

# Centre for Central Banking Studies

## Collateral management in central bank balance policy operations

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In order to achieve their monetary policy goals central banks must interact with wider financial markets through money market operations. Operations where the central bank provides reserves to the market through the means of a loan potentially leaves the central bank exposed to the risk of loss should the counterparty be unable to repay. As losses can lead to the central bank's reputation and independence being compromised, it is important that central banks undertake steps to protect themselves. Risk management in central bank operations is therefore crucial to the central bank's ability to effectively implement its policy goals.

One near-universal principle accepted by central banks around the world is that when they lend to financial institutions they do so against collateral of sufficient amount and quality. By taking collateral, should the counterparty become unable to repay, the central bank has an asset with which to make good the loss. The decision as to which securities are deemed suitable as collateral differs from central bank to central bank. The choice depends on a range of factors both internal and external to the central bank. In addition, once suitable collateral is obtained the central bank needs to devote resources to monitoring and managing the collateral such that adverse market moves do not ultimately reduce the value of the securities below that of the initial loan.

The global financial crisis has highlighted the need for central banks not to tighten collateral policies in the face of market stress. Such a strategy can provide certainty to counterparties when constructing their funding strategies. Some central banks have found that there are benefits to loosening collateral policies in times of severe stress. An easing of central bank collateral policies may free up market strains on high-quality collateral. Such policies are not without drawbacks, including the greater exposure to potential losses from lower quality collateral and the danger of creating moral hazard for counterparties in their collateral management.

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**The views expressed in this *Handbook* are those of the author, and are not necessarily those of the Bank of England.**

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# Collateral management in central bank policy operations

## Introduction

The monetary operations of the central bank are crucial to the achievement of both monetary policy and financial stability goals. In many countries, such operations require the central bank to lend money to private financial institutions to satisfy a system-wide shortage of liquidity. Through such loans they ensure that the supply of central bank money to the financial system is in line with the requirements put in place by the central bank's choice of operational framework.

Under legal and accounting regulations, central banks are set up in a similar fashion to other commercial banks. Thus they are exposed to the potential losses through the standard risk channels: credit, market, liquidity and operational risk. Therefore every time the central bank lends money to a commercial bank it is exposed to potential losses if the commercial bank is unable to repay the loan. Like commercial banks, central banks can absorb losses through their capital buffers; unlike commercial banks, who raise capital through retained earnings or the issuance of fresh securities, central bank capital levels are often tied to wider fiscal choices of the governments that often own them. In addition such losses can damage the reputation of the central bank and lead to questions regarding its operational independence should the government be forced to recapitalise it.

The primary purpose of this handbook is to outline how a central bank can limit its exposure to the risk of loss when conducting money market operations. Section 1 reviews the need for operations, discusses the form of such operations before distinguishing the contrasting challenges facing countries with surpluses or shortages of liquidity. Section 2 discusses the channels through which the central bank is exposed to the risk of loss and looks at the role of capital on a central bank's balance sheet. Section 3 introduces the concept of collateralised lending, while Section 4 details the means through which a central bank chooses the types of collateral it is willing to accept. Section 5 looks at how the central bank manages the collateral it has accepted in its operations, introducing the concepts of valuation, haircuts and margin calls. Section 6 considers whether or not a central bank should change its collateral policies in the event of a financial crisis, looking at both the advantages and risks of such a move. Finally Section 7 looks at other channels of loss that the central bank may be exposed to in its policy operations.

## 1 Central bank operations

### The need for operations

To understand why a central bank will regularly enter into transactions whereby it provides central bank reserves to commercial banks, it is important to understand the role of such reserves in the functioning of an economy. The most important place to start is with the central bank's balance sheet. Local idiosyncrasies and varying accounting standards mean that the mode of presentation and categories used can vary significantly from central bank to central bank. However, nearly all central bank balance sheets can be generalised to the form presented in **Table 1**.

**Table A** Stylised central bank balance sheet

Assets	Liabilities
Foreign assets (net)	Notes (and sometime coins)
Lending to government (net)	Required bank reserves
Market lending (net)	Free bank reserves <sup>(a)</sup>
Other items (net)	Capital

(a) Free bank reserves are defined as reserves held by commercial banks at the central bank that are held in excess of those required to satisfy contractual reserves. They may be held voluntarily as insurance against unforeseen payment shocks or involuntarily.

The main liabilities of the central bank — notes, required bank reserves and free bank reserves — are known as the monetary base. The monetary base, and in particular bank reserves, both free and required, are the ultimate means of settlement for transactions in an economy. Commercial banks settle transactions between themselves and on behalf of customers across the books of the central bank in the form of reserves.<sup>(1)</sup> In normal times confidence in this narrow transactional role of the central bank feeds broader intermediation between the commercial banks and the wider economy encouraging commercial banks to play their traditional role of maturity transformation to assist growth in retail and commercial deposits.

Central banks typically exploit their monopoly control over the supply of the monetary base, setting the terms on which they permit access to it, to achieve their policy goals.

(1) In countries where there is a real-time gross settlement payments system, intraday payments also settle in the form of reserves. As payments are made in real time, counterparties, subject to conditions, can regularly run short or long positions with the central bank as payment flows are made. At the end of the day these positions are usually squared or transferred to standing facilities. The central bank therefore is technically lending reserves intraday to counterparties running short positions and at this point has exposure not captured on its end-of-day balance sheet.

A central bank's monetary policy goal is usually to achieve price stability and thereby encourage economic growth. These targets tend to be outside a central bank's direct control and often there is a lag between central bank actions and their impact on the ultimate goal. Therefore central banks often have in addition an operational target. Operational targets are an economic variable the central bank can directly control and a crucial determinant of the ultimate goal. In recent years there has been a consensus among many central banks that short-term interbank<sup>(1)</sup> interest rates are the optimal operational target.<sup>(2)</sup> Central banks generally influence market interest rates by adjusting the terms on which they are willing to supply or absorb reserves from the market. Most central banks specify such terms and then aim to make the optimal quantity of reserves available to commercial banks so that they can fulfil reserve requirements, make interbank payments and draw down on such reserve balances to meet economic agents' demand for banknotes. If the central bank provides too much or too little reserves to the market and there are penalties for deficiencies and excesses then it is likely that the market interest rate will deviate away from the desired target.

The financial stability goals of central banks are usually less tightly defined than monetary policy goals; however, central banks have an incentive to reduce the possibility of economy-wide problems stemming from the banking sector. As noted above commercial banks play a vital role in an economy by providing maturity transformation, turning short-term deposits into long-term lending. This leaves them uniquely vulnerable to liquidity shocks, under which even solvent banks can find themselves unable to satisfy economic agents' desire for repayment of their funds. As the sole provider of reserves the central bank can provide assistance to the system by standing ready to provide additional liquidity in such an eventuality. While significant interventions of this variety are thankfully rare, the central bank's operations contribute to financial stability on a day-to-day basis by supplying the optimal level of reserves such that interbank payments can continue to be made.

### Definitions of a shortage and a surplus of liquidity

The liquidity position of the banking system in any country will impact on the degree to which a central bank will be supplying or absorbing the monetary base from the market.

If growth in the size of the central bank's balance sheet is driven by growth in the liabilities, then there exists a shortage of liquidity. In this case, the growth in demand for notes and/or the level of required bank reserves increases as the quantity or nominal size of transactions in the economy increases. Holdings of free reserves will be small and purely voluntary, driven by commercial banks' wish to insure against payment shocks and the possibility of penalties for contractual reserve deficiencies.<sup>(3)</sup> The central bank will on balance need to provide reserves to the market. It will, therefore, regularly

enter into transactions with commercial banks to provide them with reserves. In terms of the central bank's balance sheet, an increase in the liabilities will be matched by an increase in the assets through additional market lending.

In contrast if growth in the size of the central bank's balance sheet is driven by growth in its assets then there exists a surplus of liquidity. In this case growth in the assets of the central bank is met by a subsequent increase in commercial banks' involuntary holdings of free bank reserves. To implement policy goals the central bank will on balance need to absorb reserves from the market. The occasions when the central bank lends to the market will be fewer; instead it will regularly enter into transactions with financial institutions to reduce the quantity of reserves held by commercial bank by exchanging that form of liability for another. But, due to potential market distortions or in the case of financial stability inspired operations, there may still be occasions where additional reserves are provided to commercial banks.

## 2 Potential for central bank losses

### Mechanism for losses

Central banks are for all intents and purposes structured like any other private corporation. As Cukierman (2010) noted they 'are incorporated within similar legal structures and utilise similar accounting principles.' Therefore central banks are vulnerable to financial losses in the same way that any private sector institution would be. As noted above when a central bank provides reserves to a commercial bank it increases the value of its liabilities. Correspondingly the asset side of the balance sheet grows by the same amount due to an asset associated to this market lending. In an unsecured transaction the asset will be a claim on the commercial bank. In a secured transaction the asset will be the collateral underpinning the transaction. The value of the central bank's liabilities — the reserves — will be unchanged throughout the life of the transaction. However, there are a number of channels through which the value of the corresponding asset can vary. The four classic risk channels are credit, market, liquidity and operational risk:

- Credit risk is the risk of loss due to an organisation being unable or unwilling to meet its obligation.
- Market risk is the risk of loss (including unrealised mark-to-market losses) arising from a change in the value of an asset.

(1) See *CCBS Handbook No. 26*, 'Developing Financial Markets', for a definition of interbank markets.

(2) For some central banks, however, such as those in small open economies, where there is a rapid pass-through from movements in the exchange rate into domestic inflation, or those in economies where the central bank's credibility is weak, the use of an exchange rate target may be a preferred strategy.

(3) See Gray and Talbot (2006) for a discussion on holdings of free reserves.

- Liquidity risk is the risk that an asset cannot be traded quickly enough so that its value can be realised to meet a due liability.
- Operational risk is the risk arising from the execution of activities. In a narrow sense it relates to losses that arise solely due to failures of internal systems, processes and people. In a broad sense it covers all losses that cannot be attributed directly to the other risk channels.<sup>(1)</sup>

### Central bank capital and the cost of losses

Since the value of the liability related to the reserves will stay the same, another element of the central bank's liabilities must adjust if the value of the assets changes due to the risk channels discussed above. Like private sector institutions central banks carry capital on their balance sheets and like private institutions the capital buffer (or net worth calculated as the difference between the value of total assets and total liabilities) becomes the channel through which the central bank absorbs such losses.

