statistics would be based on the universe of transactions, not on survey findings that are susceptible to sampling error, and (ii) data would be collected at lower cost and higher frequency. Not all repo clearing and settlement infrastructures, however, may be capable of identifying data specifically on repo transactions, as they do not distinguish between repo transactions – in particular, bilateral repos – and regular buy-sell transactions.

Options for repo clearing and settlement infrastructures

Making available to participants vital summary statistics on the repo market would help to enhance transparency. In support of initiatives to improve market transparency, a repo infrastructure could make data available that meet the genuine information needs of market participants. An infrastructure could cooperate with industry groups or other responsible bodies that would be in a position to define meaningful summary statistics and distribute the assembled information in an appropriate way. This guidance, given in the context of the repo market, is congruent with private and public sector initiatives to foster market transparency in other financial markets. In particular, industry-led Foreign Exchange Committees in several countries, working in collaboration, conduct periodic surveys of financial institutions and publish statistics on turnover and market concentrations in foreign exchange markets. Moreover, the recently released CPSS-IOSCO consultative report *Considerations for trade repositories in OTC derivatives markets* states that a trade repository should support the transparency of OTC derivatives markets by making data available to the public.

Meaningful summary statistics on the repo market could provide information on several dimensions, including:

- the aggregate size of the market, measured by the total amount of funds borrowed and lent (outstanding amounts and turnover);
- the composition of the securities used as collateral, by asset type, credit quality, currency denomination or country/jurisdiction of issue, or other characteristics;
- the participation in the market indicating the types of financial institutions and non-financial entities;
- the concentration in the market on the cash lending and cash borrowing side (outstanding amounts and turnover);
- the maturity structure of outstanding repo transactions, possibly summarised by weighted average time to maturity;

[27] Efforts to improve transparency are being planned for the United States' repo market. The industry-led PRC Task Force on Tri-Party Repo Infrastructure intends to disseminate a monthly profile of the market. This monthly profile would be based on transaction data provided by the infrastructure, that is, the clearing banks.

- a representative range of typical haircuts and margins applied by cash lenders (collateral takers) in cash-driven repo transactions (see Section 4.6 on mitigating procyclicality); and
- the percentage of CCP-cleared repo transactions in total repo transactions.

The summary statistics should be constructed in a way that preserves the confidentiality of individual counterparties. In addition, rules should be considered that ensure the dissemination of information to market participants and the public will not contribute to market dysfunction or give one stakeholder a commercial advantage over others.

4.8 Considerations related to repo infrastructures that are part of an entity also providing commercial banking services

As noted in the introduction to Chapter 4, the diversity of institutional arrangements in repo clearing and settlement infrastructures underscores the importance of adopting a functional approach. In addition, the Working Group has identified three issues for repo clearing and settlement infrastructures which – while not posing risks going beyond those for financial market infrastructures more generally – might be particularly complex and demanding for those infrastructure providers which are part of an entity also providing commercial banking services. These institution-specific considerations are outlined below.

First, in line with current standards for financial market infrastructures on access, repo clearing and settlement infrastructures in general should ensure fair and open access. If an infrastructure provider is also a competitor of some of its participants, ensuring fair and open access is particularly crucial to prevent the perception that access to infrastructure services is blocked, restricted or withdrawn for competitive reasons, ie not solely based on objective criteria. Access should also not be influenced by interests in other business lines. This is particularly critical for repo clearing and settlement infrastructures, as access to repo markets is essential for the short-term funding of cash borrowers. The exclusion from a repo infrastructure could hence lead to severe liquidity issues for the participant concerned, potentially triggering its default.

Second, in line with current standards for financial market infrastructures on governance, repo clearing and settlement infrastructures in general should have in place arrangements to ensure that – in addition to the objectives of the owners – the interests of participants, securities issuers and the broader public are also taken into account. Where a repo infrastructure is part of an entity providing commercial banking services, great care should be taken to reflect the interests of all stakeholders (including users which are potentially also competitors) adequately in the governance processes.

Finally, to preserve participants' confidence in the repo clearing and settlement infrastructure it is critical to maintain the infrastructure provider's financial health. Confidence could be undermined by financial losses from other (banking) activities which could spill over and put the infrastructure activities at risk. Hence, if an infrastructure provider is part of an entity also providing commercial banking activities, there should be measures that minimise the potential for financial risks from other business activities to spill over to and impede the infrastructure services. If an infrastructure provider fails to take preventive measures against such spillovers, there is a significant risk that the infrastructure would experience a loss of confidence in times of crisis, or when other business activities are unprofitable.[28]

[28] This is particularly the case if the infrastructure provider carries exposures vis-à-vis infrastructure participants, eg by extending intraday credits or if it acts as a CCP.

5. Conclusion

During the recent financial crisis, repo markets proved to be a less reliable source of funding liquidity than expected in some countries. This report has investigated the extent to which the market infrastructure – ie the practices, procedures and systems used for clearing and settling repos and liquidating a defaulting cash borrower's collateral – added to the uncertainty in repo markets during the financial crisis and whether there is room for improvement.

In essence, the report has identified several issues directly or indirectly related to the repo market infrastructure that have the potential to affect the resilience of repo markets. With a view to enhancing the resilience of repo markets, the report has also discussed various options for addressing the identified issues and strengthening the repo clearing and settlement infrastructure.

As the specific arrangements for clearing and settling repo transactions vary considerably across countries or markets, not all the issues identified in this report are relevant to the same extent in each market. Nevertheless, the Working Group believes that it is worthwhile for the stakeholders in each repo market to review how the repo market infrastructure could be further strengthened. As a first step, the providers of repo market infrastructures in each country, jointly with market participants, regulators and the central bank, should attempt to develop a common view on the relevance of the identified issues for their market. Based on that, each repo market infrastructure could then evaluate which measure or combination of measures would be best suited to address the relevant issues in its specific circumstances. The range of options discussed in Chapter 4 of this report could be a starting point to facilitate this evaluation, but it should not be considered as comprehensive.

Annex 1:
The repo life cycle and the role of market infrastructures

This annex outlines the processing steps of a typical repo transaction, following the overview provided in Figure 1 in Chapter 2. It describes the role of market infrastructure arrangements in these steps and highlights some country-specific aspects. Further, this annex lists various factors explaining the array of differences between repo clearing and settlement arrangements in the analysed countries. For a comprehensive cross-country comparison of repo clearing and settlement arrangements see Annex 2.

Documentation

The contractual basis for repos varies from country to country. International master agreements such as the TBMA[29]/ICMA[30] Global Master Repurchase Agreement (GMRA) or the United States-focused MRA are frequently used. In some countries (eg France, Germany, Japan, Switzerland), domestic master agreements are used by domestic counterparties alongside the GMRA. In other countries, the international GMRA is complemented by domestic annexes in order to adapt to product-specific and legal circumstances of the respective country (eg Canada). The European Master Agreement (EMA) attempts to replace the domestic master agreements in the euro area, but its use remains limited. In addition, in Italy bilateral contracts are used instead of master agreements. In Sweden important market participants like the Riksbank and the Swedish National Debt Office have their own contracts for repos; also in Japan, the Bank of Japan has its own repurchase agreement contract.

The contracts between the cash lender and the cash borrower are complemented by agreements between participants and key infrastructures, eg trading systems, central counterparties, securities settlement systems, payment systems as well as tri-party repo service providers. For example in the United States tri-party repo services, this takes the form of a joint tri-party custodial agreement with the clearing bank, in which the clearing bank serves as custodian for both counterparties. In highly standardised repos cleared via a CCP, these contracts between participants and key infrastructures might also replace the GMRA.

Trade execution

Repo transactions are typically agreed bilaterally between cash lenders and borrowers, either on electronic trading systems or through phone or e-mail. Some inter-dealer trades are also brokered, through broker screens or via phone. Examples for electronic trading systems include BrokerTec (United States, Europe), Eurex Repo (Germany and Switzerland), TradeWeb (United States tri-party repos), MTS (Italy, United Kingdom), and inter-dealer broker electronic platforms (Canada and for GCF repos in the United States).

Trading of repo transactions is less standardised and less often electronic compared to buy-sell securities transactions. This can most likely be attributed to the lower transaction numbers and the higher need for bespoke trades in repo reflecting their role for managing liquidity.

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[29] The Bond Market Association.

[30] ICMA (International Capital Market Association) came into existence in July 2005 by a merger of the International Primary Market Association and of International Securities Market Association (ISMA). ISMA itself was the former Association of International Bond Dealers (AIBD), founded in 1969.

