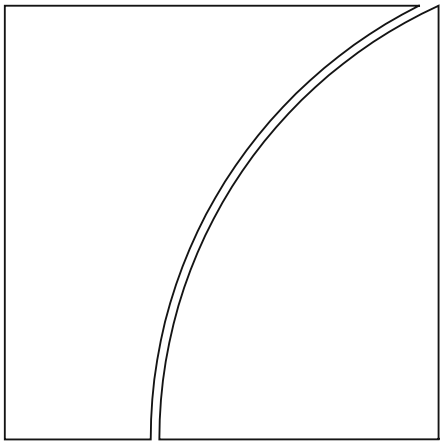
Committee on Payments and Market Infrastructures



Developments in collateral management services

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Foreword

Motivated by expected increases in demand for collateral stemming from regulatory changes and a greater preference for secured transactions, collateral management service providers are evolving their service offerings in an effort to improve efficiencies and enable market participants to meet collateral demands with existing and available securities. This report takes stock of the existing range of collateral management services as well as what innovation is under way to respond to the higher demands for collateral, and considers any increased or new settlement-related risks as a result of the innovation and evolving services.

The movement of securities and settlement of transactions for current and planned collateral management services rely heavily on existing clearing and settlement infrastructure. As a result, the report does not identify new settlement-related risks as such. However, the proposed services do have the potential to create large networks of dependencies and interconnections among financial market infrastructures and custodian banks active in providing collateral management services. Both the public and the private sector need to understand, monitor and appropriately manage the associated risks as innovations in collateral management services are introduced, and partnerships and operational connections are established, implemented and used.

The services described herein represent a point-in-time snapshot of an evolving landscape. Moreover, the implications of the potential benefits and risks identified are largely dependent on how the landscape of collateral management services develops and evolves. Collateral demand and supply factors also remain in flux, and the future equilibrium, including the degree of dependence on existing and new collateral management services, is difficult to predict at this time. On that basis, the Committee on Payments and Market Infrastructures (CPMI)[1] will continue to monitor developments in collateral management services and coordinate with other public sector bodies, as appropriate.

The report has been prepared for the CPMI by the Working Group on Developments in Collateral Management Services. The CPMI is very grateful to the members of the working group for preparing this report.

[1] The Committee on Payment and Settlement Systems (CPSS) changed its name to the Committee on Payments and Market Infrastructures (CPMI) on 1 September 2014. Please note that references to reports published before that date use the Committee's old name.

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I. Introduction and observations

Background

In 2013, the Committee established a working group to take stock of the existing range of collateral management services as well as what innovation is under way to respond to the increased demands for collateral with a view to identifying any increased or new settlement-related risks as a result of the innovation. To achieve its objective, the working group interviewed 23 financial market infrastructures and large custodian banks (service providers) that support collateral management across the globe.[2] This report details the point-in-time findings of the stocktaking exercise based on these interviews and outlines systemic risk considerations and conclusions based on the findings.

As demand for collateral continues to increase, it is critical to understand in greater detail how the market for collateral management services is evolving and what benefits as well as risks may result from such developments. Collateral management services seek to ensure that a firm can meet its various collateral obligations. Since the 2008 financial crisis, there have been a number of changes that have affected the composition of assets a firm may hold in terms of their quality. Regulatory reforms, including the liquidity coverage ratio, require firms to hold more high-quality assets on their balance sheets. Further, reforms in the derivatives market require some firms to hold additional high-quality collateral for margining of bilateral and centrally cleared derivatives transactions. Finally, market participants that provide large-scale lending have shown an increased preference for secured lending transactions over unsecured lending transactions.

These increased demands are coupled with changes such as limits on the reuse of collateral that could have a negative impact on supply, as well as segregation requirements that increase the operational complexity associated with collateral management.[3] Collectively, these changes are leading firms to broaden their focus from primarily managing their assets for balance sheet purposes to giving greater consideration to managing assets from a collateral management perspective. Moreover, these changes are driving innovation in the provision of collateral management services.

In addition to the changes to the services themselves, the universe of users of these services is expanding. Historically, the sell side (eg broker-dealers, futures commission merchants) has developed proprietary systems that allow for efficient use of collateral to satisfy obligations, or has relied upon optimisation services provided by tri-party agents. With the advent of central clearing, many buy-side market participants (asset managers, pension funds, etc) are now seeking better tools to help them satisfy their collateral obligations with maximum efficiency.

Related work

The Committee has been looking into various aspects of collateral usage and related risks since the early 1990s, with a focus on the validity and enforceability of collateral arrangements.[4] As noted in the March 2007 CPSS report *New developments in clearing and settlement arrangements for OTC derivatives*,

[2] The list of interviewed service providers is available in Annex 1, and the interview questions in Annex 2. Definitions of common terms used in this report can be found in Annex 3.

[3] The BCBS-IOSCO report *Margin requirements for non-centrally cleared derivatives* (http://www.bis.org/publ/bcbs261.pdf) restricts the reuse of collateral posted for initial margin purposes.

[4] See eg the September 1992 CPSS report *Delivery versus payment in securities settlement systems* (http://www.bis.org/publ/cpss06.pdf).

significant progress had been made since 1998 in reducing legal, custody and operational risks in collateralisation arrangements.

Prior to the 2008 financial crisis, higher demand for collateral had been driven inter alia by the increased importance of repos as money market instruments or the greater use of securities as collateral to control risks in payment systems or other financial market infrastructures (FMIs), referred to in the March 1995 CPSS report *Cross-border securities settlements*, as well as the expanding collateralisation of credit exposures in the over-the-counter (OTC) derivatives market, as highlighted in the September 1998 CPSS report *OTC derivatives: settlement procedures and counterparty risk management*.[5, 6] In particular, there had been continuously increasing use of cross-border collateral, resulting from market participants' expansion outside their countries of incorporation, as noted in the January 2006 CPSS report *Cross-border collateral arrangements*.[7]

However, since 2008, increased demand for collateral appears to have been driven by regulatory reform and changes to risk management by market participants, both locally and across borders. In response to this higher demand, existing collateral management services are being expanded and new services are being developed to support the needs of market participants.

This report takes stock of the existing set of collateral management services, as well as the innovations under way in response to greater collateral demands, in an effort to identify any increased or new settlement-related risks as a result of the rise in demand for existing services or of service innovations.

In the context of FMIs, reference to their use of collateral management services is made in the April 2012 CPSS-IOSCO report *Principles for financial market infrastructures* (PFMIs).[8] More broadly, the PFMIs set standards to ensure a common base level of risk management across FMIs, some of which offer collateral management services. Furthermore, given the importance of repo and securities lending markets to collateral management service providers (CMSPs), the working group also considered the risks in this market segment, following up on the risks identified in the 2010 CPSS report *Strengthening repo clearing and settlement arrangements*.[9]

Structure of this report

Section II provides background on the historically fragmented approach to the management of collateral, highlighting how the design of firms and the management of their businesses and assets focused primarily on the servicing of their assets and did not fully contemplate use of assets as collateral. This approach created fragmentation of information regarding assets held within a firm that often led to inefficiencies in the deployment of securities as collateral.

Section III details how collateral management services are changing in an effort to address these inefficiencies in response to expected further increases in demand for collateral. Based on information gleaned from interviews, this section details the variety of approaches being undertaken by many of the service providers to furnish customers with better tools to monitor their securities holdings and increase efficiencies in the deployment of those securities. Importantly, some service providers have

5 http://www.bis.org/publ/cpss12.pdf.

6 http://www.bis.org/publ/cpss27.pdf.

7 http://www.bis.org/publ/cpss71.htm.

8 See Principle 5, Key Consideration 6, http://www.bis.org/publ/cpss101a.pdf.

9 http://www.bis.org/publ/cpss91.htm.

already been providing some of these services to customers for many years and are enhancing their existing offering, whereas others are offering some of these services for the first time.

Section IV reviews the concept of collateral transformation, whereby a market participant exchanges, lower-quality collateral for higher-quality collateral on a short-term basis. The different ways a participant can effect a collateral transformation are reviewed, along with the mechanics of the transactions that constitute a collateral transformation trade. Finally, the discussion focuses on how CMSPs may be incorporating these services based on expected demand.

Section V describes the settlement of securities movements and transactions conducted to support collateral management services.

Sections VI and VII identify benefits and risk considerations resulting from the ongoing innovation. Section VIII concludes.

Observations

The current focus of many CMSPs is on recognising the opportunities to help market participants move away from a traditional decentralised and fragmented approach to managing collateral, and build on existing processes and relationships to approach collateral management in a more centralised way, as well as on a global, cross-border basis where possible. Innovations are being developed to provide customers with tools to manage collateral more efficiently. The range of existing and planned future services vary across CMSPs, as different market participants are expected to have varying needs and levels of sophistication when it comes to collateral management services.

A range of potential benefits and risks have been noted as a result of these innovations. The potential benefits stem largely from the efficiencies gained from market participants having better information on and increased access to their available securities to meet their collateral demands globally. Potential risks derive to a great extent from the dependencies and linkages being created across multiple firms, which increase operational risks. As CMSPs are relying on existing infrastructure to settle transactions and move securities, no new settlement-related risks have been observed at this time.

Collateral management services continue to evolve while the supply and demand dynamics for collateral remain in flux. Both providers and users of collateral management services should actively identify, measure and manage the risks associated with collateral management services to realise the positive benefits. Recognising that this report is the result of a point-in-time stocktaking exercise, the CPMI will continue to monitor developments as collateral management services evolve.

II. The fragmented approach to collateral management

Traditionally, the information on what collateral obligations exist and what securities may be available to fulfil those obligations has been managed in a decentralised manner. This fragmentation of information is the result of collateral management not being the primary driver for how a firm sets up the service provision for its securities. Historically, firms have made choices related to the servicing of individual asset classes, and therefore organisational structures have been driven by front office factors with little regard to back office design oriented to the efficient use of securities as collateral. Firms may organise themselves by different asset classes (equities desk, fixed income desk, etc) in different geographical locations, thus fragmenting the activities that generate the supply of available securities, as well as the resulting collateral obligations. In addition, firms may use multiple custodians to service their assets due inter alia to quality of service, geographical presence and a desire to avoid concentration risk. Furthermore, firms typically used not to actively consider the costs of collateralisation, and thus the process of matching available securities to existing obligations was relegated locally to a back office

function supporting the front office design, with each desk or business line responsible for knowing its obligations and having the securities on hand to fulfil them. While some firms have worked to centralise this process over time, with large global broker-dealers being the most advanced in this respect, it is only now, with the advent of increased demands for collateral, that many other large market participants are seeing the value in making significant investments to improve their processes around collateral management.