Unlike private financial institutions central banks are not subject to regulatory capital requirements. Commercial banks and other financial institutions are mandated by international and domestic regulations to hold capital buffers directly proportional to the size and riskiness of their lending activities. No such regulations exist for central banks. In addition, if a private institution wishes to increase the amount of capital it wishes to hold then it can either retain earnings or go to financial markets to raise additional funds. The ability of the central bank to do this is limited; more often than not the central bank is wholly owned by the government and such choices have wider fiscal implications.

If a central bank therefore makes losses and exhausts its capital it must usually approach the national government. The government can increase the central bank's capital level either directly through an injection of cash or through the deferment of seigniorage income.<sup>(2)</sup>

Such an approach can lead to potential questions for the central bank's policy independence. It is not beyond the realm of possibility that a government may pressure the central bank to run pro-cyclical policies if it is in their political interests to do so. While many central banks have been recapitalised without their independence being questioned, Stella and Lonnberg (2008) note that it is a concern for many others.

Were the central bank to recapitalise itself through deferment of seigniorage it faces the temptation to speed up this process by permitting faster growth in the monetary base. Such a move could further compromise the ability of the central bank to implement effective monetary policy. In addition, large financial losses can lead to wider reputational damage for a

central bank, constraining its ability to send credible policy signals.

Therefore, to insure against such negative outcomes, should central banks carry a high level of capital? Similar to the costs of recapitalisation, providing a high level of capital to the central bank comes at the cost of foregone fiscal choices.<sup>(3)</sup> Many authors have attempted to quantify the optimal level of capital for a central bank, Cukierman (2010) and Derbyshire (2010) both conclude that there is no simple correct answer. Stella (2010) finds that 'poorly capitalised central banks are often constrained in their policy choices, or, even when not constrained, sometimes loosen policy to avoid large losses for reputational or political economy reasons.' Ultimately the correct level of capital for a specific central bank will be determined by a number of unique factors related to the situation it faces. These include its institutional structure and the types of operations it undertakes. Related to this is the level of risk the central bank takes within these operations. A central bank that undertakes more risky operations will ultimately be more at risk of loss and hence will require a higher capital buffer. In addition accounting standards vary from country to country. Most significantly for central bank independence will be the relationship with its country's government. If the government is unlikely to try to influence central bank policy even in the event of central bank losses then the central bank will be able to run with a lower capital level than a central bank in a country where future governments may be tempted to try to influence central bank policy.

A further point pertaining to central bank capital levels, is that while in an accounting and legal sense central banks are structured in a similar way to private sector companies, their ultimate goals vary significantly. While private sector companies are focussed on profits and maximising shareholder value, central banks are focussed on achieving policy goals. These policy goals will often create situations where it may be socially optimal for a central bank to lose money or to take greater risks. For example if a central bank was to undertake a programme of quantitative easing it would be buying government debt at what will likely be low yields (high prices) as investors seek safety over risky assets. Such a situation would likely occur in a period of depressed growth in the economy with inflation either undershooting or being forecast to undershoot its target. A mark of success for such a

(1) A widely used definition of operational risk is the one contained in the Basel II regulations. This definition states that operational risk is the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events.

(2) In the majority of countries the main source of revenue for a central bank is seigniorage income, ie the income earned through issuing non-interest bearing liabilities such as notes and potentially bank reserves and carrying interest bearing assets. Such income is usually paid over to the nation's government. The easiest channel to recapitalise a central bank is for some of this income to be retained and added to the capital level of the central bank. In doing this, however, the government is denying itself of revenue it could otherwise have utilised for other purposes.

(3) The government either provides or foregoes seigniorage income which could have been utilised elsewhere in an economy.

programme would be economic recovery and inflation back closer to target. When the economy recovers, the yields on government debt will tend to increase (prices fall) as investors once again choose to purchase riskier assets and policy rates are raised. When the central bank comes to sell its bond holdings it will likely do this at a loss. Despite the financial loss it has been socially optimal for the central bank to undertake this programme as it has achieved its policy goal of encouraging growth and/or meeting its inflation target. This point was raised by the Deputy Governor of the Bank of England, Charlie Bean<sup>(1)</sup> when discussing the potential closing accounts of Bank's Asset Purchase Facility when it is run down at some future date: 'the aim of Quantitative Easing and the Asset Purchase Facility is to help the Monetary Policy Committee achieve its macroeconomic objective, namely hitting the Government's inflation target without generating undue volatility in output. The accounts of the Asset Purchase Facility are not designed to address these overall macroeconomic costs or benefits, which instead requires an assessment of the impact of quantitative easing on demand and inflation'.

### 3 Collateralised lending

Despite certain situations where it is socially optimal for a central bank to make losses, on a day-to-day basis, for reputational and operational purposes, central banks will look to avoid losses. Therefore, when undertaking policy operations to supply reserves to the market a central bank will employ a number of policies to attempt to minimise the possibility of suffering a loss. The main channel through which a central bank attempts to limit its risk exposure is by taking collateral when lending.

#### Collateralised lending

The majority of central banks around the world choose to lend to financial institutions solely by the means of secured transactions.<sup>(2)</sup> For some central banks, such as the European Central Bank (ECB) and the constituent national central banks within European System of Central Banks (ESCB) collateralised lending is mandated within their statute (see Box 1).

If a central bank lends to a counterparty unsecured, ie does not take collateral in the trade, then the central bank bears credit risk with respect to the counterparty. If the counterparty is unable to repay the loan from the central bank, then the central bank becomes an unsecured creditor of the counterparty; likely a long way down the tiers of seniority in terms of recovery in the event that the counterparty fails. If instead the central bank lends to a counterparty in a secured manner, ie takes some form of financial asset as security in the trade, then the central bank no longer bears credit risk with respect to the counterparty. If the counterparty were unable to repay the loan from the central bank, then the central bank will have an asset worth the equivalent of the loan. It can then

choose to hold or sell the asset to compensate for the value of the loss on the loan. By lending through secured means the central bank has not eliminated credit risk, it has merely shifted from bearing credit risk with respect to the borrower to bearing credit risk with respect to the issuer of the asset it takes as collateral. A central bank will still realise losses if both the counterparty to the loan and the issuer of the security held as collateral default simultaneously.

Despite the central bank still facing credit risk by lending secured, most choose to do so as they have more control over the degree of risk they bear. One particular challenge facing a central bank, as explained by Bindseil and Papadia (2006) (see Box 1), is that policy objectives are best achieved when counterparties have equitable access to facilities. Traditional means of mitigating credit risk in unsecured lending (credit limits and increasing pricing for lower rated counterparties) are incompatible with this. Therefore given a central bank often has little choice over the credit risk profile of the counterparties it deals with,<sup>(3)</sup> the degree of credit risk borne from operation to operation would fluctuate with the counterparties involved. In addition, Chailloux, Gray and McCaughrin (2008) note that unsecured lending by a central bank would likely skew participation in operations towards counterparties who face higher private funding costs and lack the portfolio of securities to fund in the market. This has the potential to impair the wider transmission of monetary policy. By taking collateral in lending operations, not only is the central bank able to dictate the securities it is willing to accept as collateral but also the degree of risk it is willing to be exposed to. It therefore can provide an equitable access to facilities to a wide range of counterparties of different credit quality.

#### Other benefits of collateralised lending

The taking of collateral when lending can have benefits beyond the simple reduction of the risk faced by central banks and the levelling of the playing field for access to central bank facilities among counterparties.

The eligibility of a security within central bank operations is likely to have a positive influence of the marketability of such an asset. As noted by Bindseil and Papadia (2009) 'eligibility as central bank collateral should make, everything else equal, one asset more attractive and thus increase its price and lower its yield'. The impact of this eligibility premium would be expected to be particularly high if there was a shortage of collateral in the market. Despite this seemingly logical conclusion, the eligibility premium of an asset is often difficult

(1) Bean (2009).

(2) The rare examples of unsecured lending by central banks are usually the result of incidences where suitable collateral was not readily available.

(3) Many central banks maintain minimum standards for counterparties, however, the crucial role the central bank plays in both the settlement of transactions and acting as lender of last resort in the economy means that a wide range of counterparties need to have access to central bank facilities.

## Box 1

### Collateralised lending in the euro area

The principle that the ECB and constituent central banks of the Eurosystem will never lend uncollateralised to counterparties in policy operations is enshrined in statute. Article 18.1 of the Protocol on the Statute of the European System of Central Banks and of the European Central Bank states:

18.1. In order to achieve the objectives of the ESCB and to carry out its tasks, the ECB and the national central banks may:

- operate in the financial markets by buying and selling outright (spot and forward) or under repurchase agreement and by lending or borrowing claims and marketable instruments, whether in community or in non-community currencies, as well as precious metals;
- conduct credit operations with credit institutions and other market participants, with lending being based on adequate collateral.

Bindseil and Papadia (2006) eloquently state the rationale as to why central banks should not provide uncollateralised lending:

- Their function, and area of expertise, is to implement monetary policy to achieve price stability, not to be credit risk managers.

to isolate from wider market movements. Despite this, assuming that central bank eligibility has a positive impact on the demand for an asset then a central bank can positively influence the market for different assets.

Even if the eligibility premium cannot be isolated from the price of securities, a central bank's actions in defining and managing collateral can have positive externalities for wider market practices. Zorn and Garcia (2011) note that the policies central banks employ regarding transparency and the methodology of taking and managing collateral can positively influence the behaviour of private market participants; setting what should be seen as benchmark standards.

Beyond this, greater demand for eligible assets can lead to improved market infrastructure and a deepening of financial markets.<sup>(1)</sup>

#### Collateral in central bank absorption operations

Central bank collateral policies are generally not symmetric. Often they will differ depending on whether the central bank is providing or absorbing liquidity.

- Access to central bank credit should be based on the principles of transparency and equal treatment. Unsecured lending is a risky art, requiring discretion, which is neither compatible with these principles nor with the accountability of the central bank.
- Central banks need to act quickly in monetary policy operations and, exceptionally, also in operations aiming at maintaining financial stability. Unsecured lending would require careful and time consuming analysis and limit setting.
- They need to deal with a high number of banks, which can include banks with a rather low credit rating.
- They cannot establish credit lines reflecting the creditworthiness of different banks. A central bank can hardly stop transacting with a counterparty because its limit has been exhausted. Such an action may be interpreted as a sign of deterioration of that counterparty's credit quality, resulting in its inability to get liquidity from the market, with potential financial stability consequences.
- To reflect the different degrees of counterparty risk in unsecured lending, banks charge different interest rates. By contrast, central banks have to apply uniform policy rates and thus cannot compensate the different degrees of risk.