In the United States short-term repos are often used for longer-term financing, which is achieved by repeated rollovers (or renewals) with the same counterparty. This is typically the case in transactions conducted over the phone. Where electronic trading platforms exist, constant rolling over of repos with the same counterparty is more difficult to achieve.

Confirmation/matching

Depending on how trades are executed, confirmations and affirmations of the economic terms of repo transactions are done over phone, fax, e-mail and on electronic platforms such as Bloomberg, TRAX and SWIFT. Electronic trading platforms, CCPs (eg Eurex Repo, FICC-GSD) and in some cases securities settlement systems (eg the Euroclear Trade Capture and Matching System ETCMS, and Clearstream Luxembourg's trade capture function within CmaX) also provide the relevant confirmations.

The matching process for settlement instructions stemming from a repo transaction depends on how trades are executed and the specific infrastructure set-up in the country. If trades are executed bilaterally over phone or e-mail, each trading party is usually responsible for entering the settlement instructions into the relevant settlement systems, where they are matched. This can be typically done through SWIFT or the customised interfaces of the settlement systems. If trades are executed on electronic trading platforms, it depends on the trading platform whether pre-matched instructions are sent directly from the platform to the securities settlement system, or whether the participants send the instructions individually to the securities settlement systems where they are matched. When CCPs are involved, the matched instructions are in some cases also sent from the CCP to the settlement venues (eg in France).

Central counterparty (CCP) clearing

CCPs become the lender to the borrower and the borrower to the lender in a repo transaction. Repo CCPs cover the counterparty risk in the repo transaction between the settlement of the purchase leg and the settlement of the repurchase leg. They typically also cover the replacement cost risk that would occur if one counterparty failed to settle the purchase leg.

The CPSS countries analysed can be categorised according to the relevance of CCPs in their repo markets. In Germany, Italy, France, Japan and the United Kingdom, central counterparties are core parts of the repo infrastructure arrangements. Central counterparties exist – but are of limited relevance – in the United States and Canada. However, Canada is in the process of introducing a new CCP for the repo market and Sweden is about to launch its first repo CCP. Finally, central counterparties are presently not used for the repo markets in Hong Kong and Switzerland, although Switzerland is evaluating the introduction of a repo CCP.

The repo CCPs mentioned above are all part of an existing CCP that also clears other market segments. Repo transactions are cleared on the same platform as regular buy-sell transactions and the CCPs also net within and between these transactions. Participation criteria for repo counterparties vary but typically limit participation to banks and in some cases to other regulated entities.

Use of a CCP brings about multilateral netting benefits and reduces settlement instructions to a single cash and – assuming that a collateral basket is specified – a single securities transfer. Lower settlement volumes and values allow settlement risk and operational risk related to settlement to be reduced.

The repo CCPs in the markets analysed clear both overnight and term repos. Often, for risk management reasons and in response to the demands of market participants, CCPs only clear repos against high-quality and liquid collateral, such as government bonds and other securities with a similar credit rating, which constitute the bulk of repo transactions.

Settlement of purchase leg

The purchase leg is settled on the value date. In all markets analysed, settlement of the purchase (and the repurchase leg) is conducted with the delivery-versus-payment (DVP) mechanism. The collateral transfer settles in the securities settlement system (CSDs and ICSDs, in the United States in the clearing banks), while the cash transfer settles in the domestic LVPS or on cash accounts at the CSD/ICSD or at clearing banks or settlement banks. In all markets, settlement takes place in existing payment and securities settlement systems, sometimes complemented by specific repo modules, eg for the automated selection of collateral.

Settlement of the cash leg of a repo transaction is either in central bank money or commercial bank money. Central bank money is the settlement asset in Hong Kong, Japan, Sweden and Switzerland (only CHF repos), for example. In the euro area, if repo collateral is settled via a domestic CSD or via direct links between European CSDs, the cash settlement takes place in central bank money. Settlement is in commercial bank money when repo collateral is settled in an ICSD or when the collateral was issued in an ICSD or in a CSD outside Europe. Settlement of the cash leg of foreign currency repos in the euro area is also in commercial bank money. In the tiered United Kingdom set-up, sterling and euro settlement between two settlement banks occurs in central bank money under DVP model 1.[31] In the United States, settlement of the cash leg of repos is mostly in commercial bank money, with the exception of some inter-dealer DVP repos, which settle in Fedwire Securities.

The settlement lag for repo transactions is often shorter than for buy-sell transactions. For example in Japan and Switzerland, term repos are usually settled two days after trade execution (t+2), while regular buy-sell transactions are settled t+3. These settlement lags are typically complemented by shorter settlement lags for overnight transactions (which settle also t+0 and t+1). In the United States, while there are some forward-starting tri-party repos, the vast majority is settled t+0, presumably to provide the means for broker-dealers to obtain financing of a constantly changing inventory of securities. In contrast, the standard settlement lag for buy-sell transactions in the United States is t+1.

In several markets, collateral securities are selected according to an automated process. The CSD/ICSD or the clearing bank selects the type and quantity of securities on pre-specified criteria (eg collateral basket, maturity of securities, future corporate action dates of securities, market value of securities) from the cash borrower's pool of available securities. In addition, cash lenders and cash borrowers can also choose to manually pre-specify or select a specific security to be used as collateral for a specific repo transaction. This must be defined either when the transaction is executed, or when the purchase leg settles.

The intraday timing of the settlement of the cash and the securities leg of a repo transaction depends on the settlement windows of the relevant market infrastructures. In a few cases, the timing of the settlement of the purchase and repurchase leg of repos starting and terminating on the same day is coordinated, which can both reduce the amount of intraday liquidity needed for the repo settlement and reduce the length of time of intraday credit extensions. For example, for repos in Japan cleared in the Japan Government Bond Clearing Corporation (JGBCC), the purchase and the repurchase leg are netted and settled at the same time. Participants in Euroclear Bank and BoNY Mellon Brussels are offered net cash transfer instructions for payments related to maturing and new tri-party transactions. In Switzerland, the purchase and repurchase leg are loosely linked, as the instructions for the repurchase leg are sent five minutes before sending the instructions for the purchase leg.

[31] Settlement between two clients of the same settlement bank occurs in commercial bank money. All settlement in US dollars also occurs in commercial bank money.

Repo settlement is in many cases embedded in the settlement of regular buy-sell transactions (eg in Belgium, France, Germany, Italy, Japan, Netherlands, Sweden and the ICSDs). Whether repo transactions are netted for settlement depends on the netting rules of the securities settlement system involved. For example, in France, repos are netted with buy-sell transactions for settlement. In the United Kingdom, however, the purchase legs of DBV transactions are settled sequentially in a dedicated (DBV-only) settlement window in CREST; the repurchase legs can settle at any time the following day. In other countries, eg Switzerland, settlement takes place on the same platform as regular buy-sell transactions but the transactions are initiated at different times (though they might still be settled at the same time depending on settlement delays).

Instruments and incentives are in place to avoid settlement fails in the purchase leg (and also in the repurchase leg) of a repo transaction. Securities lending and borrowing transactions are available in all analysed countries. In most markets, intraday credit is provided by the central banks directly to some or all repo participants. For example, in France and Germany, the CSD provides an automated intraday credit mechanism ("self-collateralisation service"): participants to the CSD flag the securities eligible to the Eurosystem credit operations as available for self-collateralisation with a specific indicator upon which the CSD can generate automatic intraday credit with the central bank if the cash position of the participant within the system is insufficient. In the United States, the Federal Reserve provides intraday credit to banks including the two clearing banks, which can then provide intraday credit to their participants (broker-dealers). In the United Kingdom, the Bank of England provides intraday credit via self-collateralising repos (SCRs) to enable CREST settlement banks to repo their SCR-enabled CREST members' eligible securities in return for sterling liquidity to help the settlement bank fund members' purchase of those securities.

In addition, breaking down transactions into smaller pieces and introducing more frequent settlement cycles reduces the number of settlement fails in certain countries. This is complemented by incentives to settle on time, including penalty regimes. For example, in Canada, the failing dealer is charged the target overnight repo rate. In Japan, market participants have decided to introduce fails charges after an increase in settlement failures during the financial crisis.

Collateral management and risk management

After initiating the repo, the cash lender owns the securities and both the cash lender and the cash borrower must manage the risks arising from the open repo transaction. A tri-party repo service provider and/or a CCP can offer a range of services related to administering the repo contract and managing the collateral, including performing risk management functions on behalf of the participants (eg eligibility checks, valuation, triggering margin calls).

