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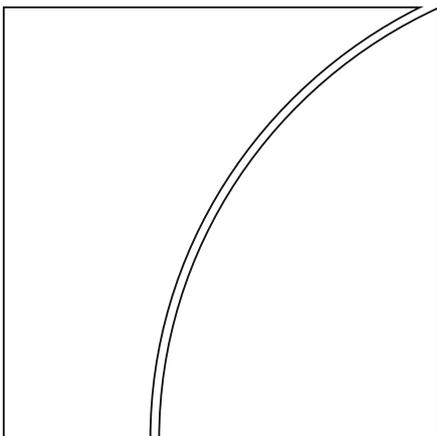
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Central bank operating frameworks and collateral markets

Report submitted by a Study Group established by the
Committee on the Global Financial System and the
Markets Committee

The Group was chaired by Timothy Lane (Bank of Canada)

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Preface

Collateral facilitates the intermediation of funds from savers to borrowers and, hence, helps the financial system allocate capital in support of real economic activity. The use of collateral has risen considerably in the aftermath of the financial crisis, and may well increase further as risk management practices continue to evolve and as financial institutions respond to regulatory changes. In this environment, the design and implementation of central bank operating frameworks is becoming more important for markets in assets that also serve as collateral. This is especially so, given the substantial footprint that key central banks have left in such collateral markets, following their large-scale asset purchases and use of other unconventional policy tools in recent years.

Against this background, in November 2013, the Committee on the Global Financial System (CGFS) and Markets Committee (MC) jointly established a Study Group on central bank operating frameworks and collateral markets (chaired by Timothy Lane, Bank of Canada) to explore whether and how the design of central banks' operational frameworks influences private collateral markets, including collateral availability, pricing, market practices, and resilience.

This report presents the Group's findings. It highlights the complex interrelationship between operational frameworks of central banks and markets for collateral. Central banks influence markets for collateral through either the supply of assets available for use as collateral (a scarcity channel), the pledgeability of assets in private transactions (a structural channel), or both. In addition to the fundamental choice of the monetary policy implementation framework, central banks' policy parameters include numerous dimensions, such as asset eligibility, haircuts and counterparty access policy. Hence, while being constrained by their mandates and legal frameworks, they have a variety of design choices to influence collateral markets as well as to fine-tune the effects of their operations for these markets.

We expect that the report, and the metrics and tools described therein, will facilitate coherent and meaningful discussions among central banks of their operational frameworks and of any impact that changes to these frameworks may have on collateral markets.

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Executive summary

Collateral markets have become increasingly important as demand for collateral assets has increased in recent years, driven by changing market practices and an evolving regulatory landscape. In this environment, the design and implementation of central bank operating frameworks has gained importance for collateral markets, as central banks' operational choices can affect these markets in a variety of ways, both intentionally and unintentionally, and *vice versa*. The potential effects of central bank operations on collateral markets are more important than ever, given the substantial footprint many central banks have left in markets for assets that also serve as collateral, following their large scale asset purchases and use of other unconventional policy tools over recent years.

Central bank operations are, in essence, asset swaps which alter the mix of assets available for use by private market participants. For example, a central bank that is providing liquidity to the financial system will typically either take collateral or purchase assets outright – so that, in either case, the central bank liquidity provided may be partly offset by a reduction in the stock of assets available for use as collateral in private transactions, such as repurchase agreements. Whether such effects on collateral markets are likely to be material depends on the size of these operations in relation to the markets for collateral assets and on whether financial market participants are constrained by the collateral available, as well as on a number of features of the financial system. Thus, these effects have the potential to become more important, due to any greater scarcity of collateral assets stemming from the global financial crisis and resulting regulatory changes.

Central banks have a number of design choices at their disposal that can influence markets for collateral – either through the supply of assets available for use as collateral, the pledgeability of various assets as collateral for private transactions, or both. In addition to the choice of monetary policy instrument and the operational parameters (scale, term, etc) of their transactions, these design choices include eligibility policy, haircuts and other terms and conditions, as well as counterparty access policy. In many cases, these choices are assigned to other objectives, notably central bank risk management; but they may be – and in some cases have been – used deliberately to support the functioning of collateral markets. Examples include the loosening of eligibility criteria by the Eurosystem during the recent euro area sovereign debt crisis, as well as the various support programmes implemented by the US Federal Reserve to support collateral markets at the height of the financial crisis.

To examine this set of issues, the report first provides a broad conceptual framework for the analysis of such changes that distinguishes two main channels of impact: scarcity effects and structural effects. Drawing on a range of sources, including case studies as well as surveys and interviews with private market participants, it then examines the effects of different central bank choices on collateral markets. The report also suggests a number of metrics and other practical tools that might be useful as central banks assess how markets for collateral assets are influenced by their operational choices.

To help clarify the impact of central bank operations on collateral markets in conceptual terms, the report also distinguishes two different policy regimes: normal times versus times of stress. In normal times, when central banks tend to operate at the margin and on a limited scale, they typically set the features of their operating

framework to be market-neutral. Beyond the intended effect on interest rates or asset prices, the impact of operations on collateral markets as such will thus tend to be small. Even so, central banks may of course decide to take targeted action to influence collateral markets even under such normal market conditions. Crisis times, on the other hand, are associated with greater scarcity of collateral in the financial system, as declining market confidence prompts a shift from unsecured to secured financing. Under such conditions, central banks may operate on a much larger scale, in some instances also inducing unintended side effects on collateral markets that have to be managed. Moreover, they are more likely to attempt to directly influence the functioning of collateral markets, for example by introducing facilities that allow banks to post illiquid collateral assets in place of liquid securities that, in turn, can be used to obtain funding in the private market.

In this light, the effects of central bank operations on collateral markets should be monitored carefully, particularly in connection with unconventional monetary policies and the eventual exit from those policies. Once central banks start to normalise their monetary policies, they will need to consider the implications for collateral markets of different tools available for use in that process.

The report also assesses the menu of available policy instruments that can influence collateral markets. Among other things, it suggests that, to prepare for any crisis response, some aspects of operational frameworks may need to be examined. This includes the adequacy of available inventories of collateral assets and of central banks' risk management capabilities in stressed financial conditions.

1. Introduction

Collateral plays a key role in supporting the allocation of funds necessary to support real economic activity. The importance of these markets has risen considerably in recent years, as demand for collateral assets has increased. The use of collateral in financial transactions, and particularly in bank funding operations, has grown in many jurisdictions in the aftermath of the financial crisis, and may well increase further as risk management practices continue to evolve and as financial institutions respond to regulatory changes.¹ In this environment, the design and implementation of central bank operating frameworks has gained importance for collateral markets. This is especially so, given the substantial footprint many central banks have left in markets for assets that also serve as collateral, following their large-scale asset purchases and use of other unconventional policy tools over recent years (see Graph 1).

As monetary policies normalise and central banks start to shrink their footprint in financial markets, collateral markets are sure to be affected. More generally, in both normal and crisis times, central bank operational frameworks and collateral policies influence asset markets, private sector collateral practices and private sector risk management. It is therefore important to understand these interrelationships in order to, *inter alia*, inform future policy development.

To facilitate a better understanding of the impact of central bank operations on collateral markets, the Committee on the Global Financial System (CGFS) and the Markets Committee (MC) jointly decided in November 2013 to establish a Study Group, chaired by Timothy Lane (Bank of Canada). The Group was asked to explore whether and how the design of central banks' operational frameworks influences private collateral markets, including collateral availability, pricing, related market practices, and market performance under stress.²

This report documents the Group's findings, which are based on information from a range of sources, including central bank case studies as well as surveys and interviews with private sector participants in collateral markets. The report aims to facilitate coherent and meaningful discussions among central banks of their operational frameworks and of any impact that changes to these frameworks may have on collateral markets.

It is organised as follows. Chapter 2 develops a broad framework for the assessment of how central bank policy choices may affect collateral markets. Specific features of central bank operating frameworks, and how changes to these features may impact collateral markets, are examined in Chapter 3, which also proposes a number of metrics and similar tools that can help central banks assess the impact that different policy choices may have on collateral markets. The final section discusses possible policy implications in the form of some high-level messages.

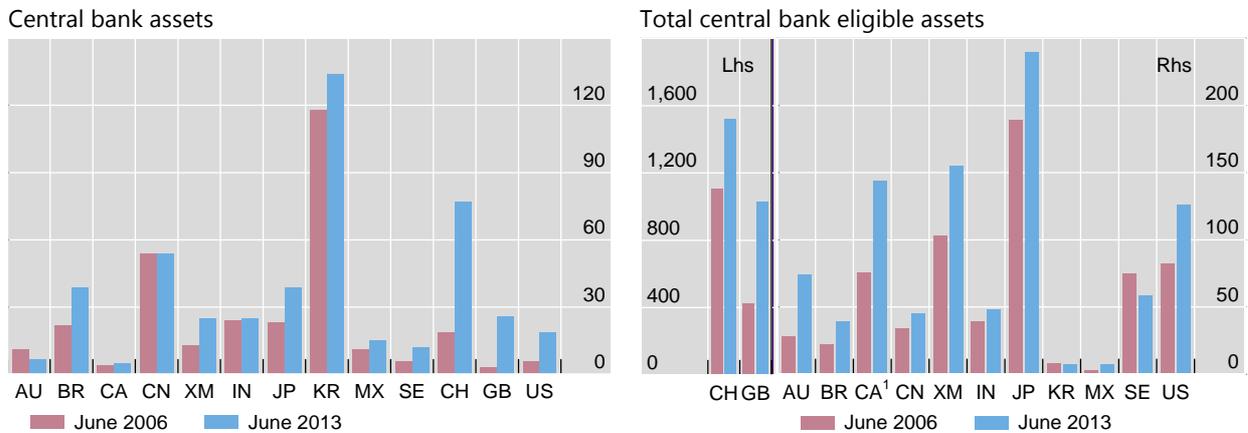
¹ For a general overview, see CGFS (2013) and Markets Committee (2013).

² A list of Group members is attached at the end of this report. Appendix 1 reproduces the Study Group's mandate.

Central bank footprint in collateral markets

As a percentage of GDP

Graph 1



AU = Australia; BR = Brazil; CA = Canada; CH = Switzerland; CN = China; GB = United Kingdom; IN = India; JP = Japan; KR = Korea; MX = Mexico; SE = Sweden; US = United States; XM = Euro area

¹ As of June 2013, only Canadian dollar assets are included.

Source: National central banks.

2. Conceptual framework

This section addresses key issues related to the impact of central bank operating frameworks on collateral markets. First, it is useful to define what collateral markets are and to discuss what central banks do, what their operating frameworks encompass, and whom they interact with. This provides some insight on central bank actions and how central bank motives and behaviour may differ across advanced and emerging market economies (EMEs). Given this background, it is possible to develop a broad framework for the assessment of how central bank policy choices may affect collateral markets. In doing so, it is recognised that central bank operations influence collateral markets through a *scarcity channel* reflecting the change in collateral availability or collateral composition and through a *structural channel* reflecting changes in the underlying structure of collateral markets.

2.1 Defining collateral markets

Collateral assets are any assets that can be used by financial market participants to collateralise a creditor's claim in normal market conditions, as well as any other assets that are likely to be used as collateral in a stressed environment. A collateral market is then simply a market that involves collateral assets.

Pledgeability. It is useful to think about collateral assets as a subset of all financial assets, with their key defining feature being market participants' ability to *pledge* them against borrowed funds. Different collateral assets may have different degrees of *pledgeability*, which measures the quantity of collateral services an asset provides. Total pledgeability can then be thought of as the product of two components: first, the total size of a given collateral market; second, the extent to which each individual unit of collateral can be used to generate funding. Changes in

central bank operating frameworks can obviously affect either or both of these components.

Collateral asset features. Whether or not assets may serve as collateral depends not only on features of the assets themselves – the fact that they are clearly identifiable, for example, reduces operational and legal risk – but also on the willingness of market participants to accept or reject these assets as collateral. Such decisions depend on the assessment of other risks associated with the assets, including credit and liquidity risks. The definition of what is or is not a collateral asset can therefore in part be endogenous to evolving market practice.³ Thus the categorisation of any particular asset as collateral may vary with time, jurisdiction and across market participants.

To be pledgeable, an asset must typically be relatively easy to value and amenable to legal segregation. Moreover, marketable assets tend to have a higher degree of pledgeability than non-marketable ones. Government debt, for example, commonly serves as collateral for repo transactions for both the private sector and central banks.⁴

Central bank eligibility. Collateral assets also include assets that are used as collateral by the central bank.⁵ These assets may or may not be used by private market participants as collateral. Typically, in “normal” times, many central banks tend to accept only a subset of the collateral used in private transactions for their regular refinancing operations.⁶ Equities, for example, are used as collateral assets by the private sector but are not generally acceptable in central bank operations. As discussed above, assets accepted as collateral in private transactions, in turn, are a subset of all available assets.

In crisis times, collateral acceptance typically becomes more conservative in private markets, and the pool of assets deemed suitable as collateral shrinks as the perceived risk of assets and counterparties rises. Central banks, on the other hand, often find that they need to expand the range of assets eligible as collateral during crises so that they can provide sufficient liquidity to the economy, and/or for financial stability purposes. For example, individual credit claims against debtors from the non-financial corporate sector may in exceptional circumstances be used as collateral with the central bank (for some central banks also during normal times). These claims can also be securitised and then either posted to the central bank or used in private collateral markets. The latter includes residential mortgage-backed securities (RMBS) and other asset-backed securities (ABS).

In summary, collateral assets are assets that can be accepted as collateral by the private sector, and/or eligible assets at the central bank. The size of this pool of assets depends on features of the assets themselves, decisions of important market participants (including the central bank), exogenous factors (such as the size of government debt markets), and whether markets are functioning normally or not.

³ See, for example, CGFS (2013).

⁴ See CPSS (2010) and FSB (2013).

⁵ Assets which are accepted by the central bank as collateral are generally referred to as “eligible” assets.

⁶ This excludes “lender of last resort” facilities, which often accept a very broad range of collateral.

2.2 Central bank operating frameworks

Central banks carry out market operations for one or more of the following three purposes. First, these operations are used to implement monetary policy. Second, they may be used to promote financial stability, including by ensuring the uninterrupted functioning of core funding markets, under either a direct or an indirect financial stability mandate. Finally, central banks provide or support the provision of financial market infrastructure.

When undertaking operations for any of these three purposes, central banks may affect collateral markets, given that such operations often involve accepting, lending, or trading collateral securities. What makes central banks special as participants in collateral markets is that they are the only counterparties that are free of counterparty and liquidity risk. As a result, central banks can, if they wish to, transact in ways that are fundamentally different from private market participants, for example in order to see through temporary variations in liquidity.⁷ The design and scope of central bank policies are therefore, together with the characteristics of the financial system, important in determining the impact of central bank operations on collateral markets.

Monetary policy

Regardless of the objectives of monetary policy, which may differ among central banks, the financial market operations in support of these objectives may have important effects on financial markets. These effects are likely to be quite different in normal times than under crisis and post-crisis conditions.

Pre-crisis arrangements. Before the crisis, when central banks in most advanced economies defined their policy stance primarily in terms of a short-term interest rate, the direct impact of monetary policy operations on collateral markets was limited. In many cases, this reflected the small size of the operations required to control interest rates. This was the case, for example, in the United States, which operated in an environment with limited reserves. But the direct impact of open market operations was typically limited also in cases where these tended to be sizeable. In the Eurosystem, for example, monetary policy was implemented in the context of a relatively large structural liquidity deficit. Refinancing operations, therefore, were much larger, but also gradual and highly predictable (see Appendix 2). In addition, any effects were more likely to be temporary, even though some measures (such as the choice of eligibility criteria) would also have more enduring effects (see Section 3.1 below).

Crisis and post-crisis arrangements. In contrast, after the crisis most advanced economies and many EMEs have looked to a broader set of instruments to implement monetary policy. Specifically, in addition to policies aimed at controlling short-term rates, central banks have engaged in policies that target longer-term interest rates, policies that aim directly at credit markets, or foreign exchange intervention to affect the exchange rate, its volatility or both.⁸ Overall, these measures have resulted in a much bigger “footprint” of central banks in

⁷ For a fuller discussion on these issues, see Chapter 14 in Bindseil (2014).

⁸ See eg Lenza et al (2010).

Sterilising liquidity surpluses

In response to the financial crisis, a number of central banks conducted large-scale asset purchases, thereby inducing or increasing existing liquidity surpluses in the banking system. In some cases, central banks sterilised these purchases by selling government bills or bonds to financial institutions. In terms of the impact on collateral markets, these transactions amounted to a collateral substitution that improved the overall quality of the available pool of collateral assets. Other central banks did not directly sterilise their large-scale asset purchases. However, as these central banks start to normalise their monetary policies, they will be confronted with the question of whether to withdraw excess liquidity from the system as part of the normalisation process

An alternative to withdrawing excess liquidity from the system would be to implement monetary policy via a so-called “floor” system. In this framework, liquidity is managed by removing the opportunity cost of holding reserves by paying interest on these balances at a policy-specified rate. In this case, the amount of reserves provided to the system may be high without driving the associated borrowing rate to zero. This has two primary benefits. First, the majority of banks will have sufficient liquidity to make their payments without incurring overdrafts, and, those that do not can do so at minimal cost. This improves the functioning of the payments system. It also reduces the need for the central bank to provide daytime credit. Second, in a stressed environment or an operational outage, additional liquidity could be supplied to the system without driving the short-term interest rate away from its target.

If a central bank instead decides to withdraw excess liquidity from the system, there are a variety of possible tools available to do so. Taking the Federal Reserve as an example, reverse repo operations, in which the central bank receives cash in exchange for collateral in the form of securities, have recently been tested as one such potential tool. Given the amount of excess liquidity in the system, the monetary policy normalisation process could result in a significant increase of effective collateral supply in many jurisdictions. And since government securities of a number of countries are used as collateral internationally, any increase in supply is likely to affect collateral markets not only locally but also globally.

Since long before the crisis, a number of EME central banks, including the Central Bank of Brazil (CBB), the Reserve Bank of India (RBI) and the Central Bank of Mexico (CBM), have tackled large-scale capital inflows by purchasing foreign currency in exchange for domestic currency. The excess liquidity created by this sale of domestic currency is sterilised in order to neutralise or reduce the liquidity surplus in the domestic banking system. Legal restrictions and repo markets that are less deep than those in the major advanced economies mean that these central banks typically withdraw excess liquidity by auctioning a range of securities through open market operations.⁹ Whereas the CBB and the RBI are not allowed to issue their own securities for this purpose, the CBM is permitted to do so. However, in order to avoid segmenting the market, the CBM mainly utilises government securities to withdraw liquidity.