For central banks that operate with a shortage of liquidity, and on balance provide reserves to the market through policy operations, many also offer both lending and deposit standing facilities. Such facilities permit counterparties to borrow or deposit funds at the end of the day. Lending facilities will often operate identically to policy operations through the means of repurchase agreements. Counterparties in such facilities will be asked to provide suitable collateral in return for the funds. Deposit facilities on the other hand are very rarely collateralised; counterparties are instead asked to make an unsecured deposit at the central bank. Such an asymmetry partly reflects operational choices, but also the role of the central bank in the economy. As the central bank is the sole creator of central bank reserves it will never face a situation where it is unable to repay money owed to a counterparty.<sup>(2)</sup>

For central banks that operate with a surplus of liquidity they on balance absorb reserves from the market in their regular

(1) See Gray (2006).

(2) If such a situation was to arise, it is not clear what good holding collateral would do for a counterparty. If the central bank is unable to provide reserves to the market it is unlikely that any trading would be able to take place.

open market operations. In such operations central banks may choose to provide collateral to counterparties, be it through the sale of central bank securities or entering into repurchase agreements for other securities held on the central bank's balance sheet. The choice to provide such collateral will not be driven by credit risk reasons,<sup>(1)</sup> but for market functioning reasons. A central bank may choose to provide a marketable security as collateral as opposed to an uncollateralised deposit to make its absorption operations more attractive to its counterparties. A downside of an uncollateralised deposit is that once the counterparty has entered into the transaction the funds are tied up at the central bank. If the counterparty then finds it needs funds during the life of the transaction it will need to go to the unsecured interbank market to borrow the funds. Depending on the credit standing of the counterparty in question and/or the depth of such market this could prove prohibitively expensive, thus discouraging counterparties from taking part in such central bank operations. If instead the central bank provides a marketable security that trades in liquid markets, then if the counterparty needs the funds it can sell the security to realise its value.<sup>(2)</sup>

As noted above, even under a surplus of liquidity, there may be situations where for financial stability reasons the central bank is required to provide additional reserves to the market. In these instances the central bank should look to take high quality collateral, similar to its peers who regularly provide liquidity to the market.

## 4 Choosing collateral

While it is a near-universal fact that a central bank will choose, or be directed by statute, to lend to the financial system only through secured transactions, the exact form of collateral acceptable to a central bank is often left to the central bank's discretion. This means that types of collateral eligible at different central banks can vary significantly. Some central banks may choose a single list of collateral for all operations. This can include a wide range of securities or only a narrow range of securities. Other central banks may choose to accept different collateral dependent on the purpose of the operation undertaken. In general it is assumed that central banks will choose the highest-rated securities available as collateral so as to limit the potential credit risk. However, as discussed by both Chailloux, Gray and McCaughrin (2008) and Cheun, Von Köppen-Mertes and Weller (2009), the exact collateral choices of an individual central bank is driven by a range of external and internal factors and the purpose of the operations they are undertaking and can change over time.

### Internal constraints

The choice of which securities the central bank may choose to accept as collateral can be driven by factors internal to the central bank. Choices regarding other aspects of the central bank's monetary operations will have a significant impact on

choices regarding suitable collateral. Most importantly the scale of the refinancing need of the financial system, the range of counterparties eligible to participate in central bank operations and whether or not the central bank wants to ensure market neutrality all play a significant role in collateral choices. The impact of these internal choices on the collateral policies of the ECB and the Federal Reserve are discussed in Box 2.

Clearly the size of the refinancing needs of the system can have a significant impact on the forms of collateral a central bank may be willing to take. A central bank at minimum needs to make enough collateral eligible to cover the size of its operations. Therefore central banks with larger refinancing needs will need to make a larger total amount of collateral eligible.<sup>(3)</sup> This does not necessarily mean that the range of securities needs to be wider, especially if there is one particular asset class available in suitable size.

Separately the range of counterparties a central bank permits to access its facilities will influence collateral choices. Different potential counterparties are likely to have different balance sheet structures and thus will hold different amounts and types of securities. If the central bank is intent in providing equitable access to central bank facilities it needs to ensure that its collateral choices do not inherently favour some institutions over others.

The importance of market neutrality to a central bank can vary significantly. If a central bank is acting in a market-neutral manner then it will aim to act such that its interventions in the market and its choices concerning collateral do not influence the pricing or market demand for an asset. As noted above, some central banks may choose to operate in a non market neutral manner to reap the benefits that granting eligibility to a security can have on broader market development. On the other hand a central bank may not wish to be seen to influence wider private financial markets and may choose instead to operate in a market-neutral manner. The desire to act in a market-neutral manner will likely require a central bank to ensure that the likely use of different securities in its operations is small compared to the total amount of such securities in issuance. This logically follows the fact that the greater the amount of an outstanding issuance of a certain security that is utilised in a central bank operation, the smaller the amount that is available on the wider market. This will likely influence the price and demand for such a security.

(1) As noted above the central bank will never face a situation where it is unable to meet its domestic currency liabilities.

(2) For a greater discussion of the choices facing a central bank when designing policy operations in a surplus liquidity situation, see Rule (2011).

(3) The size of the refinancing needs of the system are determined by the size of imposed reserve requirements and holdings of other forms of assets by the central bank.

## Box 2

### OMO collateral policy at the Federal Reserve and the European Central Bank

A clear example of how the setup of the wider framework of monetary operations impacts on collateral choices can be seen by contrasting the Federal Reserve and the ECB's operations prior to the onset of the global financial crisis in 2007. While both central banks operated with a shortage of liquidity, meaning that both on balance provided liquidity to the system on a regular basis, there was a significant difference between the refinancing needs of the two systems.

The Federal Reserve imposed only small unremunerated reserve requirements on commercial banks. In addition they focussed on backing notes in circulation through the outright purchase of US Treasury securities. Therefore short-term repos were needed only to fine-tune shifts in autonomous factors. The Federal Reserve conducted its open market operations (OMOs) through the dealing desk of the Federal Reserve Bank of New York dealing with only a small number of counterparties called primary dealers.<sup>(1)</sup> Given the limited size of OMOs, the limited number of participants and the depth of US financial markets the Federal Reserve could limit its OMO collateral to three forms of securities; US Treasury securities, agency debt and agency mortgage-backed securities.

By contrast the ECB imposed much larger remunerated reserves on commercial banks. In addition the majority of the backing of bank notes was done through temporary refinancing operations. As noted by Cheun, Von Köppen-Mertes and Weller (2009) while short-term

OMOs accounted for 3% of the Federal Reserve's balance sheet in July 2007, they accounted for 38% of the ECB's. In addition the ECB put a greater focus on permitting equitable access to its facilities meaning a much larger and broader range of counterparties was eligible to take part in its operations. As a result of these factors and the shallower nature of some European financial markets compared to the United States, the ECB needed to permit a much broader range of securities to be used as collateral. As of the start of 2007 the ECB had developed a single list of collateral,<sup>(2)</sup> composing both marketable and non-marketable securities which were eligible across all ECB operations.<sup>(3)</sup> Marketable debt instruments are any euro-denominated debt securities (including unsecured debt and asset-backed securities) issued within the European Economic Area, traded on regulated markets and which conform to certain specifications. Non-marketable securities comprise fixed-term deposits from eligible counterparties, credit claims and retail mortgage backed debts (such instruments are pools of mortgages that are pooled but not fully securitised). Both sets of assets must meet high credit standards, which was the equivalent of A2 on Moody's scale prior to the crisis.<sup>(4)</sup>

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- (1) The eligibility of firms to become primary dealers is regularly reviewed by the Federal Reserve Bank of New York and is available at [www.ny.frb.org/markets/pridealers\\_listing.html](http://www.ny.frb.org/markets/pridealers_listing.html). In addition to participating in open market operations the primary dealers must fulfil other operational criteria including participating in Treasury auctions, making market and providing market intelligence. In contrast to the small number of firms with access to open market operations, somewhere in the region of 7,500 firms have access to the Discount Window Facility.
- (2) See 'The implementation of monetary policy in the euro area — general documentation', ECB (2011) for greater details.
- (3) The only exception to this rule was that non-marketable securities were not eligible in outright transactions.
- (4) The ECB and the Eurosystem has in place credit assessment facilities to ensure that non-marketable collateral is judged to be of the same standard as the eligible collateral it takes in its operation.

Finally the overall risk appetite of the central bank will influence collateral choices. Central banks will likely be risk-averse by nature due to the potential costs of central bank losses. The severity of these costs, loss of independence and credibility, will vary based on institutional structures within the country, the relationship with the ministry of finance and the accumulated credibility of the central bank. If the central bank feels that these costs are likely to be high then it may be more risk-averse in its collateral choices than a central bank who thinks that these costs will be lower.

#### External constraints

While the internal factors discussed above may play an important role in determining which securities a central bank accepts as collateral, there are a number of factors external to the central bank that will also play a role. Importantly the legal framework of a country, the level of development in financial framework and the availability of forms of collateral can all impact on the collateral a central bank makes eligible.

In some countries the legal statute of the central bank forbids the monetary financing of government, eg the statute of the ECB and Euro System discussed in Box 1. As a result of such laws, a central bank can be prohibited from holding securities issued by the domestic government on its balance sheet thus excluding these securities as collateral. Many central banks interpret such restrictions as pertaining to purchases in primary markets, meaning they can accept securities in secondary market transactions. The rationale for accepting secondary market transactions is that the central bank is not directly financing the government. The government must be able to find a market participant who is willing to buy its debt in the primary market and to hold such securities for a period of time. It is only later on in a secondary market transaction that the central bank will obtain the government debt. The perception surrounding monetary financing can also influence the central bank's choices over whether or not to transact in the form of outright or repurchase agreements. Transacting in repurchase agreements where the securities will be returned to

the counterparty at the end of the transaction, creates a lower perception of monetary financing as there is no guarantee that the same securities will be used in subsequent transactions.<sup>(1)</sup>

While restrictions regarding monetary financing of government are relatively common around the world it is possible that the legal statute of central bank could also or alternatively exclude transactions with certain types of issuers or securities. Historically collateral policies of central banks have regularly been used to discourage or favour certain forms of securities, most notably the 'real bills' doctrine which favoured 'real economy' issuers of securities. The 'real bills' doctrine was common among central banks from the mid-nineteenth century and remained influential to the later part of the twentieth century.<sup>(2)</sup> This is in contrast to the recent desire for many central banks to act in a market neutral manner.