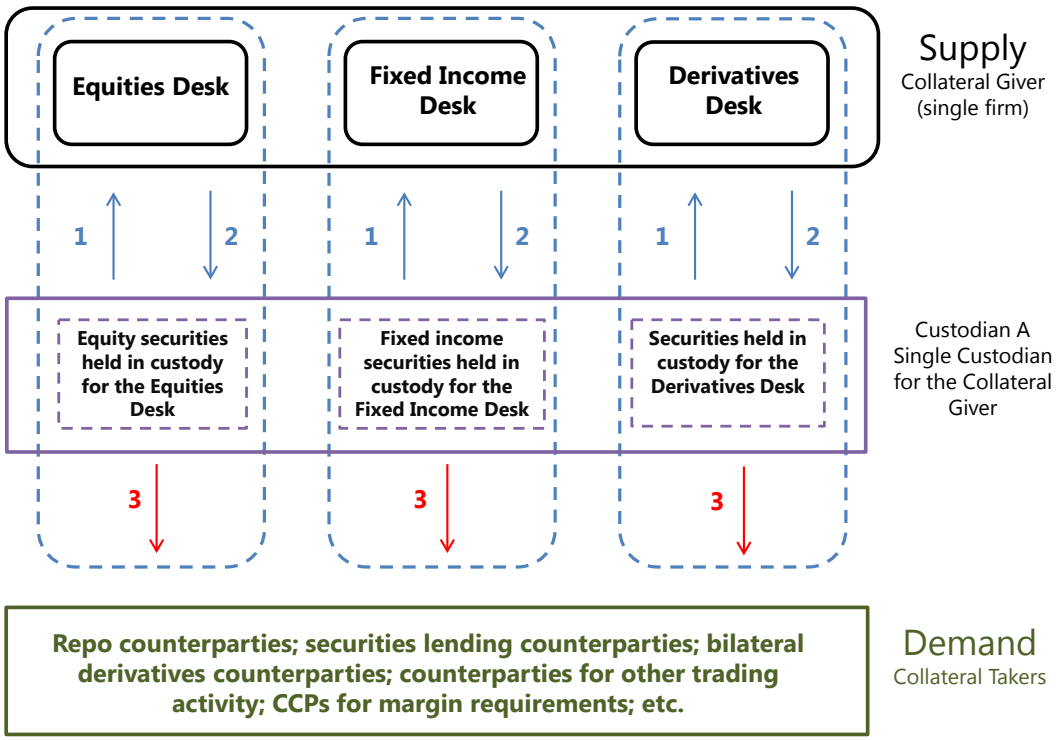
How a firm uses one or multiple custodians and/or (international) central securities depositories ((I)CSDs) will have a large impact on its collateral management activities.[10] Many firms have set up relationships in a variety of ways based on the legal or operational structure of the firm, quality of service provided by the custodian and/or CSD or a range of other factors. For example, a firm may be using one custodian in a single jurisdiction while its securities are being managed at the asset class level. This case is illustrated in Diagram 1, where a collateral giver has three separate trading desks – equities, fixed income and derivatives. The collateral giver holds its securities with a single custodian (Custodian A); however, there is no single view of the firm's aggregate securities holdings and assets are managed by asset class at the desk level. In this example, Custodian A provides basic custody services, with collateral allocations being initiated by instructions from the individual desks to meet its collateral obligations. Each desk manages its information (what collateral obligations it has incurred and what securities are available to fulfil those obligations) separately. Under such a model, instructions as to how to allocate the available securities to meet outstanding collateral obligations are issued from the silo perspective of each individual desk. For example, if the derivatives desk found itself short government bonds to fulfil a collateral obligation (eg margin requirement at a central counterparty (CCP)), it would be likely to purchase additional bonds to make good on the obligation (or perhaps post cash as collateral instead). At the same time, if the fixed income desk had excess government bonds to pledge, it would probably be more efficient to use those securities to fulfil the derivatives desk's obligation. Although all available securities are being held at the same custodian, this model of collateral management by asset class at the desk level may result in an inefficient use of a firm's available securities.[11]

[10] Use of sub-custodians by custodians in a particular market or jurisdiction adds complexity and further impacts collateral management activities.

[11] In this example, Custodian A could be replaced by an (I)CSD, with each desk maintaining a separate account at the (I)CSD and managing its securities and collateral obligations by business line rather than across the firm.

Diagram 1

Single jurisdiction, single custodian



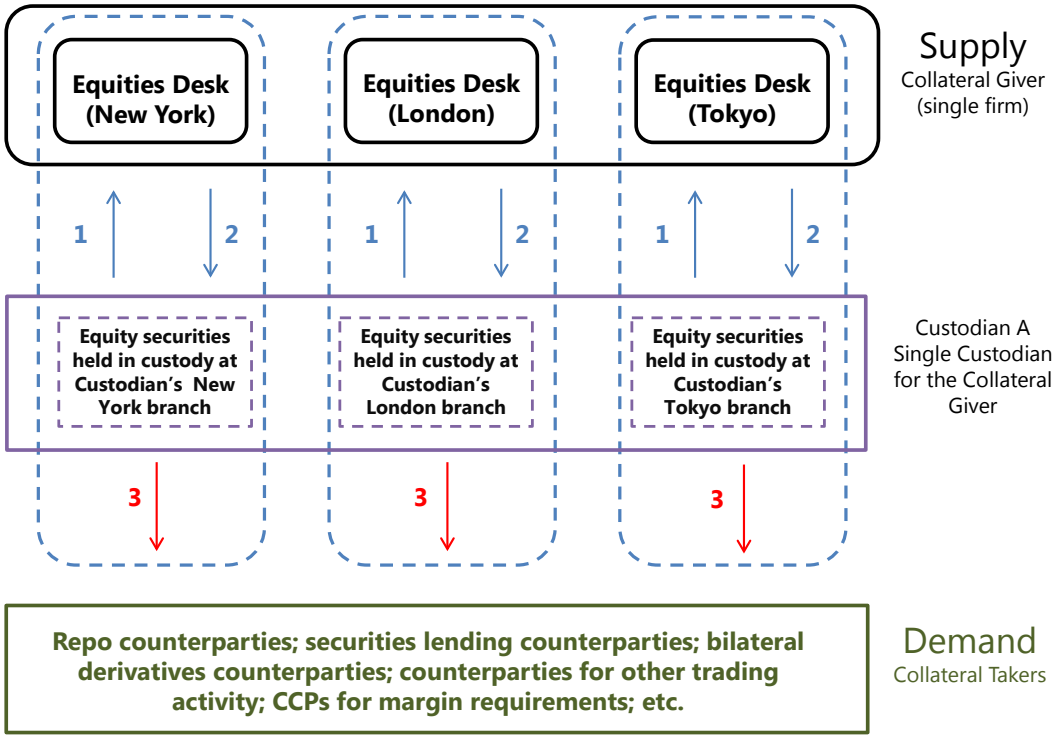
1 = Custodian sends to each desk information regarding its available securities to fulfill collateral obligations
2 = Each Desk sends instructions to the Custodian to deliver available collateral based on the Desk's obligations
3 = Custodian moves collateral based on instructions received in Step 2

Separately, a globally active firm may manage collateral obligations at the jurisdictional level, despite using the same custodian across jurisdictions. In some cases, the single custodian may have separate platforms for different jurisdictions, resulting in a fragmented view of available securities. This is illustrated in Diagram 2, where the collateral giver has equities desks in New York, London and Tokyo, with each desk using the local branch/entity of Custodian A as its custody bank. Similarly to the example described above, the collateral giver does not have a consolidated view of its aggregate securities holdings across jurisdictions. Each desk in each jurisdiction manages the information on the collateral obligations it has incurred and the available securities to fulfil those obligations separately. For instance, if the London desk found itself short XYZ securities to meet a collateral demand, it would have to obtain the necessary securities in the market. This does not take into account whether the New York or Tokyo desk might have an excess of XYZ securities sufficient to meet London's shortfall. This fragmented view of the collateral giver's available securities across jurisdictions may result in an inefficient collateral allocation for a firm set up according to jurisdictional, rather than global, demands.

ICSDs typically offer custody services to participants on a single platform. However, a fragmented outcome similar to that illustrated in Diagram 2 could occur for participants of ICSDs, depending on how the participant structures its accounts. For example, the collateral giver / single globally active firm could have an account structure at the ICSD whereby each desk in each jurisdiction manages its securities and collateral obligations in separate accounts within the ICSD.

Diagram 2

Multiple jurisdictions, single custodian

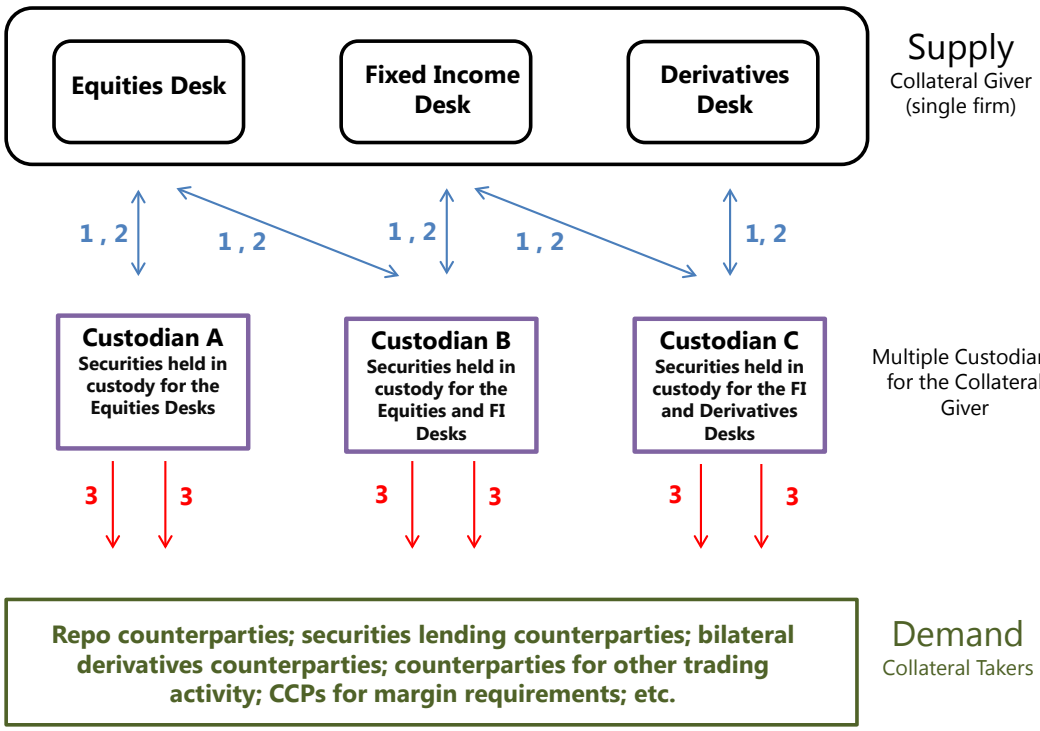


1 = Local Custodian branch sends to each local Desk information regarding its available securities to fulfill collateral obligations
2 = Each local Desk sends instructions to the local Custodian branch to deliver available collateral based on the Desk's obligations
3 = Local Custodian branch moves collateral based on instructions received in Step 2

Another example is where a globally active firm manages its collateral obligations at the jurisdictional level with different custodians. Use of different custodians may similarly result in a fragmented view of available securities. This is illustrated in Diagram 3, where the collateral giver has equities, fixed income and derivatives desks in a single jurisdiction. Within the jurisdiction, the collateral giver diversifies its custody accounts across Custodians A, B and C. In this example, once again, each custodian bank is providing basic custody services, with collateral allocations being initiated by instructions from the individual desks. Similarly to the examples described above, each desk manages its information (collateral obligations and available securities) separately and there is no consolidated view of available securities across custodians. For instance, the fixed income desk could find itself short corporate bonds in its custody account at Custodian B to fulfil a repo obligation and choose to purchase additional bonds to do so. However, at the same time the desk could be long corporate bonds in its account at Custodian C but lacks a timely view of those holdings and therefore does not use these bonds to meet its obligation. This fragmented view of available securities across custodians could add to the inefficiencies experienced by managing collateral by asset class.