Another group of central banks, which includes the People’s Bank of China (PBoC) and the Central Bank of Korea (CBK), have been actively building up foreign exchange reserves. Given their legal frameworks and market infrastructures, the resulting excess liquidity is neutralised by these institutions mainly through increased reserve requirements and by issuing central bank bonds. Both central banks as well as some of their EME peers also conduct foreign exchange interventions from time to time in order to prevent the local currency from appreciating too rapidly. Such interventions further increase the liquidity in the banking system and will affect collateral supply in the jurisdictions whose collateral assets are accumulated; and as this excess liquidity is withdrawn, the supply of collateral assets in the domestic market increases.

Similarly, if the policy rate in key advanced economies were to diverge from those in EMEs, this could lead to an outflow of capital from emerging markets, which could lead to downward pressure on EME currencies, which, in turn, could trigger central bank interventions in currency markets. In such a case, the result would be increased supply of internationally accepted collateral, such as US Treasuries, but reduced collateral supply in local markets.

⁹ Such sterilising operations using government securities were, for example, conducted by the RBI during the period 2004-08.

collateral markets (see Graph 1); and even as central banks eventually normalise their monetary policies, it will be a long time before this influence is reduced to pre-crisis levels, if ever.

One unconventional tool used in recent years is large-scale asset purchases. These result in an expansion of central bank liquidity greater than that needed to accommodate the normal demand of banks. In some cases, central banks have addressed this imbalance by imposing higher reserve requirements or by conducting liquidity-absorbing operations, such as the collection of fixed-term deposits or the issuance of central bank bills or public sector debt for liquidity management purposes. In other cases, the excess liquidity has been left in the system, with a view to providing additional monetary policy stimulus when interest rates are at or near their lower bound.

However, many central banks – including those in a number of EMEs – have been more preoccupied with the issue of draining surplus liquidity than injecting liquidity in recent years (see Box 1). As in the case of large liquidity deficits, the policy choices a central bank makes when faced with a persistent liquidity surplus can have significant implications for collateral markets in, and sometimes beyond, its jurisdiction (see Box 1, as well as the discussion in Section 3.4 on ways of managing cross-border effects).

Financial stability

Other central bank operations, including liquidity provision and lender of last resort (LOLR) activities (see Box 2), are carried out for financial stability purposes.⁹

Emergency lending facilities. Emergency lending to commercial banks and, possibly, other eligible counterparties is made on a secured basis. Central banks' collateral eligibility criteria in such transactions are an important element in protecting the central bank from potential losses, and the range of eligible assets can vary significantly across jurisdictions. In general, central banks have widened the pool of eligible assets in response to the recent financial crisis, and only some of them have since returned to their original, more restrictive, definitions for eligible assets.¹⁰

Other financial stability policies. Beyond providing liquidity in times of stress, many central banks have either explicit or implicit mandates to monitor and promote financial stability. These mandates may be more or less well defined and can include a wide array of policy choices. In addition to macroprudential policies, these may include microprudential initiatives, such as regulation of individual financial institutions or market infrastructures (see below). Central banks can also engage in initiatives that influence the structure of the financial system, eg to improve the functioning of certain markets. While such initiatives can be explicitly financial stability-related, they can also be related to monetary policy considerations (eg improving the transmission mechanism of monetary policy).

The way central banks affect the financial system can be very direct, for example by imposing certain requirements to consider specific assets eligible as collateral, or to include specific institutions as eligible counterparties. Alternatively, they can affect the system less directly, by applying moral suasion or participating and acting as catalysts in private market initiatives. All of these, in various ways, can also influence collateral markets.

⁹ LOLR is here taken to include all liquidity backstop facilities provided by central banks, which often have other labels than "LOLR".

¹⁰ See Box 3 below as well as Markets Committee (2013) for details.

Implementing lender of last resort (LOLR) policies

One particular aspect of central bank operations with the potential to significantly affect collateral markets is when a central bank acts as lender of last resort, defined as liquidity assistance outside the terms of routine operations to an otherwise solvent individual institution. The need for this type of support generally arises because of information asymmetries, which can lead to a bank run and, more broadly, to possible dysfunctions in the operation of money markets, often associated with contagion from distress at financial institutions. One important channel for this contagion is through collateral markets (eg repo and similar transactions).^①

Assistance during the crisis.^② As the global financial crisis unfolded, central banks adapted their LOLR policies and collateral frameworks. LOLR assistance was typically provided to cover liquidity shortfalls owing to an inability of the relevant institutions to obtain sufficient funding in interbank and other wholesale markets at a reasonable cost. Generally extended against the most widely accepted collateral, examples of such assistance included LOLR lending to Northern Rock (against mortgage-backed securities; September 2007) and the Federal Reserve's lending to banks through its Term Auction Facility, which auctioned pre-set amounts of funds to banks against discount window collateral.

An important feature of the response to the illiquidity in the foreign-exchange swap market, and in the Eurodollar money market, was the institution by several central banks of reciprocal currency swaps. Under this programme, banks in one jurisdiction (eg the United Kingdom) could borrow US dollars directly from the domestic central bank (ie the Bank of England), which would procure US dollars via a swap with the Federal Reserve in exchange for domestic currency (ie sterling) collateral.

During the crisis period, financial institutions in a variety of jurisdictions came under increasing pressure, with many of them struggling to raise sufficient liquidity in wholesale markets. As a result, a number of central banks had to step in with emergency liquidity support, including against highly illiquid collateral. In many cases, central banks also lengthened the tenor of their lending, expanded the pool of assets eligible to serve as collateral to secure borrowings, and widened the set of counterparties eligible to borrow.^③

Impact on collateral markets. As the character of LOLR assistance to distressed institutions evolved, there was a shift away from taking collateral that was widely accepted in private transactions towards taking less liquid, harder to value assets that had not previously been accepted. Whereas the former approach had reduced the supply of collateral assets available to the private sector (increasing collateral scarcity in these markets, though against the provision of central bank reserves), the latter had no direct effect on the effective amount of collateral available for private transactions (while, at the margin, promoting stability in the markets for newly eligible assets).

In determining what assets to accept as collateral, central banks took into account a range of factors. These included the impact of their actions on collateral markets more broadly, the increase in supply of risk-free assets, and other market-wide initiatives that were being undertaken by the central bank. As it became clear that the crisis was systemic, the decision to broaden collateral eligibility was paramount, as it offset the negative effect on collateral of some of the decisions related to individual institutions.

Lessons. Overall, a pragmatic approach was taken to secure credit in order to deal with the evolving situation and manage collateral scarcity. This suggests that it is difficult, ex ante, to establish principles about what collateral will be acceptable in all situations. This argues in favour of relatively flexible collateral frameworks. This is particularly the case in times of systemic liquidity stress, when the demand for central bank-eligible collateral increases rapidly. In this context, having banks being able to preposition collateral turned out to be helpful for some central banks, as it gave them time to evaluate the assets, as well as providing insights into banks' portfolios and risk management practices.

^① See, for example, CGFS (2010).

^② See, for example, Domanski et al (2014).

^③ As the crisis deepened, the size and, in some cases, the complexity of lender of last resort lending increased. In the United States, for example, the federal government provided funds to stem the crisis through the Emergency Economic Stabilization Act, which authorised investment in bank equity by the US Treasury. Some crisis-response actions in the United States featured both capital investments by the US Treasury and lending by the Federal Reserve Banks to address potential solvency and liquidity problems.

Financial market infrastructure

Many central banks play a substantial role in the provision of financial market infrastructure, such as payment and settlement systems as well as trading platforms, and the design of these infrastructures has an important influence on collateral markets.

Infrastructure design and collateral markets. As part of their role as operators of financial market infrastructure, central banks make decisions regarding the design and functioning of such systems that may impact private sector collateral availability and composition (see Appendix 3 for a fuller discussion of such effects). One example is collateralisation policies for the provision of intraday liquidity in order to ensure the smooth functioning of payment systems. The degree to which such intraday credit is collateralised affects the overall demand for collateral, and hence the net supply of collateral available for other purposes. Another type of decision concerns the operational choices for central bank-operated infrastructure. Examples include the extent to which central bank collateral policies for overnight and intraday lending are coordinated, as well as the restrictiveness of collateral requirements in settlement arrangements, both of which will affect the availability of collateral. Finally, the introduction of liquidity savings mechanisms (LSMs) in payment systems can reduce intraday liquidity needs. Such mechanisms, if used more widely, could help offset the increasing demand for intraday liquidity and reduce the impact on collateral markets, thereby improving the overall availability and mobility of collateral.¹¹

Infrastructure choice and monetary policy. Central banks often conduct their monetary policy operations via electronic trading platforms. These platforms can either be constructed exclusively for monetary policy purposes or the central bank can choose to use the same infrastructure as other market participants. The latter case might lead to increased activity on these platforms, supporting gains from improved efficiency and acceptance, and ultimately to enhanced financial stability. Fully integrated infrastructure for collateralised transactions can further enhance these effects.¹²

2.3 How do central bank operations affect collateral markets?

This section provides a taxonomy of the channels through which central bank operations are likely to affect collateral markets, and it also discusses how collateral markets can influence policy frameworks and actions.

Mutual influences between central bank operations and collateral markets. Central bank actions can impact collateral markets through a *scarcity channel* and a *structural channel*. Scarcity effects result from the impact of central bank operations on the prices, rates, and price volatility of collateral assets arising from changes in the availability of collateral, or the collateral composition of the market. Structural

¹¹ See Mersch (2014) for a fuller discussion of collateral mobility and related issues.

¹² In Switzerland, for example, most financial market transactions involving securities (eg repo transactions or trades on the Swiss stock exchange) are settled in an integrated infrastructure that is run by market infrastructure providers overseen by the Swiss National Bank (SNB). In addition, the SNB plays an important role by providing liquidity to the payments system and by using the integrated trading and securities settlement systems for the implementation of monetary policy operations.

effects include effects from the designation of eligible securities, as well as changes in clearing and settlement systems and other infrastructure support. Scarcity and structural effects can be intended, for example when the central bank aims to influence prices of collateral assets through direct interventions, but they can also be unintentional side effects of operations involving collateral assets or changes to operational frameworks.

Of course, the two channels may interact: the structural effects of central bank actions may condition the transmission of the scarcity effects of these operations, and structural effects will tend to also induce scarcity effects by influencing the collateral services provided by a given stock of collateral assets.

Box 3

Collateral markets: structure and effect on central bank policy

This box illustrates some of the ways by which collateral availability and market infrastructure in a particular jurisdiction may influence the design of central bank monetary policy implementation procedures. Four representative examples of market structure are considered: first, a jurisdiction with only a small amount of outstanding central government securities, typified here by Australia; second, a jurisdiction with a large and well developed market for government securities, typified by the United States; third, a monetary union in which no securities are issued by the union itself, but instead are issued at the national level, typified by the Eurosystem; and, fourth, a jurisdiction with developing financial markets, typified by India.

1. Jurisdiction with little or no central government debt

Jurisdictions with little or no federal, or central government, debt face distinctive challenges. In Australia, for example, the Reserve Bank has had to make a number of changes to the way it operates in collateral markets as issuance of government securities has fallen substantially.

The first such change was a progressive broadening of eligibility criteria, which predated the global financial crisis. The central bank also operates, on behalf of the Australian Office of Financial Management, a facility that allows eligible parties to borrow via repo specific Australian treasury bonds from unissued stock against a fee. Because the fee is relatively high, the facility is used only as a last resort by dealers to avoid failing on securities settlements with counterparties. The liquidity effect is managed via an offsetting repo transacted at the same time.

As a result of the shortage of high-quality collateral in the domestic market, the RBA, at times, uses foreign exchange swaps as an adjunct to domestic repos in order to manage system liquidity. Thus, the RBA's domestic market operations are closely integrated with management of the Bank's foreign exchange reserves, and the Bank participates in short-term money markets offshore, including as a receiver of collateral.

The RBA will also offer certain deposit-taking institutions a committed liquidity facility (CLF) from 1 January 2015 in order for them to meet their Basel III liquidity target. The CLF grants participating banks the option of selling eligible securities to the RBA under repo. The Bank's universe of eligible collateral is wider than the assets deemed to be high-quality liquid assets by the Australian prudential regulator.

2. Jurisdiction with active federal or national government debt market

Many jurisdictions have deep and liquid national government bond markets. The United States is one example, featuring both an active federal debt market and a sizeable amount of marketable debt. More generally, the United States has well developed, deep, and integrated capital markets which play a key role in credit intermediation in the economy.

The Federal Reserve, by statute can transact only in a limited number of assets for open market operations, including Treasuries and federal agency securities. The US Treasury securities market is one of the largest and most liquid financial markets in the world, with marketable debt outstanding of \$12 trillion as of end-April 2014. The creditworthiness and liquidity of Treasuries make them highly pledgeable collateral assets, including in private transactions.

Given the depth of liquidity and well-functioning nature of the Treasury market, the Federal Reserve has sufficient scope to conduct operations. Historically, those operations have been arranged with a small set of primary dealers — government securities dealers who have an established trading relationship with the Federal Reserve. However, transactions in the government debt markets were only a means to an end, ie the settlement of transactions ultimately led to a change in the level of reserves held by the banking system. More recently, the operating objective for operations has been directed at acquiring more substantial volumes of securities. Again, given the depth of US government bond markets, such operations have been possible without substantially affecting the functioning of those markets (see Box 5).

3. Monetary union with no “union” debt issuance

Unless a monetary union also comprises a fiscal union, there is no counterpart to the national debt used by a national central bank. In the case of the European Union, there is no fiscal union, and consequently there are no large amounts of government debt issued as a joint liability of the members of the monetary union. The rather complex structure of the Eurosystem’s operational framework with thousands of eligible counterparties and a broad range of eligible collateral is determined by the characteristics of the euro area financial system.

The Eurosystem’s monetary policy framework is formulated with a view to ensuring the participation of a broad range of counterparties, reflecting the strongly bank-based financial landscape of the euro area. Banks traditionally play a prominent role in financial intermediation and are relatively large by international standards. For example, the total assets of the euro area banking sector correspond to around 300% of GDP, as compared to less than 100% of GDP for the United States. The bulk of open market operations in the euro area has taken the form of reverse transactions providing liquidity against collateral. Euro area collateral markets are not fully integrated and as a result not as deep as the markets for similar assets in other jurisdictions. The ECB, therefore, accepts a large set of asset types as collateral, provided that these satisfy a number of eligibility criteria.

Finally the structure of euro repo markets is quite different from those in the United States. The market is dominated by bilateral repos, mostly via CCPs. Tri-party repos play only a small role. Given the large number of ECB eligible counterparties, participants in the interbank repo market normally also have access to ECB liquidity. In principle, therefore, repo market participants can substitute between the interbank market and the Eurosystem facilities depending on market conditions.

4. Jurisdiction with developing financial markets

India is an example of an EME with a reasonably active domestic government securities market. Over the last 10 years, the amount of outstanding Indian government bonds increased by around 18% per year, to around 45% of nominal GDP (at factor cost) in March 2013. This period also saw significant growth in the daily average trade volumes, which increased almost sevenfold in the last decade, primarily as a result of improvements in market infrastructure and the issuance of securities across various maturity points on the yield curve.

The collateral framework of the Reserve Bank of India (RBI) is “narrow and differentiated” in the sense that only national and state government securities are accepted as collateral for its repo operations (see Markets Committee (2013)). The significant amount of outstanding central government securities, together with the reasonably deep and liquid secondary market, makes such securities the main type of eligible collateral for RBI’s operations. The RBI did not materially broaden its collateral acceptance policy as a crisis response. The eligible counterparties for central bank operations continue to be commercial banks and primary dealers. Banks are mandated to maintain a certain percentage of their liabilities in government securities, and typically hold sufficient surplus securities.

The RBI has no exchange rate target, but, depending on the situation, it intervenes either as a buyer or a seller in the foreign exchange market to reduce volatility. Sometimes, its stock of government securities is inadequate for sterilising the impact of foreign exchange interventions at times of significant capital inflows. As it is not authorised to issue its own paper, the RBI has used government securities through additional primary market issuance to absorb excess liquidity when required. The proceeds from such issuance of government securities are kept in a sequestered account of the government with the RBI, which also allows liquidity to be injected through redemptions, buyback through auctions and de-sequester (transfers of balance to the central government) for the government’s budget operations.

At the same time, the composition and structure of collateral markets also influences policy frameworks and actions themselves. Two central banks may seek to meet identical mandates in different ways because of differences in their respective financial market structures (see Box 3 for examples).