Outside of legal restrictions on the forms of security a central bank is permitted to accept under its statute, legal issues can play a significant role in shaping collateral eligibility. When a central bank enters into a repurchase agreement with a counterparty it is taking ownership of the security so that in the event of counterparty default the central bank has an asset of value to avoid losses. The central bank needs to be certain in such a situation that it legally owns the security and is able to dispose of the security as it sees fit. Any ambiguity related to the ability of a central bank to realise in a timely manner the value of a security, will likely discourage the central bank from accepting such securities as collateral.

In addition to potential legal restrictions, the development of financial systems and infrastructure can also influence a central bank's decision regarding eligible collateral. In less-developed financial systems the forms of securities held and traded by counterparties may be limited. There may not be active or developed corporate or asset-backed security markets, limiting the potential forms of securities the central bank can accept. The distribution of securities across different market participants can also influence the choice of securities that are eligible. If for example only a small subset of counterparties holds the majority of a certain form of securities, such as government bonds, then the central bank cannot equitably deal with all participants in the financial system as many will not have access to the eligible collateral. In such instances a central bank may need to take a wider range of securities as collateral.

Market infrastructure can also influence the choice of eligible collateral, with underdeveloped or unreliable settlement systems limiting the ability of a central bank to confidently accept some forms of securities.

As discussed above, whether the central bank is looking to have an active or a passive role in broader financial markets

will determine the amount of collateral the central bank needs to make eligible in its operations. Depending on the total amount of different securities in issue this may require the central bank to make a wider range of securities available. For some central banks a plentiful supply of high-quality securities, such as government bonds means that collateral needs are easily satisfied. For other central banks, however, even domestic government securities may be in short supply. Many resource-rich commodity exporters have little need to issue government debt meaning that the central bank may be forced to look to non-domestic currency securities as a means of finding sufficient collateral to satisfy the financial system's needs.

At the extreme the central bank could solve this issue by merely making as wide a range of collateral eligible as possible. However, such a strategy could lead to sub-optimal outcomes for the central bank as there are costs involved in taking collateral. Bindseil and Papadia (2009) use a simple cost-benefit approach to estimate the extent to which a central bank should be willing to widen its collateral pool. The model balances the benefits to the financial system of widening the collateral pool against the costs to the central bank of taking different collateral.<sup>(3)</sup> In Bindseil and Papadia's model the optimal choice of collateral for a central bank is one where ranking the collateral from the least expensive to the most expensive for the central bank, the marginal benefit to the system of widening the collateral pool further to take the marginally more expensive collateral is equal to the marginal cost to the central bank of doing so. Prior to this point the benefit of widening the range of eligible collateral is greater than the cost, past this point the costs outweigh the benefits. The optimal choice of collateral in this model varies with the size of the refinancing need of the system.

### Multiple collateral pools

Once a central bank has considered these internal and external constraints, it faces an additional choice as to whether the same range of securities should be eligible in all of its operations?

A rationale for taking a different range of collateral in different operations is that the central bank may have different goals when conducting different operations. As discussed above, a central bank may have both monetary policy and financial stability goals. While monetary operations can be used to implement both goals, there can arise a conflict in the means of achieving such goals. In particular, achieving monetary policy goals is often served by ensuring that the optimal

(1) Potentially as different counterparties will be active in subsequent operations or because the counterparty owning the specific security could choose to deliver different securities based upon wider market movements.

(2) For more background on the 'real bills' doctrine see Bindseil (2004).

(3) These costs include the physical costs of actually accepting such collateral through use of payments systems, time spent monitoring and valuing the securities and the potential costs of losses due to the riskier collateral.

quantity of reserves is available to the system, such that counterparties can make interbank payments and fulfil reserve requirements. On the other hand financial stability goals can be achieved by providing extra liquidity to the system in times of stress. One means through which a central bank can provide additional liquidity to the system without compromising its ability to set monetary policy is to exploit the range of eligible collateral.

As an example of this consider a counterparty holding two forms of collateral, both of high quality but one perceived to be strong and one perceived to be weaker.<sup>(1)</sup> In normal times the counterparty should be able to borrow in the market using both forms of collateral. Therefore the counterparty would be indifferent if the central bank accepted only the strong form of collateral in its operations. In times of stress it is likely that market participants will be less willing to accept perceived weaker forms of collateral in return for funding. Therefore if the central bank is unwilling to take the weaker form of collateral the counterparty faces problems accessing funding. The central bank could ease this potential channel of stress by using elements of its monetary operations to focus on achieving financial stability goals, ie supporting the ability of solvent commercial banks to fund in illiquid markets.

The Bank of England makes this distinction when permitting a wider range of collateral to be used in its indexed long-term repo operations and Discount Window Facility (see Box 3).

Other central banks, such as the ECB, have a single list of collateral for all operations.<sup>(2)</sup> As noted by Cheun, Von Köppen-Mertes and Weller (2009), one advantage of doing so is that it eases operational complexities and permits counterparties to pre-position collateral at the central bank. By pre-positioning counterparties are safe in the knowledge they can easily access any facility and not face a last minute scramble to shift collateral if say they need to move between intraday facilities and end-of-day standing facilities. Bindseil (2009) went further, suggesting that if a central bank can see value from accepting a certain type of security such that it supports wider financial stability goals, then it should accept such securities as collateral in all operations. If the central bank has chosen not to accept such securities in some operations then it may suggest that there are issues behind such a decision. Bindseil lists potential drawbacks such as legal ambiguity over the treatment of such securities, potential handling or risk assessment costs; a lack of liquidity or difficulties in valuation as potential reasons why a central bank has chosen not to accept a certain form of security as collateral.

Chailloux, Gray and McCaughrin (2008) refute this argument, suggesting that many central banks choose only to accept certain forms of security, normally the highest-quality securities, as collateral because they are unable to price

discriminate in their lending operations.<sup>(3)</sup> This means that faced with a wide range of eligible collateral commercial banks will choose to provide the lowest-quality and hardest to finance in the market collateral to the central bank. Therefore a form of Gresham's law<sup>(4)</sup> affects collateral choices, raising risks to the central bank and discouraging prudent collateral choices among counterparties. To enforce prudence a central bank may choose to limit the collateral it chooses to accept in some operations, potentially those related to the implementation of monetary policy under normal conditions. As discussed later, in times of stress central banks may choose to review such collateral choices.

### Monitoring eligibility

Even after a central bank has chosen what it believes to be a suitable range of collateral, it needs to ensure that the chosen securities continue to conform to the standards desired. This means a central bank must continually monitor its universe of eligible collateral and stand ready to make changes. In particular, a central bank should ensure that the chances of default for the issuers of eligible securities have not increased to a point where it is bearing undesirable credit risk.

The simplest method that a central bank can employ to monitor the credit worthiness of both issuers and underlying securities is to rely upon the opinion of private sector ratings agencies. Such agencies produce commentary and ratings on a vast array of marketable securities and issuers that is regularly reviewed and updated in light of developments.

Many central banks will choose not to wholly rely on the opinions of third parties and will in addition maintain their own internal ratings assessment process. While third-party ratings are often a good starting point for assessing credit standards, the risk preferences and overall outlook of the private sector agencies may differ from those of the central bank. In addition the central bank may have access to information, through its prudential regulation functions, about the issuers or securities that is unavailable to the ratings agencies. This leads many central banks to leave the final judgement over which collateral should be eligible in their operations to their own discretion.

In addition, while the universe of securities covered by rating agencies is normally wide, many central banks accept non-marketable securities, where there is likely to be no

(1) Securities can be judged across a range of characteristics including inherent credit risk, marketability and legal structures, market participants' willingness to hold securities with different inherent features can vary with market conditions.

(2) During the financial crisis the ECB made minor steps away from a centralised list by permitting the temporary acceptance of additional performing credit claims that satisfy specific (national) eligibility criteria under the responsibility of the constituent National Central Banks (NCBs).

(3) While the central bank can apply different levels of haircut to different securities the need to steer market interest rates limits the central bank's ability to price discriminate.

(4) Attributed to Sir Thomas Gresham (1519–79) it is commonly stated as 'bad money will drive out good', with reference to situations where undervalued and overvalued forms of money circulate concurrently in a system.

### Box 3

## Collateral pools at the Bank of England

The Bank of England accepts different pools of collateral in different operations. Different operations are designed to play different roles, implementing both the Bank's monetary policy and financial stability goals. Therefore different collateral policies are appropriate. In the Bank's provision of an intraday real-time gross settlement (RTGS) payments system and in its short-term open market operations and standing facilities, the primary purpose is to ensure the effective distribution of the correct amount of reserves to the banking system. Therefore in such operations the primary concern for the Bank of England is to insure against credit risk. Hence it accepts only a narrow collateral set comprising certain high-quality securities which are liquid in all but the most extreme circumstances. In the Bank's indexed long-term repo operations to provide an effective liquidity insurance mechanism to the banking sector as a whole, the Bank is prepared to lend against a wider set of collateral, including private sector securities that normally trade in liquid markets. And in the discount window facility (DWF) and extended collateral term repo facility (ECTR), consistent with these facilities being a liquidity back-stop, the Bank is prepared to lend against still wider classes of collateral.<sup>(1)</sup> In being prepared to lend against a broad range of collateral, the Bank aims to ensure that its liquidity insurance framework is consistent through time, by giving the market clarity on the terms on which the Bank will lend, both in normal times and times of stress. These arrangements are summarised in **Table 1** below.

**Table 1** Eligible collateral pools in Bank of England operations

Collateral	Narrow OMO	Wider OMO	DWF securities	DWF loans
RTGS	✓	✗	✗	✗
Operational Standing Facilities	✓	✗	✗	✗
Short-term repo OMOs	✓	✗	✗	✗
Indexed long-term repo OMOs	✓	✓	✗	✗
Discount Window Facility	✓	✓	✓	✓
Extended collateral term repo	✓	✓	✓	✓

The Bank publishes high-level collateral eligibility criteria for its operations, which set a baseline for the quality of collateral accepted. Ratings assigned by the rating agencies only play a role by publicly indicating the broad standards of credit quality expected in the securities accepted. The Bank forms its own independent view of the risk in the collateral taken and only accepts collateral that it can value and risk manage effectively. The types of securities contained with the different collateral pools can be summarised as follows:

- **Narrow open market operation (OMO) collateral** — consists of high-quality securities that are expected to trade

in liquid markets in all but the most extreme circumstances. It comprises UK government debt, issued in both sterling and foreign currency, Bank of England securities and sovereign and central bank debt issued by Canada, France, Germany, the Netherlands and the United States.