Diagram 3

Single jurisdiction, multiple custodians



1 = Each Custodian sends to each Desk information regarding its available securities to fulfill collateral obligations
2 = Each Desk sends instructions to its applicable Custodian to deliver available collateral based on the Desk's obligations
3 = Each Custodian moves collateral based on instructions received in Step 2

While all of these models are different and represent only a sample of the variations that exist, what they have in common is that they provide partial information on available securities to different parts of a firm, which leads to a decentralised approach to managing the supply of available securities and matching that supply to the demand for those securities, likely resulting in an inefficient approach to collateral management from a firm-wide perspective.

A firm has a variety of available securities at its disposal to help satisfy its range of collateral obligations. In addition, for many of those obligations, a range of available securities would be eligible to satisfy the obligations. For example, many repo transactions and bilateral derivatives transactions follow a predefined schedule that will permit a range of assets to be pledged to fulfil collateral obligations. Similarly, CCPs typically accept a range of collateral specified in advance to satisfy a margin call.[12] As a greater proportion of derivatives trades are centrally cleared or become subject to bilateral margin requirements, thereby increasing demand for collateral to fulfil margin obligations, a firm will have some flexibility in what assets fulfil which obligations when a broad range of assets is accepted as collateral. Despite this flexibility, the historically fragmented view firms have of available securities has been a barrier to the most efficient deployment of available securities to satisfy those obligations.

[12] Such specifications are predicated on the risk management practices of a CCP, which impose concentration limits and specify the quality of acceptable collateral.

III. Current and evolving approaches to the provision of collateral management services that address fragmentation

Increasing collateral demands are creating strong economic incentives for firms to find ways to leverage existing asset servicing infrastructure to move away from fragmented views to a more comprehensive view of holdings to support better deployment of available securities to satisfy collateral obligations. As noted in the 2006 CPSS report *Cross-border collateral arrangements*, "banks may find it costly to hold sufficient quantities of eligible collateral in every market in which they operate directly, and may face mismatches between the location of their liquidity needs and the collateral they hold". While the 2006 report found no evidence of collateral shortages in routine situations, the high degree of innovation currently being introduced by CMSPs suggests that customers are seeking to dramatically improve the efficiency of their collateral management processes in response to increased demands for collateral around the globe.[13] Specifically, discussions with interviewed firms revealed the following ongoing initiatives to improve collateral management efficiency:

- Establishing partnerships and building tools to aggregate information on available securities.[14]
- Establishing partnerships and building tools to aggregate available securities through movements of collateral.
- Adopting optimisation tools for the first time.
- Improving optimisation tools where they already exist.

Optimisation is a process whereby a CMSP uses information on a customer's available securities and collateral demands to determine and maintain an efficient allocation. Collateral allocation is the actual issuance of instructions to effect collateral movements. Developments in collateral management services are squarely focused on improving the output of the optimisation process, by broadening the scope of the information inputs across locations and/or developing more sophisticated optimisation algorithms to generate more efficient allocation recommendations. These services also seek to take into account the timing of collateral obligations so that customers are fulfilling their obligations on time, especially when collateral demands need to be satisfied by a given deadline. These services include taking into account a given day's pre-agreed obligations, but may also include intraday changes and calls for collateral as well as forward-looking analysis and projections.

It is important to note that different market participants will have varying needs and levels of sophistication when it comes to collateral management services. This was reflected in the different stages of innovation observed across the set of interviewed firms.

Efforts to aggregate views of a customer's holdings and increase access to available securities

Aggregate views are being developed in a variety of ways. First, many of the largest custodians have implemented, or have plans to implement, a custodial platform that is global in nature. This will be a single system or set of connected systems that allows a customer a single view of all its available collateral held by the custodian, regardless of location. Furthermore, for a customer with multiple legal entities, firms provide access control functionality that supports various permutations of views depending on the level of permissioning. For example, an individual may be able to see available

[13] The 2013 CGFS report *Asset encumbrance, financial reform and demand for collateral assets* also noted that although temporary supply-demand imbalances for high-quality assets may arise, there is no evidence or expectation of permanent or widespread scarcity of such assets in global financial markets (http://www.bis.org/publ/cgfs49.htm).

[14] In some cases, CMSPs are also taking into account available cash balances in a variety of currencies as well as projections of future cash and securities settlements.

securities only for a single legal entity, a subset of affiliated entities, or the "top of the house" view to help facilitate legally permissible movements of securities across affiliates to support a more efficient deployment of collateral.

In addition to a custodian providing its customer a single view of holdings at that custodian, a number of custodians are making technological improvements to support a view of holdings that includes assets held away from the primary custodian. These "custody-agnostic" models support aggregation of available securities across multiple custodians within or across locations to provide the customer with a single view of all holdings. This is a critical step, as some firms may be conducting business in jurisdictions where their primary custodian does not provide collateral management services and this functionality of aggregating information across locations and jurisdictions will enable firms to improve collateral management efficiency. Moreover, this development will allow market participants to preserve some degree of diversification for custody services, where desired.

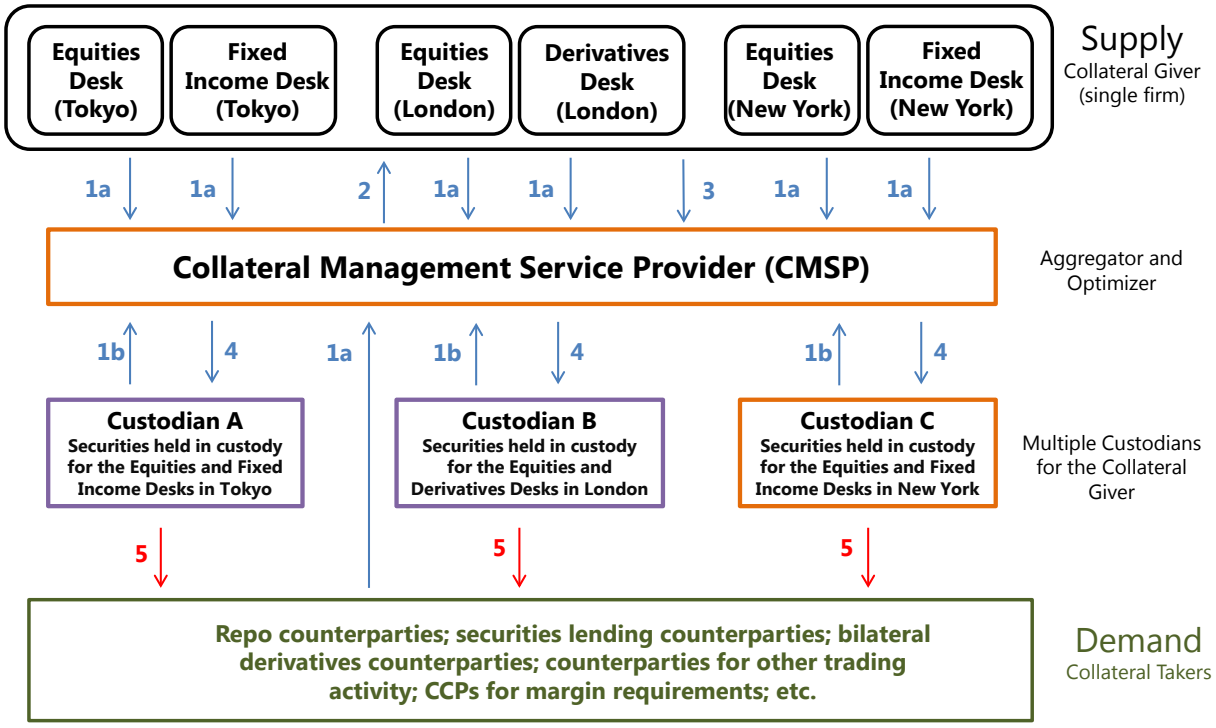
Solutions seeking to aggregate information across custodians vary greatly in terms of the timing of updates to the aggregate view. When the CMSP is also the custodian, the information on available securities is real-time. However, in cases where the assets are held at a custodian that is not the CMSP or does not belong to the same corporate group, the accuracy of the information on available securities will be a function of the frequency with which the information is provided. In some cases, customers are asking secondary custodians to provide information once a day early in the morning, to facilitate the efficient deployment of collateral to fulfil obligations during that business day in that jurisdiction. Others are providing multiple updates throughout the business day. The most sophisticated model observed includes the sending of a duplicate SWIFT message to the primary custodian when a transaction takes place at a secondary custodian, allowing for a near real-time update of the aggregate view.

The desired end goal of all these efforts is to get as close as possible to a single view of all available securities, regardless of where they are held, in real time. This aggregation of supply information is a necessary prerequisite for the efficient deployment of available securities to meet collateral obligations. Diagram 4 illustrates the custody-agnostic model, where the customer (ie collateral giver) has desks across asset types and across jurisdictions. The customer has accounts at local custodian banks in each jurisdiction. In addition, the customer has a CMSP, which serves as an information aggregator. The CMSP may or may not be a unit of a custodian bank and receives custody information related to the customer's accounts either directly from the relevant custodian bank or from the customer. In this example, Custodian C and the CMSP are two separate business units of one firm. As a result, the CMSP already has real-time access to assets held in custody at its firm. It separately receives information from Custodians A and B and aggregates this information across jurisdictions and asset classes. The customer is then provided with an aggregate view of available securities on a global basis, allowing for greater efficiencies at desk level and across the entire firm. For example, at the end of the business day Custodian A in Tokyo will send the information on the customer's available securities to the CMSP. The CMSP will aggregate these positions so that the desks in New York and London have information on securities in Tokyo that are available to meet collateral obligations. The same will occur at the London close, with the CMSP receiving information from Custodian B. By providing the customer with an aggregate view of available securities across asset classes and jurisdictions, this model works towards eliminating the obstacles created by managing collateral using fragmented information. The use and settlement of available securities, however, are limited to the operating hours of local custodians and/or local securities settlement systems.[15]

[15] In some instances, a local custodian may be part of a larger global custodian network that operates on a 24-hour basis and settles the movements of securities internally.