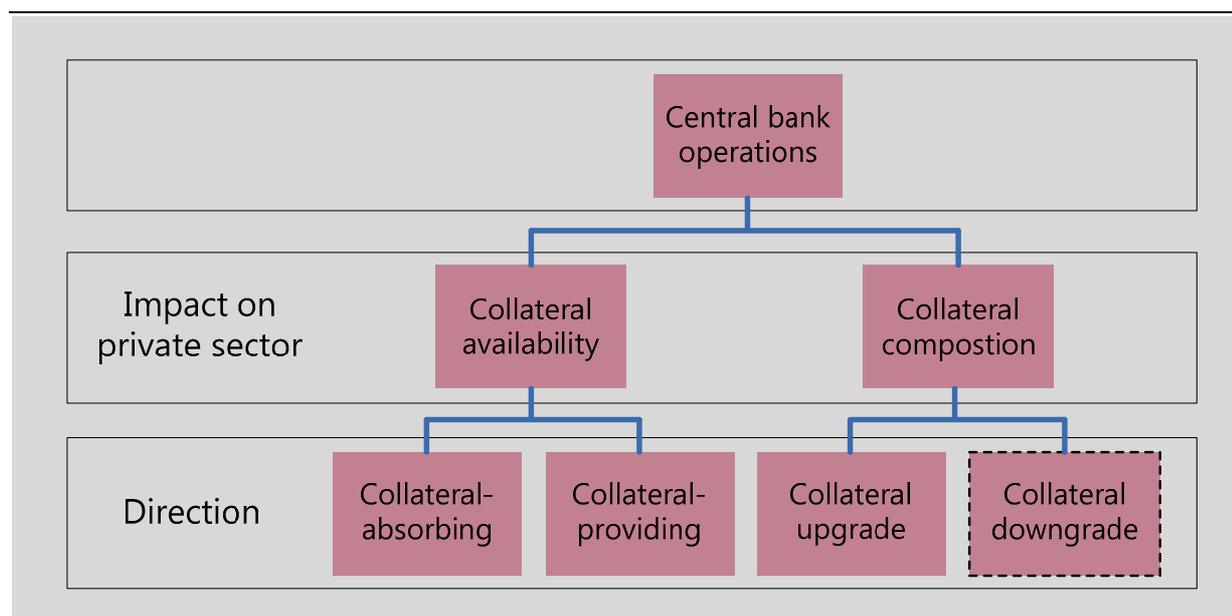
The scarcity channel

Most central bank operations are effectively asset swaps, involving the exchange of claims that are imperfect substitutes for each other.¹³ This is most obvious when central banks engage in securities lending or actual collateral swaps (ie when two types of non-cash collateral asset are exchanged against each other). Yet, it also applies to more traditional operations, such as open market operations (OMOs) or repo lending, which exchange collateral assets (either through outright purchases or in the form of collateral) against central bank reserves.¹⁴

Collateral availability and composition. The scarcity channel can therefore be thought of as influencing collateral markets by altering either collateral availability or collateral composition in the market. This is designated by the second level of Graph 2. Collateral availability can be increased or decreased depending on whether central bank operations are collateral absorbing or collateral providing. Collateral-

The scarcity channel and central bank operations

Graph 2



¹³ Although asset swaps typically involve exchanging the cash flows from a security with fixed payments for a floating market rate, an asset swap in its most basic sense is simply an exchange of two assets. It is in this sense that the term "asset swap" is used here.

¹⁴ While central bank reserves are accessible only to a limited set of counterparties, such cash balances can themselves serve as collateral. For example, cash is typically used as collateral to support trades in over-the-counter derivatives markets. In what follows, however, collateral markets are always defined as markets for non-cash collateral assets.

absorbing operations include outright purchases by the central bank, repos,¹⁵ secured loans, and redemptions or buybacks of instruments such as central bank bills against central bank reserves. Conversely, collateral-providing operations include outright sales, reverse repos and issuance of central bank instruments. Notably, these require that a sufficient stock of the relevant collateral assets is available on the central bank's balance sheet (or that the central bank has the right to issue its own securities or borrow them from the Treasury). Pure changes in collateral composition result from operations that adjust the quality of available collateral in the market. Such operations could involve either outright collateral swaps or securities lending.

Securities lending and collateral reuse. Following this logic, securities lending facilities can help to increase the effective supply of collateral for a given stock of assets. Securities lending may be used to counteract the scarcity effects of central banks' own collateral-absorbing operations on the effective supply of collateral available in the market (against central bank reserves). Central banks can to some extent offset such effects via securities lending or similar activities, making their collateral available for reuse.¹⁶ This can help to increase the available supply of securities seen as scarce, and may also serve to stabilise collateral reuse more generally – which tends to be strongly procyclical in that market reliance on such collateral will decline in times of deteriorating market conditions (see Box 4).¹⁷

In practice, however, this direct effect may not be attainable. Even so, securities lending facilities may still have an indirect effect on collateral markets by improving overall funding conditions and/or secured funding costs – for example, by providing specific securities (eg "specials") as a secondary and temporary source to avert market squeezes and settlement failures.

The structural channel

Central banks can also affect collateral markets by changing the existing structure of these markets or by introducing new structures. As mentioned, such structural changes will often tend to also induce scarcity effects and therefore affect the prices, rates, and volatility observed in collateral markets.

Structural eligibility effects. Structural effects often reflect central bank decisions as to which assets it will accept in its operations, ie its eligibility policy. A decision to accept a type of asset as collateral will increase its pledgeability, inducing an increased willingness to create these assets and hold them on balance sheet. For example, depository institutions would be willing to hold on their balance sheet certain amounts of possibly illiquid and/or non-marketable loans as a result of the central

¹⁵ Note that in the case where repurchase agreements are characterised from the perspective of the central bank it would be reverse repos that are liquidity-providing/collateral-absorbing.

¹⁶ The degree of collateral reuse is sometimes referred to as "collateral velocity"; see Singh (2011). Bleich and Dombret (2014), in turn, discuss the role of collateral reuse in stress times.

¹⁷ In times of severe market stress, collateral reuse might be expected to fall. For example, non-bank providers of collateral might become increasingly reluctant to allow the reuse of their collateral due to an elevated awareness of counterparty risks. As a result, the supply of collateral in the private markets will decrease, suggesting that central bank actions (eg via securities lending operations) can reduce strains in collateralised funding markets.

Collateral reuse in the Swiss repo market^①

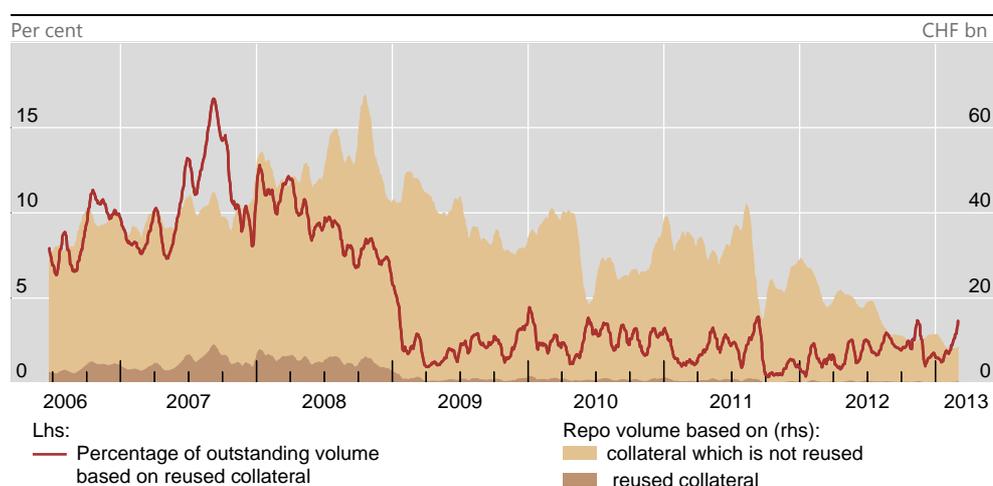
By reusing collateral, securities can theoretically be used multiple times to collateralise different transactions, increasing the effective supply of collateral assets for a given stock of securities at both the individual and aggregate levels. In other words, even though individual securities are not typically reused more than once, collateral reuse can have a multiplier effect on the stock of collateralised financial claims.

While rehypothecation is distinct from reuse, the effect exists for both activities. CGFS (2013) defines rehypothecation as “the right by financial intermediaries to sell, pledge, invest or perform transactions with client assets they hold”. The reuse of collateral, in turn, is defined as “securities delivered in one transaction [that] are used to collateralise another transaction”.

Regardless of the considerable impact that collateral reuse might have, little is known about its magnitude and micro-funded empirical studies are rare. An exception is Fuhrer et al (2015), who provide a systematic empirical study based on actual transaction data from the Swiss franc (CHF) repo market. They find evidence of limited collateral reuse in CHF repos, with activity levels remaining broadly constant until about mid-2007, when roughly 10% of the outstanding volume was secured with reused collateral. Afterwards, reuse increased and reached its highest value in the autumn of 2007, at more than 15%, before dropping at the end of 2008 and remaining at very low levels afterwards (Graph A).^② The reused collateral typically originates from a long-term repo (one month and longer) and is then reused in a shorter-term transaction.

Given banks’ available pools of collateral, it is estimated that through reuse the pool of available collateral had increased by around 7.5% by late 2008. Moreover, there is evidence that market participants tend to reuse collateral more frequently in times when collateral scarcity increases, alleviating some of the scarcity effects.

Outstanding volume in the CHF interbank repo market¹ Graph A



¹ 15-day moving averages.

Source: Fuhrer et al (2015).

^① The discussion in this box is based on Fuhrer et al (2015).

^② Estimates of the degree of rehypothecation in the United States, based on dealer banks, suggests that the percentage of rehypothecated collateral ranged from 80% to 90% prior to the crisis, before declining to around 75% after the crisis; see Kirk et al (2014). Singh (2011) provides even higher estimates, suggesting that, for US broker-dealers, collateral was rehypothecated around two times on average as of end-2007, and around 1.4 times as of end-2010. The European Systemic Risk Board (ESRB (2014)) applied a related approach using more granular data and estimated that collateral was rehypothecated on average once as of February 2013 for a sample of European banks.

bank's willingness to accept them at standing lending facilities subject to its haircut and pricing policies. Despite the fact that the central bank may only be expected to encounter these assets as collateral in "crisis" times, the pricing and market impact of their eligibility would likely be affected also in normal times (ie via eligibility premia – price effects associated with greater willingness to hold central bank-eligible assets).

Other design features. How assets can be pledged in central bank operations can also influence the underlying market. For example, the possibility of using own-name assets might impact the amounts issued more than market prices, as securities can be issued for the sole purpose of being pledged as collateral (this is allowed, for example, under the Eurosystem's collateral framework for ABS or covered bonds; see Cheun et al (2009)).

When assets that were previously highly illiquid, or even non-marketable, are made eligible, the effects will tend to be different from those for more liquid securities. For example, if loans are made eligible, that may increase incentives for additional lending – either through improved funding terms or because eligibility allows the on-sale of these assets and, hence, provides capital relief.

There will also be substitution effects. For example, if banks have non-marketable assets on their balance sheets that are made eligible, this will free up other securities that were formerly used in operations to be used for other purposes. These securities can then be used, say, in financing transactions in the interbank market, thereby widening the availability of assets in this market. Using freed-up collateral for securities lending or collateral swaps reduces the scarcity of collateral and may therefore reduce the price. Banks may also replace marketable eligible assets against marketable non-eligible collateral (as other assets can now be used as collateral) in order to optimise asset allocation, thereby affecting the demand for non-eligible and marketable assets.¹⁸

Influence on market practices. Finally, structural effects can also arise from a central bank's influence on market practices. Box 5 provides a number of examples relating to changes in the repo market in the United States. Moreover, central banks can influence regulatory practices, which, in turn, can have structural effects on collateral markets and practices in those markets. At the same time, there are limits to how much central banks can influence market practices. For example, these limitations are illustrated by the Bundesbank's historical experience of using bills of exchange as a vehicle for supplying liquidity to the economy from the 1960s onwards.¹⁹ Even though these bills received preferential treatment in central bank lending – in effect subsidising borrowing compared to other forms of central bank financing – they ultimately lost importance as repo transactions instead gradually gained in importance in the German market.

¹⁸ See also the discussion in Markets Committee (2013).

¹⁹ Bills of exchange were an instrument of borrowing by trade and industry in Germany. The Bundesbank had the right to buy and sell such bills of exchange from and to banks at its policy rate, the discount rate, provided they satisfied certain specified conditions, ie high credit quality and short maturity.

Federal Reserve influences on US repo market structures

The market for repurchase agreements, or repos, plays an important role in US capital markets. The repo market allows dealers to fund their own securities or those obtained via their intermediation services. As in other jurisdictions, the market also plays a key role in the implementation of monetary policy, as the Federal Reserve has historically used repos to fine-tune the supply of reserves in the commercial banking system. This box characterises the structural influences the Federal Reserve has had in the development of the tri-party repo market, as well as in the introduction of a settlement fails charge for US Treasuries.^①

Tri-party repo market structure

Although repos have been in existence since at least the early part of the 20th century, it was not until the late 1970s and early 1980s that the market expanded rapidly. This was, in part, related to two major changes in repo contracting conventions.^② The first was the treatment of accrued interest in the repo contract and the second was the exemption from the automatic stay of bankruptcy. Before 1982, the convention in repo contracts was to ignore accrued interest in the agreement. This meant that, as coupon-bearing collateral neared a coupon payment, the market value of the collateral was no longer appropriately aligned with the haircut. The issue rose to prominence after the failure of Drysdale Government Securities (a securities dealer) in mid-1982, leading to a twofold reaction by the Federal Reserve (see Welles (1982)). First, it acted by temporarily suspending the limits on loans of Treasury securities to primary dealers, allowing lent securities to finance dealer short positions, and making clear it stood ready to act as lender of last resort. Second, the Federal Reserve announced that it would begin recognising accrued interest in its own repurchase agreements. Prompted in part by this new policy, the Association of Primary Dealers in US Government Securities adopted the recommended resolution for recognition of accrued interest.

The second major change in contracting conventions related to the bankruptcy treatment of the collateral used in a repo. Since a repo agreement could be interpreted as a type of secured loan (rather than two separate transactions) it was unclear whether the securities serving as collateral could be freely sold in the event of a bankruptcy. This issue came to its head following the bankruptcy of Lombard-Wall, a government securities firm. The bankruptcy court issued a temporary restraining order prohibiting the sale of collateral provided by the firm in its repo contracts. The Federal Reserve reacted to the court decision in two ways. First, the Federal Reserve Bank of New York (along with various market participants) publicly stated that the decision would undermine the liquidity of the repo market. Second, the Federal Reserve petitioned Congress to change the bankruptcy status of certain classes of repo collateral. Changes to legislation in 1984 introduced the exemption for repo contracts collateralised with Treasury and agency securities, certificates of deposit or bankers' acceptances.

The two aforementioned changes in contracting conventions contributed to a rise in the popularity of repo contracts in the early 1980s. By the mid-1980s, a number of different dealers and clearing banks had adopted the tri-party structure that had been introduced in the late 1970s, with tri-party repo gradually rising to prominence. On the eve of the crisis in 2008, the collateral value in the tri-party repo market reached \$2.8 trillion, corresponding to almost 20% of US GDP.

In an effort to ameliorate the vulnerabilities in the tri-party structure highlighted during the crisis, the Federal Reserve Bank of New York sponsored an industry-led effort aiming to reduce reliance on intraday credit, make risk management practices more robust to a broad range of events, and take steps to reduce the risk that a dealer's default could prompt destabilising fire sales of its collateral by its lenders. The effort to improve the resilience of the tri-party platform is ongoing, but considerable steps have been taken to reduce the amount of intraday credit needed for daily settlement.

The Treasury Fails Charge

One tenet that underpins the strength of the US Treasury market and the associated repo market is that transactions involving Treasury securities settle reliably and efficiently. A settlement fail occurs if the security is not delivered, either at the opening or closing leg of a repo transaction, or if a seller of a security fails to deliver the security to the buyer in an outright sale.^③ Before the crisis, the convention, in the event of a settlement fail, was to reschedule the delivery of the security to the following day without imposing a penalty or changing the previously agreed upon price of the security. This process could then be repeated until eventual settlement.

Sporadic and short-lived settlement fails are typical in the Treasury market and generally occur as the result of miscommunication or operational errors. However, more widespread and systematic settlement fails can have pernicious effects such as increasing operational and counterparty risk along with compromising market liquidity. Before the financial crisis there were three noteworthy waves of fails – in 1986, in 2001 (after the September 11th attacks) and in 2003. Despite calls for changes to address the problems of persistent fails, market conventions remained unchanged. Persistent settlement fails generally occur when the demand to borrow a security outstrips the supply. These imbalances may be starkest in low rate environments and exacerbated by the presence of strategic fails – selling short a security without the intent to deliver the security in a timely manner.^①

In late 2008, after Lehman Brothers filed for bankruptcy and the level of short-term rates dropped precipitously, Treasury fails ballooned. In response, the Federal Reserve made changes to its security lending programme by reducing the minimum loan fee and by expanding the limit on total borrowings by a single counterparty. However, these changes, along with a number of reopenings of Treasury issues by the US Treasury, were not sufficient to reverse the rise in fails.

As a result, the Treasury Market Practices Group (TMPG) – a group sponsored by the Federal Reserve Bank of New York and comprising professionals from private financial institutions – recommended implementing a fails charge as initially suggested by economists at the Federal Reserve Bank of New York (Fleming and Garbade (2002)). This penalty charge would take the form of a side payment in order to coordinate with the existing payment and settlement infrastructure. The institution of the Treasury fails charge in May 2009 resulted in a marked decrease in settlement fails. This curative change of market convention provides another example of the central bank's role in maintaining financial stability, in this case mediated through the private sector, by responding to the evolving landscape of collateral markets.

^① Although settlement fails can occur in outright sale transactions, many of the fails are associated with repo transactions.

^② See Garbade (2006) for a more comprehensive discussion.

^③ See Garbade et al (2010) for further discussion.

^④ See "Treasury Market Best Practices" Federal Reserve Bank of New York, <http://www.newyorkfed.org/tmpg/TMPFBestPractices070209.pdf>.

3. Policy dimensions and the measurement of scarcity and structural effects

As discussed above, changes to any of the features associated with the central bank operating framework may impact collateral markets through both scarcity and structural channels. These features and associated design choices can be categorised into four dimensions: (1) *eligibility policy*, ie the range of securities eligible as collateral for a given type of operation, (2) *haircuts* and other risk mitigants applied by the central bank in its terms and conditions, (3) the *counterparty access policy* that determines whether a programme is open to a broad or narrow range of competing financial institutions, as well as (4) the *operational parameters* (size and term of the transactions, allocation via eg auction or standing facility etc).

This section discusses these features in more detail and describes their possible theoretical impact on collateral markets via the scarcity and structural channels. Observed effects of changes in these policy parameters are also explored, although, in most cases, the difficulty of establishing a credible counterfactual makes statistical analysis difficult. Consequently, impacts are assessed mainly with the help of case studies, where possible, and evidence from discussions with private sector market participants. Nevertheless, some of the metrics and tools employed in the analysis may be useful for central banks in considering the impact of their operations on collateral markets. Overall, available quantitative evidence suggests that the effects of central bank operating frameworks on collateral markets are

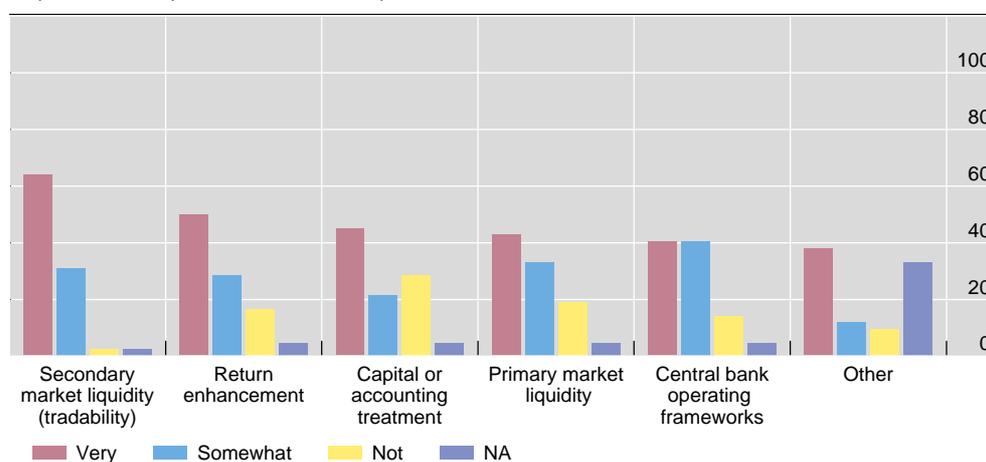
relatively limited, although they can be sizeable in some circumstances (especially when these effects are intended).