- **Wider OMO collateral** — like the narrow OMO collateral pool, the wider collateral pool contains only high-quality securities. The wider range of securities eligible within this list are expected to trade in liquid markets with predictable price and liquidity, such that the value could easily be realised in the event of a counterparty default and that the Bank can confidently risk manage them. There are a wide range of securities eligible under these criteria which includes; government and central bank debt issued by a wide range of countries, bonds issued by major international institutions, G10 government guaranteed agency securities, US housing agency issued AAA-rated securities and a range of AAA-rated asset-backed securities. The asset-backed securities eligible in the wider collateral list must meet a further range of criteria, including containing underlying securities in cash (ie not synthetic), not relying on third party guarantees for rating and not being own name securities.
- **DWF securities** — the range of securities eligible in the DWF securities list contains all of the securities eligible in both the narrow and wider collateral with the addition of a wider range of highly rated asset-backed securities. One major difference between the DWF securities list and the wider OMO collateral list is that counterparties are able to deliver own name securities in the DWF facilities.
- **DWF loans** — in addition to the wide range of securities eligible in the discount window facility the Bank will in addition accept pools of residential mortgage, consumer loan (excluding credit card), commercial real estate and non-bank corporate loans providing they meet certain criteria.

The Bank of England continually monitors the range of securities it accepts as collateral in its operations and reserves the right to make alterations to this list. The current details of the Bank's collateral policy can be found at [www.bankofengland.co.uk/markets/money/eligiblecollateral.htm](http://www.bankofengland.co.uk/markets/money/eligiblecollateral.htm).

(1) In addition to accepting different types of collateral in different operations the Bank of England also deals with a different range of counterparties across different operations. As noted the primary goal of the Bank's short-term OMOs and standing facilities is to ensure the distribution of reserves across the banking system to support the implementation of monetary policy. In such operations the Bank is willing to deal with any counterparty who meets a small list of criteria. In its indexed long-term repo and DWF facilities the Bank is providing liquidity insurance to the banking system to ensure against potential liquidity risks. In such operations the Bank would normally provide such insurance only to the banking sector due to the crucial role that banks pay in the provision of payments services both to the wider financial system and corporates and households.

relevant coverage of such securities. This means the central bank must perform their own due diligence on such securities to ensure they meet the required standard.

### Communication

Once the central bank has established the range of securities it is willing to accept as collateral, it is beneficial for all participants in the market to be aware of these choices. Many central banks go to great lengths to make their list of eligible collateral publicly available, publishing not just the general principles but in-depth lists of the ISINs<sup>(1)</sup> eligible securities.<sup>(2)</sup> By maintaining a central information point for collateral eligibility, the central bank can easily update counterparties to any changes made to eligibility as the result of ongoing eligibility monitoring.

## 5 Managing collateral

While the techniques above will likely limit the credit risk a central bank is exposed to during lending transactions, it does not eliminate the possibility of losses. The central bank is still exposed to market and liquidity risk with respect to the securities held as collateral. When holding both marketable and non-marketable securities, the value of such securities can change over the life of the transaction. Such changes in the value of the security can occur as a result of factors both idiosyncratic or market-wide. If the central bank has not put methodology in place to deal with these changes, it could find in the event of a counterparty default that it is not holding securities of sufficient value to cover the loss on the defaulted loans. In addition, while the value of the securities may appear by market prices or models to be of sufficient value to cover the losses the central bank may find it cannot realise this value in a timely manner.

Therefore to protect themselves against these potential losses a central bank will employ a range of techniques to ensure that it is always holding a sufficient amount of collateral. Such techniques will commonly take the form of a combination of haircuts, valuations, margin calls and limits. The Bank of England employs all of these elements in its collateral management practices (see Box 4).

### Haircuts

In general when a central bank makes a loan it will ask for collateral of an initial value greater than the value of the loan. This additional collateral is referred to as the haircut and it is designed to protect the central bank against negative changes in the value such collateral. Haircuts are a form of overcollateralisation.

The exact level of haircut applied to each security will vary dependent on the characteristics of the security. Fundamentally the purpose of the haircut is to ensure there is only a limited chance that the value of the collateral falls

below the value of the loan during the life of the transaction. The calculation of haircuts is a multilayered task, primarily based upon the past behaviour of the value of specific securities.

The primary determinant of a haircut should be a measure of the likelihood of such a negative change in value occurring. Such chances can be proxied by the potential volatility of the market price of a security. The universally accepted measure of such volatility in value of a security is Value-at-Risk (VaR). VaR is made up of a number of elements and is best understood as the greatest loss that can be expected to happen with a given probability over a specified time period. For example if a security has a 99% ten-day VaR of £100 million, then over any ten-day period an investor can expect that in 99 cases out of 100 the security will not decline in value by more than £100 million.<sup>(3)</sup> (See Box 5 for more details on VaR.)

In choosing a relevant threshold (such as 99%) and holding period (such as ten-day) the central bank should take into account its own risk preferences and the maturity of its operations. An extremely risk-averse central bank would choose a higher threshold than a less risk-averse central bank (potentially 99% versus 95%). The most relevant holding period a central bank can choose would be one that is in line with the maturity of its operations. Ultimately this is the length of time the central bank wants to be certain that it is protected from loss. Therefore if the central bank is lending overnight, the one-day VaR will be the most relevant. If the central bank is lending for two weeks, then the ten-day VaR will be of greater importance.

Standard VaR calculations are usually based upon the historical price data of the security in question. While this is fine for marketable securities where a reliable price history exists, if the central bank believes that the price history of a security is unreliable or is accepting non-marketable securities, where such prices do not exist, then such a calculation may not be possible. In addition, while reliable prices may exist for certain forms of securities, the central bank may expect that potential losses may not be captured in the historical realisations of the price.<sup>(4)</sup> Instead the central bank must establish an alternative method of establishing the likely volatility in the value of such securities. In such situations, stress tests or scenario analysis can provide a guide to the likely volatility. These can be based

(1) International Securities Identification Number.

(2) As examples see [www.bankofengland.co.uk/markets/money/eligiblecollateral.htm](http://www.bankofengland.co.uk/markets/money/eligiblecollateral.htm) and [www.ecb.int/paym/coll/html/index.en.html](http://www.ecb.int/paym/coll/html/index.en.html).

(3) It is important to note that VaR is merely a threshold measure, while in the example given above the investor will not expect the security to decline in value by more than £100 million over ten days ninety nine times out a hundred, VaR says nothing about how large the potential loss could be on the one occasion out a hundred the loss does exceed the threshold. This drawback could be especially relevant as it is likely in a stressed scenario that the central bank will be looking to realise the value of the collateral it is holding.

(4) This could be the case for newer types of assets that have not been traded through stressed conditions.

## Box 4

### Haircuts, valuation and margin at the Bank of England

To protect itself against loss in the event of a counterparty default the Bank of England employs haircuts, valuation and margin call techniques to all securities taken as collateral in any of its operations. An in depth summary of these techniques and examples can be found in Breeden and Whisker (2010), but are summarised here.

#### Haircuts

When lending in an operation the Bank requires a counterparty to provide an amount of collateral in excess of the value of the funds it is receiving. This haircut is the first line of defence in protecting the Bank against adverse moves in the underlying value of the collateral it is holding. The haircut applied to individual securities is comprised of two parts: a 'base' haircut for the asset class and an 'add-on' for any idiosyncratic features of the specific security.

The base haircuts applied to narrow sovereign and supranational securities are based upon the historical volatility of the price of such securities (specifically a 99% five-day VaR is applied). In addition for fixed-rate securities the haircuts increase with time to maturity to protect against potential interest rate risk. For a range of wider collateral, including the asset-backed securities accepted in the indexed long-term repo and DWF facilities, the Bank uses stress tests based upon adverse event scenarios to capture potential price falls that may not be reflected in historical price data.

The 'add-on' haircuts reflect the risks inherent in any idiosyncratic features of the securities. The most commonly

upon the performance of similar assets or a calculation based upon potential changes in the fundamentals underpinning the value of the security.

VaR and/or model based scenarios provide a first building block for the calculation of haircuts. Often additional elements must be added to fully ensure that in the case of counterparty default, a central bank will be able to realise sufficient value from the collateral to meet the value of the loan. Many of these elements involves the taking of additional collateral to account either through 'add-ons' for the idiosyncrasies of certain forms of collateral, or potentially to account for the extra time a central bank may need to hold the illiquid or idiosyncratic securities before being able to realise their value.

The most common 'add-ons' applied by central banks are on securities denominated in foreign currency; priced from models; non-marketable or 'own-name'.<sup>(1)</sup>

applied of these are additional collateral required if the securities are not sterling denominated, reflecting exchange rate risk. For securities which need to be priced off a model and any own-name securities provided by counterparties additional 'add-ons' are applied.

A full summary of the Bank's haircuts applied to lending and draining operations can be found at [www.bankofengland.co.uk/markets/money/eligiblecollateral.htm](http://www.bankofengland.co.uk/markets/money/eligiblecollateral.htm).

#### Valuation

Once the Bank has accepted the eligibility of the offered collateral and set the relevant haircut it continues to monitor the value of the collateral throughout the life of the transaction. On a daily basis the Bank will revalue all of the collateral it is holding using the latest available information.

Where possible this revaluation is done by taking the latest price paid for such securities available from a publicly available source. Where market prices are not available, or thought to be unreliable, the Bank will use model-based techniques including using discounted cash flow valuation for fixed-income securities and historical performance data for asset-backed securities.

#### Margin calls

Once the Bank has revalued the collateral, it will compare the new value of the collateral against the amount owed by the counterparty. If the new value of the securities has deviated from the original value of the loan by a set amount, then the Bank will either call for addition margin in the form of extra securities, in the case of price falls, or return collateral to the counterparty in the event of a price increase.

With foreign currency securities, volatility in the exchange rate between the currency of the loan and the currency of the security could still lead to the central bank holding insufficient collateral even if the price of the security has not exceeded its original VaR. Therefore an additional haircut may need to be applied for foreign currency securities.<sup>(2)</sup>

As discussed below, for securities that are priced using current market pricing there is no uncertainty regarding the current valuation. Current market prices are indicative of recent transactions and hence other market participants' valuations. However, for securities that need to be valued using model-based techniques there is a greater chance that such valuations may not be the same as other market participants

(1) 'Own-name' securities are those where the issuer of the security is also the institution providing it as collateral. Such a situation can arise through the use of asset-backed securities as collateral.

(2) A VaR calculation based upon spot exchange rates may be a good starting point for judging the potential scale of such a haircut.

## Box 5 Value-at-Risk

Hull (2010) provides a concise introduction to Value-at-Risk (VaR), discussing both the history of the measure and its various incarnations.