The collateral securities received by the cash lender can be held in various ways. In bilateral repos, the securities are transferred from the cash borrower to the cash lender. In tri-party repos, securities are transferred between the cash borrower and the cash lender within the securities accounts held with the tri-party repo service provider, which acts as agent for the cash lender and the cash borrower. If a CCP is involved in the transaction, the CCP becomes the cash lender for the cash borrower and the cash borrower for the cash lender. However, in most countries the CCP does not hold the securities collateral received from the cash borrower but delivers it on to the cash holder. In some larger markets, such as the United States or the euro area, these different repo arrangements exist alongside each other.

Repo counterparties need to manage risks arising during the repo lifetime. For repos based on collateral baskets, eligibility lists and criteria need to be constantly updated and haircuts and margins must be assigned. Once the collateral is transferred, collateral needs to be

marked to market on a regular basis and margin calls are triggered to ensure adequate collateralisation of exposures. In almost all markets margins and/or haircuts[32] are applied. In some markets, they are specified bilaterally between the trading parties. On electronic trading platforms, there may be a default haircut and margin. In markets where a CCP is involved, the CCP effectively standardises the margins and haircuts as it becomes the counterparty to the cash borrower and the cash lender. By contrast, tri-party repo agents typically only implement the haircuts and margins agreed by the counterparties. In some specific cases, they may review the haircuts and margins in order to caution their participants, but do not decide on the level of haircuts and margins applied. Other risk management instruments frequently used in non-CCP repos include bilateral counterparty credit lines and collateral concentration limits.

Collateral substitution – where provided for in the contract – allows collateral to be replaced during the lifetime of a term repo. The practices for substituting collateral vary widely between markets: first, the European tri-party repo service providers and some euro area CSDs (eg Clearstream Banking Frankfurt for Eurex GC Pooling repos) allow for fully automated substitution. Second, in Canada, there is limited substitution, as counterparties must explicitly agree to the ability to substitute at the time of the transaction and then the substitution can happen on any day. Substitution for term repos with the Bank of Canada is only allowed on specific days (twice each month). In Japan, collateral substitution is supported for repos with the Bank of Japan. Finally, in other markets substitution is achieved through other means. In the United States, all tri-party and GCF term repos are unwound each day and securities are re-allocated to existing term repos and new repos. Also for DVP repos presented to the CCP (FICC-GSD), two new netting instructions with the same maturity date would be entered, with the effect of substituting the collateral in the original repo. In the United Kingdom, although CREST does offer a term repo product, overnight DBVs are the dominant form of repo activity in CREST. In order to use DBVs, term repos are broken down into overnight instructions. Hence they are unwound every day and must be re-entered, thereby providing an opportunity for substitution. In Hong Kong, collateral substitution is not supported, but the borrower can repurchase its collateral by early termination of the repo and generating a new repo for the remainder of the term with different collateral.

Some repo markets allow for the re-use of collateral received by the cash lender. The possibility for re-use might be unlimited (eg in the case of Swiss tri-party repos) or limited to re-use within one or several securities settlement systems (eg in the case of the German Eurex Repo GC Pooling segment). Collateral re-use is of particular importance for cash lenders' re-financing needs. In Switzerland and Germany, cash lenders can use repo collateral for re-financing with the central bank. In these two countries, collateral eligibility criteria for the interbank repo market and central bank operations are to a large degree identical, which facilitates refinancing with the central bank.

The possibility for the cash lender to re-use collateral received is to some extent linked to collateral substitution rights. If collateral can be freely re-used by the cash lender (ie also outside the securities settlement system), collateral substitution can only be limited or based upon the consent of the lender. This is, for example, the case in Switzerland, which allows for free re-use of collateral by the lender, but limits collateral substitution rights. The German Eurex Repo GC Pooling segment allows for substitution but – due to automation

[32] The application of a haircut leads to a difference between the market value of a security and its collateral value. Haircuts are taken by the cash lender in order to protect itself from losses arising from declines in the market value of the security, should the need arise to liquidate the collateral. Margins refer to over-collateralisation of an exposure. Hence, haircuts are expressed as a discount (on collateral value), while margins are expressed as a mark-up (on exposures).

requirements – limits re-use of collateral to those securities settlement systems that allow for full information exchange (currently Clearstream Banking Frankfurt and Clearstream Banking Luxembourg) and to the central banks that accept the re-use of collateral (currently Deutsche Bundesbank).

Settlement of repurchase leg

Upon termination of the repo, securities collateral is returned to the cash borrower and cash, including interest, is returned to the cash lender. For the settlement of the repurchase leg, counterparties rely on the same payment and securities settlement systems as for the purchase leg.

Collateral liquidation (in case of default)

If the cash borrower defaults, the cash lender will need to take possession of the collateral and liquidate it to cover its losses or refinance the collateral to obtain liquidity. This requires a clear and enforceable legal documentation as well as adequate operational capabilities to take possession of and liquidate a potentially large collateral portfolio. While this might be straightforward for larger banks, it might prove challenging for smaller and non-bank participants. Alternatively, a counterparty might rely on a securities dealer or custodian bank to liquidate collateral. Further, financial markets under stress might not be able to absorb large amounts of collateral liquidated at the same time by various counterparties, which can make liquidation even more difficult and lead to fire sale conditions. If the cash lender holds insufficient collateral, it will attempt to receive the remaining cash amount by other means, typically through the regular bankruptcy proceedings or – if contractually and legally possible – by netting with other liabilities vis-à-vis the cash borrower.

If the cash lender defaults, the cash borrower can use the cash to repurchase the collateral in the spot market. If the cash borrower has over-collateralised its exposure (eg due to initial margins and/or haircuts), it will attempt to retrieve the surplus collateral. To mitigate the potential risk of losing initial margins and/or haircuts, Euroclear Bank offers the separation of the initial margin required by the cash lender on a dedicated separate account in the name of Euroclear Bank (via a pledge agreement).

Sales of securities delivered as collateral take place through regular transactions on the securities markets and are settled in the respective securities settlement systems. Instead of liquidating immediately, counterparties can decide to re-finance collateral instead of liquidating it immediately. For this purpose, ready access to funding liquidity is critical. Counterparties may also decide to hold the collateral, potentially in combination with hedging exposures against adverse price movements through derivative instruments. This could stretch the time span and reduce the potential for fire sale conditions.

In the markets analysed for this report, there is no dedicated liquidation facility for repo collateral. Tri-party repo service providers do not take responsibility for collateral liquidation, but may facilitate the liquidation of collateral by providing administrative support to the surviving counterparty. If a CCP is involved in the transaction, the CCP covers the counterparty risk and protects the remaining counterparty to the repo transaction from any losses. The surviving counterparty would not need to liquidate collateral or to repurchase collateral as the CCP would fulfil its obligation towards the surviving counterparty. As the CCP concentrates counterparty risk, it might face the liquidation of particularly large portfolios. This is compensated by a range of risk-mitigating measures: first, CCPs typically ask for margins that apply both to the cash lender and the cash borrower side. In addition, CCPs usually employ strict collateral eligibility criteria, which should limit market risk in case of a default. CCPs also establish penalties and other measures to ensure good settlement discipline. Finally, CCPs usually have a set of rules and organisational procedures (eg loss allocation procedures) in place to manage a participant default.

Factors influencing repo clearing and settlement arrangements

The array of cross-country differences in repo clearing and settlement arrangements can be explained by several factors, whose particular relevance may differ from country to country:

- ***Market infrastructure for buy-sell transactions:*** As the repo clearing and settlement arrangements rely to a large extent on the infrastructure arrangements for buy-sell transactions, differences between these infrastructures in various countries are also reflected in the repo arrangements. The majority of the differences outlined in paragraph 2.15 can, in part, be attributed to differences in the infrastructure for buy-sell transactions.
- ***Repo market size and structure:*** The size of the repo market can influence the repo clearing and settlement arrangements. Large volumes and values create economies of scale and make automation of some or all processing steps economically feasible. The number, size and type of repo market participants as well as their business needs may also explain differences in repo clearing and settlement arrangements between countries. In the United States, for example, the use of repos by securities dealers to re-finance their trading portfolio through short-term repos, the size of the repo market, and the rapid turnover generally in the United States government securities market led to the need for daily, efficient access to collateral. From an operational point of view, daily mass unwinds by the clearing banks in the tri-party repo market for collateral substitution purposes was the most adequate response.
- ***Capital markets:*** The depth and liquidity of capital markets, particularly government securities markets, influence the availability of high-quality collateral in a repo market. Where capital markets play less of a role, repo market development might be hampered. However, where the availability of domestic sovereign collateral is restricted, cross-border collateral[33] and corporate securities might be accepted as an alternative. This can create new or additional infrastructural demands for the settlement of repo transactions using this type of collateral.
- ***Access to central bank services and market infrastructures:*** The extent to which repo market participants and/or providers of repo infrastructures have access to central bank services (including intraday/overnight credit) can also influence certain aspects of repo clearing and settlement arrangements, such as tiering in access to repo infrastructures.
- ***Use of repo markets by central banks:*** Many central banks implement monetary policy via repo transactions and are hence active in repo markets. Through this role, they may have an influence on the clearing and settlement arrangements for repo transactions.
- ***Other factors:*** Legal, accounting, and capital treatment of repos may also influence the development of repo markets and the relevant market infrastructure. For example, the accounting standards appear to be a driver for CCP use in the European Union where repos are on-balance sheet items and netting is subject to restrictive conditions by IFRS standards. This makes the use of a CCP an efficient tool for achieving on-balance sheet netting.