Diagram 4

Multiple jurisdictions, multiple custodians and custody-agnostic collateral management service provider



1a = Collateral Giver and some collateral takers send information to the CMSP regarding the Collateral Giver's available securities and collateral obligations
1b = Each local Custodian sends to the CMSP information regarding the Collateral Giver's available securities to fulfill collateral obligations
2 = The CMSP aggregates the information across jurisdictions and Desks, recommends optimal use of available securities, and sends to the Collateral Giver the recommended allocation of collateral that most efficiently fulfills all collateral obligations
3 = The Collateral Giver affirms recommendations or provides instructions for alternative deployment of collateral to the CMSP
4 = The CMSP sends instructions to each local Custodian based on instructions received in Step 3
5 = Each local Custodian moves collateral based on instructions received in Step 4

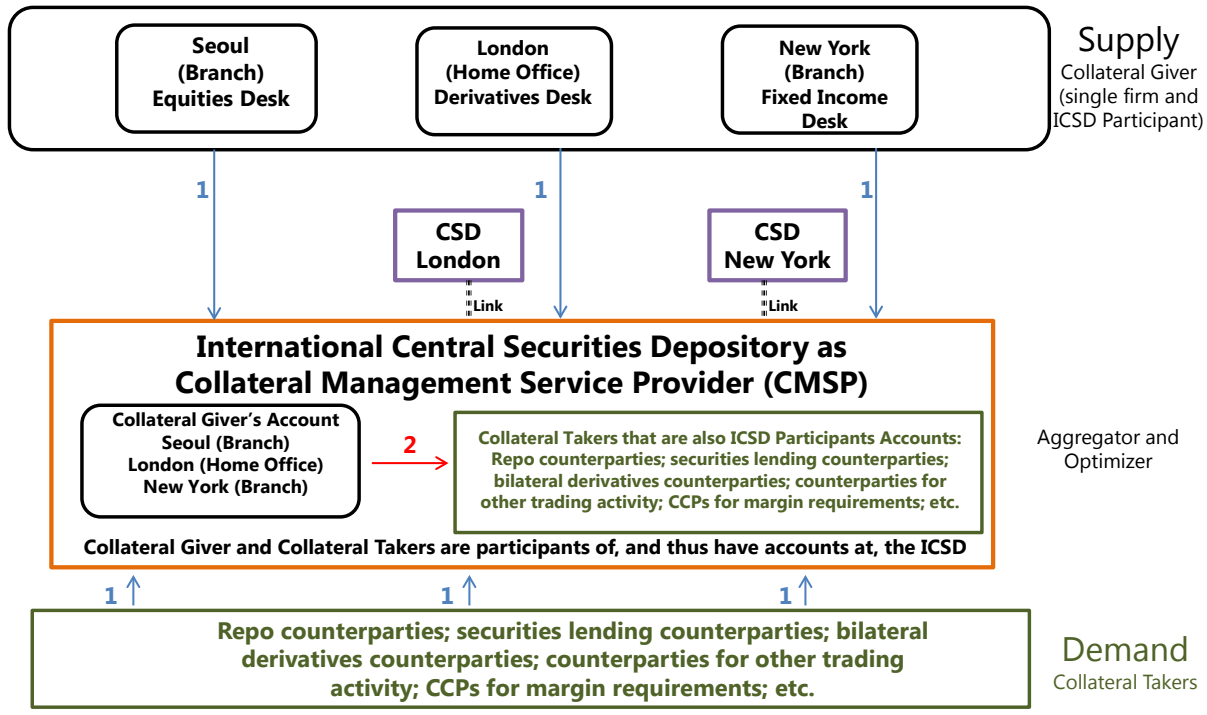
ICSDs enable their participants to obtain aggregate views on the entirety of the latter's securities holdings held with the ICSD, including securities held by ICSD participants via link arrangements. Diagram 5 illustrates the services available at ICSDs, whereby a customer (collateral giver) is a participant in the ICSD and holds its securities in the ICSD, including via link arrangements between the ICSD and local CSDs. The ICSD, as CMSP, having established direct or indirect (ie via a custodian participating in the local CSD) links with local CSDs, has information on and can access the entirety of a participant's securities for collateral management purposes.[16] The collateral takers are also participants in the ICSD. Both the collateral giver and the collateral takers provide information to the ICSD as CMSP regarding collateral obligations. With this information, the ICSD runs its optimisation process and may automatically generate collateral allocation instructions for the collateral giver/takers based on the results. Unlike the custody-agnostic model, the ICSD will also process the movement of securities on the books of the ICSD, since counterparties included in the optimisation and allocation process are participants in the ICSD. If the collateral giver does not have sufficient securities in the ICSD environment, it can source collateral by (i) transferring securities from its own account at the linked CSD

[16] The entirety of a participant's securities includes the participant's securities that were issued and are held at the ICSD and the participant's securities that were issued and are held, via ICSD link arrangements, at a linked CSD.

to its securities account in the ICSD with a free-of-payment (FoP) settlement occurring in the linked CSD, (ii) purchase securities from another participant in the ICSD with settlement occurring in the ICSD, or (iii) purchase securities from a participant in the linked CSD with settlement occurring in the linked CSD.

Diagram 5

Multiple jurisdictions, ICSD as collateral management service provider with links to other CSDs



Link = The ICSD has direct or indirect links with other CSDs. Securities held by ICSD participants via these link arrangements are included in the respective collateral pool of the ICSD participant and available to the ICSD as CMSP.
1 = The collateral giver and collateral takers send notification to the ICSD regarding their triparty transactions
2 = The ICSD will determine the optimal use of available securities and generate the underlying collateral allocation instructions; collateral transfer is settled on the books of the ICSD

Efforts to further increase access to available securities through aggregation

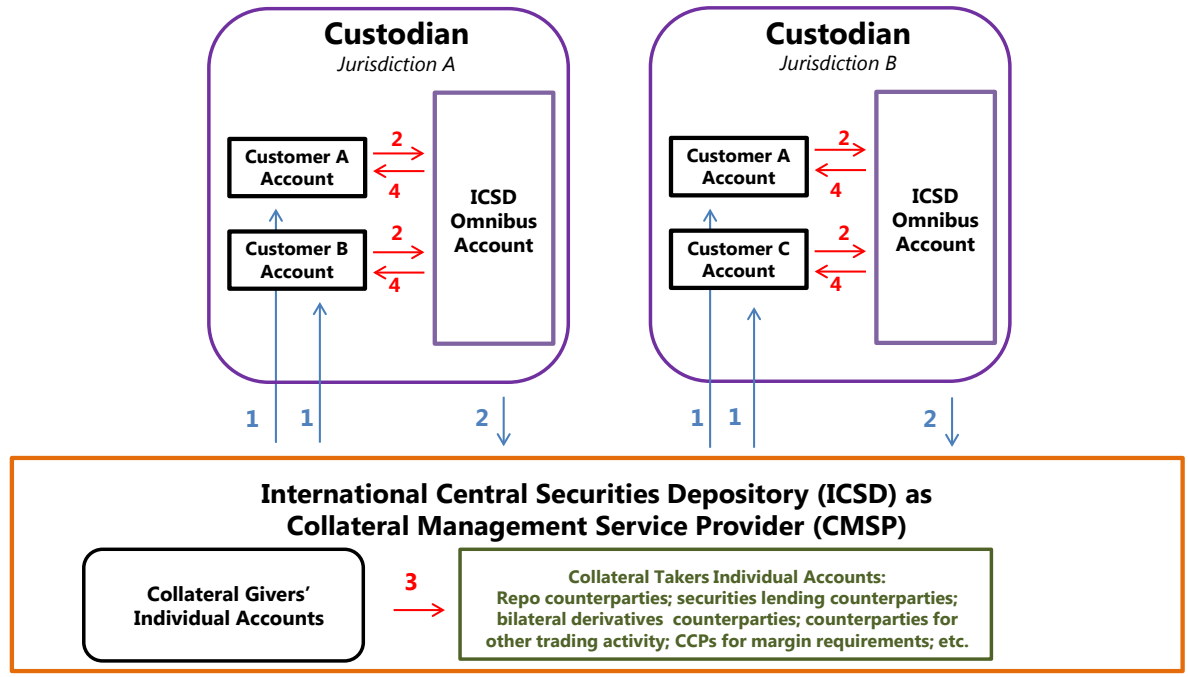
In addition to the services described above, ICSDs are seeking to further enhance the aggregation of collateral, to include assets held away from ICSDs, for a subset of their participants with certain partner agents and for a limited number of securities markets. Such aggregation of assets could, and to some extent can already, be achieved for mutual clients of the respective ICSD and a partner custodian. The starting point of this process is having the mutual customer define which securities held away from the respective ICSD are eligible to be swept, by power of attorney (PoA) granted to the ICSD, from the mutual customer's account at the partner custodians to an omnibus account that the ICSD has at each respective partner custodian. In addition to enhanced aggregation resulting from partnerships with regional custodians, there are also plans to establish links with partner CSDs in order to provide similar collateral aggregation and services to mutual customers of both the ICSD and the partner CSD.

Eligibility criteria identifying what assets may be moved include (but are not limited to) asset type, credit rating, country of issuance and currency denomination. This eligibility screening is necessary, as the customer may need or wish to keep some securities in its account at the partner custodian to fulfil

any regulatory (minimum amount of assets) or business requirements (seek to avoid moving securities that may result in near-term substitutions) at the partner custodians. Once the schedule that defines the eligibility criteria has been completed, any securities deemed eligible for movement per the customer's schedule are available for FoP transfer, for collateralisation purposes only, from the mutual customer's account at the ICSD's partner custodian to the ICSD's omnibus account at that partner custodian. As Diagram 6 illustrates, securities made eligible by the mutual customer of the respective custodian and the respective ICSD will be available to fulfil collateral obligations of the customer as part of the optimisation and allocation process at the ICSD. Although the technical setup of the transfer process varies by ICSD, both solutions involve sweeping eligible securities into the ICSD omnibus account on the books of the custodian to meet collateral obligations in the ICSD environment. Securities are swept back to the customer's account at the local custodian in the local market in accordance with the technical setup of the ICSD's services. The sweep process is supported by PoA documents between the mutual customer, the ICSD and the relevant custodian to allow for the rebalancing/sweeping of securities consistent with the filters set by the customer. The timing and frequency of information updates on securities made available by the mutual customer for collateralisation purposes at the ICSD may vary according to the degree of sophistication of the information exchange mechanism as agreed between the respective custodian and the ICSD. In addition, the timing and frequency of the sweeps depend on the settlement rules of the partner custodian and the local market. This service provision is limited to mutual customers of the partner custodian and the ICSD. As a consequence, while securities are moved to an omnibus account opened in the ICSD's name at the custodian, the ICSD simultaneously credits such securities to the mutual participant's securities account which the latter holds with the ICSD and the ICSD's collateral optimisation process is conducted at the individual customer level.