Ultimately VaR is a means of making a statement along the following lines: 'We are X per cent certain that we will not lose more than V dollars in time T' on an investment or portfolio. Therefore it gives an ability to state the maximum loss that can be expected over a specific amount of time with a certain degree of probability. For example a ten-day 95% VaR of £200 million would mean that 95 times out of 100 the loss on an investment will not be greater than £200 million over a ten-day period.

Pioneered by JPMorgan in the late 1980s, VaR was an attempt to provide a simple snapshot for its chairman as to the amount of risk the firm was exposed to on a daily basis. Through time other banks also developed their own measures of such risk and ultimately such a calculation became part of wider bank

regulations including as an aspect of Basel II where many of the parameters of VaR are standardised across institutions.

Despite its utilisation in regulatory frameworks there remains a vast array of methods to calculate VaR. Many use historical price data while others use estimated variances and covariances of asset price data to estimate a value for VaR on portfolios of assets.

Despite its universal acceptance as a risk metric, it is important to note that VaR is a threshold measure: while it provides a guide to the amount that can be expected to be lost with some degree of certainty on the majority of occasions, it says nothing about the potential losses once the threshold is exceeded. For example, while VaR may give a guidance as to the maximum loss expected with a 99% degree of certainty, it says nothing about the potential loss that additional 1% of the time. As such additional measures such as expected shortfall or Conditional Value-at-Risk, which attempt to model the likely losses should the threshold of VaR be exceeded have also been developed to give some guidance to risk managers about potential losses.

due to the assumptions required. To insure against such potential mismatches in valuations, the central bank can impose a higher haircut for securities for which it has less confidence in the current market value of.

When a central bank accepts a counterparty's own-name securities as collateral there is likely to be a high degree of correlation between the performance of the security and the performance of the issuer. As the central bank will only need to realise the value of the securities in the event of a default, there is likely to be read across from the health of the issuer to the security. Many central banks will therefore refuse to accept unsecured own-name debt securities issued by counterparties, as there is little difference from lending unsecured.<sup>(1)</sup> However, many central banks will take own-name asset-backed securities relying on the value of the underlying assets to act as collateral. Even here, the health of an issuer is likely to be linked to the health of the assets it holds, and hence central banks will often impose higher haircuts on such securities.

When the central bank comes to realise the value of the security, it is unlikely to be able to do so instantly and at the latest valuation. The realisation of collateral takes a certain amount of time, which can vary depending on the security and related legal and physical infrastructure. Gonzalez and Molitor (2009) note that there are three distinct stages through which the central bank must hold the collateral before realisation of the final value. The first is the 'valuation period', which covers the gap between the last valuation of the

collateral and opportunity to call for additional margin and the time of the default. The second is the 'grace period', which covers the period it takes to establish whether or not the counterparty has in fact defaulted and any time required to obtain legal ownership of the collateral. The final period is the 'realisation period'; this is the time it takes for the central bank to be able to sell the securities in the market in an orderly manner. Depending on the size of the central bank's holdings compared to the overall size of the market, it may not be possible to realise all of the value at once without significantly moving market prices. The ability to realise value may be a particular issue in accepting non-marketable securities. Therefore, the central bank will need to consider the likely length of the realisation process when setting a haircut and potentially require a higher haircut for securities where legal or market liquidity issues may delay the realisation of value.

### Valuation and margin calls

Imposing a sufficient haircut at the start of a transaction will provide the central bank with a degree of protection against adverse market moves. However, the central bank needs some mechanism through which to ensure that the value of the collateral it is holding is sufficient to cover the value of a loan in the event of default throughout the life of the transaction. To ensure that this is the case, the central bank must continue to monitor the value of the collateral it is holding.

<sup>(1)</sup> The ECB will accept unsecured debt securities issued by banks as collateral provided they are submitted by other counterparties who have purchased them in primary or secondary markets.

The process of valuation will vary for the type of security being held as collateral. For marketable securities that trade in liquid markets the process of valuation will rely on accessing the latest market prices. While there are usually a plethora of market prices available for many securities, the central bank will likely choose those from independent sources, such as independent data providers, to avoid any bias and prices that reflect recent activity.<sup>(1)</sup>

For non-marketable securities or for those securities that do not trade in liquid market the central bank will need an alternative method for valuing such securities. Most central banks will use a model-based approach in such situations.

For fixed income securities a common approach is to use discounted cash flow modelling<sup>(2)</sup> where implied market interest rates are used to evaluate the future payment streams embedded within the instrument. For asset-backed securities often valuation is more complex as the timing of payments may be uncertain. In such situations, historical prepayment and performance data either provided by the issuer or from benchmarking against similar securities can be utilised.

When it comes to the frequency of valuation the central bank needs to strike a balance between ensuring that the valuations it chooses are up to date and the costs involved in performing the valuation. At one extreme the central bank could value the securities it is holding at very infrequent intervals, however, it runs the risk that the value of the securities changes to such a degree that in the event of a counterparty default the central bank is exposed to losses. At the other extreme a central bank could maintain real-time valuation, however, such a process would entail significant costs to the central bank. Resources would need to be dedicated solely to the task. Since the rationale of the haircut is to insure against a certain degree of negative price movements, real-time valuation is unlikely to be necessary. Therefore most central banks choose a revaluation frequency that strikes this balance. For many, a frequency of daily revaluation insures against the surprise of potentially large negative price moves but does not lead to excessive costs related to the resources required.

If the central bank finds that the value of collateral has fallen below the value of the initial loan, then the central bank is exposed to loss in the event of a default on the loan. Therefore the central bank needs some method to rectify this situation. The most common mechanism is for the central bank to perform what is referred to as a margin call. When the central bank finds the value of the collateral has fallen below the value of the loan it can ask the counterparty to provide additional collateral.<sup>(3)</sup> At the same time should the value of securities have risen, many central banks will permit the counterparty to reclaim some of the now excess collateral.

As margin calls are not a costless task, the central bank will not perform them in real-time to ensure the value of collateral is always unchanged. The central bank will likely choose to perform margin calls at the same frequency as it performs valuations. In addition, to save on administration, the central bank will likely only make margin adjustments once the value of the underlying collateral has moved a certain amount in either direction. This trigger amount is usually discretionary to the central bank and is designed to avoid unnecessary fine tuning of collateral value. Margin call policies may or may not be symmetric with regard to requiring extra collateral or returning excess. In a symmetric system the central bank will set a symmetric range around the initial value of the collateral and call for margin to return the value of the collateral to its initial value once it moves outside of the range. On the other hand, an asymmetric policy could see the central bank choose to call for additional margin to return the value of the collateral to its initial value only once it falls below the (value of the loan but returns collateral to the counterparty once the value increases by a different set amount).

### Limits

As discussed above, the ability of a central bank to realise quickly the value of collateral in the event of a counterparty default is dependent on the depth and liquidity of the market for such securities. If the central bank finds it is holding a large position in a relatively thin and illiquid market it may find it either needs to accept a lower price or sell the security over a longer time horizon. A further channel of loss for the central bank would be the joint default of both a counterparty and issuer, which would leave the central bank holding potentially worthless securities. The scope of potential losses in such a scenario will be directly linked to the size of the central bank's exposure to the defaulted counterparty and the scale of its holdings of the defaulted collateral. One means of limiting both potential channels of loss is to impose limits on the amount of certain types of securities that can be provided as collateral.

In imposing limits central banks generally find it easier to deal on a counterparty-by-counterparty basis than to attempt to enforce limits across the whole of the portfolio. As noted by Chailloux, Gray and McCaughrin (2008): 'it would be difficult

(1) Gonzalez and Molitor (2009) recommend using bid prices instead of offer or mid-prices as this reflects the level that market participants are willing to pay for such securities. The bid price is used by, among others, the Bank of England and the ECB as the price to value collateral holdings.

(2) Investopedia defines discounted cash flow as a 'valuation method used to estimate the attractiveness of an investment opportunity. Discounted cash flow (DCF) analysis uses future free cash flow projections and discounts them (most often using the weighted average cost of capital) to arrive at a present value, which is used to evaluate the potential for investment.' See [www.investopedia.com/terms/d/dcf.asp#axzz1zUsE4al](http://www.investopedia.com/terms/d/dcf.asp#axzz1zUsE4al).

(3) The additional collateral provided does not necessarily need to be the same security, many central banks will allow counterparties to adjust the form of security used as collateral during the life of the transaction, see the section on managing collateral. The important element is to ensure that the value of the collateral provided is sufficient to cover the value of the loan such that in the event of counterparty default the central bank is not exposed to losses.

to restrict one bank's access to central bank operations on the grounds that another bank had used the same type of collateral'.

### Storing collateral

The discussion thus far has paid little attention to the physical transfer of collateral between counterparties and central bank. Long gone are the days where counterparties would need to deliver the physical certificate of a security to central bank. The delivery of collateral these days primarily concerns the legal transfer of ownership of various securities. Such transfers can occur either within settlement systems, both domestic and international, or bilaterally for securities not contained within such depositories.

When a security is handled within a domestic settlement system the process of delivery is relatively straightforward. As long as both the central bank and counterparty maintain accounts with the settlement system, delivery involves little more than an instruction to move the collateral from one account to another. The central bank should ensure in advance of accepting any form of collateral in this way that the legal framework governing the settlement system meets the required criteria for the central bank to maintain ownership in the event of a counterparty default. As long as these criteria are met then securities that are held within settlement systems can be readily used as collateral in central bank lending.

One of the advantages of using marketable securities within settlement systems is that often a prerequisite for their entry into such depositories is that they meet certain required legal standards. This is often confirmed by the drafting of legal documentation which makes the transfer of such securities very straightforward. Therefore such securities can be very quickly utilised as collateral, avoiding lengthy legal checks which may slow down the ability of a counterparty to use securities as collateral.

Once suitable collateral has been transferred to the central bank's account within the settlement system, it is the central bank's job to ensure that such collateral maintains sufficient value. Should additional collateral be required, or excess collateral be returned, the party with whom the action lies needs only to give the instruction to move the required collateral.

Many central banks also accept international securities which are stored in settlement systems overseas. Again as long as the central bank and the counterparty maintain accounts within such a settlement system, the delivery of collateral involves little more than an instruction to move the collateral between accounts. Often there are costs, both financial and resource-related, to a central bank maintaining accounts at a wide range of international settlement systems. Therefore

often central banks work in conjunction with their peers in other countries. Legal documentation can be put in place which will allow a domestic central bank to act as a correspondent agent for other central banks. In such transactions the collateral is managed by the central bank in the country where the settlement system is located on the behalf of international central banks. The most notable example of such an agreement is the Correspondent Central Bank Model (CCBM) used in the Eurosystem. Under the CCBM national central banks manage their domestic collateral on behalf of the other central banks within the system. The working of the CCBM is discussed in Box 6.