The general importance of the design choices of central bank operating frameworks is highlighted in results from a survey of market participants conducted by Study Group members (Appendix 4). More than 80% of respondents consider such frameworks to be a “very” or “somewhat” important element with respect to their participation in collateral markets (see Graph 3).²⁰ Still, it is clear from Graph 3 that a number of other factors, including market liquidity and regulatory/accounting treatment, are considered to be “very important” by a greater fraction of respondents. In terms of impact on collateral markets, the survey reveals that when central bank operating frameworks are perceived to be important, they are primarily important for prices and volatility in collateral markets – underscoring the central role of the scarcity channel.

Factors influencing participation in collateral markets

Importance; in per cent of total respondents

Graph 3



Source: National central banks.

3.1 Eligibility policy

The designation of which securities are eligible collateral for borrowing from the central bank differs across jurisdictions (and, in some cases, across different lending facilities at the same central bank).²¹ In most jurisdictions, legal constraints set the boundaries for which securities can be considered as eligible collateral. Given these constraints, the choice of which securities are acceptable depends on a number of factors. Most prominently, eligibility restrictions help to shield the central bank from financial losses by focusing on assets of sufficiently high quality.²² Prior to the crisis,

²⁰ This is based on a sample of 42 institutions in jurisdictions that used a “long-form” multiple choice survey; see Appendix 4 for more details. Around 40% of these institutions were located in the euro area and about 25% in the United States; the results therefore mainly reflect responses from these two jurisdictions.

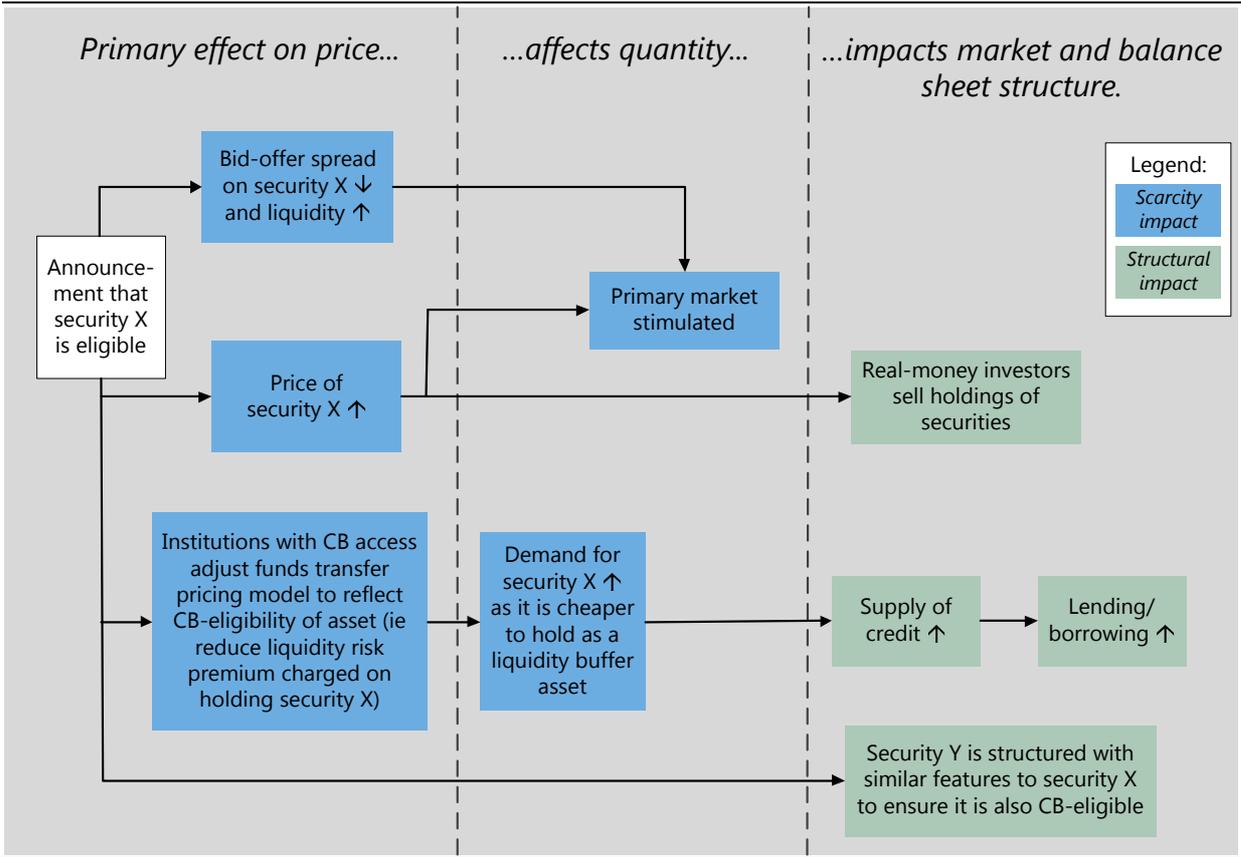
²¹ In general, eligibility for purchases versus borrowing is distinct, with eligibility for purchases being more restrictive.

²² Individual design choices, and combinations thereof, can differ in terms of the costs imposed on the implementing central bank. For example, in terms of the operational or reputational costs

many central banks only accepted assets that were both of high credit quality and highly liquid. However, given stresses in specific markets as a result of the crisis, central banks have in many cases had to expand their eligibility criteria to include less liquid assets (which they can do as a result of their superior capacity to bear liquidity risk compared to commercial banks).²³ At times, central banks have also overridden eligibility criteria based on credit ratings, as, for example, during the recent fiscal crisis in the euro area. Central banks' policy choices, as informed by the underlying financial market structure and the characteristics of the asset markets, will, in turn, shape the effects that any changes to eligibility requirements may have on collateral markets.

Theoretical effects. Changes to central bank eligibility are expected to have both structural and scarcity effects on collateral markets. Structurally, assets will tend to become more pledgeable per unit if they are eligible as collateral at the central bank. This structural effect on the value of a collateral asset that is designated as central bank-eligible is likely to be borne out even if there is no outstanding borrowing at the central bank using this asset as collateral. Thus, there may be an eligibility premium that represents the increased desirability of the asset

Transmission map – possible impacts of making a new asset central bank-eligible Graph 4



involved in accepting more complex collateral assets or assets perceived as being of lower liquidity. These cost considerations can constrain central bank choices, but are not considered in more detail for the purposes of this report.

²³ See also the discussion in Bindseil (2014).

as a result of the new classification. Changes in eligibility restrictions can also act through the scarcity channel if, as a result, the availability or composition of collateral changes (eg via incentives for market participants to issue the relevant assets). Moreover, eligibility of non-marketable assets may induce central bank counterparties to use these with the central bank in place of marketable assets, with the marketable assets then deployed in private markets. These substitution effects can magnify the impact of any change in eligibility criteria for collateral markets.

The theoretical impacts of a change to eligibility policy are illustrated in Graph 4, which shows the different structural and scarcity effects of such a change in central bank eligibility policy based on a so-called “transmission map”.²⁴ In general, the eligibility of a marketable asset has a positive effect on its market price and liquidity, as demand for that asset picks up in private markets. This reflects its increased attractiveness as a liquidity buffer asset (ie its increased “pledgeability” from having been accorded central bank collateral status). Apart from such scarcity effects, central bank eligibility may give rise to structural effects too, as discussed above, for example impacting balance sheet structures in the market, or inducing market participants to structure other assets in ways similar to the newly eligible asset.

The survey of market participants conducted by the Study Group shows that, while central bank policies in general are not considered as the most important factor for the functioning of collateral markets, particular aspects of such policies are still seen as influential. Specifically, almost 70% of respondents view collateral eligibility policies as having a considerable impact on collateral market functioning, with another 20% of respondents viewing it as having “some” impact (see Graph 5, left-hand panel). To the extent that respondents see eligibility policies as affecting collateral markets, collateral acceptance (ie whether a specific asset is accepted as collateral at the central bank) is cited as the most important aspect, while margining and pricing schedules are seen as being less important (Graph 5, right-hand panel). Nevertheless, eligibility choices are of course tightly linked to these other factors (see below).

Evidence. Quantitative analysis of the effects of central bank eligibility is sparse,²⁵ but evidence from case studies broadly supports some of the theoretical impacts discussed above. For example, when the RBA made Australian state and territory government debt eligible in 1997, the spread between those assets and Australian Government debt temporarily narrowed from around 20 to 5 basis points. Even though the effect of eligibility is hard to isolate from other factors, this is consistent with the presence of a structural impact – the greater pledgeability of Australian state and territory government debt resulted in increased demand, driving yields down relative to collateral assets which were already eligible.

²⁴ On the possible use of this tool in the context of macroprudential policies, see CGFS (2012).

²⁵ Empirical studies in the academic literature find little evidence for the existence of a meaningful eligibility premium. Bindseil and Papadia (2006), for example, exploit the inclusion of a specific asset class in the Eurosystem’s eligibility base to measure the relative impact on their liquidity without finding support for a material eligibility premium. More recent research by Bartolini et al (2011) shows that the three main classes of collateral securities in the US market (Treasuries, agency securities and MBS) can be ranked in terms of their collateral value in the repo market, and that holders of Treasuries are able to borrow at substantially lower rates than holders of the two other types of securities. Specifically, the authors report that this advantage is around 5 basis points on average, but that it can be considerably higher in times when liquidity needs are particularly large.

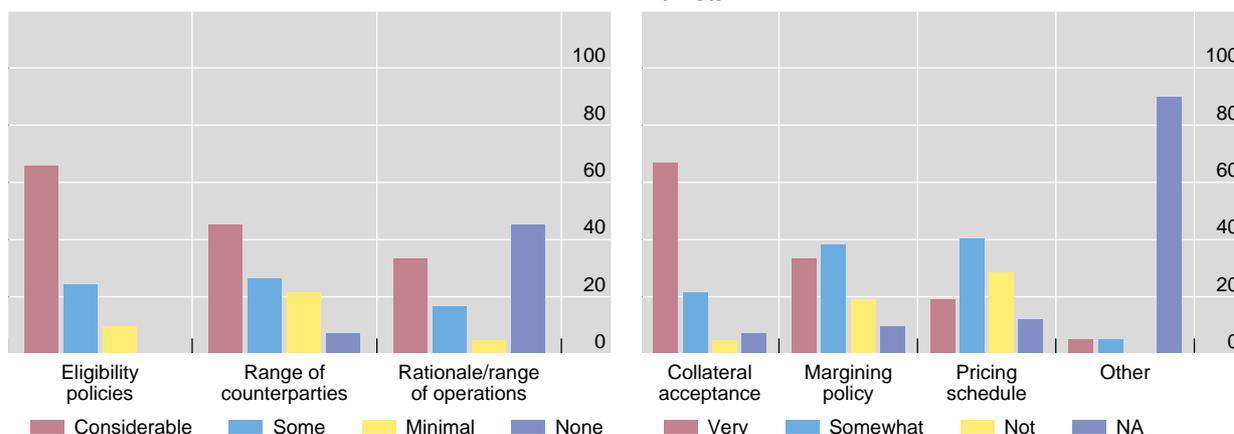
Effects of central bank policy on collateral markets

In per cent of total respondents

Graph 5

Central bank policy effects on collateral markets

Importance of central bank eligibility policy on collateral markets



Source: National central banks.

In principle, announcement of eligibility can have an impact even before the new policy is formally in effect. For example, the Bank of Canada's announcement of different phases of its term Purchase and Resale Agreement facility was associated with both a transitory and a persistent reduction in the liquidity premium for banks' three-month funding costs – an average reduction of 9 basis points in the three month CDOR-OIS spread.²⁶ This underscores the liquidity insurance benefits of holding assets that gain central bank eligibility.

At the same time, some debt markets are so large and liquid that central bank collateral policy has only a limited impact on the market. As such, several central banks surveyed for this report responded that there had been no observable quantitative impact when they had targeted assets from such deep and liquid markets in order to broaden eligibility – a factor that can help mitigate many possible side effects (such as the implicit subsidy of broadened eligibility for asset holders). Examples include the Central Bank of Mexico's move to accept US dollar cash collateral and Sweden's Riksbank making own-use covered bonds eligible. The ECB, in turn, reported only weak statistical evidence of market impact when it made foreign currency-denominated assets eligible (see Box 6).²⁷

Eligibility is also a key element of central bank operating frameworks because other ways of altering central bank collateral policy may not come into effect without prior changes to eligibility. One example is haircuts and other risk mitigants, as discussed in more detail below. Another example is access policies. In the United

²⁶ Care should be taken when interpreting this result, though, as some of the term PRA announcements happened concurrently with other announcements, such as the eligibility of non-mortgage loans in the large value payment system – another factor that may have contributed to lower bank funding costs, as measured here (see Enejajor et al. (2010)).

²⁷ An important caveat is that many of these policy changes were made during the 2007–09 period in a context of considerable market dislocation, possibly masking the impact of central bank eligibility decisions.

Eurosystem eligibility of foreign currency-denominated assets

The Eurosystem generally only accepts collateral denominated in euros. However, on two occasions, in October 2008 and again in September 2012, the collateral framework was temporarily extended to include debt instruments denominated in certain other currencies.

This box examines the price effect of such changes on the affected assets, which could be indicative of an “eligibility premium”. It does so by estimating the price reaction around the announcement of an asset’s inclusion in the Eurosystem’s collateral eligibility base. The implicit assumption is that such an announcement does not carry any additional informational content related to the fundamentals of the particular asset. Thus, any price reaction is assumed only to reflect the value of the option to convert the relevant asset into reserves through reverse operations.

Three dates are considered: 15 October 2008, 12 November 2008 and 6 September 2012. On these dates, it was announced that marketable debt instruments denominated in US dollars, pounds sterling and Japanese yen, when issued and held in the euro area, were eligible as collateral in Eurosystem credit operations. The price reaction is computed over time windows starting one day prior to an announcement and extending to one day following the announcement. This time window should be narrow enough to exclude the impact of other factors at play, but also wide enough to capture market expectations incorporated in the price immediately prior to the announcements.

Table A presents some summary statistics for each of the considered dates, as well as after pooling all observations together. From an initial population of around 2,000 newly eligible assets, there is only a limited share, ranging from 283 to 351, with available price quotes around the respective announcement days, indicative of the very low liquidity in many of these assets. In general, announcements of extended eligibility are associated with relatively small average price movements, ranging from -0.09% to 0.18 , with low statistical significance. In fact, only for the first announcement in October 2008 can the average response be considered as marginally significant, with a p -value of 0.08.

Eurosystem collateral eligibility expansion: price impact on affected assets¹

Table A

| | 15 Oct 2008 | 12 Nov 2008 | 6 Sep 2012 | All dates (pooled) |
|------------------------------|-------------|-------------|------------|--------------------|
| Number of observations | 351 | 339 | 283 | 973 |
| Observations >0 | 236 | 222 | 110 | 568 |
| Observations ≤0 | 115 | 117 | 173 | 405 |
| Median | 0.02 | 0.02 | -0.01 | 0.01 |
| Mean | 0.18 | 0.03 | -0.09 | 0.05 |
| p -value (t-test: mean >0) | 0.08 | 0.40 | 0.93 | 0.23 |

¹ Price responses are calculated over a time window starting one day prior to an announcement and extending to one day following the announcement.

Source: ECB.

Kingdom, for instance, until October 2009, only banks with over £500 million in eligible liabilities were granted access to the Bank of England’s Sterling Monetary Facilities. But even when smaller banks were granted access, their ability to use these facilities was limited by the amount of eligible collateral they possessed. An important factor was that they were too small to issue securitisations and so, at the time, their limited holdings of gilts and other government debt were their main eligible assets. In 2011, the Bank of England thus made non-securitised loans eligible, increasing the amount of usable collateral, in particular for these small institutions.

There is also evidence that eligibility-induced issuance incentives can be an important source of structural effects, as banks look to issue more of certain types of central bank-eligible assets. In line with this reasoning, for example, the issuance of bank bills and CDs in Australia increased from around \$40 billion in 2002 to some \$80 billion in 2007 once the RBA had made them eligible. Similarly, there is evidence that market participants tend to adjust their asset allocations in ways that see assets structured so as to meet central bank eligibility criteria. For example, the introduction of ABS transparency requirements by various central banks appears to have had structural effects on collateral issuance patterns, based on changes in the documentation of newly issued ABS in order to comply with these requirements.²⁸ There is also some evidence from discussions with market participants that banks and other ABS issuers have structured their deals to ensure that they meet central bank eligibility requirements and that investors use assets' central bank eligibility as a broad quality benchmark.²⁹

3.2 Haircuts

The haircut policy of a central bank, together with its assessment of the underlying credit quality of eligible collateral and other risk mitigants, is one of the key dimensions of its operations in collateral markets. As a general rule, the importance of haircuts will differ across central banks according to their operational setup, with operations based on structural liquidity deficits more likely to have facilities with broad collateral pools and differentiated haircuts. At the same time, most central banks represented on the Study Group indicate that the main driver of their haircut policy is risk management, and not the broader policy goal of providing liquidity to the market. Central banks are most likely to be called upon to lend in stressed market conditions when other market participants are reluctant to do so. This involves a trade-off, as haircuts need to be sufficiently conservative to be able to withstand potential asset market stress but still supportive of the central bank's policy objectives.