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[33] Collateral is considered to be cross-border if at least one of the following is foreign: the currency of denomination, the jurisdiction in which the assets are located, or the jurisdiction in which the issuer is established. For more information see the 2006 CPSS report on *Cross-border collateral arrangements*.

Annex 2:
Cross-country comparison of repo markets and repo infrastructure arrangements in selected CPSS countries

(a) Key characteristics of repo markets

Country/ market	Dominant type of repo	Central bank uses repos for monetary policy implementation or liquidity distribution purposes	Main market participants	Do these market participants have access to central bank (CB) liquidity facilities?	Use of master agreements	Pre-trade anonymity assured (by trading platform or broker)	Post-trade anonymity assured (by CCP)
Canada	Bilateral.	Yes, but no use of tri-party service provider.	Central bank, banks and non-banks (pension funds, insurance companies, hedge funds).	Large dealers (which are mainly banks) have access to CB liquidity facilities, as do some smaller dealers.	GMRA now gradually replacing the standardised domestic agreement initially established by the Investment Industry Regulatory Organization of Canada.	No.	No.
Euro area (incl. Belgium, Luxembourg and Netherlands)	Bilateral and tri-party.	Some national central banks (eg in Belgium, NBB uses pledge for monetary policy operations).	Banks and non-banks.	Typically, only banks have access to CB liquidity facilities.	GMRA, complemented by domestic annexes or customised with special provisions. In some countries there are domestic master agreements (eg *Convention-Cadre Relative aux Opérations de Pensions Livrées* in France). The European Master Agreement (EMA) attempts to replace the domestic master agreements in European countries, but remains rarely used.	Typically not, but some exceptions when CCP is used.	Typically not, but some exceptions when CCP is used.
• **France**	Bilateral and bilateral with CCP.	Bank of France uses pledge for monetary policy operations. PLCs (Pensions livrées conservatoires), which correspond to repos, are used to provide intraday liquidity to facilitate settlement in the SSS.	Banks and non-banks.	Only the banks have access to CB liquidity facilities.	See euro area answer.	When CCP is used.	When CCP is used.

(a) Key characteristics of repo markets (cont)

Country/ market	Dominant type of repo	Central bank uses repos for monetary policy implementation or liquidity distribution purposes	Main market participants	Do these market participants have access to central bank (CB) liquidity facilities?	Use of master agreements	Pre-trade anonymity assured (by trading platform or broker)	Post-trade anonymity assured (by CCP)
• **Germany** (Eurex Repo/ Euro GC Pooling)	Bilateral. (For tri-party see euro area.)	Bundesbank uses pledge for monetary policy operations. Collateral can be delivered to Bundesbank, inter alia via Clearstream's collateral management system Xemac which is integrated with Euro GC Pooling and allows flexible re-use of collateral within the system.	Banks and a few selected non-banks.	All banks have access to CB liquidity facilities.	For repos concluded outside Eurex Repo, domestic, European and international master agreements are used. For Eurex Repo/Euro GC Pooling, standardised contracts for relevant services are used.	Yes.	Yes.
• **Italy**	Bilateral.	Yes, for asset management purposes only.	Banks and non-banks (investment firms, insurances, investment companies, asset management companies and governmental entities/central banks).	Only banks and investment firms (the latter under specific conditions) have access to CB liquidity facilities.	Mostly bilateral contracts; master agreements are not generally used for domestic transactions.	When CCP is used.	When CCP is used.
Hong Kong	Bilateral (some aspects of tri-party).	Yes, separate facility for HKMA use only.	Banks and non-banks.	Only banks have access to CB liquidity facilities.	GMRA.	No.	No.

(a) Key characteristics of repo markets (cont)

Country/ market	Dominant type of repo	Central bank uses repos for monetary policy implementation or liquidity distribution purposes	Main market participants	Do these market participants have access to central bank (CB) liquidity facilities?	Use of master agreements	Pre-trade anonymity assured (by trading platform or broker)	Post-trade anonymity assured (by CCP)
Japan	Bilateral.	Yes, but on separate systems from interbank market.	Banks and non-banks (dealers, inter-dealer brokers, money market and pension funds).	Only banks, dealers and inter-dealer brokers have access to CB liquidity facilities.	Customised domestic master agreements prepared by the Japan Securities Dealers Association, referring to GMRA.	No.	No.
Sweden	Bilateral.	Yes.	Banks and non-banks (pension funds, insurance companies, hedge funds).	Most repo market participants have access to CB liquidity.	GMRA; special contracts for repos with Swedish National Debt Office and Riksbank.	No.	No.
Switzerland	Tri-party.	Yes.	Banks and non-banks (securities dealers, regulated large and active money market funds and insurances).	Banks and securities dealers as well as insurances and money market funds active on the repo market have access to CB liquidity.	Swiss Master Agreement (SMA) or GMRA with Swiss Annex. Most participants have signed the SMA, while only a few use the GMRA with Swiss Annex. A repo transaction requires that both counterparties have signed the same master agreement.	No.	No.

(a) Key characteristics of repo markets (cont)

Country/ market	Dominant type of repo	Central bank uses repos for monetary policy implementation or liquidity distribution purposes	Main market participants	Do these market participants have access to central bank (CB) liquidity facilities?	Use of master agreements	Pre-trade anonymity assured (by trading platform or broker)	Post-trade anonymity assured (by CCP)
United Kingdom	Bilateral; some DBV features are similar to tri-party repos.	Yes.	Banks and non-banks.	In CREST, only CREST settlement banks have access to CB liquidity facilities (although the Bank of England provides intraday liquidity provided through self-collateralising repos (SCRs) which enable CREST settlement banks to repo their SCR-enabled CREST Members' eligible securities in return for sterling liquidity to help the settlement bank fund CREST Members' purchases of those securities).	GMRA, and LCH.Clearnet rules for CCP-cleared repos.	Yes for repos traded on automated trading systems; no for others.	When a CCP is used.
United States (tri-party)	Tri-party.	Yes.	Money market mutual funds, institutional investors and asset managers, broker-dealers.	Only banks have access to Fed liquidity facilities.	MRA (Master Repo Agreement).	No.	No.

(b) Collateral

Country/ market	Similar collateral eligible for interbank and central bank repos	Collateral concentration limits	Automated selection of collateral	Re-use of collateral[34]	Substitution of collateral
			Markets		
Canada	Interbank market accepts narrower range of collateral, as Bank of Canada has expanded its range of eligible collateral during the crisis. Normally, the Bank of Canada accepts only government of Canada collateral.	Yes.	No.	Yes. The central bank, however, does not re-use the collateral it has accepted.	Yes in the interbank market if agreed to at the time of the trade. For term repos with the Bank of Canada, substitutions are allowed on specific days.
Euro area	Most of the collateral used in interbank markets is also eligible with the Eurosystem. The range of central bank eligible collateral at Eurosystem level was already very broad before the crisis and since 2007 includes also non-marketable assets such as credit claims (bank loans) which are not generally used in market repo transactions.	Yes.	Yes (for tri-party repos).	Yes.	Yes (usually consent of counterparty required).
● **France**	See euro area.	Yes.	No. But the securities eligible for the Eurosystem credit facilities are automatically selected by the SSS to generate automatic intraday credit with the central bank if the cash position of the participant within the system is insufficient.	Yes.	Substitution is possible: it must be agreed by both counterparties.

[34] Re-use describes the further use of collateral received by the cash lender in a repo transaction for its own purposes (eg for regular purchase-sell transactions, for lending transactions, for another repo transaction as cash borrower etc).