In addition to marketable securities contained with settlement systems, many central banks also accept a wide range of non-marketable securities. Due to the bespoke nature of many of these securities, their delivery as collateral may be slower and more complicated. This does not necessarily limit their use as collateral. Crucial to their expeditious use is ensuring that such securities meet eligibility criteria and that legal documentation can be put in place to ensure their transfer. As such processes can be lengthy, the role of pre-positioning is important. Pre-positioning involves counterparties making the central bank aware of the potential pools of assets that they may wish to use. Then the central bank can check the eligibility of the assets and draw up draft legal agreements to permit the transfer of such assets. Pre-positioning is also a lengthy process that is often time consuming, however, central banks can speed up the process by implementing standard procedures and processes that must be followed along with templates for information that must be provided and legal documents that must be signed.

### Substituting collateral

Many central banks permit counterparties to substitute collateral during the life of a transaction. In such a scenario, a counterparty will replace the collateral it has originally pledged to the central bank with an alternative form of collateral. Given the fluctuating value of collateral through the life of a transaction it may become financially advantageous for the counterparty to make use of the pledged collateral in an alternative transaction. However, as the loan from the central bank needs to be backed, counterparties will be required to provide an alternative form of collateral to do so. As long as all eligibility criteria are met, no limits are exceeded and the value of the collateral is sufficient to back the loan (including haircuts) then such a swap of collateral entails little operational note for the central bank as it will continue to hold adequate collateral to back its exposure to the counterparty.

### Managing collateral in the event of a counterparty default

As discussed above the reason a central bank takes collateral and then ensures it retains sufficient value is so that in the event of a counterparty default, it retains an asset of sufficient

## Box 6 Cross border use of collateral in the euro area

Within the euro area, monetary operations, including intraday payments which are linked by the TARGET system, are conducted at a disaggregated level. This means that German banks will access facilities provided by the Bundesbank, Spanish banks will access facilities provided by the Banco de España and so on. To ensure therefore that all counterparties have fair access to all operations the Eurosystem permits all counterparties to utilise all eligible collateral with their domestic central bank no matter where such collateral is held.<sup>(1)</sup> Such collateral policies are managed through the Correspondent Central Banking Model (CCBM).

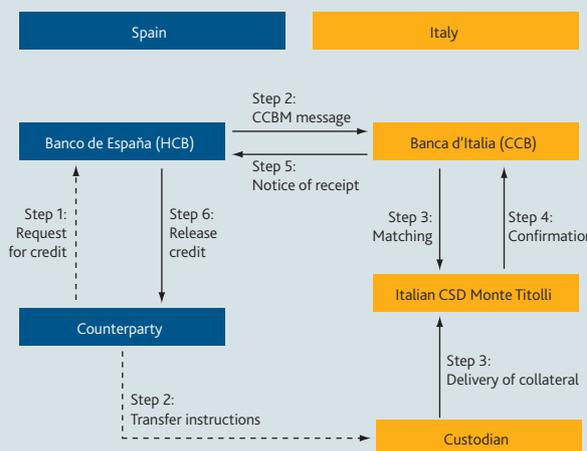
The ECB explain the working of CCBM as follows: a counterparty 'must transfer the eligible assets to an account maintained by the local national central bank (NCB) in the 'issuing' securities settlement system (SSS) (ie the SSS in which the securities have been issued and deposited). The local NCB is in general the central bank of the country where the SSS is located. The local NCB will then hold the collateral on behalf of the central bank granting the credit (the host central bank (HCB)) and thus act as a correspondent central bank (CCB). The transfer in the issuing SSS is generally effected on behalf of the counterparty by a local custodian participating in the system'.

A Spanish bank wishing to obtain credit from the Banco de España using Italian domiciled collateral will follow the following process (Figure 1):

- 1 The Spanish bank requests funds from the Banco de España stating the intention to use Italian collateral.
- 2 The Banco de España will contact the Banca d'Italia asking it to take receipt of the relevant collateral held in the Italian settlement system (in this example Monte Titoli<sup>(2)</sup>).
- 3 Banca d'Italia contacts Monte Titoli to ensure the collateral is delivered.
- 4 Monte Titoli confirms successful settlement to the Banca d'Italia.
- 5 Banca d'Italia processes the collateral, applying relevant haircuts and performing valuation and notifies the Banco de España once this process is complete.
- 6 The Banco de España credits funds to the Spanish bank's reserve account.

Throughout the life of the transaction the NCB will be responsible for the valuation and monitoring of the collateral pledged and will contact the HCB if additional margin is required. The HCB will then contact its domestic bank to ensure such requests are matched.

Figure 1



Source: ECB.

While the example above covers the procedures in place for marketable securities held within settlement systems, procedures also exist within the CCBM mechanism to allow eligible non-marketable assets to be used in a similar way.

(1) An added advantage of such a system is that it simplifies access to facilities meaning that pan-European banking institutions do not necessarily need to maintain central bank access in all countries in which they operate.

(2) Monte Titoli is a large cross-asset settlement system operating in Italy.

value to insure against financial loss. What has not been discussed is how the central bank should approach the task of realising this value. Ultimately the central bank has a choice between selling the asset to another counterparty or holding on to the asset. The choice will be influenced by wider market functioning at the time of the default. If the default of a counterparty is unexpected, it is not too far fetched to expect market functionality to be impaired. In such conditions the central bank may have little choice but to hold the asset until market functionality improves as it will find it difficult to sell the asset at a reasonable price. Other factors than market functioning can also dictate how the central bank deals with the collateral. In particular, the central bank must take into account the availability of reserves to the wider financial system when considering how to deal with the assets as any transaction will likely change this.

To understand the different impacts of holding the collateral to maturity or selling it, the balance sheets of the central bank and the wider financial system must be considered. When the central bank enters into a transaction with a counterparty it appears on both sides of its balance sheet. On the liability side there is the issuance of fresh reserves. On the asset side the holding of securities. The position of the counterparty is more complicated as many operational frameworks rely on the interbank market to distribute reserves around the system. This often means that the counterparty that enters into the transaction with the central bank does not end up holding the reserves. In aggregate the reserves available to the system are determined by the central bank's actions and hence a decision about a defaulted counterparty will have wider implications.

In selling the assets received from the defaulted counterparty to another counterparty the central bank will be taking reserves from the purchasing counterparty. This will reduce the total quantity of reserves available to the system. The central bank can always adjust the level in subsequent operations if it chooses to. This may be required, either due to higher precautionary demand from commercial banks in stressed market conditions or an increase in the remaining commercial banks' reserve requirements as a result of the transfer of deposits from the failed bank.

Selling the reserves is likely to be preferable if the assets taken as collateral are not ones that the central bank wishes to hold indefinitely or if the central bank does not want to permanently reduce the size of the refinancing needs of the system. In addition, there may be legal restrictions that differentiate the securities the central bank can take in repurchase transactions and those it can hold permanently on its balance sheet.

If the central bank holds on to the assets, the effect is similar to that of a permanent transaction, where the assets are bought outright, and will not initially affect the availability of reserves to the wider financial system, or the make-up of the

central bank's balance sheet. However, such a move does affect the size of the subsequent refinancing needs of the system and will reduce the amount that the central bank needs to roll over in subsequent operations.

Holding on to the assets may be preferable option if the impact on the size of required refinancing is small (or offset by an increase in demand for reserves for the same reasons noted above) or the assets are the types of assets that the central bank is comfortable in holding to maturity.

## 6 Collateral policies in a crisis

Central bank lending will usually make up a small temporary segment of wider commercial bank funding.<sup>(1)</sup> Commercial banks will use both deposits and a wider range of financial market sources to secure the majority of their funding. While many of the assets used in such transactions will be eligible in central bank operations, in normal times the central bank, for the reasons noted above, will likely lend only against a narrow range of specified collateral. Therefore many of the assets that commercial banks hold and use for market funding will not be eligible in central bank operations. Examples include other forms of securities traded in bilateral repo transactions (such as corporate bonds or international sovereign bonds) or securities created through bank funding strategies (such as unsecured bank debt or asset-backed securities).

Under normal financial market functioning commercial banks are normally content with such a state of affairs. Given that the functioning and pricing of financial markets can be affected by shocks, most prudent commercial banks will have a significant degree of crossover between assets used in both central bank operations and in wider market transactions. Profit-maximising commercial banks will choose the deployment of such assets dependant on the prevailing costs of doing so.

In times of stress it may become more difficult for commercial banks to fund in wider financial markets using certain types of assets. As commercial banks become more concerned about either their own funding position or their exposure to others, funding becomes more expensive. In such a situation it is important for the central bank not to react in the same way and tighten its collateral policies (except in exceptional circumstances). Were the central bank to react in a similar way to commercial banks it would make it almost impossible for commercial banks to plan funding strategies and potentially have a significant impact on medium term financial stability.

(1) As noted by Fisher (2009) if central bank monetary policy implementation is dependent on the central bank adjusting the amount of reserves available to the banking system, the central bank cannot provide medium-term funding to commercial banks without significantly impairing its ability to deliver its monetary policy and financial stability goals.

Such a policy by the central bank is called the 'inertia principle' and implies that in times of stress, to support wider financial stability the central bank should become more willing to bear risk. While initially such a principle sounds counterintuitive, Bindseil (2009) noted that the 'increasing social returns to additional risk taking by a central bank in a crisis situation appear to always outweigh the increasing costs of the central bank taking more risks'.

Situations may arise where the central bank needs to step beyond merely leaving its collateral policies inert in the face of market stress. In certain situations the central bank may choose to loosen the standards it normally applies and accept a wider range of securities. Examples of such scenarios include where the central bank needs to act a lender of last resort to a solvent but illiquid institution; where an asset class is struck by illiquidity, but remains fundamentally solvent;<sup>(1)</sup> or where the central bank needs to increase the quantity of lending to the financial system beyond the amount of the available collateral pool. During the global financial crisis which began in 2007, many central banks around the world reacted by loosening their collateral policies to accept a wider range of collateral. The changes made by the Bank of England are discussed in Box 7.