Theoretical effects. Central bank haircuts will tend to impact collateral markets through the structural channel, by changing the degree of pledgeability of a given set of collateral assets. In doing so, they are closely tied to asset eligibility in that broader collateral pools will tend to imply more differentiated haircut schedules. At the limit, haircuts approaching 100% imply ineligibility. But they can also have scarcity effects – the greater the haircut on an asset, the more of the asset the counterparty must provide to the central bank in order to collateralise a given amount of borrowing, thereby reducing the quantity of the collateral available to generate funding in private markets or for other purposes. On the other hand, higher haircuts may lead to substitution effects by incentivising counterparties to post other types of collateral (see the example discussed in Box 7).

A key determinant of the influence of haircut schedules on collateral markets is how they are set and how often they are adjusted. Typically, central banks seek to set

²⁸ One example is the European ABS loan-level initiative, which was aimed at improving transparency in ABS markets by requiring loan-by-loan information to be made available and accessible to market participants, and to facilitate the risk assessment of these securities when used as collateral by Eurosystem counterparties in monetary policy operations (see CGFS (2013)).

²⁹ On the possible role of central banks as standard setters in securities markets, see CGFS (2013).

haircuts in ways that align the residual risks of eligible collateral assets (a practice sometimes termed the *neutrality principle*).³⁰ In this context, haircuts would affect markets primarily in cases where they do not satisfy the neutrality principle. Such deviations can very well be intentional, say, due to macroprudential considerations.³¹ This would be the case, for example, when central banks choose higher haircuts than those set in the markets, at least in normal times, in order to avoid undue procyclicality from haircut changes.³² Indeed, given that central banks are large idiosyncratic players in collateral markets, in the sense that they are free of counterparty and liquidity risk, it may well be argued that central bank collateral frameworks should not necessarily be neutral.

Indeed, even when a central bank does not intend to influence markets, its risk control framework might not adjust frequently enough to remain completely neutral as market conditions change. As a result, the central bank's haircuts may act as a cap on market haircuts: since they can always repo an asset with the central bank at a set haircut, market participants are unlikely to do so with a private market counterparty unless the relative pricing in private markets is sufficiently attractive. At the same time, by specifying a specific haircut for an asset, the central bank discloses its assessment of the asset's credit quality, liquidity properties, and possibly other types of risk, which in itself may influence the haircuts set by market participants and CCPs. This highlights the trade-offs that central banks face with respect to the degree of transparency of their operational frameworks. Although a fully transparent regime, which explicitly publicises eg the central bank's haircut, margining and pricing schedules, may benefit market participants in some regards, it may also induce them to rely too heavily on the central bank's criteria, instead of making their own risk assessment.

Evidence. Evidence from both empirical analyses and case studies on the impact of haircut policies is limited, and opinions varied in discussions with market participants. Some suggested that haircuts observed in collateral markets could change if the central bank were to modify its own haircuts for a given security or collateral class (see Appendix 4). Others, including some investment and asset management firms, reported that because they trade only very high-quality sovereign debt, they are not charged haircuts on this collateral by their repo counterparties and are therefore not affected by changes to central bank haircuts. Indeed, some market participants thought that CCPs' haircuts had a much more significant impact on market practice.³³ More generally, many market participants

³⁰ To achieve such risk neutrality, central banks often use market-based prices and haircuts that, in theory, should reflect actual market and liquidity risk. As a result, no eligible asset should in principle be privileged over another, and unintended distortions in the market should be kept to a minimum.

³¹ For a more detailed discussion, see CGFS (2010).

³² In the context of elevated liquidity premia, in principle, central banks may also temporarily consider choosing haircuts inside those quoted in the market in order to support market functioning or restart market activity. On the difficult trade-offs applying in this context, see CGFS (2014).

³³ CCPs reported that their larger members were very sensitive to differences between their haircuts and those of central banks, and would optimise their collateral so that it could be placed where it would be cheapest to deliver. In addition, counterparties would challenge a CCP if their haircuts materially exceeded that of a central bank. One CCP in particular noted that their primary concern is

Haircut changes to the Eurosystem's additional credit claims (ACC)

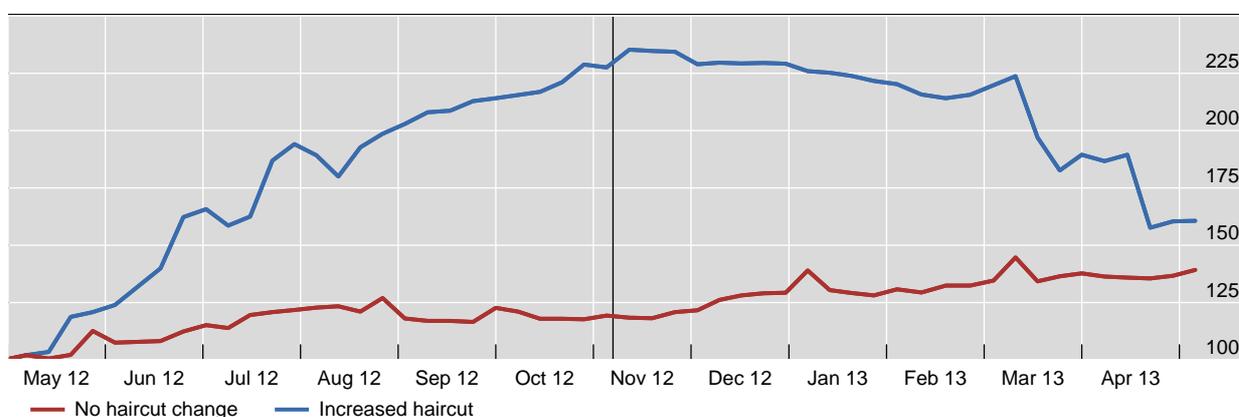
In July 2012, Eurosystem central banks conducted a review of haircuts applied to ACCs, resulting (after ECB approval) in a significant haircut increase for some categories of ACCs as of November 2012. Specifically, for the ACCs affected, the haircuts rose from less than 20% to as much as 80% of the book value of these claims.

One way of assessing the effects of this change is to track the evolution of the share of ACCs over total credit claims posted as collateral before and after the implementation of the increased haircuts, grouped by whether the jurisdictions accepting ACCs were affected by the increase or not.^① Graph A displays the weekly evolution of this share from April 2012 to April 2013.^② In countries where haircuts did not change, the use of ACCs continued to grow at a modest but steady pace throughout the period. By contrast, in jurisdictions affected by the rise in haircuts, ACC use expanded rapidly before the change – more than doubling between April and November 2012 – but subsequently stalled and reversed after haircuts were raised.

Use of ACCs over total credit claims at concerned Eurosystem central banks¹

25 April 2012 = 100

Graph A



The vertical line denotes the date of implementation of increased ACC haircuts in some jurisdictions (7 November 2012).

¹ Simple average across index numbers of individual jurisdictions (ie across national central banks).

Source: Eurosystem.

By separately examining the evolution of ACCs and other collateral categories posted with the respective national central banks, it is clear that the trends in Graph A are not driven by the denominator. Graph B displays the growth patterns of the absolute values of assets posted as collateral. Clearly, the change in haircut policy had an impact on ACCs only in the affected jurisdictions; in all other cases the prevailing trends continued.

Statistical tests confirm that the growth rate of posted collateral changed in a statistically significant manner following the increase in haircuts, for assets that were affected by this change. Using weekly data on the use of assets at the individual bank level, grouped according to whether the assets were affected by the rise in haircuts, average weekly growth rates of the value of assets posted were calculated before and after the change in haircuts. Table A shows that for assets with unchanged haircuts, there is no significant difference (based on a t-test) between the average growth rates before and after the haircut policy change (Panel I). Instead, for assets affected by the increase in haircuts the growth rate in the second period was substantially lower than prior to the increase in haircuts. Moreover, the difference in growth rates, about 2.75% on a weekly basis, is highly statistically significant (Panel II). These results are confirmed for paired observations of growth differences, ie considering average differences calculated for each bank (Panel III).

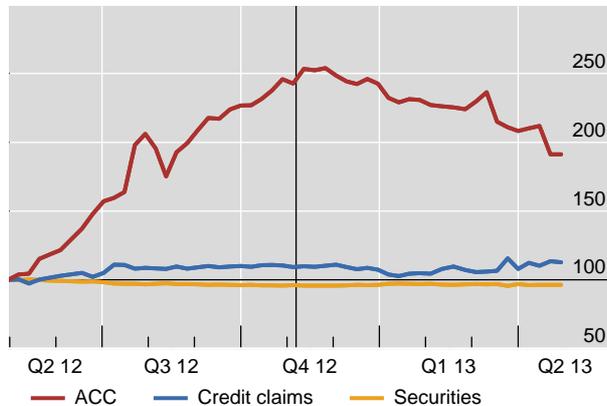
risk management, whereas central banks must consider the broader policy implications of their decisions. According to that CCP, this explained why their own haircuts have considerably exceeded those of the ECB on peripheral euro area sovereign debt in recent years.

Collateral use at concerned Eurosystem central banks

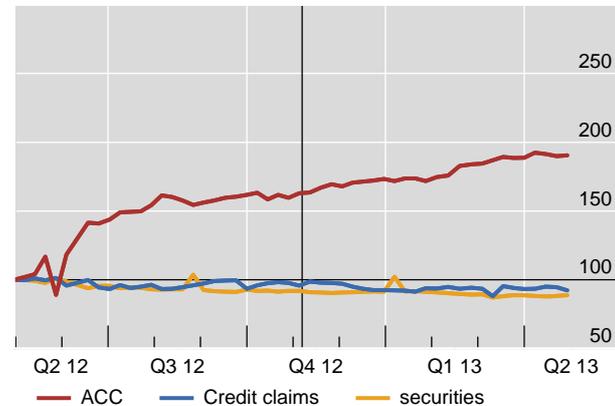
25 April 2012 = 100

Graph B

Jurisdictions where haircuts rose



Jurisdictions with no change in haircuts



The vertical line denotes the date of implementation of increased ACC haircuts in some jurisdictions (7 November 2012).

Source: Eurosystem.

To conclude, the statistical results corroborate the descriptive evidence documented in Graphs A and B with regard to the effect of rising haircuts on the use of assets as collateral. The effects uncovered here can be considered relatively “clean” in the sense that the analysis has been restricted to a single quite homogeneous category of assets, ie non-marketable ACCs, for which some specific assets were subject to a significant change in haircuts while others, with otherwise similar characteristics, were not.

Weekly growth rates of posted collateral by asset type

Table A

| | Number of observations | Mean | StDev | Minimum | Maximum | t-Stat | p-value |
|--|------------------------|---------|--------|---------|---------|---------|---------|
| Panel I: Assets with unchanged haircut | | | | | | | |
| Subperiod: | | | | | | | |
| After change | 139 | -0.0003 | 0.0881 | -0.5064 | 0.4924 | | |
| Before change | 130 | 0.0033 | 0.0553 | -0.1210 | 0.5115 | | |
| Difference (after–before) | | -0.0036 | 0.0741 | | | -0.4041 | 0.6927 |
| Panel II: Assets affected by the increase in haircut | | | | | | | |
| Subperiod: | | | | | | | |
| After change | 55 | -0.0092 | 0.0186 | -0.1196 | 0.0634 | | |
| Before change | 52 | 0.0183 | 0.0351 | -0.0970 | 0.2290 | | |
| Difference (after–before) | | -0.0275 | 0.4460 | | | -3.1800 | 0.0019 |
| Panel III: Paired observations, after – before haircut change | | | | | | | |
| Event: | | | | | | | |
| No haircut change | 128 | -0.0069 | 0.0703 | -0.5064 | 0.1560 | -1.1114 | 0.2664 |
| Increased haircut | 52 | -0.0280 | 0.0553 | -0.2447 | 0.0504 | -3.6512 | 0.0003 |

[ⓐ] The analysis is based on a data set consisting of weekly observations on the use of collateral of Eurosystem counterparties, which provides detailed information for each bank about the characteristics of the individual assets deposited with the concerned national central bank of the Eurosystem. ACCs are compared with “total credit claims”, and not with total assets deposited as collateral, since in the first case the two components of the ratio are more homogeneous.

[ⓑ] To gauge the impact on the amount of collateral posted, the shares are based on the value of collateral before haircut.

indicated that the price volatility of the underlying asset and collateral quality remained the main determinants of haircuts.

Responses by market participants in the euro area differed somewhat from this more general assessment, in that a majority of respondents viewed the central bank's operating framework as particularly relevant for haircut schedules in collateral markets. Several respondents mentioned the case of Eurex as a possible example of how an increase in ECB haircuts could lead to an increase in the haircuts for transactions that are cleared via CCPs. This suggests that central bank haircuts matter most when they differ from those quoted elsewhere. Moreover, the ECB's haircuts are apparently used sometimes as a baseline also for bilateral repo trades. It was mentioned, for example, that many of the haircut schedules of collateral service agreements are arranged based upon the ECB's schedules.

One particularly interesting piece of empirical evidence on the effects of changes to a central bank's haircut policies on collateral markets is the application of the Eurosystem's increase in haircuts to "additional credit claims" (ACCs). The ACC framework was implemented by the Eurosystem in December 2011 as a temporary measure to allow credit claims, such as pools of residential mortgages, to be eligible in some euro area jurisdictions (see Tamura and Tabakis (2013) for further details).³⁴ Following its introduction, the use of this new type of collateral rapidly gained ground among counterparties across a number of euro area economies. In 2012, haircuts for some categories of ACCs were significantly increased in some of these jurisdictions, affecting the composition of the pledged collateral pool. Specifically, the use of ACCs in central bank operations in the affected jurisdictions fell substantially due to their relatively reduced attractiveness as a collateral asset (see Box 7).

3.3 Counterparty access policy

The counterparty access policy of the central bank is one of the key factors linking central bank operations with how funding conditions are determined in the economy. In particular, whether the access policy is "wide" or "narrow" (ie open to a broad range of competing institutions or only to a limited subset), can matter for the pricing of collateralised funding and other conditions facing banks in the economy.³⁵ Specifically, while differences between both setups will typically be small under normal circumstances – reflecting differences in the degree to which a given financial system is market- or bank-based – they can be expected to increase in more stressful environments.

Narrow vs wide frameworks. In a narrow access policy framework, where only a limited number of banks have access to central bank operations (broker-dealer system), banks with access may influence the funding conditions for other banks in need of central bank liquidity. Since banks' collateral has to go through a broker-dealer before being posted at the central bank, the terms of any transaction between banks and dealers will matter, including in terms of pricing and haircuts (adding to any haircut demanded by the central bank).

³⁴ Eurosystem central banks that decided to accept such credit claims, set the relevant eligibility criteria and risk control measures, subject to the ECB Governing Council's prior approval.

³⁵ See Markets Committee (2013).

In a wide access policy framework, all banks will face similar conditions when applying for central bank funding. Moreover, all else equal, the broader the range of eligible counterparties, the more diverse the pool of collateral assets held on their balance sheets is likely to be (see Cheun et al (2009)). Hence, contingent on the limited (large) number of eligible asset classes and the shallowness (depth) of the markets in which they trade, the impact of changes in the operating framework on collateral markets (eg collateral asset prices, volatility, volume) should be more (less) significant. As discussed in Appendix 2, in times of financial distress, including liquidity freeze episodes, central banks operating with a narrow range of counterparties may need to enlarge that range, in order to ensure broad access to liquidity for the financial system. This is consistent with central banks' activities during the crisis, as documented in the literature (see Markets Committee (2013)).

Theoretical effects. As for other design choices, changes to central banks' counterparty policies can lead to both scarcity and structural impacts. A broadening of counterparty access, for example, may have structural effects if new counterparties divert funding into central bank-eligible assets to be able to benefit more from central bank liquidity insurance. Another structural effect could be that new counterparties may switch asset allocation from high-quality assets, as perceived by the market, into lowest-quality central bank-eligible assets, thereby adjusting their liquidity buffers.³⁶ As mentioned, a central bank that broadens counterparty access may find that it needs to also broaden the range of eligible assets in order to be able to provide meaningful liquidity provisioning to new counterparties, which are often smaller institutions with limited holdings of high-quality and liquid collateral (see Section 3.1 above).

Scarcity effects, in turn, could be induced if broadening counterparty access helps to reduce the cost of funding for new counterparties, which are perceived as less risky and more resilient to liquidity shocks once they have direct access to central bank facilities. As a result, they would need less collateral (or face lower haircuts) to raise the required funding, thereby reducing the scarcity of collateral.

Evidence. The Study Group survey of market participants revealed that the eligible range of counterparties was the second most important aspect (behind eligibility policies) in terms of its perceived impact on collateral market functioning (Appendix 4). About half of the respondents considered counterparty policy as having a considerable impact, while another 20% viewed it as having some impact.

Tentative case study evidence is provided by the expansion of the Bank of Canada's term purchase and resale agreement (term PRA) facility in 2008, which included broadening the range of eligible counterparties.³⁷ The move had a direct

³⁶ Interactions between liquidity regulation and central bank operations are the subject of a separate CGFS-MC Working Group and are not discussed here.

³⁷ Kraenzlin and Nellen (2014) provide some further empirical evidence of the importance of counterparty access to central bank funding. They find a statistically and economically significant funding advantage in the Swiss franc unsecured money market for banks with access to central bank and secured interbank funding. Before the financial crisis, such banks paid some 6 basis points less, on average, for unsecured loans in the interbank market than banks without access to the SNB's operations and the repo market. This price advantage gradually disappeared following the Lehman bankruptcy, reflecting the diminishing value of direct access to secured funding in the wake of the central bank's crisis response.

The Canadian term purchase and resale agreement programme

The Bank of Canada responded to heightened crisis-related funding pressures by conducting term purchase and resale agreement (term PRA) operations. These operations were designed to provide short-term (but longer than overnight) collateralised funds to counterparties. As funding conditions continued to deteriorate in late 2008, the Bank of Canada responded by materially expanding the scope of the term PRA facility, including by expanding the eligible counterparties from solely primary dealers to include all direct participants in the Large Value Transfer System (LVTS), but also by increasing the size of the operations and broadening the range of acceptable collateral.

The term PRA facility was effective in influencing funding conditions. Following the most aggressive implementation of the term PRA programme in the latter part of 2008, there was a fairly rapid decline in bank funding spreads, including those in collateralised markets.

