Risk managing loan collateral at the Bank of England

By Alice Alphandary of the Bank's Risk Management Division.[1]

- The Bank stands ready to lend to its counterparties against eligible collateral, which includes a wide range of securities and portfolios of loans that can be adequately risk-managed through a combination of prudent eligibility criteria, valuations and haircuts.
- When accepting portfolios of loans as collateral, the Bank undertakes an extensive due diligence process to understand and mitigate the legal and financial risks associated with these loans and the level of uncertainty surrounding these risks.
- Residential mortgages now represent the majority of collateral pre-positioned and the Bank's Risk Management Division uses loan-level data as an input to its credit stress and cash-flow models to calculate the stressed value of these loans in extreme, but plausible, scenarios.

Overview

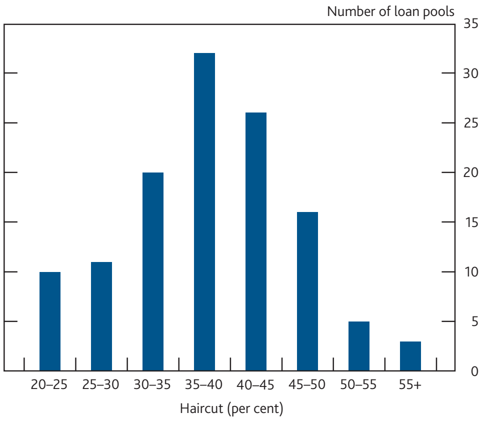
In pursuit of its objective of maintaining financial stability, the Bank stands ready to provide a wide range of banks and building societies (hereafter 'participants') with liquidity at a range of maturities against a broad set of collateral. In addition to securities, this includes portfolios of loans ('loan pools'), which must be 'pre-positioned' with the Bank before counterparties can draw liquidity against the collateral.

The Bank undertakes an in-depth review of potential loan collateral to ensure that it is protected against risks in the loan pool. It ensures that it can obtain legal ownership of the collateral and any associated cash flows in the event that the Bank's counterparty defaults. And it ensures that it is protected against financial risks associated with the collateral, and, importantly, understands the extent of the uncertainty around the level of these financial risks.

The Bank's Risk Management Division applies prudent eligibility criteria and valuations, along with conservative, through-the-cycle haircuts. The Bank uses credit stress and cash-flow models to determine the haircuts on pools of residential mortgages, which represent the majority of collateral pre-positioned. But the Bank does not set haircuts mechanistically and undertakes a thorough due diligence to consider qualitative risk factors before accepting a loan pool and setting the final haircut on it.

As shown in the **summary chart**, the modal haircut on residential mortgage loan pools is between 35%–40%, meaning that a participant can borrow 60%–65% of the value of the loans' outstanding principal balance.

Summary chart The distribution of haircuts applied to residential mortgage loan pools(a)



Sources: Bank of England and Bank calculations.

(a) Data as at 31 December 2013.

The Bank also accepts pools of other loans, including loans to small and medium-sized enterprises, corporates and registered social landlords and personal loans. Due to the less homogeneous nature of these asset classes, the Bank's framework for setting haircuts on them is necessarily more bespoke.

Once pre-positioned, the Bank monitors pools of loans to assess emerging risks. This is increasingly important given that the Bank had £352 billion loans pre-positioned at the end of 2013.

(1) The author would like to thank Clare Rogowski for her help in producing this article.

While at the aggregate level, lending creates deposits, at the level of individual institutions, banks and building societies (collectively referred to as 'participants' in this article) need to consider their sources and costs of funding in order to finance lending to households and businesses. They can attract funding from a range of sources: taking deposits from individual household and corporate savers; issuing debt or equity that is purchased by investors; or obtaining funding from other financial institutions. When counterparties, including the Bank of England, lend to each other they may take collateral — in which case the lending is said to be 'secured' — to guard against the risk of losses in the event that their counterparty defaults. In the case of the Bank of England, HM Treasury is its sole shareholder and so by adopting prudent risk management practices, the Bank seeks to minimise risks to public funds. In market-based transactions, this collateral normally takes the form of securities, which can include bonds, equities and asset-backed securities (ABS). But because of the Bank's special position in the markets where it may become the lender of last resort, it may need to lend to a given participant on a much greater scale than the amount which that participant would be able to borrow from any other single financial market participant.

Given the potential scale of lending that the Bank may be required to undertake and that all of it is done on a secured basis, the Bank needs to accept a wide range of collateral. So in April 2011, it began to accept portfolios of loans that participants had on their balance sheets. In addition, an independent review, completed in 2012 by Bill Winters[1] into the Bank of England's framework for providing liquidity to the UK banking system, recommended that 'the Bank should continue to broaden the range of eligible collateral for its Discount Window Facility (DWF) and other facilities beyond the substantial portion of bank assets already allowed…and, as such, might include allowing drawn revolving credit facilities as eligible collateral'.

This article explains the process for using loan collateral to raise funding with the Bank of England and is divided into two sections. The first section discusses the ways in which counterparties are able to borrow from the Bank of England in times of stress against a range of securities and loan collateral. The second section discusses how the Bank risk manages loan collateral through its eligibility criteria and loan valuations and haircuts. It sets out the approach used by the Bank's Risk Management Division to determine haircuts on loan pools in a prudent and conservative way, based on adverse hypothetical scenarios for credit losses. The range of haircuts that have been applied on loan collateral is discussed alongside some of the idiosyncratic factors that can influence the size of these haircuts.