Diagram 6

(Virtual) aggregation of customer securities held across custodians



1 = The ICSD has a view into the mutual customer direct holdings and, in some cases, settlement activities at a partner custodian and includes this information in the ICSD's optimization process
2 = In order to fulfill collateral obligations in the ICSD, securities are transferred from the customer's account at the local custodian to the ICSD omnibus account at the local custodian; custodian informs the ICSD of such transfers
3 = Securities are used by the ICSD for the collateral allocation on the ICSD platform and remain in custody in the ICSD omnibus account at the local custodian
4 = Securities are transferred back from the ICSD omnibus account at the local custodian to the customer's account at the local custodian

Collateral optimisation

Once a CMSP has sufficient information on an individual customer's supply of available securities (including via the aggregation of information described above), the CMSP can determine how to best meet the range of collateral obligations faced by this customer through the optimisation process. Operationally, this is a process that can be run at various times during the day and results in recommendations on how best to deploy the available securities. Once a customer has agreed to some or all of the recommendations, the allocation process – the issuance of instructions for collateral movements – will take place. In some cases, this process is fully automated based on collateral eligibility criteria provided upfront by the customers of the CMSP. Instructions may be issued by the customer or by the CMSP if the customer and the service provider have an agreement or standing settlement instructions in place. Depending on where the collateral is held, these instructions may be to a custodian or (I)CSD. Linkages between (I)CSDs can be further optimised for collateral management purposes by making use of a common collateral management system or by making the collateral management systems operated by linked (I)CSDs compatible between each other. Factors critical to achieving the latter include common definitions of collateral baskets that are eligible in both (I)CSDs, the sharing of information on collateral holdings, and compatibility between (I)CSDs' collateral management systems' functionalities.

Historically, sell-side firms have made use of optimisation tools either via their tri-party repo agent or through their own proprietary systems to meet collateral obligations associated with settling repo and securities lending transactions, and margin calls. Conversely, the buy side has had less need for as sophisticated an approach to collateral management. This is probably due to the fact that many buy-side firms tend to own a significant amount of high-quality collateral outright and have historically had fewer collateral obligations. However, the advent of the mandatory central clearing of OTC derivatives and its associated collateral requirements, as well as bilateral margining requirements, are forcing the buy side to think more strategically about its approach to the management and deployment of its collateral.

Based on the interviews with firms, a variety of optimisation solutions are being developed and offered with varying levels of sophistication, based on customer need. First, with a few service providers, there is no customer demand for improvements to collateral management and thus these service providers have no current plans to offer optimisation services. The customers of these service providers tend to be local participants with ample available securities to fulfil their current and expected future collateral obligations. In that context, they do not see value in making investments in automation to make more efficient use of collateral. Second, there are service providers that have not historically used optimisation tools, but are now seeing customer demand for such services and have therefore initiated efforts to provide such functionality. Third, there are service providers that have offered optimisation services and are seeking to improve those services and/or enhance collateral aggregation arrangements for their customers. The second and third of these cases are discussed in more detail below.

Adoption of optimisation tools

CMSPs that have not historically provided optimisation services but are now seeing customer demand for such services are opting to buy the technology to improve their existing local collateral management service offering rather than investing in proprietary optimisation functionality, which is a significant infrastructure investment. Some service providers have begun to outsource their own technology through partnerships with CMSPs that do not currently have their own automated optimisation processes. The collateral management capabilities being provided through these partnerships include optimisation of collateral as well as the issuance of collateral allocation and substitution instructions to be proposed by the CMSP and executed in the respective local market. The optimisation process allows the collateral giver to prioritise the allocation of certain categories of eligible assets according to customer preferences, while respecting the eligibility requirements of the collateral receiver. For

example, a collateral giver may prefer to prioritise allocation via a "cheapest to deliver" rule.[17] Through the optimisation process, the best possible collateral allocation is proposed and the necessary securities movements to be settled in the local market are indicated. The movements of securities are typically automated at the local level, whereby the collateral optimisation service generates a set of proposed settlement instructions for movements and substitutions. There is an unlimited right of substitution in the optimisation process, and substitution can be either simultaneous, in the case of delivery versus delivery (DvD) or by submitting two delivery-versus-payment (DvP) instructions, or conditional while using FoP delivery, depending on the settlement capabilities of the partner.

These partnerships allow for quick implementation of collateral optimisation by local market service providers that have not historically had such capabilities.

Improvements to existing optimisation tools

Separate and distinct from efforts to launch optimisation services for the first time are the significant efforts being undertaken by some CMSPs that have historically had optimisation processes in place and also serve customers with cross-border activities. The firms driving these efforts are existing tri-party agents. They are adopting enhancements, as described above, which seek to aggregate available securities or information on available securities and then apply that more comprehensive supply to their outstanding obligations. Further, these firms are working to add counterparties on the demand side (collateral takers), including bilateral repo counterparties, bilateral securities lending counterparties, central counterparties and central banks. Through this improved aggregation of available securities (or information on available securities), as well as improvements to aggregation of demand for collateral, the tri-party agents are able to conduct more comprehensive and efficient optimisation for the benefit of the customer.

While better aggregation of the supply of available securities and demand for collateral improves the optimisation results, thereby increasing the efficiency of collateral management, this is not the only innovation taking place. Some CMSPs are increasing the sophistication of the algorithms used to generate recommendations on how best to deploy collateral holdings. Historically, these algorithms have been somewhat rudimentary in nature and have been limited to (i) cheapest to deliver and (ii) customer preference (where the firm prioritises its list of counterparties, with collateral then being deployed according to the counterparty hierarchy).

The innovation under way at one CMSP is aimed at moving beyond the above-mentioned models to a service that better calculates the true economic value of a piece of collateral, including the costs associated with certain available securities versus others. In order to achieve this goal, the firm is developing a multifactor optimisation tool that will allow a customer to take into consideration a number of additional criteria, such as:

- The transactional costs of deploying a piece of collateral.
- The tax implications of deploying a piece of collateral.
- The desire to maintain a minimum cash balance.
- Securities that are likely to be in high demand.
- Concentration issues.

In addition, this service provider is building functionality that will provide information on how a firm could change its existing pool of assets to better meet its obligations. For example, if a customer is short US dollars and holds Japanese yen as well as US corporate bonds, the optimisation process

[17] "Cheapest to deliver" refers to an algorithm which seeks to deploy collateral starting with the lowest-quality collateral and moving up the quality ladder until all obligations are fulfilled.

includes functionality that can determine whether it is economically preferable to conduct an FX trade to sell the yen for US dollars, or to lend out the US corporate bonds for US dollars. It is important to emphasise that this service provider only provides this information as recommendations to the customer, who would then need to separately take steps to execute the recommended transactions. Based on discussions with this service provider and other interviewed firms, a customer is not currently permitted to issue standing instructions to the CMSP that would result in the latter acting on the optimisation results to transform collateral (described in more detail in Section IV below).

Despite this high degree of innovation observed at one service provider, it appears that most CMSPs will continue to channel their resources towards optimisation recommendations that focus on the cheapest-to-deliver principle or customer preference, probably because many customers find these criteria sufficient to meet their needs with respect to efficient management of collateral.

Innovations to address segregation requirements

The innovations related to the aggregation of information, optimisation and allocation of available securities for collateral management purposes are targeted at traditional customers of service providers, such as large broker-dealers, and non-traditional/potential customers from the buy side such as pension funds. Further innovations are being developed that will specifically target the needs of the buy-side customer base, particularly as mandatory clearing requirements are implemented for those market participants. An example of this is a "quad-party" model which seeks to address collateral segregation requirements for market participants accessing CCPs through another clearing member. The four parties involved are the client (indirect clearing member), the (direct) clearing member, the CCP and the client's custodian. The model seeks to make it easier for a client to deliver collateral directly to a CCP to meet margin requirements. Innovations targeting the buy side, such as the quad-party model, add an additional layer of complexity for the custodian to the array of collateral management service offerings – in terms of the possible legal issues regarding segregation, and operational risks in managing frequent collateral movements for multiple clients.

IV. Collateral transformation

As supply and demand dynamics for collateral continue to evolve, it is possible that efforts to make more efficient use of existing collateral will not be sufficient to fully satisfy individual obligations. If that is the case, some market participants may need to exchange available, but ineligible, securities for other securities that meet eligibility criteria in order to fulfil their collateral obligations. Undertaking transactions to achieve this outcome has been defined as "collateral transformation".

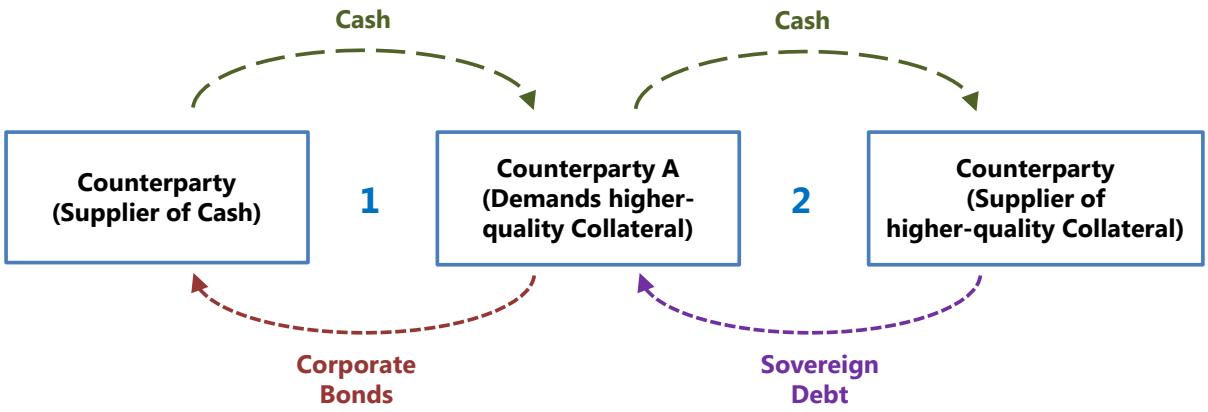
There are different ways to achieve collateral transformation. For instance, a market participant may lend out corporate bonds in exchange for high-quality sovereign debt. One way to achieve collateral transformation is through FoP movements, with the lower-quality collateral always moving first.