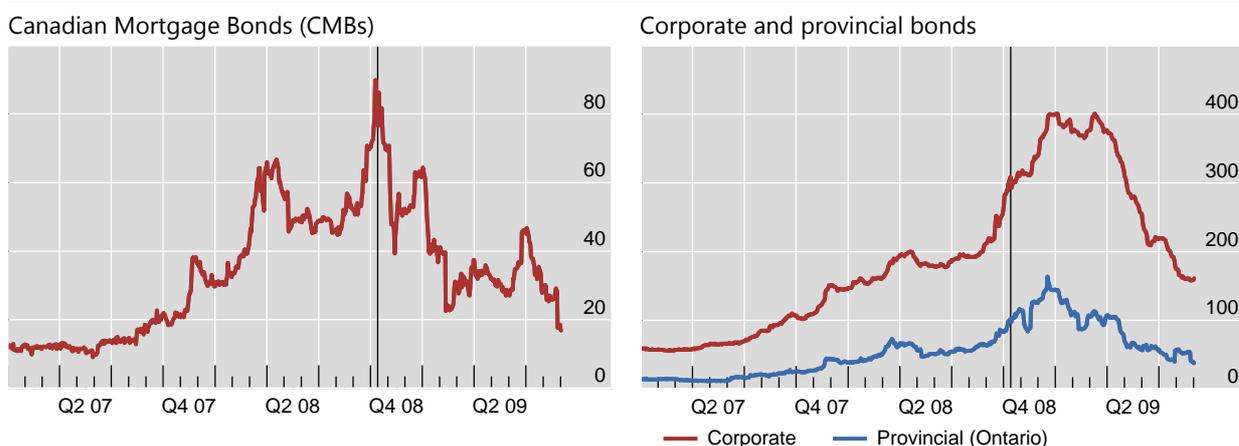
Deteriorating funding conditions during the crisis had led to a marked increase in the yield spreads on Canadian Mortgage Bonds (CMBs) relative to bonds issued directly by the government. Since CMBs are explicitly guaranteed by the government, any changes in the spreads of CMBs therefore reflected differences in market liquidity rather than in credit risk. Following the significant expansion of the term PRA in late 2008, CMB spreads declined significantly, dropping by more than 30 basis points (Graph A, left-hand panel). This reduction in CMB spreads occurred while other spreads (for corporate and provincial securities) continued to increase as the crisis intensified (Graph A, right-hand panel). This suggests that the measures taken to expand the term PRA programme had a direct impact on the market liquidity of this segment of the Canadian collateral market, enhancing its usefulness in collateralising private market transactions.

One caveat in interpreting these results, however, is that the expansion of the term PRA facility coincided with other assistance measures, including direct purchases of pools of insured residential mortgages by the government, which may also have contributed to downward pressure on CMB spreads.

Canadian spreads relative to government bonds¹

In basis points

Graph A



¹ The vertical line shows the date the Bank of Canada significantly expanded the size of term PRA operations and extended eligible counterparties to include all direct LVTS participants (14 October 2008). Data are for five-year bonds.

Source: Bank of Canada.

impact on collateral markets in Canada in the form of substantial declines in mortgage bond spreads (see Box 8). Yet, while this suggests that this policy dimension may be important for collateral markets, the change in counterparty access coincided with changes in other important design features (such as increases in the size of the operations and broadening of the range of acceptable collateral),

blurring their effects.³⁸ The effects of the expansion of the term PRA facility can therefore also be seen as evidence of the importance of operational parameters more generally (see Section 3.4 below).

3.4 Operational parameters

In addition to eligibility, haircuts and counterparty access policy, the operational terms of transactions make up the fourth key dimension of central bank operations in collateral markets. There are at least three relevant operational factors to central bank collateral operations: the size of the operations, the term of the transactions, and the type of allocation mechanism. The last factor, the type of allocation, refers to the fact that some repo or asset purchase operations are conducted on a demand-driven basis, while others are done on a competitive auction basis.

Theoretical impact. Since central bank operations are effectively asset swaps, the impact of those swaps depend on their size, term and other features. The term of any such transactions determines how long the collateral will remain encumbered at the central bank. The longer the asset is encumbered, the less time it is available for reuse in the market, and hence the greater the possible scarcity.³⁹ This may then guide other design choices, such as whether the relevant collateral is made available for reuse via securities lending (see above).

Encumbrance is also affected by the scale of central bank operations. Some central bank facilities are designed to provide large amounts of liquidity to the market as a whole (withdrawing collateral), while others are there only for bilateral (and, hence, likely more limited) use. The greater the scale of the operation, the more collateral can become encumbered at the central bank, adding to any scarcity effect.⁴⁰ Market functioning, in turn, will depend crucially on the scale of the respective central bank operation (and the encumbered collateral) relative to the size of the underlying market or market segment. Moreover, the type of transaction, ie “permanent” operations such as outright purchases as opposed to temporary operations such as repos, will be important in this regard.⁴¹

Evidence. The recent crisis provides some evidence for the scale effects of central bank operations on collateral markets. For example, as mentioned above, before the crisis many central banks supplied central bank liabilities regularly via the repo of government securities or bank assets. Because these operations were

³⁸ The expansion of the term PRA facility also coincided with the introduction of the Insured Mortgage Purchase Program, a scheme under which the Canadian government would purchase residential mortgages from financial institutions, further complicating the interpretation of subsequent price moves in Canadian mortgage bonds.

³⁹ Obviously, in cases where the central bank sterilises liquidity surpluses, the term of transactions will instead matter for how long the additional collateral will be available in the market, and how accessible it is for reuse.

⁴⁰ The scale and term of a transaction will also tend to be important for the impact on collateral markets when operations are not strictly aimed at collateral markets *per se* (eg in the case of large-scale asset purchases).

⁴¹ The delineation of permanent and temporary operations is not always clear when the term of temporary operations is very long.

The Bank of England's gilt Asset Purchase Facility (APF)

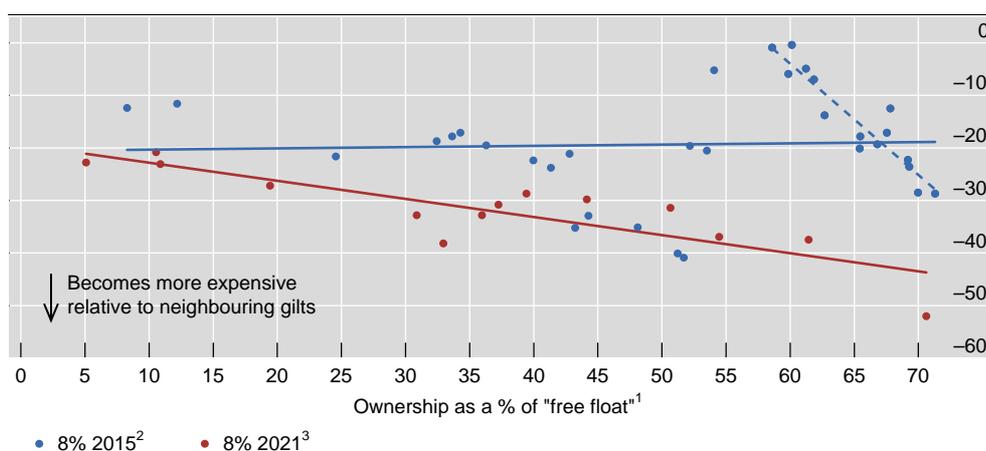
Under the Asset Purchase Facility (APF) for gilts, the Bank of England purchased large amounts of UK government bonds (gilts) in order to induce scarcity effects on longer-duration and credit risk-free collateral assets. The Bank purchased gilts across the UK yield curve in regular purchase auctions. The extent to which it purchased individual gilts depended on auction participants' and market behaviour. Soon after its launch, the APF had accumulated large amounts of specific gilts relative to other gilts in the market, such that there was a risk of causing undesired scarcity effects in individual gilt market segments. To avoid these effects, the Bank introduced a 70% limit on its purchases of any given gilt and, together with the UK Debt Management Office, launched the APF Gilt Lending Facility. This facility ensured that gilts owned by the APF were available for lending to gilt market participants.

As of mid-2014, the APF owned over 70% of the free float of the 8% 2015 and 8% 2021 gilts and there is some evidence that, relative to neighbouring gilts, these securities increased in value as the APF's ownership approached 70% of the free float. Graph A illustrates the (butterfly) spreads of these two gilts to their neighbouring gilts on APF operation days (ie the spread earned from purchasing two units of the 8% 2021 gilt and selling one unit each of the next shortest and next longest maturity gilts). As the APF's ownership increased, the 8% 2021 gilt became more expensive (ie its yield fell) relative to its comparators. While the same clear trend is not observable for the 8% 2015 gilt for the 0–60% APF ownership range, there may be some evidence that it increased in value relative to neighbouring gilts as ownership increased beyond 60% of the free float.

UK gilt relative value – butterfly spreads

In basis points

Graph A



¹ Gilts in issue minus UK government holdings. ² The butterfly spread of the 8% 2015 gilt to the 4.75% 2015 and 4% 2016 gilts. ³ The butterfly spread of the 8% 2021 gilt to the 4.75% 2020 and 4% 2022 gilts.

Sources: Bloomberg, Bank of England and Bank of England calculations.

reasonably predictable and limited in size, they had a relatively limited impact on the associated collateral markets via the demand or supply of collateral assets, ie via scarcity effects (see eg Appendix 2).

By contrast, in its Large-Scale Asset Purchases, the Federal Reserve has purchased relatively large amounts of government securities and agency mortgage-backed securities,⁴² which had the intent and effect of significantly influencing their

⁴² At the end of 2013, the Federal Reserve held agency MBS and Treasury securities to a value of \$3.8 trillion. Treasuries made up \$2.2 trillion of this, representing almost 19% of all marketable Treasury

price and availability in private markets.⁴³ Programme size, therefore, was set to maximise an intended scarcity effect aimed at a compression of premia and demand spillovers into other markets. Other central banks have operated similar programmes, such as the Asset Purchase Facility (APF) for gilts used by the Bank of England. The latter also highlights how relative size across different market segments can be managed to minimise unintended side effects in terms of market functioning (see Box 9). While the effects discussed above relate mainly to the direct pricing impact of operations on assets that are often used as collateral, such operations can also affect the use of these assets as collateral *per se* as a result of greater scarcity of the assets, as well as through increased encumbrance.

Although the impact of policy operations on collateral markets may primarily stem from volume (ie scale) effects and their impact on prices, the announcement of a temporary and extraordinary operation in a crisis situation can have an immediate effect. An example is the Eurosystem announcement in May 2009 of the launch of the Covered Bond Purchase Programme (CBPP), which was aimed at stabilising the market for covered bonds in the euro area and helping resolve banks' refinancing problems. Beirne et al (2011) found that covered bond spreads tightened noticeably – by up to 7 basis points – in most euro area covered bond markets on the day of the CBPP's announcement. Another example is the introduction of central bank foreign exchange swap lines during the financial crisis. These currency swaps, as well as increased cross-currency collateral eligibility, played an important role in managing cross-border stresses during the crisis.

4. Summary and policy implications

This report aims to facilitate coherent and meaningful discussions among central banks of their operational frameworks and of any impact that changes to these frameworks are likely to have on the markets for collateral assets. To this end, the previous sections provided a broad conceptual framework for the analysis of such changes. In reviewing the evidence for the effects of different central bank choices on collateral markets, previous sections also provided a number of metrics and other practical tools that could aid central banks' assessments of how their operational choices may affect the markets for collateral assets.

Based on this analysis, one can draw a number of lessons:

1. **Frameworks and policy intentions.** Central bank operating frameworks, by their reliance on asset swaps for the conduct of central bank operations, influence collateral asset markets in a variety of ways. While they are not usually the most important factor influencing these markets, the evidence presented in this report indicates that the influence of central banks may at times be significant. In some instances, operations or operational features chosen for other reasons may have unintended effects on the availability of collateral and its pledgeability. In other cases, central banks may intentionally influence them to better achieve their policy objectives. They can do so either by targeting

securities; the holdings of agency MBS represented around 28% of outstanding fixed-rate agency MBS (see Federal Reserve Bank of New York (2014)).

⁴³ See, for example, Christensen and Gillan (2012) and Meaning and Zhu (2011).

specific collateral assets directly in the course of policy implementation (eg via large-scale asset purchases), or by taking action aimed at mitigating unintended side effects of other policy measures in collateral markets (eg by introducing securities lending programmes).

Central banks, therefore, need to understand the channels through which these effects play out, and they need to consider any effects from their operations for collateral markets as they implement their policies. An important requirement in this context is access to the relevant information on key collateral markets to better assess and manage any central bank impact, including metrics such as market size across different segments, market composition across different types of participants, as well as any proxies for eligibility premia (see below). This requires a mixture of market intelligence and “hard” data.

2. **Constraints and design choices.** A central bank’s choice of operating framework will reflect its policy mandate, legal constraints, and the structure of the relevant financial markets. Moral hazard concerns also constrain the set of policies that central banks are willing to pursue. All these factors will have a bearing on instrument choice and, hence, on the way these choices influence collateral markets. Systems that are more bank-based, as in the case of the euro area for example, tend to have broader central bank collateral frameworks and access policies than those with a more capital market-based structure (eg the United States). Liquidity-absorbing central banks, in turn, will tend to use different tools than those that are primarily liquidity providers. Instrument choices, finally, will differ across normal and stressed environments (see below).

Yet, while constrained by these factors, central banks can use a wide variety of design choices to influence collateral markets as well as to fine-tune the effects of their operations for these markets. In addition to different instrument choices (such as outright purchases versus collateralised lending) these include: *eligibility policy, haircut and other terms and conditions, access/counterparty policy, as well as operational parameters* (such as the size and term of the transactions as well as the allocation mechanism).

3. **Interdependencies.** Design choices, however, cannot be made independently. Collateral eligibility, for example, is tightly linked to haircut policy. (In effect, a 100% haircut on a given asset amounts to the ineligibility of that asset in central bank operations). Given risk management considerations, haircut settings can therefore counteract the intention of eligibility decisions. There is also a time dimension, in that risk management capabilities can constrain the effectiveness and time frame of an intended extension of eligibility. Eligibility, in turn, may have to be adjusted to achieve the desired impact on any changes to counterparty access, as illustrated by the UK experience where a widening of counterparty access required a concomitant increase in eligibility to ensure its effectiveness. Acceptance of more asset types across central banks, therefore, has generally gone hand in hand with more granularity in haircut and margin schedules as well as expanded counterparty access.

Regulatory requirements, along with its risk management capabilities, can be an important constraint on the central bank’s ability to actively use (changes to) eligibility criteria and haircuts to manage the impact of its policies on collateral markets. For example, eligibility criteria or haircuts that are different to those defined under requirements such as the liquidity coverage ratio (LCR)

will affect banks' incentives to participate in individual central bank operations or markets and can, for a given operation, incentivise banks to pledge less liquid and/or lower-quality assets within the range of assets defined by the central banks' eligibility requirements. Absorption of such assets by the central bank can then lead to higher counterparty and concentration risks, unless counterbalanced by other parameter choices.

Hence, in making these design choices, decisions relative to observed market practices are an important determinant of their impact. Haircuts, for example, will generally matter less for assets that are not used as collateral in private markets, as there are no displacement effects. Yet, they will tend to matter most when they differ from haircuts set elsewhere. Within the constraints set by risk management considerations (see above), both effects can be used to better manage the desired impact of policy measures.

4. **Useful tools and experiences.** While the specifics of how central banks may want to manage their influence on collateral markets will differ across jurisdictions and central bank mandates, central banks have gained experience with a number of useful instruments that can help in this regard.

One of these is securities lending facilities, which can be used to offset strains from supply-demand imbalances in specific collateral assets as well as to mitigate more general encumbrance effects resulting from collateral-absorbing central bank operations. Committed liquidity facilities, in turn, can help address more structural shortages of collateral assets (eg in the context of liquidity regulation). Eligibility rules and related structural requirements, then, can serve as a catalyst for changes in collateral market practices that are expected to have positive externalities (such as the ABS transparency initiatives recently sponsored by a number of central banks). Central bank currency swaps and cross-currency collateral eligibility, finally, have been used successfully to manage cross-border effects in some cases, provided that corresponding risk management demands have been met.

5. **Infrastructure design.** The operational design of market infrastructures can have a significant impact on collateral markets, especially as regulatory reforms result in greater reliance on collateralised funding. Since many central banks implement monetary policy and financial stability measures via central bank-operated infrastructure, the impact of infrastructure collateral requirements and other constraints must be considered when assessing the overall impact on collateral markets.

Efficient operational design of infrastructure can help improve the overall availability and mobility of collateral, allowing it to be reused more efficiently. Moreover, as financial institutions grow increasingly interested in the efficiency of their allocation of collateral, infrastructure policies and constraints may become even more important.

6. **Crisis preparedness.** A key distinction is between normal times and times of financial stress. In normal times, central banks typically operate at the margin and on a limited scale, which tends to constrain the impact of their operations on collateral markets. In times of stress, however, both the scale and method of central bank activity will tend to change. As was observed in the global financial crisis, central banks generally extended the tenor of lending, widened the eligible pool of assets acceptable as collateral, and expanded the set of counterparties eligible to borrow from the central bank. Such significant

changes suggest that it may be important for central banks to undertake robust planning focused on crisis preparedness. With good planning, responses to extreme events are likely to be more robust and resilient.

One area of planning is to consider what constitutes a suitable inventory of assets for use in collateral transformation activities (ie in order to supply high-quality assets into the market, as needed (eg against lower-quality or less liquid assets)). Another aspect is whether the central banks' risk management capacity is sufficient to assess asset quality for an enlarged pool of assets, if necessary, and to set appropriate haircuts. Moreover, some central banks may need to take steps to ensure they have adequate operational capacity to handle new types of collateral at short notice in a crisis situation.

Depending on the operational framework and market structure in place (ie whether or not the central bank can rely on deep and liquid markets for government securities), this can argue in favour of planning for somewhat wider asset pools (eg for longer-term refinancing operations) and flexible operational setups even during normal times (or in favour of maintaining capacity to accept such asset pools). For example, central banks are typically unwilling to take or lend against assets that they cannot understand, value and manage. Examining collateral outside of those assets currently eligible for use as collateral in lending operations can thus serve to provide better flexibility to the central bank in times of stress. In this context, having banks pre-position collateral was found useful operationally by some central banks, as it provided them with ample opportunity to value the collateral without encumbering the market participant's balance sheet. The same logic applies to the ability of central banks to manage a potentially wider set of counterparties. Maintaining a close dialogue with the supervisor can help in understanding the condition of both counterparties and assets, while maintaining appropriate incentives for central bank counterparties to manage risk.