(b) Collateral (cont)

Country/ market	Similar collateral eligible for interbank and central bank repos	Collateral concentration limits	Automated selection of collateral	Re-use of collateral	Substitution of collateral
• **Germany** (Eurex Repo/ Euro GC Pooling)	Both baskets in Euro GC Pooling are subsets of Eurosystem eligible collateral; 11 baskets on Eurex Repo are largely Eurosystem eligible, too.	No explicit collateral concentration limits, but any asset with potential close-link to any participant is excluded from the ECB-basket dominantly used in Eurex Repo.	Yes.	(a) Collateral from GC Pooling repos can be re-used in other GC Pooling repos. (b) In addition, re-use of collateral vis-à-vis the central bank is important.	Yes, real-time auto-substitution in Euro GC Pooling. No for 11 Eurex repo baskets.
• **Italy**	Interbank market typically accepts smaller collateral range compared to central bank.	Usually not applied for high quality collateral.	No.	Yes.	Yes, but consent of counterparty is required.
Hong Kong	Interbank market accepts wider range of collateral compared to eligibility criteria of HKMA.	No.	Yes.	Yes.	No (early repurchase as alternative).
Japan	During the crisis, BoJ's eligible collateral list for repo operations was expanded to be similar to repo collateral typically used in the interbank market (all JGBs).[35]	No.	No.	Yes	Permitted for some repos, depending on the contractual foundations (master agreement).
Sweden	Riksbank accepts a wider set of collateral than private repo markets.	Yes.	No.	Yes.	Yes (always for repos with Riksbank, usually also for interbank repos).

[35] Bank of Japan's eligible collateral for intraday/overnight credit facility differs from the eligibility criteria for its repo operation.

(b) Collateral (cont)

Country/ market	Similar collateral eligible for interbank and central bank repos	Collateral concentration limits	Automated selection of collateral	Re-use of collateral	Substitution of collateral
Switzerland	99% of all collateral used for interbank repos is also eligible for SNB repos.	No (but delivery of own ISINs is prohibited and automatically checked).	Yes.	Yes.	Yes (but counterparty's consent required).
United Kingdom	Collateral baskets have been defined in accordance with BoE operations, although they are also used more generally.	Yes (optional).	Yes.	Yes, re-use is possible (for example in other DBVs), but the need to return collateral on a daily basis to the collateral giver places constraints on re-use.	DBVs are overnight. But where a series of repo instructions are created to effect a term transaction, automatic substitution on a daily basis is implied by the use of the selection algorithm at daily re-entry of the instruction.
United States (tri-party)	Not all interbank used collateral is eligible with the Fed.	Yes.	Yes.	No for tri-party and GCF repos (but yes for DVP repos).	Yes, by means of mass unwinding of all term repos each day and reallocating securities to existing term repos and new repos (for tri-party and GCF repos). For bilateral DVP repos, substitution is possible but requires the consent of both counterparties. For DVP repos presented to the CCP (FICC-GSD), two new netting instructions with the same maturity date would be entered, with the effect of substituting the collateral in the original repo.

(b) **Collateral** (cont)

Tri-party service provider	Similar collateral eligible for interbank and central bank repos	Collateral concentration limits	Automated selection of collateral	Re-use of collateral	Substitution of collateral
Selected European tri-party service providers					
Euroclear Bank	Eligibility criteria are set by participants and not by the tri-party provider.	Yes.	Yes.	Yes.	Yes.
Clearstream Banking Luxembourg	Eligibility criteria are set by participants and not by the tri-party provider. Typically not all Eurosystem-eligible collateral is eligible for tri-party, but some customers have adopted Eurosystem eligibility criteria to re-use collateral with Eurosystem.	Yes.	Yes.	Yes.	Yes.
BoNY Mellon (Brussels)	Eligibility criteria are set by participants and not by the tri-party provider.	Yes.	Yes.	Yes.	Yes.

(c) Risk management tools

Country/market	Use of bilateral counterparty credit lines for repos	Margins and/or haircuts applied for repos[36]	Regular mark-to-market valuation of repo collateral
		Markets	
Canada	Yes.	Yes (except for large primary dealers).	Yes (daily).
Euro area	Yes.	Yes.	Yes (daily).
• **France**	Yes.	Yes.	Yes (daily).
• **Germany** (Eurex Repo/ Euro GC Pooling)	Yes (in non-CCP segment). No specific credit lines for CCP-repos. Global CCP line for all CCP products may be used.	Yes (CCP applies margins).	Yes (daily).
• **Italy**	Yes (in transactions not backed by the CCP).	Yes: always in transactions cleared by CCP; as far as transactions not cleared by CCP are concerned, only major players apply margins and haircuts.	Yes (daily) at least as far as CCP-cleared transactions are concerned.
Hong Kong	Yes.	Haircuts, but no margins.	Yes.
Japan	Yes.	Yes, but haircuts are rarely observed in practice except for the BoJ operations.	Yes, daily, but less frequent in practice except for BoJ operations.
Sweden	Yes.	Yes, but normally not for interbank repos.	Yes (daily).
Switzerland	Yes.	No.	Yes (twice daily).
United Kingdom	Yes (by settlement banks).	Yes.	Yes (effected by daily unwind and wind of DBVs).
United States (tri-party repos)	Yes.	Yes.	Yes.
		Selected European tri-party service providers	
Euroclear Bank	N/A.	Yes.	Yes (at least once per day).
Clearstream Banking Luxembourg	N/A.	Yes.	Yes.
BoNY Mellon (Brussels)	N/A.	Yes.	Yes (daily).

[36] The application of a haircut leads to a difference between the market value of a security and its collateral value. Haircuts are taken by the cash lender in order to protect itself from losses owing to declines in the market value of the security, should the need arise to liquidate the collateral. Margins refers to over-collateralisation for an exposure. Hence, haircuts are expressed as a discount (on collateral value), while margins are expressed as a mark-up (on exposures).

(d) Repo clearing and settlement arrangements and operational aspects

Country/ market	Trading	Clearing	Securities settlement	Cash settlement	Automation of processing	Contract standardisation[37]
			Markets			
Canada	Phone and voice broker supported with broker-screens; no specific infrastructure.	FINet (CCP provided by the Canadian Depository for Securities (CDS). A new repo CCP is currently being introduced.	Canadian Depository for Securities (CDS).	LVTS (Canadian large-value payment system).	Confirmations and entering transactions into CDS is mostly manual. The degree of automation achieved by a participant varies, also depending on the internal systems of a participant.	Limited standardisation of contracts.
Euro area	Electronic trading platforms (eg Eurex Repo, BrokerTec, MTS), through voice brokers, and bilaterally over the phone.	Eurex Clearing AG, CC&G and LCH.Clearnet SA.	Various (I)CSDs.	TARGET2 (large-value payment system) and cash accounts with the ICSDs.	Degree of automation varies. For tri-party services, once a transaction is entered into a tri-party service platform, straight through processing is possible.	Some products are standardised (eg GC products with standardised maturities on electronic trading platforms).
• **France**	Electronic platforms (Broker Tec, MTS). Voice brokers and bilaterally over the phone.	LCH.Clearnet SA.	Euroclear France.	TARGET2 (large-value payment system).	Bilateral repos with CCP are highly automated: trades are received by the CCP directly from a trading venue or a matching platform. On settlement date, the CCP generates settlement instructions in the SSS where the securities are delivered. Settlement process through Euroclear France is fully automated. Lower degree of automation for bilateral repos.	Limited standardisation of contracts.

[37] Repo transaction standardisation refers to repo collateral, term, risk management and related issues. A market is considered to be highly standardised if most transactions are conducted under a limited set of terms, with standardised collateral (eg by agreeing on common collateral baskets), and with identical risk management standards.

(d) Repo clearing and settlement arrangements and operational aspects (cont)

Country/ market	Trading	Clearing	Securities settlement	Cash settlement	Automation of processing	Contract standardisation
• **Germany** (Eurex Repo/ Euro GC Pooling)	Eurex Repo.	Eurex Clearing AG.	Clearstream Banking Frankfurt (incl. Xemac). Clearstream Banking Luxembourg (incl. CmaX) and Euroclear Bank Brussels.	TARGET2 (large-value payment system) for CBF settlement, and cash accounts with Clearstream Bank-ing Luxembourg and Euroclear Bank Brussels.	All processing steps completely automated, achieving full straight through processing.	Highly standardised contracts.
• **Italy**	MTS-PCT; separate segment of MTS.	CC&G and LCH.Clearnet SA.	Express II (securities settlement system, operated by the Italian CSD Monte Titoli).	TARGET2 (large-value payment system).	All processing steps completely automated, achieving full straight through processing for repos traded on MTS. For repos traded OTC, settlement instructions need to be entered manually.	Some products are standardised (eg MTS traded repos).
Hong Kong	Phone and Reuters dealing.	N/A.	CMU (CSD).	HKD CHATS (Large-value payment system).	No automation between trading and settlement. Once settlement instructions are entered into the settlement system, the settlement process is automated.	Limited standardisation of contracts.
Japan	Electronic trading system; but also phone and e-mail.	JGBCC (CCP for JGB repos and JGB purchase-sell transactions).	BoJ-Net JGB Services (CSD).	BoJ-Net Funds Transfer System (large-value payment system).	Some processing steps are automated. With respect to repos with CCP, after entering transactions into the pre-settlement and matching system provided by JASDEC (Japan Securities Depository Center), they are automatically cleared at JGBCC.	Only collateral standardised.