Not only will the loosening of collateral standards by a central bank automatically make it easier for commercial banks to access central bank facilities, they can also have a positive impact on wider financial market transactions. As noted previously, widening the pool of available collateral in central bank operations reduces the strain on the availability of high-class collateral. Often such strains appear as commercial banks become less able to fund with all but the highest-quality assets in wider markets. Given that such assets are usually the assets that central banks accept in their operations, increasing wider market demand can put strains on their availability. Therefore if the central bank becomes willing to accept the collateral that the market is no longer willing to accept, it will free up collateral to be used in other transactions. Even if the central bank is unable to widen its collateral list, it could potentially achieve a similar effect by reducing the refinancing burden of the financial system.<sup>(2)</sup>

While the loosening of collateral policies in a crisis can have benefits, it is not without risk. The most obvious risk comes from the financial and reputational damage that could occur as a result of a loss to the central bank. However, as discussed in the inertia principle it is nearly always the case that the social benefits of preventing a wider financial crisis will offset any potential losses by the central bank. This does not mean however, that the central bank should be reckless in its crisis response. As discussed above, ultimately central bank losses will result in fiscal choices for a government and could in the extreme case threaten the central bank's independence. Therefore the central bank needs to ensure that it can

adequately value and risk manage any new collateral it is willing to take. In extremis if the central bank is unable to satisfactorily manage the new collateral or believes that the collateral is intrinsically worthless, then the central bank must refuse to accept it and aim to solve the financial stress through other means.

A further risk from the central bank being willing to widen its collateral list in times of stress is that it can create moral hazard for commercial banks. The knowledge that the central bank will be willing to take a wider range of collateral in times of stress may lead commercial banks to make imprudent choices when it comes to collateral management, assuming the central bank will always respond by bailing them out. Therefore the central bank needs to consider means of discouraging such behaviour. Potential options available include ambiguity in actions<sup>(3)</sup> or imposing penalties for using the newly accepted collateral, such that their use is discouraged in all but the most extreme scenarios.

## 7 Operational risk management

The processes discussed above, properly implemented, should protect the central bank to a large degree against the credit, market and liquidity risks embedded within the process of lending to commercial banks. In addition to these risks there remains a further category of risk incidents through which a central bank can be exposed to potential losses: operational risk. There are many ways to define what is meant by operational risk. Under its broadest definition operational risk covers all losses that cannot be attributed directly to credit and market risk incidents. One of the most common definitions used for operational risk is the one enshrined within the Basel II framework: 'the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.'

Unlike the other forms of risk discussed above, operational risk can arise from a wide variety of sources, including:

- Fraud, arising from both external and internal sources. Central banks could be exposed to losses if either external or internal practitioners deliberately mislead with the intention of making personal profits.
- Damage to physical assets. The process of lending funds, accepting collateral and managing collateral all involves physical architecture such as buildings and computer

(1) For example the freezing of all asset-backed securities markets, even AAA residential mortgage-backed securities, following the emergence of stress in sub-prime residential mortgage-backed securities and collateralised debt obligation markets in the summer of 2007.

(2) For example in December 2011, the ECB cut the mandatory reserve requirements for financial institutions in the euro area from 2% to 1% of eligible liabilities in an attempt to free up encumbered collateral.

(3) See Bindseil (2009) for a wider discussion on the advantages of the central bank leaving ambiguity concerning its choices.

## Box 7

### Example of collateral polices through the global financial crisis: Bank of England

Prior to the global financial crisis the Bank of England accepted a relatively narrow range of securities in its lending facilities. The list comprised UK government securities and securities issued in sterling or euro by European Economic Area governments and certain supranational agencies, rated Aa3 (Moody's scale) and above. Such securities were eligible across all of the Bank of England facilities at the time, intraday payments systems, short-term open market operations (OMOs), long-term OMOs and the lending standing facility.<sup>(1)</sup>

With the onset of the financial market crisis in the summer of 2007 the Bank of England began to widen the range of collateral, offering a number of special long-term repo operations. Collateral eligible in such operations included a wider range of government bonds, lower-rated sovereigns including a wider range of currencies. In addition for the first-time tranches of highly rated residential mortgage and credit card backed securities as well as covered bonds were acceptable as collateral. Due to the pricing of the operations, in comparison to prevailing market rates at the time the operations went unfilled.

As money market strains intensified towards the end of 2007, the Bank once again offered a series of special long-term repos against a slightly modified list of wider collateral.<sup>(2)</sup> This time there was demand for funds in these operations. Further long-term repos were conducted through the spring of 2008 in response to acute bouts of financial stress.

Counterparty demand for funds in long-term repo operations against wider collateral intensified following the collapse of Lehman Brothers in September 2008. As a result the list of eligible collateral was widened further to include a wider range of AAA-rated asset-backed securities, including those backed by commercial property and student loans. In addition UK bank debt issued under the HM Treasury administered Credit Guarantee Scheme was also eligible in the operations.

Throughout this period, collateral acceptable in the remaining Bank of England operations — intraday payments systems, short-term OMOs, long-term OMOs and the lending standing facility — remained unchanged, covering just the narrow list of securities previously eligible.

In October 2008 the Bank of England also launched its Discount Window Facility (DWF), which was fundamentally an asset swap. Under the terms of the DWF, a counterparty could enter into a bilateral agreement with the Bank of England where it could swap a range of illiquid collateral for more

liquid collateral, usually UK government bonds. The initial list of collateral included the securities eligible in the Bank of England's long-term repo operations. Over time this list was widened to include further types of securities and pools of loans held on commercial banks' balance sheets.

In the summer of 2010 the Bank of England made alterations to its long-term repo operations. Prior to the crisis these had been designed as a balance sheet management tool. Through the crisis, as discussed above, they became a means of providing funds to counterparties against a wider range of collateral. However, the setup of the operations suffered from a number of drawbacks: the set spread for using wider collateral, no means of judging the scale of demand and a bidding process that exposed counterparties to interest rate risk. As an attempt to solve these issues, the Bank of England launched the indexed long-term repo operations (ILTRO). In this operation there is no longer a set spread for using wider collateral as opposed to the traditional narrow collateral. Counterparties now bid as a spread to indexed Bank Rate over the life of the transaction. The penalty for using the wider collateral is now determined by the bidding patterns in each auction. In addition, from the bidding pattern the Bank of England can judge the demand for funds against wider collateral and so can choose to increase the size or frequency of future operations.<sup>(3)</sup>

With the establishment of the ILTRO and the DWF as permanent features within the Bank of England's Sterling Monetary Framework, the collateral lists were rationalised to the list described in Box 3 during July 2011.

The introduction of the Extended Collateral Term Repo facility, which was announced in December 2011 and activated in June 2012, saw the Bank create a further means of providing liquidity to the market against the widest range of collateral.

(1) The deposit standing facility was an uncollateralised facility. As discussed previously it is rare for a central bank to provide collateral in an overnight standing facility where it is borrowing reserves from the financial system.

(2) See Box 5 of Chailloux, Gray and McCaughrin (2008) for the full list of eligible collateral in such operations.

(3) See Fisher (2011) or Klemperer (2010) for an overview of the working of the Bank of England's ILTROs.

systems. Damage to any of these could lead to the central bank being unable to operate in a normal fashion potentially exposing it to loss.

- Systems failures. As with damage to physical assets, a similar failure of the systems put in place to manage the lending process could expose the central bank.
- Execution and process management. While a central bank may put in place back-up plans that can deal with failures to physical assets and systems, ultimately there will always be room for human error which could leave the central bank exposed to losses.

Mitigating against all sources of operational risk would be at minimum immensely time consuming, expensive and potentially impossible. Therefore in attempting to limit potential exposures the first step is to identify the most likely and the most costly sources of risk. Importantly, these do not necessarily mean the same thing. Once the central bank has identified these channels it can go about putting in place controls and processes that limit these potential impacts. This could involve putting in place processes for detecting fraud and ensuring back-up plans are in place for damage to physical assets or systems. In addition processes can be put in place to limit the scope for human error, including ensuring all operational staff have proper training and checks are put in place to limit the reliance on individuals.

Managing operational risk is an ongoing process and potential incidents will occur within even the best-run systems. For a central bank, best practice involves regular reviews of incidents and procedures. Through learning from errors the central bank can try to reduce the chances of such incidents occurring again.

## Conclusion

In financial systems characterised by a shortage of liquidity, central banks will need to provide reserves to the market in order to achieve their policy goals. Hence, the central bank must take part in operations that expose it to potential losses. Therefore it must take steps to limit its potential exposure to avoid damaging both the reputation and independence of the central bank, and incurring fiscal costs if the central bank is owned by the government. Losses for the central bank accrue in the same way as for any financial institution and occur in balance sheet terms when the value of the assets falls, eroding capital. The value of assets can decline due to a number of risk channels including credit, market, liquidity and operational risks.

The first crucial step that a central bank can take to limit its exposure to potential losses is to only lend in a collateralised manner. When providing reserves to a counterparty the central bank should take securities in return. Then in the event

that the counterparty is unable to repay the loan, the central bank is left holding securities which it can use to cover the loss. There is significant variation across central banks as to the types of securities they are willing to hold as collateral. These choices are often influenced by both internal and external factors. The main internal factors include: the operational framework; choices regarding the size of the system's refinancing needs, the risk appetite of the central bank, dictated by the potential impact of losses, and the extent to which the central bank wants to impact market functioning. External factors include the legal status and availability of collateral choices.

While lending in a collateralised manner will limit the potential for losses related to credit risk, other risk factors can still lead to central bank losses in the event of a counterparty default. The value of securities taken as collateral will vary over time and therefore the central bank needs to ensure that it remains at least equal to the value of the loan they are secured against. To do this central banks employ techniques related to valuation (tracking the value of the securities), haircuts (overcollateralising initial loans) and margin calls (requesting additional securities if the value of the securities falls below the value of the loan).

The careful implementation of collateral policies coupled with accurate management of collateral can limit the potential losses for a central bank should a counterparty default. However, in the event of such a default the central bank will be faced with a choice between selling or holding on to the collateral. While such a choice will be influenced by the functioning of financial markets at the time of default the central bank needs to consider the likely impact on the availability of reserves to the wider financial system.

In the event of a financial crisis there are many good reasons why a central bank should respond in the opposite way to other financial market participants and leave its risk management policies at minimum inert. By leaving policies unchanged, commercial banks can plan for such an event with a degree of certainty. A central bank could go further and attempt to ease financial market strains by loosening collateral policies and potentially freeing up high quality collateral. However, such a move is not without risks: first it exposes the central bank to potentially greater losses and secondly it creates a potential moral hazard for commercial banks. Were commercial banks to believe that the central bank will always respond to financial market stress by loosening collateral standards they may be encouraged to be less prudent in their choices regarding assets to hold.

The successful implementation of collateral policies is often complemented within central banks by sound operational risk frameworks which aim to reduce the potential for loss through a wide range of other sources.

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