7. **Transparency.** Central banks face trade-offs when choosing the degree of transparency associated with their operational frameworks. A fully transparent regime, which explicitly publicises eg the central bank's haircut, margining and pricing schedules may result in market participants using these to set their risk management parameters, instead of making their own risk assessments. On the other hand, a clear benefit of transparency is that counterparties are able to formulate better contingency funding plans because they know with more certainty which conditions they will face.
8. **Policy normalisation considerations.** Different tools to normalise monetary policy following the implementation of unconventional measures in the aftermath of the financial crisis will affect collateral markets differently across jurisdictions. Allowing runoffs of securities (as they mature), reverse repos, or asset sales would, if employed, tend to add to the supply of collateral assets available to the private sector, although with different implications for central bank balance sheets. The central bank's balance sheet will shrink in the case of runoffs and outright sales, while in the case of reverse repos the size of the balance sheet will be unaffected, although its composition will change. Central bank bills, in turn, will add new collateral assets, while other liquidity-draining tools, such as term deposits, will in general not add to collateral asset supply. In principle, therefore, and depending on instrument choice, central banks have a wide variety of options at their disposal to manage the policy normalisation process, while taking into account the impact on collateral markets.

A number of factors are important in this context. One is that the operating framework that central banks might choose to exit into (at least for some time) may be different from the framework that was in effect before the financial crisis. For example, in some jurisdictions, central banks operating with a floor system since the crisis may find it undesirable to go back to a corridor system for the foreseeable future. This may influence instrument choice and could necessitate additional measures to manage collateral market impact.

Another important factor is balance sheet composition and size. Asset holdings will shrink over time as they mature. Active adjustments, therefore, are only needed to the extent that central bank balance sheets shrink less rapidly than appropriate, given economic conditions. If the central bank does see a need to actively shrink its balance sheet, the ability to sell assets will depend on market depth (ie supply-demand conditions in collateral asset markets), with higher-quality, more liquid markets being more accommodative than those for lower-quality collateral. If such sales are undesirable, other liquidity-draining (collateral-supplying) tools need to be available to manage system liquidity and collateral supply. The preferred tools will depend on the specific situation in each jurisdiction, and on considerations such as the risk of spill-over effects across borders or market segments.

9. **Research.** Survey evidence from market participants shows that central bank eligibility policies are seen as a very important factor in collateral markets, and that, more generally, central bank operating frameworks can significantly affect prices in those markets. However, quantitative evidence of such effects, including, importantly, on the size and other characteristics of eligibility premia remains elusive. Given their potential importance in assessing the impact of central bank operations on collateral markets, more research is needed to pin down the determinants and economic relevance of eligibility premia with respect to central bank collateral eligibility. Better access to relevant data is a key requirement to make progress along this dimension, and efforts to make such data available to the academic community should therefore be welcomed.

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Appendix 1: Study Group mandate

Scope of work. To facilitate a better understanding of the impact of central bank operations on collateral markets, it is decided to establish a joint CGFS-Markets Committee Study Group. Building on the earlier work by both Committees,⁴⁴ the Group is asked to explore whether and how the design of central banks' operational frameworks influences private collateral markets, including collateral availability, pricing, related market practices, and market performance under stress.

The Study Group is asked to develop a conceptual framework for examining these issues and, where possible, provide analytical results and/or case studies (drawing on recent experiences with changes in operating frameworks) to support its findings.

Key questions to be addressed would include:

- **Impact of operational frameworks on collateral markets.** What are the channels through which various features of central bank operational frameworks affect collateral markets as well as market functioning more generally (eg in interbank markets)? How do these channels vary across time and economic conditions (ie normal times versus times of stress), or across asset markets? Are the channels different during periods in which unconventional monetary policies are in place? Are these effects primarily domestic, or are there potentially important cross-border or sectoral spillovers? Is there scope for feedback effects (ie ways through which collateral availability affects the design or effectiveness of central banks' operations)?
- **Policy implications.** To the extent that central banks' operating frameworks may have system-wide effects via collateral markets, should these effects be taken into consideration in designing these frameworks, and if so, how? How do these design choices interact with choices made in other policy areas, including liquidity regulation? Should central banks view the availability of collateral as a policy transmission channel (under stress conditions or more generally), and if so, how is it related to other elements of the policy framework? What role (if any) should central banks play in providing collateral-related intermediation or transformation services?

Process. The Study Group will be established after the November 2013 meetings of the two sponsoring Committees and will be chaired by Timothy Lane (Bank of Canada). The Group will work through teleconferences and face-to-face meetings. It would aim to reach out to the private sector and academia and would coordinate its work with the efforts of other central bank groupings, as appropriate.

To help focus the Group's work, it is expected to submit a progress update to the CGFS and the Markets Committee in May 2014. Based on any guidance by the sponsoring Committees' received on this occasion, the Group would then aim to deliver its draft final report in November 2014.

⁴⁴ See Committee on the Global Financial System, "Asset encumbrance, financial reform and the demand for collateral assets", *CGFS Publications*, no 49, 2013, and Markets Committee, "Central bank collateral frameworks and practices", *Markets Committee Publications*, no 6, 2013, for recent work on related issues.

Appendix 2: Pre-crisis and crisis implementation of monetary policy – two examples

This appendix, using the euro area and the United States as examples, describes key features of policy implementation before the financial crisis as well as how implementation has changed as a result of the crisis, and discusses broad implications for collateral markets.⁴⁵

Euro area monetary policy implementation

Until the start of the financial crisis in August 2007, the implementation of the ECB's monetary policy was characterised in particular by the following features:

1. *Separation principle between liquidity management and monetary policy stance.* Prior to the crisis, the ECB made a clear separation between, on the one hand, the determination of the monetary policy stance and, on the other hand, its implementation through liquidity operations. While the monetary policy stance was aimed at serving the ECB's primary objective, namely the maintenance of price stability, the implementation of the stance through liquidity operations was aimed at steering very short-term money market rates close to the ECB's key policy rate.
2. *Absence of outright portfolio for monetary policy purposes, compensated by large temporary operations.* Before the crisis, the Eurosystem had not conducted outright operations for monetary policy purposes, due to the lack of a single euro area sovereign bond market. Instead, the Eurosystem implemented its monetary policy through temporary operations that could involve very large amounts.
3. *Use of the MRO to signal the monetary policy stance and additional role of LTRO.* Before the crisis, the weekly Main Refinancing Operation (MRO) provided the bulk of the central bank liquidity and was pivotal in steering market interest rates via its minimum bid rate. By contrast, the three-month Longer-Term Refinancing Operations (LTROs), played only a supplementary role by providing additional longer-term refinancing to the banking system. They were not intended to send signals to the market, which is also why the Eurosystem acted as the "rate-taker" in these operations.
4. *Wide standing facilities corridor.* Before the start of the financial crisis, the width of the corridor between the two ECB standing facilities, the Marginal Lending Facility and the Deposit Facility, stood at 200 basis points. This was wide enough to ensure that the standing facilities were only used in exceptional circumstances and that counterparties made all efforts to transact in the market rather than rely on the costly standing facilities.
5. *Broad acceptance of collateral in all refinancing operations.* The Eurosystem monetary policy framework has been characterised by a broad acceptance of collateral, in terms of asset classes and credit quality (subject to appropriate risk control measures). This broad collateral framework is justified by (i) the large size of the monetary policy operations and (ii) the absence of fully

⁴⁵ For a broader perspective, focusing on collateral frameworks, see Markets Committee (2013).

integrated capital markets in the euro area and the lack of consolidation of the banking sector. The framework ensures a low cost and abundance of collateral for a broad range of counterparties across various jurisdictions.

6. *Wide range of eligible counterparties.* All credit institutions subject to minimum reserve requirements are eligible to participate in the Eurosystem's operations, provided they are deemed financially sound and meet some basic operational requirements. This policy ensures a level playing field by taking into account differences in countries' banking structures. It also overcomes the challenge of choosing a small number of counterparties in an environment where banking consolidation is lacking.

Prior to the crisis, the Eurosystem, despite the large scale of its temporary operations, played a limited "intermediation" role as it provided just the amount of liquidity needed by the banking system on aggregate, letting the banks redistribute liquidity in the interbank market. Several features of the Eurosystem monetary policy framework have supported activity in the interbank market, in particular the large size of the standing facilities corridor and the averaging mechanism for the fulfilment of reserve requirements.

The ECB's broad collateral framework has also had a positive impact on market activity and liquidity in both the repo market and the markets for the underlying securities. It allowed banks to participate in private repos while maintaining collateral buffers, consisting mainly of assets not accepted normally in the private repo market, for potential recourse to central bank liquidity. In addition, the ECB's haircuts are often used as references for haircuts in private repo markets. Overall, the ECB collateral framework has contributed to the gradual integration of euro area markets; however, this process has been disrupted by the financial crisis.

Changes in the implementation of the ECB's monetary policy since the start of the financial crisis

The start of the financial crisis in August 2007 led to major changes in the implementation of the ECB's monetary policy.

The inherent flexibility of the Eurosystem's operational and collateral framework initially helped the ECB address the challenges of the crisis by merely adjusting its framework without changing its principles. Faced with dysfunctional money markets, the ECB provided more long-term liquidity and took on a larger intermediation role in the distribution of liquidity since October 2008 by narrowing its standing facilities corridor and by conducting its operations as fixed rate, full allotment tenders. Moreover, collateral eligibility was further broadened.

However, the ECB had to go beyond merely adjusting the parameters of its monetary policy framework by taking non-standard measures aimed in particular at addressing market dysfunctions that severely impaired the transmission of its monetary policy. The ECB has implemented several outright purchase programmes since 2009, targeting the covered bond market and the sovereign bond market as well as the securitisation market. The fact that the ECB had to implement such programmes indicates the limits in the capacity of a broad collateral framework to address localised market dysfunction.

US monetary policy implementation

Before the crisis, the implementation of the Federal Reserve's monetary policy was characterised by the following features:

1. *Large size of outright monetary policy portfolios, small size of temporary operations.* The Federal Reserve adapted its monetary policy framework to the large and deep US capital markets. In particular, the size and depth of markets for US Treasury securities, agencies and agency MBSs allowed the Federal Reserve to conduct outright purchases in these segments while preserving market neutrality. Prior to the crisis, the Federal Reserve's outright asset portfolio amounted to approximately 91% of its balance sheet, and it was able to implement monetary policy with only very small temporary operations.
2. *Open market operations conducted with primary dealers.* Open market operations have been the Federal Reserve's main tool for managing the aggregate level of reserves in the banking system and thereby controlling the federal funds rate. For this purpose, the Federal Reserve has relied on a relatively small number of primary dealers who are active in government and agency securities markets as a way of affecting the supply of reserves available to the banking system.
3. *No interest on reserves.* Prior to 2008, the Federal Reserve did not have the authority to pay interest on reserve accounts. As such, the supply of reserves in the banking system was managed within a narrow range relative to demand for reserves. However, at times, if supply was far in excess of demand, the overnight federal funds rate could fall substantially from its intended target level.
4. *Discount window as backstop for depository institutions.* The Federal Reserve distinguishes between depository institutions (banks) that have access to primary credit (discount window) lending, and counterparties that are eligible for its open market operations. All depository institutions that have a reserve account with the Federal Reserve and an adequate supervisory rating have access to the discount window against a very broad range of collateral. Lending through the discount window has largely served the function of "lender of last resort".
5. *Narrow collateral eligibility for open market operations, broad collateral eligibility for the discount window.* Collateral eligible for open market operations is very restricted under the Federal Reserve Act: effectively only obligations issued or fully guaranteed by the United States or any agency of the United States.⁴⁶ By contrast, a wide range of collateral is eligible for the discount window.

Prior to the crisis, the Federal Reserve's monetary policy implementation essentially operated through the primary dealers, who played a key role in maintaining liquidity in private repo markets and in underlying collateral markets.

⁴⁶ The Federal Reserve Act permits Federal Reserve Banks to purchase and sell a number of other assets, among them banker's acceptances, foreign exchange, and obligations issued or fully guaranteed by foreign governments or agencies of foreign governments. These other assets are of limited practical consequence due to the nature of such operations, changes in market practice since their inclusion in the Federal Reserve Act or other limitations.

Primary dealers typically relied on short-term secured financing arrangements. At the same time, prior to the crisis, the Federal Reserve's balance sheet was structured to maintain a small deficiency in the level of reserves. This allowed for regular fine-tuning operations with primary dealer counterparties to adjust the supply of reserves.

As a supplementary "safety valve", the discount window typically functioned as a backstop, serving as a source of reserves when conditions in the federal funds market tightened significantly or when individual depository institutions experienced short-term funding pressures. However, the stigma associated with obtaining liquidity support through the discount window made banks extremely reluctant to use the facility, even in times of crisis.

Changes in the implementation of the Federal Reserve's monetary policy since the start of the financial market crisis

The Federal Reserve addressed the challenges of the crisis by first making discount window borrowing more attractive, and by providing more term liquidity to depository institutions against a broad range of collateral. It also made cross-border dollar liquidity available through the use of dollar liquidity swaps with foreign central banks. As the crisis developed, the Federal Reserve introduced new tools aimed at providing liquidity directly to borrowers and investors in key credit markets, in particular the commercial paper market and the ABS market. The introduction of various collateralised lending programmes effectively broadened the number and types of counterparties to which, and types of collateral against which, the Federal Reserve extended credit. In 2008, as the supply of reserves was increasing significantly, the Federal Reserve received authority to begin paying interest on reserves.⁴⁷

As the federal funds rate approached the zero lower bound, the Federal Reserve reinforced its accommodative stance by implementing Large-Scale Asset Purchases of Treasuries and agency debt and MBS.

Design of non-standard operations in the euro area and the United States

A comparison of the non-standard operations in the United States and in the euro area against the backdrop of their respective financial systems shows how the structure of the financial system has an impact on the design of the operations.

In the US, the breadth and liquidity of Treasury and agency MBS collateral markets allowed the Fed to smoothly conduct asset purchases without severely disrupting collateral markets. In the euro area, defining an asset purchase schedule was initially seen as more challenging. Instead, the LTROs provided an alternative funding channel for banks in the face of illiquid markets, allowing banks to post significant amounts of credit claims that were not traded in private markets. Moreover, given the heterogeneity of government debt markets and the fragmentation of the banking system in the euro area, the breadth of eligible collateral for the LTROs was a means to achieve wide effects across the euro area banking and financial system.

⁴⁷ The authority to pay interest on reserves was initially established under the Financial Services Regulatory Relief Act of 2006, but such payment was not authorized to start until October 2011.

In terms of the impact on collateral markets, asset purchases have typically had a much more direct impact than repos, as they represent direct market demand. In the case of a repo transaction, central bank counterparties may mobilise collateral that lies “idle” on their balance sheets. In this case, repo transactions may have minimal impact on collateral markets.

Finally, it is worth noting that the counterparty policy of the central bank is important in the case of repos, but less so in the case of asset purchases. In the latter case, the counterparties act merely as market intermediaries between the central bank and investors who want to sell their assets. By contrast, the large number of counterparties in the ECB operations was a necessary feature to achieve a system-wide effect across the euro area.

Appendix 3: Financial market infrastructure (FMI) and collateral markets

To facilitate the safety and efficiency of transactions, central banks typically operate one or more systems to transfer both funds and securities in the local currency.⁴⁸ Central bank design of such systems and their related collateral policies may affect the demand for collateral and the availability of collateral for alternative uses. Likewise, central bank choices about implementing monetary policy tools using one infrastructure versus another may result in different effects on collateral markets. Moreover, central bank actions to influence key operational features of private sector infrastructure may also impact collateral availability.

Central bank payment system policies

The provision of intraday credit is a recognised part of central banks' role in the payment system. Central banks provide intraday liquidity to enhance the smooth functioning of payment systems and typically require collateral to be pledged to mitigate the credit risks involved or they offer intraday credit through repo facilities.⁴⁹ Compared to an uncollateralised intraday credit regime, this collateralisation requirement may increase the overall demand for collateral and reduce the supply of collateral available for other purposes. Likewise, the types of collateral deemed eligible to secure intraday credit can affect the composition of collateral available for other purposes.

A majority of central banks have implemented free collateralised intraday credit, which may encourage the use of intraday liquidity when the opportunity costs of the collateral are low. While collateralisation of intraday liquidity use may reduce the collateral available for other purposes, it is generally considered desirable to protect the central bank from loss.

Coordination of central bank collateral policies for overnight and intraday lending can help increase the availability of collateral. A majority of central banks accept the same types of collateral for both overnight and intraday lending and pool the collateral for both lending facilities.⁵⁰ This allows participants to manage their collateral in a single pool against an aggregate exposure value, rather than having to assign specific assets to specific loans, thereby improving efficiency.

Design of central bank-operated FMIs

In response to the recent financial crisis, regulatory reforms are increasing the share of banks' assets that are encumbered and reducing the amount of collateral available for other uses. As institutions, in turn, place greater focus on optimising the use of collateral, central bank FMI design choices that affect collateral availability and mobility become even more important. Complex institutions increasingly demand real-time information on collateral availability and the

⁴⁸ See CPSS (2003).

⁴⁹ The Federal Reserve is a notable exception; it incentivises collateralisation, but continues to offer unsecured intraday credit for a fee in order to provide flexibility to market participants.

⁵⁰ See Markets Committee (2013).

flexibility to transfer collateral on a 24/7 time frame.⁵¹ The design of payment systems can either support or hinder collateral mobility. One example of how payment systems can affect collateral mobility relates to central bank FMI operating hours. Longer operating hours for a securities settlement system can facilitate participants' use and transfer of collateral, thus increasing collateral mobility.

The restrictiveness of collateral requirements in settlement arrangements can also affect the availability of collateral assets. When central banks' eligible collateral requirements are restricted to high-quality domestic assets, internationally active banks can find it costly to hold sufficient quantities of collateral in every market in which they operate.⁵² Mismatches between the location of their liquidity needs and the collateral they hold may result in liquidity and collateral pressures. Several central banks have responded by adopting approaches to accepting foreign assets. The launch of TARGET2-Securities in the EU, for example, will remove several operational barriers for cross-border settlement. The Eurosystem has also taken initiatives in support of cross-border tri-party collateral movement, which will allow institutions to access their assets regardless of the location of the counterparty or tri-party service. Such cross-border collateral arrangements can help increase the collateral available and relieve some collateral pressures.