Another way a market participant could transform collateral is to lend out a security of lower quality (eg corporate bond) for cash and then use the cash received to procure higher-quality securities (eg sovereign debt), as shown in Diagram 7. These transactions are traditional securities lending and repo transactions, supported by standard agreements, and each is conducted on a DvP basis. The two transactions may be linked, meaning that the cash generated from the securities lending transaction is specifically earmarked for the repo transaction with either the same counterparty from the securities lending transaction or a different, predetermined counterparty. Unlinked collateral transformation also consists of securities lending and repo transactions; however, there is no earmarking of the cash generated from the securities lending transaction. Accordingly, the timing of these two DvP transactions

is dependent on when the market participant wishing to transform collateral executes each transaction in the market. Regardless of whether the two transactions are linked, it is important to note that securities lending activity and repo activity are typically conducted in different areas of a given firm, which may not be aware of the connection between the two transactions.

Diagram 7

Collateral transformation



1 = DvP transaction in which the counterparty in need of higher-quality collateral (Counterparty A) exchanges lower-quality collateral (corporate bonds) for cash with a willing counterparty
2 = Following transaction 1, Counterparty A exchanges the cash for the desired higher quality collateral with a willing counterparty in a subsequent DvP transaction. The supplier of higher-collateral may or may not be the same as the supplier of cash in transaction 1

These types of transactions and their associated risks are not new. In fact, market participants have been conducting these types of collateral transformation trades for years. The new element is that this activity is being marketed to procure collateral specifically to meet regulatory requirements, including posting of margin to CCPs. In some jurisdictions, market participants typically do lend out lower-quality securities for cash collateral and reinvest that cash in repos against higher-quality assets. However, these transactions are not necessarily conducted with the goal of obtaining higher-quality collateral to serve a specific purpose. Rather, firms invest in high-quality repos because that is commensurate with their risk appetite, as opposed to, for example, conducting these trades to obtain high-quality collateral to pledge to a CCP.

While there has been speculation of collateral shortfalls or dislocations, interest in collateral transformation by market participants to meet increased collateral demands remains muted. There are a variety of reasons why this activity has not developed, many of them temporary.

First, some changes that may raise demand for collateral have not been phased in yet, since jurisdictions operate on different timelines for mandatory central clearing and margin requirements for non-centrally cleared trades. Multiple market participants noted that implementation of mandatory clearing requirements has not yet advanced to the point where those market participants are experiencing shortfalls in collateral readily available to pledge, thereby resulting in a potential need to engage in collateral transformation. It should also be noted that the needs of market participants may vary based on current balance sheet holdings and investment activities. For example, in some countries, pension and sovereign wealth funds already hold ample amounts of high-quality collateral relative to

their derivatives activity and thus may rarely need collateral transformation services. However, in other countries, these same entity types may face collateral shortages.

Related to the current holdings of market participants, one of the reasons why many market participants have ample collateral is the relatively flat yield curve. A steepening of the yield curve might create stronger incentives for firms to hold a greater amount of less liquid collateral than they currently do and thus may increase the need for or economic viability of collateral transformation trades. Finally, as some CCPs consider expanding their list of eligible assets to fulfil margin obligations (eg by acquiring corporate bonds), that may also reduce demand for collateral transformation services.

Despite this current state, some CMSPs are making plans to meet potential future demand for collateral transformation services. First, CMSPs already have the capability to identify shortfalls in the collateral needed to fulfil obligations. At present, that information is provided to the customer, who will use it to determine what steps to take, which may include engaging in repo or securities lending transactions or outright purchases to obtain the needed collateral. As noted above, one service provider is developing an optimisation process that will include recommendations on how to alter one's existing available collateral if a shortfall exists. None of the interviewed firms suggested that they were contemplating that their collateral management business would be acting in a principal role for collateral transformation trades at this stage.[18] Rather, the CMSP would be in a position to identify any shortfalls and then issue recommendations to the customer, who would execute the necessary transactions to address the shortfall. For example, if a CMSP identified a shortfall of sovereign debt, it might recommend that the customer use its excess cash to engage in a repo to procure the sovereign debt and also refer the customer to the firm's repo desk. So, while the CMSP may not be counterparty to the trades, it is quite possible that another business line in the same firm becomes principal to the trade.

V. Settlement of securities transactions

Settlement of the securities transactions associated with collateral management services, whether they be to fulfil repo, securities lending or margin obligations, is not affected by any of the collateral management innovation under way. For most repo and securities lending transactions, when the transaction is between two counterparties that use the same custodian or (I)CSD, internal DvP transfers will take place on the books of the custodian or (I)CSD.[19] In some cases, the custodian or (I)CSD may provide intraday credit to the receiver of the security if it does not have available cash to pay for receipt of the security at the time of transfer. When the counterparties use different custodians (or hold the securities in their own account) at a CSD, transfer of the securities is achieved through a DvP transaction across the securities settlement system. Similarly, the CSD (or the custodian of the client) may provide intraday credit to the recipient of the securities.

For margin obligations, the securities will move FoP from the custodian or the account of the collateral giver to the account of the recipient. Also for substitutions, the new securities being substituted in to fulfil the obligation are moved FoP, before the existing securities are returned to the customer FoP. For some service providers, substitutions will be performed by two simultaneous DvP transactions.

[18] While the firms interviewed did not plan to act in a principal role to facilitate collateral transformation, it is important to note that those which provide securities lending services as part of their collateral management service may be acting as guarantor/principal to ensure return of the lent security (or equivalent) to the lender in the event of a borrower default.

[19] Some securities lending transactions that involve a direct exchange of securities for securities (as opposed to securities for cash) are conducted as two separate FoP transactions, with the borrower's securities utilised as collateral moving first.

For movements across securities settlement systems, settlement finality and the legal framework supporting finality are articulated by the FMI in its rules and made known to all participants. As such, how the movement of securities on an end-to-end basis to support collateral management services (e.g. initial allocations, re-use, substitution, recalls, etc.) settle will vary depending on the securities settlement system. For internal transactions that are not conducted across a securities settlement system, but rather on the books of the custodian, finality may be defined only in the contracts of the customers of the custodian and may not be explicit or consistent across custodians and customers.

Settlement may occur in central bank money or commercial bank money, depending on how the associated payments are effected by the relevant security settlement system or collateral management service provider. Where commercial bank money settlements are part of the CMSP's processes, the associated risks should be understood and managed accordingly.

VI. Potential market benefits

The innovations occurring in the provision of collateral management services have the potential to improve market efficiency and transparency within the global financial system. By providing market participants with better tools to identify and move securities, participants should be able to mobilise their available securities more easily and efficiently to fulfil collateral obligations on an ongoing basis. As a result, collateral shortfalls should be easier to address, resulting in fewer fails and the greater safety of the overall market.

Consolidation of securities information

By aggregating information on available securities across locations, a centralised view of a firm's global collateral positions is obtained. This approach, in and of itself, may be risk-reducing for any individual collateral giver or taker and may lower systemic risk if it is widely adopted by large financial institutions. The traditional siloed approach to managing collateral is not only inefficient, but may also impede a firm's ability to adequately manage collateral demands in times of stress. For example, a firm may experience a collateral shortfall in location A that could be met with the excess securities it holds in location B. Lacking a timely, aggregate view of, and access to, available securities across locations may result in the firm having to undertake additional transactions to procure the collateral, potentially adding stress to the market, or cause the firm to fail on its delivery obligation. The current innovations in collateral management services described in this report should enable firms to improve collateral management efficiency. These innovations may also mitigate the risk of settlement fails by identifying where the firm may hold excess securities to meet collateral obligations and by utilising the operational connections and partnerships developed to facilitate the movement of securities across locations for collateral management purposes. In the example described above, the firm could identify the excess securities available in location B and move them to meet its collateral obligation in location A, thereby avoiding entering the market in a stressed situation or failing on its delivery obligation. Furthermore, this development will allow market participants to preserve some degree of diversification in custody services, where desired.

Improved mobility of securities

Given consolidated information on available securities, their efficient allocation, and automated solutions for their substitution and allocation, firms will in some cases also be able to deploy available securities more quickly to meet various collateral demands. In normal market conditions, this is an economic

benefit to the firm. In times of market stress, rapid deployment of available securities may be crucial in mitigating systemic issues. For instance, with better visibility of available securities and better access to them, firms may be better positioned to rapidly deploy securities to meet margin needs at CCPs in times of increased market volatility or to pledge to central banks in emergency situations to gain increased access to the lender of last resort.

Increased market liquidity

A firm's ability to make more efficient use of its available securities across locations may boost liquidity in a number of markets. First, in the current environment, many firms may hold excess securities as a "collateral buffer" in local markets to ensure they can meet their changing collateral obligations on a timely basis. In the future, aggregation and optimisation tools will allow firms to identify and access available securities more easily and allocate them more efficiently across borders to fulfil their collateral obligations towards counterparties, FMIs and central banks. In such a context, there may be less of an incentive for firms to hold these buffers, thereby potentially increasing use of these assets for other purposes, which may in turn increase market liquidity. Moreover, greater use of collateral transformation and reuse of securities could similarly increase transactional activity, which may result in deeper liquidity.

Increased operational automation and standardisation

The automation and standardisation of many operations related to collateral management at individual institutions and on a market-wide basis may reduce the operational risks in manually conducting collateral management operations and enhance operational efficiency. Furthermore, this may enable a market participant to manage increasingly complex and rapid collateral demands.

VII. Potential risks

While market innovations in collateral management services may provide a number of benefits, they also entail potential associated settlement risks that are important for CMSPs and firms using such services to understand and consider. Although the innovations to collateral management services discussed in this report do not appear to be introducing new risks, these innovations are increasing dependencies across a number of systemically important financial institutions and market infrastructures across locations. In addition to the new linkages being created, a greater desire for more efficient collateral management on the part of buy-side market participants may bring new users to these services. The interconnections required to aggregate and efficiently allocate available securities are likely to exacerbate a number of risks. As collateral management services evolve and are increasingly adopted by a large number of market participants, the implications of operational disruptions to these services, and reliance on collateral optimisation and transformation tools, must be well understood and appropriately managed to avoid potential systemic consequences, particularly in times of stress.

Increased inherent operational risks and potential implications

Market innovations in collateral management services are resulting in additional operational complexity and increasing operational risk due to the number of operational connections and/or partnerships required to facilitate information exchange and aggregation of available securities. While this aggregation may create opportunities to deploy securities more broadly than in the past, effective deployment may require multiple movements of securities across locations to ultimately fulfil collateral obligations. Therefore, service providers will need to have adequate operational capacity to support

increases in the number of movements of securities taking place to fulfil collateral obligations in normal and stressed market conditions.