(d) Repo clearing and settlement arrangements and operational aspects (cont)

Country/ market	Trading	Clearing	Securities settlement	Cash settlement	Automation of processing	Contract standardisation
Sweden	Phone.	A repo CCP is about to be launched.	Euroclear Sweden (CSD).	Riksbank accounts administered by Euroclear Sweden (CSD).	Limited automation, most steps performed manually.	Limited standardisation of contracts.
Switzerland	Eurex Repo.	N/A.	SIX SIS (CSD).	SIC (Large-value payment system) for CHF-transactions. SIX SIS and euroSIC for other currencies.	All processing steps completely automated, achieving full straight through processing.	Highly standardised contracts.
United Kingdom	Electronic trading platforms; through voice brokers; and bilaterally over the phone.	LCH.Clearnet U.K., RepoClear segment.	Euroclear U.K.&IR (CREST).	Euroclear U.K.&IR (CREST).	Highly automated. Arrangements including electronic trading platforms, LCH RepoClear and Euroclear U.K.&IR (CREST) are fully automated, achieving straight through processing.	DBV and CCP repo based on standardised contracts.
United States (tri-party repos)	Phone and inter-dealer broker platforms.	N/A (FICC-GSD is used for clearing GCF repos).	Tri-party repo agents.	Tri-party repo agents.	Some process steps highly automated, others not, also depending on product.	Limited standardisation of contracts.

(e) Settlement

Country/ market	Repos settled via DVP mechanism	Repo settlement integrated with settlement of buy-sell or SLB transactions	Settlement in central bank money	Coordinated settlement of terminating and new repos (or daily unwinds)	Settlement window for repos (in CET)	Incentives to avoid settlement delays	Securities lending and borrowing (SLB) available
Markets							
Canada	Yes.	Yes.	Yes.	Only if repo is cleared via CCP.	07:00–16:00. Non-DVD settlement can occur up to 19:30 with funds flowing through LVTS.	Yes (penalties).	Yes, private and Bank of Canada.
Euro area	Yes.	Yes.	Yes if the securities leg is settled in a CSD. No if the securities leg is settled in a tri-party agent or the European subsidiary of a US clearing bank.	No.	Various, depending on system.	Yes.	Yes.
• **France**	Yes.	Yes.	Yes.	No.	Euroclear France: 20:00–03:00 and 05:00–19:00.	Yes.	Yes: the CSD does not directly provide SLB, but there is an active OTC SLB market for which the CSD provides settlement services.
• **Germany** (Eurex Repo/ Euro GC Pooling)	Yes.	Yes.	Yes for all GC-Pooling Repos. For repos on Eurex Repo, 97% of settlement volumes are in central bank money; only the small part of repos settled via ICSDs are settled in commercial bank money.	No.	10:30–16:00.	Yes (Penalties; settlement delivery process developed with market; release of collateral from integrated central bank collateral pool).	Yes.

(e) Settlement (cont)

Country/ market	Repos settled via DVP mechanism	Repo settlement integrated with settlement of buy-sell or SLB transactions	Settlement in central bank money	Coordinated settlement of terminating and new repos (or daily unwinds)	Settlement window for repos (in CET)	Incentives to avoid settlement delays	Securities lending and borrowing (SLB) available
● **Italy**	Yes.	Yes.	Yes.	No.	07:00–18:00.[38]	Yes (penalties).	Yes.
Hong Kong	Yes.	No.	Yes (non-bank CMU members engage a settlement bank).	No.	01:30–11:30.	No.	Yes.
Japan	Yes.	Yes.	Yes.	Yes (through clearing in JGBCC).	01:00–08:30.	Yes (a new fails charge scheme will be introduced).	Yes, provided by BoJ.
Sweden	Yes.	Yes.	Yes.	No.	08:00–17:00.	Yes (penalties and disclosure).	Yes.
Switzerland	Yes.	Yes (but initiated in different time slots).	Yes for CHF. No for other currencies.	Purchase and repurchase leg are only loosely linked, as the instructions are sent five minutes apart but the settlement can be delayed.	07:50–16:00.	Yes.	Yes.
United Kingdom	Yes.	No (dedicated settlement window).	Yes with tiered structure for sterling and euro. Settlement in commercial bank money for US dollars.	No.	16:00–17:10; real-time settlement of the purchase leg of the DBV, but repurchase legs can settle at any time the following day in realtime.	No formal incentives imposed by the system.	Yes, but SLB not directly provided by the CSD, just the service to facilitate SLB between participants.

[38] Settlement continues until 18:30, but last 30 minutes reserved for queue clearing.

(e) Settlement (cont)

Country/ market	Repos settled via DVP mechanism	Repo settlement integrated with settlement of buy-sell or SLB transactions	Settlement in central bank money	Coordinated settlement of terminating and new repos (or daily unwinds)	Settlement window for repos (in CET)	Incentives to avoid settlement delays	Securities lending and borrowing (SLB) available
United States (tri-party repos)	Yes.	No.	No.	No.	14:00–24:00 (tri-party repos).	No.	Yes.
Selected European tri-party service providers							
Euroclear Bank (also settles bilateral repos)	Yes.	Yes.	No.	Possibility for participants to net money transfer instructions for payments for maturing and new tri-party deals (per currency).	Real-time 02:30–18:00. Overnight batches 22:00–23:30 and 01:00–02:30.	For the settlement of bilateral repos a fail-driven automatic securities lending and borrowing program. For the settlement of tri-party repo transactions partial settlement.	Yes, for the settlement of bilateral repos. Settlement of collateral movements related to tri-party collateral management services based on available positions.
Clearstream Banking Luxembourg (also settles bilateral repos)	Yes.	Yes. Bilateral and tri-party repo settlement are integrated in the standard DVP settlement process.	No.	Possibility for participants to net money transfer instructions for payments for maturing and new tri-party deals (per currency).	Real-time 22:00–18:00; start of day batch 21:00–22:00; end of day batch 18:00–19:00; overnight batches with Euroclear Bank.	No incentives or penalties laid down in the rules.	Yes.

(e) Settlement (cont)

Tri-party repo service provider	Repos settled via DVP mechanism	Repo settlement integrated with settlement of purchase-sell or SLB transactions	Settlement in central bank money	Coordinated settlement of terminating and new repos (or daily unwinds)	Settlement window for repos (in CET)	Incentives to avoid settlement delays	Securities lending and borrowing (SLB) available
BoNY Mellon (Brussels) (also settles bilateral repos)	Yes.	Yes.	No.	Possibility for participants to net money transfer instructions for payments for maturing and new tri-party deals (for the major currencies).	Global coverage 24-hour operating window.	Yes, cash loan to failing party at above-market rate.	Yes.

(f) Central counterparties (CCPs) in repo markets

Name of CCP	Country of domicile	Repos cleared on same platform as buy-sell transactions and netted with such transactions	Repo maturities eligible in CCP	Type of direct members for repo clearing, number of members in brackets[39]	Governance of CCP
FINet	Canada	Yes.	Overnight and term repos.	Membership is open to any CDS participant. To date, the facility is used by some banks and smaller dealers.	CDS is jointly owned by its users; the TSX stock exchange, investment dealers and the major banks.
Eurex Clearing AG	Germany	Yes.	Overnight and term repos.	Limited to banks (37).	Eurex Clearing is a subsidiary of Eurex AG, which is 50% owned by Deutsche Börse AG and 50% owned by SIX Swiss Exchange AG. The interests of users are considered via a user advisory board.
LCH.Clearnet SA	France	Yes.	Overnight and term repos.	Banks and non-banks (investment firms) (103).	LCH.Clearnet is a subsidiary of LCH.Clearnet Ltd Group, a financial holding company which is also the owner of LCH.Clearnet Ltd based in the U.K. The Group has moved towards a user-owned structure with an increase of major users of the CCP in its ownership.
CC&G (Cassa di Compensazione e Garanzia)	Italy	Yes.	Overnight and term repos.	Banks and non-banks (investment firms) (18).	CC&G is 86.36% owned by Borsa Italiana SpA, which is in turn owned by London Stock Exchange Group Holdings (Italy) Ltd, fully owned by the Holding London Stock Exchange Group plc.
JGBCC (Japan Government Bond Clearing Corporation)	Japan	Yes.	Overnight and term repos.	Banks and non-banks (brokers, inter-dealer brokers) (35).	Owned by clearing members.
LCH.Clearnet Ltd	United Kingdom	Yes.	Overnight and term repos.	Banks and non-banks (investment firms) (43).	LCH.Clearnet Ltd is a subsidiary of LCH.Clearnet Ltd Group, a financial holding company which is also the owner of LCH.Clearnet SA based in the France. The Group has moved towards a user-owned structure with an increase of major users of the CCP in its ownership.
FICC (Fixed Income Clearing Corporation)	United States	No.	Overnight and term repos.	Banks and non-banks (broker-dealers, inter-dealer brokers) (59).	FICC is a subsidiary of DTCC, which is owned by banks, broker-dealers, mutual funds and other companies in the financial services industry.