Another FMI-related development that affects collateral markets is the increased use of liquidity savings mechanisms (LSMs) in payment systems and securities settlement systems. There are a wide variety of LSMs, including offsetting algorithms, conditional queuing, time-varying tariffs, and payment-splitting mechanisms that have the potential to reduce the need for intraday liquidity and the corresponding need for collateral. Since most intraday liquidity is required to be secured by collateral, this also allows more collateral to be available for other uses. For example, the introduction of an LSM in CHAPS, the UK's Large Value Payment System, led to around a 20% reduction in intraday liquidity demands in that system.⁵³

Similarly, the design of securities settlement systems (SSSs) can impact collateral availability. Most such systems are based on a delivery-versus-payment mechanism that involves the simultaneous settlement of securities and cash, reducing settlement risk. Several of the SSSs also have auto-collateralisation features that allow participants to use purchased securities immediately as collateral. These mechanisms both increase the availability of collateral, and allow for its more efficient use.

⁵¹ See CPMI (2014).

⁵² See CPSS (2006).

⁵³ See Davey and Gray (2014).

Appendix 4: Responses to surveys and interviews with market participants

Background on survey respondents

This appendix summarises the responses to the surveys and bilateral interviews conducted by the Study Group in 13 jurisdictions. The majority of respondents were banking institutions, although asset managers, hedge funds, clearing houses and corporations were also surveyed in a number of jurisdictions. Respondents were active in a wide range of collateral market activities including repurchase agreements (repo), securities lending, and clearing across a variety of products. While respondents were primarily involved in local government bond markets, many also participated in a diverse array of other collateral types, such as foreign government bonds, other fixed income products (eg corporate debt, agency debt), currency, derivatives, and equity markets. Survey respondents were provided with either a long-form survey which included multiple choice and open-ended questions or a short-form survey which only included open-ended questions. Some jurisdictions also followed up with bilateral interviews to discuss responses.

The appendix is organised according to the structure of the surveys, which included questions related to: (1) participation in collateral markets; (2) features, transmission channels, and effects; (3) normal vs crisis times; (4) normalisation of policy; (5) changing market structures and regulation; and (6) policy issues.

Participation in collateral markets⁵⁴

With respect to the factors influencing respondents' participation in collateral markets, nearly two thirds of respondents saw secondary market (tradability) conditions as a very important factor (see Graph 3 in Section 3). About half of the respondents also pointed to return enhancement, capital or accounting treatment, and primary market (marketability) liquidity as very important. Around 40% of respondents indicated that central bank operating frameworks were a very important element with respect to their participation in collateral markets, while another 40% or so considered it "somewhat important". Of note, no non-bank financial institutions viewed central bank operating frameworks as very important.

Overall, most respondents across jurisdictions indicated that their involvement in collateral markets is governed by both internal controls and external factors. Among the former, counterparty limits, collateral types, risk appetite, and liquidity mandates were commonly cited, while the latter included regulatory requirements and the degree of market liquidity.

⁵⁴ The graphs in this appendix, as well Graph 3 and 5 in the main text, are based on responses from those central banks that used the long-form survey: the central banks of China, India, Korea, the United States, and the European Central Bank. Information from the eight other jurisdictions that used the short-form survey is, nevertheless, included in the discussion throughout this appendix.

Features, transmission channels, and effects

With regard to the *features* of central bank's operating frameworks that affect collateral markets, roughly 70% of respondents viewed collateral eligibility policies as having a considerable impact (see Graph 5, left-hand panel, in Section 3.1). Among this group of respondents, collateral acceptance was cited as the most important aspect, while margining and pricing schedules were seen as having a more limited impact (Graph 5, right-hand panel). Both the range of counterparties and the rationale and range of central bank operations were viewed as having less of an impact than eligibility policies. Indeed, only about half and one third of respondents, respectively, pointed to these factors as having a considerable impact.

To the extent that the rationale and range of central bank operations were judged as having an impact on collateral markets, a share of respondents ranging between one half and nearly two thirds saw the nature of the operations as being very important (Graph A4.1). Of note, most non-bank financial institutions did not view the tenor of central bank transactions as being very important.

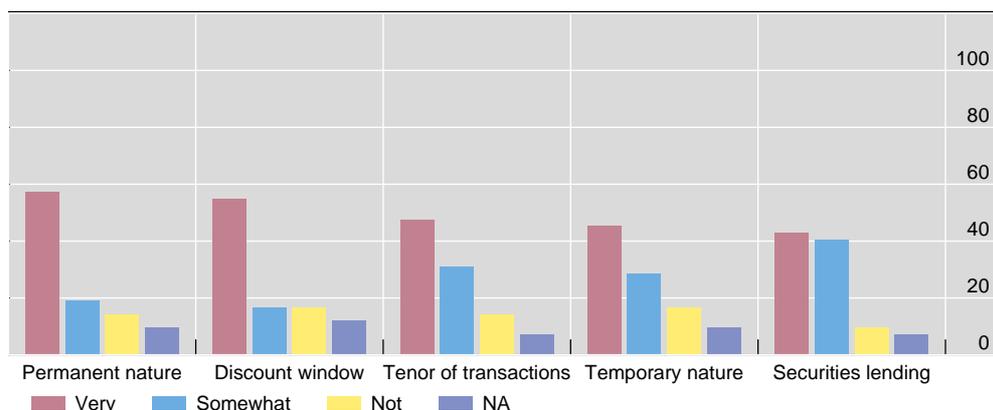
With respect to the *channels* through which central banks' operational frameworks affect collateral markets, survey respondents saw the pricing channel as being more important than the quantity channel. In particular, the impact on prices and volatility was seen as being very important, while the impact on haircuts and liquidity was seen only as relatively less important (Graph A4.2, left-hand panel).

Finally, among those jurisdictions that chose to survey participants regarding the price impact of specific features of central bank operating frameworks on yields and market liquidity, around 40% of respondents judged those effects to be very large (Graph A4.2, right-hand panel). A greater percentage of non-bank financial institutions than banks viewed the yield and liquidity impacts as being very large.

Importance of the nature of central bank operations for collateral markets

In per cent of total respondents

Graph A4.1

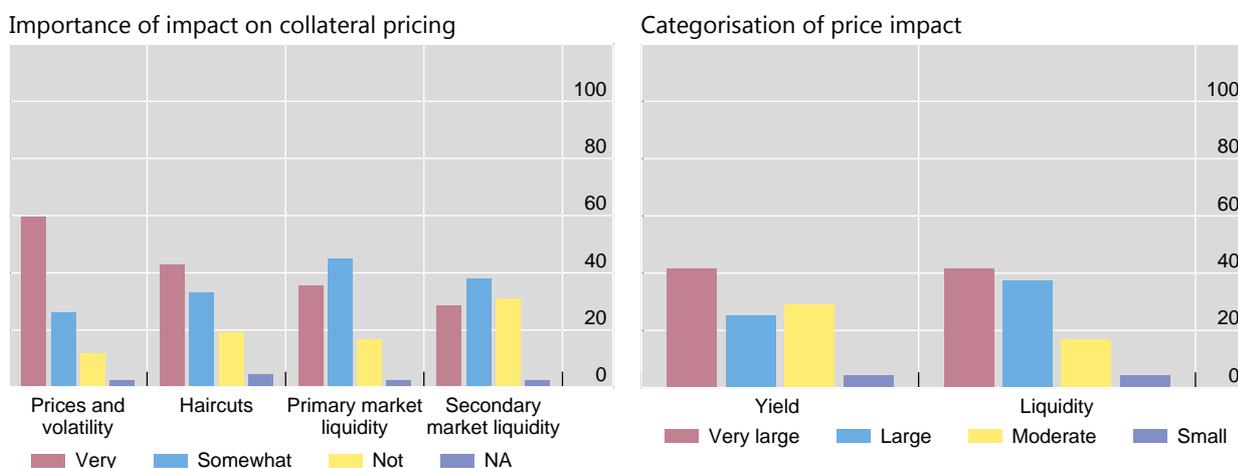


Source: National central banks.

Impact of central bank policy choices on collateral markets

In per cent of total respondents

Graph A4.2



Source: National central banks.

Impact of central bank frameworks on respondent firms' operations

On balance, respondents indicated that central banks' operating frameworks have a notable impact on their liquidity management practices, in part by altering the availability of collateral in repo markets and the pricing of high-quality liquid assets. Similarly, some respondents noted that cash collateral reinvestment and securities lending activity are influenced by the central bank's framework through the amount of available lendable collateral. Some also indicated that their liquidity risk management frameworks explicitly account for their interactions with central banks in collateral markets in both normal and stressed market conditions.

Respondents noted that trading and investment mandates were also impacted by central banks' operating frameworks, as was participation in collateral markets across jurisdictions. For example, pension firms in a number of jurisdictions noted a shift in participation to more active liquid collateral markets that can support their derivative or stock-borrowing activities. In the United States, participants active in the MBS market suggested that the Federal Reserve's asset purchase programmes have had a notable impact on their own operations, including portfolio and liquidity management as well as funding.

Haircuts: determinants and interaction with operating framework

Responses were mixed with respect to the importance of central bank operating frameworks in determining haircuts in the private market. Many suggested that haircuts observed in collateral markets could change if the central bank were to modify its own haircuts for a given security or collateral class, particularly if central counterparties followed suit. In fact, some indicated that the central bank's haircut schedule could establish "benchmark" haircuts for the collateral types available in the market, and that this could impact liquidity in the marketplace.⁵⁵ However, many

⁵⁵ As one respondent put it, "An increase in haircuts will induce a participant to consider a possible loss of liquidity (to the extent it is relying on central bank access in its liquidity plan) if it does not

indicated that collateral quality and the price volatility of the underlying asset remained the main determinants of the haircut, although some noted that the counterparty's creditworthiness and overall repo market liquidity were also influential factors.

In the euro area, a majority of respondents viewed the ECB's operating framework as particularly relevant for haircut schedules in collateral markets, effectively establishing a baseline for the private market. For example, many of the haircut schedules in collateral service agreements are based on the ECB operating framework. By contrast, respondents in the United States did not suggest there was a direct link between the haircuts that prevail in repo markets and those applied by the Federal Reserve. However, they acknowledged that a change in haircuts by the central bank would indirectly affect haircuts in the private market. And respondents in the United Kingdom noted that a change in haircuts by CCPs had a larger market impact than a change by the central bank.

Internal transfer pricing, and other factors

To manage funding, respondents generally indicated that they make use of some form of internal transfer pricing, including internal limits. It was noted that the use of internal transfer pricing reduces the reliance on central bank funding. However, to the extent that changes in the central bank operating framework affect pricing and/or the supply of funding, these changes could feed through into the risk and market-making behaviour of trading businesses. In addition, while regulatory requirements were considered when interacting with central banks, the most important factors were pricing and reputational risk.

With respect to jurisdictional considerations, respondents indicated that their firm-wide liquidity management explicitly takes into account the local central bank's operating framework in each jurisdiction. Respondents further noted, however, that their participation in secured funding markets across jurisdictions is driven primarily by client demand and business needs rather than by individual central banks' operating frameworks.

Normal vs crisis times

Respondents noted a number of changes in their approach to collateral management as a result of the recent global financial crisis. These include:

- Reduced counterparty concentration by raising secured funding from a more diverse set of counterparties;
- Increased tenor of secured funding books, with a particular focus on funding for less liquid assets, to reduce rollover risk;
- Infrastructure improvements to facilitate greater collateral mobility and increase collateral velocity;
- Shift to secured funding products that provide more credit protection;
- Greater focus on matched funding, eg by ensuring that internal financing can replace repo financing in times of impaired repo markets;

similarly adjust its haircut schedule. A reduction in haircuts by the central bank would influence a participant to consider lowering haircuts to remain competitive in the market."

- Higher rates and haircuts for non-traditional collateral;
- Revised collateral guidelines, ie more restrictive acceptance policies; and
- Increased importance of secondary market liquidity as a criterion for collateral acceptability.

In most cases, survey respondents indicated that they had moved away from ratings-based limits to an internally determined, pre-approved credit list. Some have also centralised collateral management and taken steps to improve efficiency.

Impact of unconventional monetary policies

Respondents pointed to a range of changes in collateral markets as a result of the implementation of unconventional policies.⁵⁶ In the United States, respondents indicated that asset purchases have resulted in some scarcity of high-quality collateral, which, combined with the diminished willingness of dealers to inventory these assets, has contributed to wider bid-ask spreads. However, respondents in the euro area suggested that unconventional policies allowed the use of collateral for longer durations and effectively imposed a floor on lower-quality collateral, increased collateral upgrades and tightened spreads in certain asset classes.

Respondents further reported increased fails in some jurisdictions, as the cost of failing is substantially reduced when interest rates are very low. They also reported lower rate volatility in money and repo markets as a result of asset purchase programmes or refinancing operations. Finally, some respondents indicated that the introduction of unconventional measures effectively made the central bank a market-maker for collateral. They noted that, in certain jurisdictions, the central bank determined not only the price for certain types of collateral (by fixed rate full allotment and maturity extensions), but also affected the criteria for collateral eligibility in the repo market (by expanding the collateral framework).

Some respondents in jurisdictions that did not employ unconventional policies, including emerging markets, suggested that yields on government bonds in their home market have been suppressed by increased demand from overseas investors searching for yield. These respondents further noted that they expected spillover effects to their markets as central banks in jurisdictions that resorted to unconventional measures eventually normalise policy. Others noted that the advent of asset purchase programmes by major central banks contributed to lower liquidity and higher volatility in their domestic cash bond market, and that unconventional liquidity provision tools affected their domestic collateral markets.⁵⁷

Policy normalisation

Respondents expect collateral markets to be significantly affected during the normalisation process through the channels identified in the survey, particularly via pricing and volatility as well as liquidity effects. Respondents anticipate that these effects will reflect increased availability of collateral as central banks drain liquidity and supply collateral. However, they also expected that it would be difficult to

⁵⁶ Of note, many of the respondents are global firms that operate both in countries with and without unconventional policies.

⁵⁷ Respondents from one emerging market jurisdiction noted that both the Federal Reserve's LSAPs and the ECB's LTROs and MROs had an impact on their domestic collateral markets.

separate the impact of policies aimed at normalising monetary policy and that of regulatory initiatives.

Respondents noted that the Federal Reserve's overnight reverse repurchase agreement facility to drain liquidity and the use of an extended set of eligible counterparties have the potential to significantly affect the way collateral markets operate and interact with the central bank's operating framework. The degree to which the central bank will operate with an extended set of counterparties and the extent it will choose to rely on this tool may significantly affect both the level and the volatility of collateral market rates.

Regulatory initiatives and evolving market structures

Regulatory initiatives

Respondents argued that, since the financial crisis, regulatory initiatives and changing market structures have had a significant impact on collateral markets, increasing demand for high-quality collateral and reducing liquidity in those markets. In addition, line with earlier reports (see CGFS (2014), market trends and regulatory requirements in many jurisdictions have resulted in a reduction in balance sheets allocated to the financing of low-return liquid assets, reducing dealer intermediation for these assets in the market. Dealer respondents globally noted that they have begun optimising their balance sheet usage to meet return targets and to manage regulatory requirements, for example by dropping clients or reducing their own availability for funding and collateral.

Consistently, buy-side respondents (especially asset managers and leveraged funds) reported a sharp reduction in access to dealer balance sheets and in the number of available dealer counterparties. As a result, some argued that it had become increasingly difficult to find collateral for reinvesting cash and at times they have been forced to hold cash uninvested. In addition, some buy-side respondents noted that they are increasing their efforts to find other ways to source collateral assets and invest cash, including by developing counterparty relationships with non-bank financial institutions such as real estate investment trusts (REITs).

Respondents also pointed to other regulatory initiatives that may further affect liquidity and costs in collateral markets. For example, they expressed concerns about the financial transaction tax in European jurisdictions, which may make repurchase transactions more expensive. Respondents were also anxious with respect to international proposals concerning limits on the reuse and rehypothecation of collateral, and with initiatives such as the Volcker Rule in the United States.

Evolving market structures

Respondents highlighted a number of structural changes as having important effects on collateral markets. Stricter standards for initial margin requirements on derivatives transactions have substantially increased demand for higher-quality collateral and have reportedly reduced liquidity. In Europe, changes to capital rules for insurance companies have arguably had similar effects. In the United States, newly announced rules by the Securities and Exchange Commission (SEC) are estimated to have resulted in a shift of \$500 billion from prime funds, which invest primarily in commercial paper and government securities, to government funds, which invest solely in government securities. In addition, tri-party market reform

efforts have contributed to important operational changes in the repo market, apparently resulting in reduced liquidity within the repo market. Due to these changes, respondents reported tremendous demand for both collateral optimisation and committed repo facilities by a range of counterparties such as insurance companies and CCPs, who by regulation need to hold high-quality collateral for margining purposes or need committed liquidity.

Survey respondents noted that some adverse effects of reduced liquidity are already evident. For example, fails in repo and other fixed income markets have increased and become more persistent. Hedging costs have apparently increased, reflecting in part a shortage of higher-quality collateral.

Possible policy measures

Respondents identified a range of potential policy measures that could improve the functioning of collateral markets. Unsurprisingly, they advocated greater flexibility with regard to the implementation of regulatory initiatives and additional market structure improvements. In addition, they pointed to ways in which central banks could facilitate more efficient use of collateral and possibly increase its availability.

Respondents suggested that broadening the eligibility criteria of certain assets for the purposes of meeting capital requirements would help alleviate some pressure on government securities and possibly motivate the private sector to increase the acceptance of other asset classes for collateral purposes. Some changes are already taking place, including the inclusion of corporate securities as an eligible form of collateral by some central counterparties. In addition, some jurisdictions such as India pointed to continued development of markets, including that for corporate bonds, as a means of helping to expand eligibility criteria.

Respondents also highlighted a number of important market structure improvements across jurisdictions. The potential for central clearing of high-quality, liquid repo assets was cited as perhaps the most significant initiative that could preserve market functionality. Jurisdictions such as Canada, various EU countries, Japan and the United Kingdom already use central clearing for a significant amount of repurchase transactions, specifically in government securities. For some of those jurisdictions, respondents advocated that clearing counterparties consider accommodating transactions across a wider range of asset classes, including corporate debt and ABS.

Finally, respondents pointed to the introduction of collateral transformation and optimisation services by broker-dealers and custodian banks, which could result in a positive change in the effective supply of collateral. In addition, respondents pointed to progress made in collateral optimisation services in helping manage their inventory of collateral assets to satisfy collateral requirements across various counterparties.

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