It will also be important for service providers that support the aggregation of available securities to ensure that they are reliable and resilient, particularly if customers rely heavily on aspects of -these collateral management services to help meet collateral obligations. The interconnectedness between FMIs and custodian banks required to support the services described introduces complexity to business continuity planning. Robust operational connections and coordination on business continuity planning between service providers and their partners in support of collateral management services will be important to ensure that the procedures adopted by one linked party do not present conflicts for another linked party where dependencies have been established. Key considerations for such coordination include an understanding of recovery timing following an operational disruption on the part of each service provider, procedures for communicating with customers in the event of an operational disruption (including timing) and time zone factors. The implications of an operational disruption that deprives a customer of part of or its entire aggregated collateral view may give rise to a range of challenges, from an inefficient deployment of collateral to an inability to fulfil collateral obligations, that may have a broader systemic impact.

As firms become more confident in and reliant on automated improvements to support easier movement of securities across borders, they may reduce the buffers of excess collateral they currently hold in local markets to meet potential collateral obligations in those markets. Consequently, during an outage of some or all of the operational connections that support the aggregation of information on available securities, the likelihood increases of a customer failing to have adequate collateral to fulfil its obligations in one or multiple markets. This outcome is magnified when multiple firms rely on the same services and connections and collectively lose their ability to efficiently manage their collateral – for example, if a number of customers were reliant on collateral outside the local market to fulfil their obligations in the local market and there was an operational outage at the CMSP, preventing the aggregation of collateral information and cross-border collateral movements for these customers. As a result of the outage, all of the customers would be actively trying to source collateral in the local market to meet the local collateral demands, which may generate significant volatility in the local market. Furthermore, if demand exceeds supply, not all firms may be able to meet their collateral obligations. In that event, market participants should consider the downstream implications of fails in various markets, including if the fail was related to securities that a customer procured for onward delivery to a CCP in fulfilment of margin obligations. The inability of the customer to meet its margin obligation may result in the CCP enacting its default procedures against the participant, which in turn could cause lenders and counterparties to pull away.

In addition to disruptions to the operational processes that support collateral management efficiencies, it should be noted that the timeliness of information provided on an ongoing basis to support the aggregation of available securities held across locations and custodians ranges from near real-time to periodic updates. Some service providers noted that they may receive information on collateral held away from them only once a day. The frequency with which the information is updated can influence the risk of fails, as stale information may give rise to an instruction to deploy a security that is actually no longer available because it has been used for another purpose. This risk may arise in both a local and a cross-border context. Locally, a customer may use multiple custodians, and if the CMSP is not receiving timely information on available securities, activity taking place in real time locally may result in stale data on available securities. In the cross-border context, markets with different operating hours and differing availability of custodial support may hamper the receipt of accurate information on available securities. In both cases, this may result in more fails, as firms then have less time to find (or source) an alternative security to fulfil the obligation.

Risks associated with collateral optimisation

The increased use of optimisation tools that focus on a cheapest-to-deliver model could result in a higher proportion of lower-quality collateral being provided to those willing to take it than was perhaps the case when the pledging of collateral was a less automated process. For example, if an FMI or bilateral counterparty accepts corporate bonds for margining purposes, an automated cheapest-to-deliver model will always seek to provide the maximum amount of corporate bonds as collateral to that entity before considering the pledging of higher-quality collateral. FMIs and bilateral counterparties accepting collateral should understand that they are likely to receive more of the lower-quality collateral on their collateral eligibility schedules and that they need to be able to appropriately manage the collateral they receive. FMIs can apply several principles in the PFMI, including appropriate margining and concentration limits. Consistent application of the PFMI by market infrastructures can help mitigate potential concentration risks resulting from a more efficient allocation of collateral by market participants.

In addition, a key component to maintaining optimal use of collateral is substitutions. As regulations enacted to address liquidity risk in funding markets result in market participants extending the tenor of financing transactions, such as repos, more collateral substitutions may be necessary through the life of a trade than was previously the case. For example, prior to 2008, much of the repo market was overnight or one-week, which meant that the securities used to collateralise a trade were typically the same throughout the life of the trade. As market participants in some locations extend repo transactions to 30, 60, 90 days or longer, the securities used to collateralise that trade may change multiple times through the life of the trade as the pledgor of collateral sells and buys securities over time and the optimisation process seeks to improve collateral management efficiency. Likewise, as collateral is being optimised for a given firm, the collateral pledged by that firm to an FMI to fulfil margin obligations may similarly be changing. As a result, while counterparties receiving collateral will always receive collateral in conformance with any predefined criteria, the underlying collateral will change more frequently, which may present new risk management challenges to the takers of the collateral, who may be used to historically receiving a more static pool of collateral to manage counterparty risk exposures. FMIs can apply Principle 5 of the PFMI to mitigate the risks associated with the use of a more dynamic collateral management process by market participants.

Risks associated with collateral transformation

While it appears thus far that CMSPs have no intention of automatically undertaking collateral transformation activities on behalf of a customer, such action may be a natural progression over time. Current services seek to make best use of available securities, identify any shortages and, in some cases, present recommendations on how best to address shortages. However, practices may evolve to the point where the CMSP begins acting on recommendations to address securities shortages, in an agent role, on behalf of the customer. Transformation transactions triggered by optimisation and automatically effected by the CMSP may obscure risks to both the collateral giver and collateral receiver.

It is possible that the CMSPs will eventually offer automated transformation services as part of their overall service offering, whereby a customer may not be fully aware of its reliance on collateral transformation as a source of needed collateral. Without full knowledge of its dependency on collateral management services, the customer would not be well positioned to effectively manage the associated risks. One risk related to an unknown dependency arises if the CMSP terminates the transformation services and the customer must suddenly source collateral elsewhere.

Similarly, it is also possible that an opaque market for collateral transformation will develop between clearing members and their clients if clearing members embed these transactions in their provision of clearing services. Such a practice may obscure risks to clearing clients, as the client may not

know how it met its obligations to the CCP (through use of existing collateral or through some combination of existing holdings and transformation of its holdings).

A key risk is the likely maturity mismatch between the trade that has generated the collateral requirement and the transformation trade undertaken to procure the needed securities to fulfil the collateral obligation. For example, a derivatives trade may be a multi-year trade requiring collateral to be pledged as margin throughout the life of the trade. However, the transformation trade (perhaps a repo) to obtain the collateral to be pledged to the CCP or bilateral counterparty in support of the trade may, for example, be an overnight trade or an open trade. Even for transformation trades that are months in tenor, the party receiving the higher-quality securities for onward pledging in fulfilment of a collateral obligation is likely to face significant mismatch risk. Market participants engaging in such activity should understand this mismatch risk and the potential implications. For instance, if the transformation trade is terminated and the participant is unable to source high-quality collateral to return to the counterparty, it may be forced to terminate activity at the CCP in order to receive back the pledged high-quality collateral or default on its delivery to the collateral transformation counterparty. Both options present considerable risk to the individual market participants involved as well as possibly the broader market.

The risk becomes greater as more firms develop a reliance on collateral transformation. During the 2008 financial crisis, a number of securities lenders pulled back high-quality collateral in response to market uncertainty and concerns over the creditworthiness of large broker-dealers. If such action recurred in a future stress event, cutting off the supply of high-quality collateral on which market participants have grown reliant through collateral transformation, it would reduce the capacity of those participants to source high-quality collateral to meet obligations via such transactions. With limited access to high-quality collateral, market participants may seek other ways to address their collateral obligations. One such option might be to attempt to sell the lower-quality collateral that they are unable to transform to generate cash to help meet their obligations. Such an action in a stressed market may lead to fire-sale conditions. A second option might be to start unwinding activity, such as derivatives trades, to reduce collateral obligations. This may further increase market volatility in a time of stress.

Another key risk associated with a dependency on collateral transformation stems from the potential complexity of timing associated with identifying the collateral obligation and completing the transaction that provides the securities needed to fulfil the collateral obligation. For example, a market participant may have little time between receipt of notification for some collateral obligations and the deadline to meet those obligations. This could be particularly acute in times of market stress and increased volatility, when for example a market participant experiences unexpected margin calls. In such cases, it is unlikely, given settlement conventions for repo and securities lending transactions, that a collateral transformation transaction could be completed to provide the necessary securities to fulfil the collateral obligation on a same day basis.[20]

As collateral transformation services evolve, it will be important for service providers and customers to effectively monitor, measure and manage the associated risks. Work currently under way at the FSB on shadow banking is seeking to improve the ability to monitor repo and securities lending activity, which may help in understanding collateral transformation trends.

[20] Settlement conventions for repo transactions vary by jurisdiction, but typically settle on a t+1 or t+0 basis in Europe and t+0 in the United States. However, in the US, where repo transactions settle same day, a market participant needing to meet a margin call early in the day cannot rely on the repo leg of a collateral transformation, as settlement and delivery of the security occur after 3.30 pm.

Increases in cross-border activity

It is likely that significant efficiency will be achieved through more cross-border deployment of securities to fulfil collateral obligations, including reuse of securities across borders. Such activity may magnify risk if there is no clarity or agreement on applicable laws, finality of settlement, dispute resolution and other relevant legal aspects that may vary by jurisdiction. As such, it will be critical for CMSPs that facilitate the movement of securities across borders to conduct the necessary analysis to understand and mitigate the risks associated with their services that facilitate the movement of securities across borders. It will similarly be critical for the users of those services to have an understanding of the attendant rights and risks when their collateral is being used across borders.

VIII. Conclusions

The information obtained from interviews and associated findings outlined in this report is the result of a point-in-time stocktaking exercise; however, many of the services described herein are still evolving. Additionally, the supply and demand dynamics of collateral are likely to shift as mandatory clearing requirements are phased in and as economic conditions change. CMSPs are taking into account changing conditions and are likely to continue to respond with new innovations and/or modifications to existing services. In that context, the providers and users of such services should actively identify, measure and manage the risks associated with collateral management services. It is important that the public and the private sector be aware of potential risk areas depending on how collateral supply and demand factors change and how supporting collateral management services evolve.

The innovation under way is relying on existing infrastructure and market transactions to improve collateral management services. Consequently, new types of risk are not being introduced. Nevertheless, this innovation is increasing dependencies across a number of systemically important financial institutions and market infrastructures across locations. In addition to the new linkages being created, a greater desire for more efficient collateral management on the part of buy-side market participants is bringing new users to these services.

As collateral demands continue to rise and collateral management services are in turn increasingly adopted, market participants may become more and more reliant on those services to fulfil their obligations. Against that background, collateral management services may reach a level of criticality that makes them a systemically important activity. In the interim, as CMSPs are developing a view into a customer's available securities and collateral obligations, they may serve as an effective means to monitor the continuing evolution of supply and demand as well as customer reliance on the various aspects of their service provision.

The focus on improvements to optimisation for the purposes of efficient collateral allocation may move market participants closer to "just-in-time" collateral management. Both market participants and service providers will need to be prepared for less predictable collateral demands. In times of market stress and increased volatility, a broad number of customers may experience unexpected demands for collateral that may need to be fulfilled quickly. It may be important for market participants to test their ability to procure collateral and CMSPs to test their capacity to process a large number of unexpected collateral movements in stressed scenarios.