[39] Banks include all entities regulated according to domestic banking regulation; non-banks includes all other categories of participants.

(g) Tri-party repo service providers[40]

Name of tri-party repo service provider	Country of domicile	Institutional type	Settlement asset	Participants/ Members	Provision of specific services						
					Validating and matching of repo terms	Instructing cash settlement	Verifying and selecting collateral	Initiating purchase and repurchase	Collateral mark-to-market valuation	Issuing margin calls	Collateral liquidation in case of default
Euroclear Bank	Belgium	ICSD (dedicated market infrastructure).	Commercial bank money.	Banks and non-banks (broker dealers, supranational entities, central banks, custodians, investment managers).	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	Euroclear Bank assists non-defaulting participants but only to facilitate the (standard) settlement process of collateral positions.
BoNY Mellon (Brussels) (Global Collateral Management with operational hubs in Brussels, Singapore and New York)		Commercial Bank.	Commercial bank money.	Banks and non-banks (fund managers, hedge funds, corporates, broker dealers, central banks).	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	BoNY provides separate service, but which is not part of collateral management services.
CMU	Hong Kong	CSD (dedicated market infrastructure).	Central bank money.	Banks and non-banks.	Yes.	Yes.	Yes.	Yes.	No.	No.	No.
Clearstream Banking Luxembourg (CmaX)	Luxembourg	ICSD (dedicated market infrastructure).	Commercial bank money.	Banks and non-banks.	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	No.

[40] A tri-party service provider acts as an agent for the repo counterparties, for example by selecting repo collateral (based on eligibility criteria defined by the counterparties), initiating the securities and cash transfer, and processing administrative and risk management procedures.

(g) Tri-party repo service providers (cont)

Name of tri-party repo service provider	Country of domicile	Institutional type	Settlement asset	Participants/ members	Provision of specific services						
					Validating and matching of repo terms	Instructing cash settlement	Verifying and selecting collateral	Initiating purchase and repurchase	Collateral mark-to-market valuation	Issuing margin calls	Collateral liquidation in case of default
SIX SIS	Switzerland	CSD (dedicated market infrastructure).	Central bank money for CHF, commercial bank money for other currencies.	Banks and non-banks (securities dealers, regulated and large money market funds, regulated and large insurances, market infrastructures).	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	No.
Euroclear U.K. & Ireland (CREST)[41]	United Kingdom	CSD (dedicated market infrastructure).	Central bank money settlement with tiered structure for sterling and euro. Settlement in commercial bank money for US dollars.	Banks and non-banks.	Yes.	Yes.	Yes.	Yes.	Yes, effected through daily unwinds and winds.	Yes, effected through daily unwinds and winds.	No.
JPMorgan Chase (Europe)		Commercial bank.	Commercial bank money.	Banks and non-banks.	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	No.
BoNY Mellon (US)	United States	Commercial bank.	Commercial bank money.	Banks and non-banks (broker-dealers, investment firms).	Yes.	Yes.	Yes.	Yes.	Yes.	Through daily unwinds.	No.
JPMorgan Chase (US)		Commercial bank.	Commercial bank money.	Banks and non-banks (broker-dealers, buy-side).	Yes.	Yes.	Yes.	Yes.	Yes.	Through daily unwinds.	No.

[41] While typically not considered a tri-party repo service provider, Euroclear U.K. & Ireland's (CREST) DBV service provides functionality that is in some ways similar to tri-party repo.

Annex 3:
Overview of repo market developments during the financial crisis

Country/ market	Changes to repo market volumes and values	Changes to eligible collateral and collateral used in repo markets	Changes to weighted average repo maturity	Changes to repo margins and haircuts	Changes to repo settlement fails	Other notable changes or issues in repo markets	Government/central bank actions taken with regard to repo market
Canada	Volumes and values went down in absolute terms: (a) Deleveraging of banks' balance sheets; (b) Cutting of repo lines for smaller and leveraged clients dealing through prime brokerages; (c) Inadequate compensation for operational and legal risk in low-interest environment. This led to a lack of market liquidity, lack of price transparency, wider bid-ask spreads and repo credit line reductions for some borrowers.	Higher quality requirements (namely Canadian government bonds) for interbank repos.	Shorter maturities, mostly only overnight term deals.	Smaller and leveraged clients dealing through prime brokerages faced higher haircuts.	No material increase in failed transactions.	None.	Bank of Canada: (a) was active in repo market to provide additional funding; (b) was somewhat active in SLB markets to lend hard-to-borrow government bonds; (c) broadened the list of central bank eligible repo collateral; (d) broadened the range of eligible counterparties (large institutional accounts); (e) supported industry-led initiative to create a CCP for repo transactions.

Overview of repo market developments during the financial crisis (cont)

Country/ market	Changes to repo market volumes and values	Changes to eligible collateral and collateral used in repo markets	Changes to weighted average repo maturity	Changes to repo margins or haircuts	Changes to repo settlement fails	Other notable changes or issues in repo markets	Government/central bank actions taken with regard to repo market
Euro area	Interbank repo market volumes/values went down during the crisis: (a) General deleveraging; (b) Concerns about collateral quality and counterparty quality; (c) Valuation problems; (d) Lack of high-quality collateral. But the relative share of repo transactions compared to total interbank money market increased. Also, outstanding values increased in the CCP-cleared GC repo segment in France (cleared by LCH.Clearnet SA).	(a) General lack of high-quality collateral; (b) Generally increased cross-border use of collateral; (c) For interbank repos focus on government securities; covered bonds hardly used for interbank repos; (d) Increased range of eligible collateral for central bank repos; (e) More use of ABS and non-marketable assets for central bank repos; less use of government bonds for central bank repos.	Shorter maturities (strong increase in overnight repos).	Increased haircuts especially for longer maturities (beyond 3–6 months).	No persistent rise in settlement fails.	None.	The Eurosystem expanded the range of central bank repo eligible collateral.
● **Belgium** (tri-party service by Euroclear Bank)	Contraction in the Euroclear Bank tri-party volumes of around 25%, in line with the development in the European repo market as a whole, mainly triggered by a general deleveraging.	Flight to quality in terms of collateral assets (AAA rated assets used as collateral increased from 50% to 60% of the total outstanding between December 2007 and December 2009).	Move to short-term repos (proportion of overnight repo transactions rose from around 30% to 40% between December 2007 and December 2009).	Changes to the haircut levels implemented according to the (pre-agreed) requests from counterparties.	None.	None.	(see euro area)

Overview of repo market developments during the financial crisis (cont)

Country/ market	Changes to repo market volumes and values	Changes to eligible collateral and collateral used in repo markets	Changes to weighted average repo maturity	Changes to repo margins and haircuts	Changes to repo settlement fails	Other notable changes or issues in repo markets	Government/central bank actions taken with regard to repo market
● **Germany**	Increase in absolute volumes, values and participants (incl. more international participants), especially in GC Pooling repos: (a) Counterparty risk mitigated by CCP; anonymity provided by CCP is essential to participants; (b) Possibility to re-use collateral (re-useable ECB basket) with the Bundesbank addressed liquidity concerns; (c) Application of the Eurosystem valuation rules in Euro GC Pooling.	Rating requirements for ECB basket remained unchanged (although Eurosystem eased rating requirements). By end November 2008, the EXTended Euro GC Pooling basket was introduced, including more than 23,000 eligible assets.	Longer maturities.	None.	No changes, due to specific secure set-up (collateral transfer out of the system upon request).	Collateral quality and counterparty risk concerns became more important for participants. Move of Euro GC Pooling to a cash-driven repo market.	(see euro area)
● **Italy**	(a) Small absolute volume reduction (by 4%); but relative growth of repo market compared to overall interbank money market; (b) Shift from special repos to government securities GC repos.	(a) More government securities GC repos; (b) Reduction in special repo segment.	Shorter maturity (strong increase in overnight repos).	Increase in the margins applied by the CCP. Before June 2009 the CCP applied a 15% haircut on all securities. Starting from June 2009 the haircuts applied by the CCP vary according to the different duration of the securities.	None.	Move away from electronic trading to OTC, which allows counterparties to be chosen in advance and transactions to be kept confidential. Lower use of CCP for repos, which is explained by the fact that overnight repos increased but CCP did not clear overnight repos (starting from November 2009 it started to clear and guarantee overnight repos traded on the MTS/PCT segment).	(see euro area)