As these services begin to play a greater role in supporting a customer's ability to fulfil its collateral obligations, particularly through use of cross-border transactions, it may be important for service providers to work collaboratively to ensure the ongoing reliability of the services given the complexity of networks being created to support such services.

The CPMI and other public sector bodies have a strong interest in monitoring and understanding the continued evolution of collateral management services and how to appropriately manage the associated risks. The CPMI will continue to monitor further developments in collateral management services and coordinate with other public sector bodies, as appropriate, in considering any follow-up work.

Annex 1: List of interviewed firms

ASX Group (Australia)

Bank of New York Mellon (United States and Belgium)

Bank of Tokyo-Mitsubishi UFJ (Japan)

Barclays (United Kingdom)

BNP Paribas (France)

CDS Clearing and Depository Services (Canada)

Citigroup (United States)

Clearstream (Germany and Luxembourg)

The Depository Trust & Clearing Corporation (United States)

Deutsche Bank (Germany)

Eurex (Germany)

Euroclear (Belgium)

Iberclear (Spain)

JPMorgan Chase (United States)

Korea Securities Depository (Korea)

LCH Clearnet (France and United Kingdom)

Mizuho (Japan)

Monte Titoli (Italy)

Northern Trust (United States)

SIX SIS Ltd (Switzerland)

Société Générale (France)

State Street (United States)

Annex 2: Questionnaire

The questions are organized by the different types of collateral management services as defined above. However, the working group would also be interested to understand any other services related to collateral management services that may not fall under one of these categories. If you offer collateral management services with different characteristics, please be prepared to discuss those services as well.

Part 1. General description of collateral management services

- Please list and describe existing or new collateral management services that are or will be offered to meet expected increased collateral demands?
  - Which services are being developed on existing operational connections?
  - Which services require establishment of new operational connections?
  - Which services are for domestic purposes and which services are for cross-border purposes?
- Who are your target customers for these services?
  - How were the targeted clients identified? Are they existing clients? Does the firm expect to onboard new clients? To what extent are new clients different from existing clients (for both new clients to the firm and existing clients of the firm but new to the service)?
- What are your estimates of the size of the existing market as well as the potential market for collateral management services?
- Who do you view as the other key collateral management service providers? For example, what firms do you view as providing similar services and what firms do you view as providing complementary services relative to your firm's collateral management services?

Part 2. Collateral optimization informational services (if applicable)

- Describe the scope of services that are intended for informational purposes (ie services that do not provide transactional functionality). What is the intended purpose of such services (eg to provide clients with an aggregate view of collateral holdings, including cross-border, cross-currency and cross CSD/custodian, etc.)?
- What existing operational connections permit you to aggregate a client's collateral positions for informational purposes? How are such connections structured? What, if any, changes are planned to existing connections? If your services will require new operational connections, how will they be structured?
  - What, if any, connections provide a client with real-time visibility into its overall or global collateral position? If the information is not real-time, what is the process and timeline for refreshing a client's position?
  - What impediments exist that hinder your firm's ability to aggregate a client's cross-border, cross-currency and cross-CSD/custodian collateral position?
- What legal underpinnings and documentation support the operational connections? Are such underpinnings purely contractual or also statutory or regulatory?

Part 3. Collateral optimization transactional services (if applicable)

- What types of underlying transactions are conducted to effect collateral optimization with transactional components (eg collateral transfer from one account to another, securities lending, repo, other)?
- Please prepare diagrams depicting the end to end movement of collateral associated with any collateral optimization transactional services you provide. Please include, as relevant, existing and planned operational connections that facilitate the movement of collateral. Please note and prepare to discuss:
  - Where you serve as agent and/or principal in each part of the transaction and the relevant legal entity executing or booking each part of the transaction.
  - Which transactions utilize intraday credit and who provides such credit, if applicable.
  - What is the process to address outstanding intraday credit extensions at the end of the day? For example, is there a process to reverse intraday credit or convert it to overnight credit?
  - Which transactions may be conducted cross-border and may involve the exchange of cash or securities of different currencies.
  - Any existing or planned operational connections.
  - Please describe any substitution capabilities available for clients to facilitate optimization.
  - What, if any, key vendors do you rely on for messaging, operational algorithms or other critical components of the process?
- Describe the extent to which your organization understands the underlying motivation of the transaction. (eg whether collateral is moved for the purpose of meeting margin requirements at a CCP).
- Do you contractually link any of your transactional services to your provision of clearing services?
- Are re-hypothecated or reused securities a source of collateral for your optimization services? If yes,
  - Are there limits?
  - Do you track ownership of the collateral?
  - What measures facilitate timely access to the collateral?
  - What measures are applied in case of a default within the reuse chain (eg assistance in connecting surviving members of the chain)?
- Can collateral received after completion of optimization be re-hypothecated or reused? If yes,
  - Are there limits?
  - Do you track ownership of the collateral?
  - What measures facilitate timely access to the collateral?
  - What measures are applied in case of a default within the reuse chain (eg assistance in connecting surviving members of the chain)?

- What legal underpinnings and documentation support the individual transactions and the operational connections? Are such underpinnings purely contractual or also statutory or regulatory?
- How and when does legal ownership of collateral transfer as it moves through linked FMIs and other operational connections?

Part 4. Collateral transformation services (if applicable)

- What types of transactions do you conduct to effect collateral transformation (eg securities lending, repo, total return swaps, other)?
  - What types of assets are involved in collateral transformation? Are the higher quality assets in transformations typically sourced from your own asset holdings or external sources (eg via the repo market)?
  - Please share any data available to quantify these transactions, including size of activity, assets utilized, tenor, and cross-border activity, where applicable.
- Please prepare diagrams depicting the end to end movement of collateral associated any type of collateral transformation services you provide (eg a depiction of a direct exchange of securities for securities versus a depiction of two independent trades such as a securities lending trade and a repo trade. Please note and be prepared to discuss:
  - Where you serve as agent and/or principal in each part of the transaction and the relevant legal entity executing or booking each part of the transaction.
  - The typical counterparties in a collateral transformation.
  - Which transactions utilize intraday credit and who provides it, where applicable.
  - What is the process to address outstanding intraday credit extensions at the end of the day? For example, is there a process to reverse intraday credit or convert it to overnight credit?
  - Which transactions may be conducted cross-border and may involve the exchange of cash or securities of different currencies.
  - Please describe any substitution capabilities available to facilitate transformations.
  - When each of the transactions takes place:
    - If the transformation consists of a simultaneous exchange of securities, describe how/when finality is achieved.
    - If the transformation consists of multiple, independent trades, when is each trade settled and final? (eg if a securities lending transaction and a repo transaction together result in the collateral transformation.) Are the transactions "linked" in any way, for example, in the unwind process?
- Are re-hypothecated or reused securities a source of collateral for your transformation services? If yes,
  - Are there limits?
  - Do you track ownership of the collateral?
  - What measures facilitate timely access to the collateral?

  - What measures are applied in case of a default within the reuse chain (eg assistance in connecting surviving members of the chain)?

- Can collateral received after completion of transformation be re-hypothecated or reused? If yes,
  - Are there limits?
  - Do you track ownership of the collateral?
  - What measures facilitate timely access to the collateral?
  - What measures are applied in case of a default within the reuse chain (eg assistance in connecting surviving members of the chain)?
- Please prepare diagrams depicting the unwind process for the transactions depicted and include the elements noted above, where applicable. Please identify any differences for the unwind process in collateral transformations involving re-hypothecated or reused collateral.
- Please describe any substitution capabilities available for clients to facilitate changing the collateral during the life of a transformation.
- Please describe any functionality that supports the rolling of transformations.
- Describe the extent to which your organization understands the underlying motivation of the collateral transformation (eg whether collateral is transformed for the purpose of meeting margin requirements at a CCP).

Part 5. Risk management

- How do you identify, measure and control settlement related risks associated with increased collateral management services?
  - What are the settlement-related risks (including credit, liquidity and cross-currency) associated with these services? How are these risks controlled? For example, are collateral transformations settled on a delivery-versus-delivery basis (including where there are multiple trades settling simultaneously)?
  - What analysis has been done to identify the risks from provision of these services in normal and stressed market conditions? How do you define a stressed market condition?
  - What new risks have been identified with your provision of these services?
  - What risks have been identified from the re-hypothecation or reuse of collateral (cash or securities)?
  - How is the risk management framework being adapted to capture these risks?
  - What policies and procedures exist or are being developed to manage these risks?
- What arrangements are in place to ensure continued service provision in the event of an operational disruption? Are there arrangements in place to facilitate the manual transfer of collateral if automated systems are unavailable?
- Do you offer segregation facilities to your clients? If so, what are the features of the facilities and what constraints and advantages do you see in this service in terms of collateral safety and availability?
- What role would you play in the event of a user default?

- How is a collateral receivers' access to collateral protected in the event of a collateral giver's default?
- By what means can a collateral giver recover collateral provided to a collateral receiver in default?

Part 6. Potential impediments/opportunities for improvement

- How are services impacted by increasing divergences, including different pooling, in collateral eligibility criteria?
- Describe any specific impediments to making further improvements to collateral management efficiency.

Annex 3: Glossary of terms

Collateral allocation: the issuance of instructions to effect collateral movements.

Collateral informational services: mechanisms that facilitate (i) the identification of collateral sources (supply) for a given market participant, where the collateral may be held in various locations and entities, and/or (ii) the identification of collateral demands for a given market participant. Informational services may be real-time or periodically refreshed, and may also cover information across multiple legal entities, collateral types, jurisdictions, currencies and markets.

Collateral management services: includes, but is not limited to, informational, optimisation and transformation services.

Collateral management service providers: custodian banks and (I)CSDs that provide collateral management services to other market participants; services include, but are not limited to, informational, optimisation and transformation services.

Collateral optimisation: services that match collateral supply and collateral demand for a given market participant and seek to enhance the efficiency of collateral use for the market participant based on algorithms and other tools employed by the service provider.

- Optimisation services may be solely *informational*, whereby the service provider is making recommendations on how collateral should be deployed and the market participant determines whether to effect the recommended transaction to move collateral.
- Optimisation services may also include a *transaction* component, whereby the service provider is authorised to transfer, reposition or post collateral on behalf of the market participant.

Collateral transformation: services that facilitate the ability of a financial institution to exchange, on a short-term basis, lower-quality assets for better-quality collateral (or cash), in essence upgrading the quality of the customer's collateral.

Cross-border: cross-border transactions are the movement of securities from one jurisdiction to another.

Operational connections: connections between unrelated legal entities aimed at providing the operational capability to facilitate collateral management services for informational and/or transaction purposes, at both a domestic and cross-border level.

Annex 4: Working group members

This report was produced for the CPMI by the Working Group on Developments in Collateral Management Services.

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