Overview of repo market developments during the financial crisis (cont)

Country/ market	Changes to repo market volumes and values	Changes to eligible collateral and collateral used in repo markets	Changes to weighted average repo maturity	Changes to repo margins and haircuts	Changes to repo settlement fails	Other notable changes or issues in repo markets	Government/central bank actions taken with regard to repo market
● **Luxem-bourg** (tri-party service by Clear-stream Banking Luxem-bourg)	Decrease of tri-party repo volume and increase of repo through CCP (anonymity, reduced counterparty risk) as well as use of collateral with central banks.	(a) Changes to eligible collateral requested by tri-party participants (eg focus on liquid assets and excluding MBS, ABS, CDO). (b) The possibility to re-use with the central bank collateral received from repo transactions was an advantage. (c) Adaptation of collateral criteria by participants to match Eurosystem criteria.	Shortened; now mainly overnight (more than 50%) and open maturity (could be closed anytime, 28%).	Increased margins/ haircuts requested by tri-party participants (reducing the available collateral pool); in some cases tri-party provider adapted haircuts and margin requirements for participants on its own.	No evident, persistent change of settlement efficiency.	None.	(see euro area)
Hong Kong	None (repo market currently at early stage).	None.	None.	None.	None.	None.	None.
Japan	Down in absolute terms: (a) Higher sensitivity and attention to counterparty risk of foreign financial institutions; (b) Higher sensitivity and attention to risk of settlement fails by some primary lenders of funds. This led to some participants avoiding transactions on the repo market especially with foreign financial institutions and the avoidance of certain (originally not BoJ-eligible) collateral (floating-rate JGBs, inflation-indexed JGBs).	(a) Tightened for interbank repos (rejection of some initially not BoJ-eligible collateral, eg floating-rate JGBs and inflation-indexed JGBs). (b) Widened for BoJ repos to include floating-rate JGBs and inflation-indexed JGBs.	None	None	Increase in settlement fails and intraday settlement delays after Lehman default (until end of September 2008).	Spread between GC repo rate and uncollateralised call rate widened until end of 2008. CCP took several days to liquidate the JGBs after the failure of Lehman Brothers.	(a) BoJ provided abundant funds through repos and unconventional money market operations during the Lehman default. (b) BoJ widened eligible collateral for repo operations to include floating-rate JGBs and inflation-indexed JGBs. (c) BoJ relaxed the conditions for securities lending facility.

Overview of repo market developments during the financial crisis (cont)

Country/ market	Changes to repo market volumes and values	Changes to eligible collateral and collateral used in repo markets	Changes to weighted average repo maturity	Changes to repo margins and haircuts	Changes to repo settlement fails	Other notable changes or issues in repo markets	Government/central bank actions taken with regard to repo market
Sweden	Sharp decrease in values and volumes, which can be attributed to: (a) Reluctance to repo out securities with desired characteristics; (government securities) (b) Increased awareness of counterparty risk; (c) Balance sheet constraints and reduced counterparty limits. The repo market functioned better than the unsecured interbank market during the crisis. Due to lack of data, it remains open whether this also translated into an increase in the relative importance of the repo market.	Demand for borrowing government securities from Swedish National Debt Office overnight increased.	Shortened maturities.	Haircuts for non interbank repos increased.	No.	Liquidity issues resulted in lack of price quotes. Repo rates rose above OIS. This reflected increased risk aversion, a preference for holding cash and a compensation for higher collateral volatility.	The Swedish National Debt Office started issuing large extra volumes of T-Bills to meet heightened demand. The money from these extra auctions was placed in reverse repos with mortgage bonds as collateral. The Swedish National Debt Office was thus conducting an asset swap as it took duration and credit from the market in form of covered bonds and replaced them with short T-bills. For repos with Riksbank: (a) Reduction of minimum rating requirement for collateral; (b) Use of own covered bonds for counterparties.

Overview of repo market developments during the financial crisis (cont)

Country/ market	Changes to repo market volumes and values	Changes to eligible collateral and collateral used in repo markets	Changes to weighted average repo maturity	Changes to repo margins and haircuts	Changes to repo settlement fails	Other notable changes or issues in repo markets	Government/central bank actions taken with regard to repo market
Switzerland	Slight decrease in values because of: (a) Low-interest rate environment; (b) Abundant liquidity provided by SNB. But: increase in number of participants in the repo market. While there is no recent data available on the relative volumes in the repo market vs. unsecured interbank money markets, annecdotal evidence suggests that the relative importance of the repo market increased during the crisis.	No changes to eligible collateral. But: change in relative weight of some asset classes used as collateral for repos.	None.	None.	None.	As there is no CCP and trading relies on bilateral credit lines, some repo participants had only activated a small number of other participants as possible repo counterparties.	Increase in liquidity provided by SNB through repo as part of low interest monetary policy and quantitative easing, complemented by an increase in repo maturity. Encouragement of repo participants to activate larger number of other participants as possible repo counterparties (conducted by trading platform operator, in co-ordination with SNB).
United Kingdom	General deleveraging reduced absolute volumes/ values, but relative importance of repos in interbank money market increased; also, repo volumes cleared by LCH.Clearnet Ltd increased during the crisis.	None.	Shortened.	Higher margins reflecting market illiquidity and deterioration in credit quality, but not market volatility.	Increase in settlement fails during Lehman default; trades automatically closed out under trade venue/CCP default rules could not be allowed to settle and Lehman's settlement participation in CREST was frozen by law.	Increase of repos cleared through a CCP – in particular sterling GC repo transactions and euro repo transactions cleared by LCH.Clearnet Ltd's RepoClear increased over the period.	Relevant measures include: widening the collateral eligible in long-term open market operations; establishing a temporary Special Liquidity Scheme to swap high quality mortgage-backed and other securities for UK Treasury Bills for up to three years; establishing the Discount Window Facility which enables eligible counterparties to borrow gilts against a wide range of collateral; and the provision of temporary US dollar liquidity swap facilities.

Overview of repo market developments during the financial crisis (cont)

Country/ market	Changes to repo market volumes and values	Changes to eligible collateral and collateral used in repo markets	Changes to weighted average repo maturity	Changes to repo margins and haircuts	Changes to repo settlement fails	Other notable changes or issues in repo markets	Government/ central bank actions taken with regard to repo market
United States (focus on tri-party repo)	Down for interbank repo markets: (a) General deleveraging; (b) Credit lines were cut and concentration limits tightened; (c) Lenders pulled back from repo markets, as the low government collateral repo rates were not enough to compensate for the risk that securities might not come back. Volumes/values increased for repos with the Fed (see facilities to the right) and for FICC-cleared repos.	Focus on treasury and agency collateral due to heightened risk aversion and valuation uncertainty. Repos in corporate or structured products were essentially no longer possible.	Term repo markets dried up, with little activity in maturities longer than one week.	Increase in margin requirements.	Settlement fails in tri-party repos cannot occur as collateral cannot be transferred out of the accounts with the tri-party agents. Settlement fails increased. However, in treasury markets, with the extraordinarily low GC repo rates, the cost of failing was reduced.	Tri-party repo agents (clearing banks) reconsidered the practice of routinely extending intraday credit to broker-dealers. As US government collateral was in high demand, the repo rate for such collateral was pushed down to only a few basis points above zero.	The range of acceptable collateral with the Fed was broadened to include all eligible tri-party repo collateral, including non-USD denominated securities. Several new facilities were established by the Fed: (a) Term Auction Facility allows banks to borrow against a wide range of collateral, including securities that are not widely pledged in private markets. (b) Primary Dealer Credit Facility mitigated reluctance of clearing banks to extend intraday credit, since dealers unable to arrange overnight financing could come to the Fed. (c) Term Securities Lending Facility allows dealers to offer relatively illiquid securities as collateral in exchange for a loan of Treasury securities. This promotes liquidity in the financing markets for Treasury and other collateral.

Annex 4:
Members of the Working Group

This report was produced for the CPSS by the Working Group on Repo Market Infrastructures.

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