Pre-positioning loans and securities with the Bank as collateral

The Bank's response to the Winters Review

Governor Carney's October 2013 speech, and the accompanying document outlined the changes to the Bank's Sterling Monetary Framework (SMF) in light of recommendations made in Bill Winters' review, together with the changing regulatory and financial market landscape.[2] In particular, they clarified that the Bank of England is 'open for business', that is, the Bank stands ready to provide liquidity to the UK banking sector when needed, by providing liquidity at longer maturities, against a wider range of collateral, at a lower cost and with greater predictability of access.[3]

In response to the Winters Review, the Bank of England established three criteria that an asset class must meet to be eligible as collateral:

(a) **Quantity**. It must be held in sufficient quantity by a range of SMF-eligible participants to support the Bank's lender of last resort function.

(b) **Risk management**. The Bank should be able to risk manage eligible assets using existing resources or with additional resources obtained at a proportionate cost. This risk management should mitigate the financial and operational risks associated with holding the collateral.

(c) **Avoidance of any unsecured exposures to other SMF participants**. Unsecured assets issued by an institution that participates in the SMF would not provide the Bank with robust risk mitigation benefits if accepted by the Bank as collateral. For example, unsecured bank debt would expose the Bank to high and uncertain amount of 'wrong-way' risk, since the value of unsecured bank debt is likely to decrease substantially at the time that banks are looking to collateralise borrowing from the Bank.

As part of this follow-up work, the Bank announced in October 2013 that the drawn portion of corporate revolving credit facilities would become eligible collateral, representing a further expansion to this collateral set. Following this announcement, and other changes made during the financial crisis, the Bank has one of the widest lists of eligible collateral among central banks.[4]

Providing liquidity insurance facilities

In order to access these SMF facilities, banks and building societies must apply to the Bank to become SMF participants. There is a presumption that all banks and building societies

(1) See Winters (2012).
(2) See Carney (2013) and Bank of England (2013).
(3) Other changes to the SMF are discussed in greater detail in the 'Sterling Monetary Framework Annual Report 2013–14' on pages 218–225 of this *Quarterly Bulletin*.
(4) See Bank for International Settlements Markets Committee (2013).

that have been authorised by the Prudential Regulation Authority (PRA) may sign up for the SMF and have full access to borrow in SMF facilities against eligible collateral.(1) Participation in the SMF is subject to the Bank being satisfied that the legal and operational requirements of the bank or building society in question are met, and may be subject to the provision of a guarantee from another group entity.

At present, only banks and building societies have access to the Bank's SMF facilities. In his review, however, Winters recommended that the Bank consider making certain liquidity facilities in the SMF available to non-banks, such as broker-dealers and central counterparties. As mentioned in the 'Sterling Monetary Framework Annual Report 2013–14' in this edition of the *Quarterly Bulletin*, the Bank is investigating whether to expand SMF access to reflect the increasingly important role of non-banks and capital markets. If any non-banks were granted access to some or all of the Bank's liquidity insurance facilities, lending would be collateralised and the Bank would manage this collateral in a manner consistent with the processes described in this article.

In the first instance, participants should insure themselves against liquidity risk — the risk that they become unable to fund their activities in the market. They may do this by holding portfolios of high-quality, highly liquid assets, which can be easily turned into cash in order to meet their liquidity needs as they come due, such as if depositors wanted to withdraw some or all of their funds. Liquid assets generally mean debt issued by the most creditworthy sovereigns or cash held on account at central banks.(2)

But it is sub-optimal for the banking sector as a whole and the UK real economy if participants insure themselves to too high levels, since this would divert cash away from productive lending to agents in the real economy.(3) In order to prevent this from happening, central banks can play a role by providing liquidity insurance facilities — facilities that solvent commercial banks and building societies can use to finance their assets if they are unable to access market funding. Such facilities should only be used significantly in stressed environments, whether these be stressed conditions in the market as a whole, or idiosyncratic factors affecting a specific participant. There is, however, a balance to be struck: through provision of these facilities by the central bank, participants may not elect to insure themselves against liquidity risk to a prudent level (so-called 'moral hazard'). In order to guard against moral hazard, international regulatory authorities such as the Basel Committee on Banking Supervision and national prudential supervisors, such as the PRA, require banks and building societies to hold an appropriate stock of liquid assets relative to their funding profiles.(4)

Eligible collateral

When the Bank lends funds in its operations, it accepts participants' assets as collateral so that it is protected against credit risk — the risk of the participant defaulting before it has repaid the funds that the Bank has advanced. This is because the Bank needs to protect taxpayers as far as possible from any unnecessary risk of loss incurred through its operations that help to deliver its policy goals of ensuring monetary and financial stability.(5) A significant financial loss could harm the Bank's credibility, threaten central bank independence and impair its ability to discharge its statutory responsibilities.

The types of collateral accepted by the Bank are broad and are split into three categories:

- Level A — high-quality sovereign debt that is liquid in almost all market conditions;
- Level B — high-quality sovereign, supranational and private sector debt and highest-quality ABS that are normally liquid in the market; and
- Level C — less liquid securitisations, own-name securities and portfolios of loans, including mortgages that are not normally liquid in private markets.(6)

The differing credit quality and liquidity of these types of collateral means that not all collateral can be used in all facilities, as shown in **Table A**. The price of the funding also varies with the degree of liquidity enhancement (where less liquid collateral is swapped for gilts or cash, which are more liquid), so it is most expensive to use Level C collateral. The facilities that only accept Level A collateral are for implementing monetary policy, whereas the facilities that accept all levels of collateral are liquidity insurance facilities.

Table A Collateral eligibility by SMF facility(a)

Facility	Level A	Level B	Level C
Operational Standing Facility	✓	✗	✗
Short-Term Repo	✓	✗	✗
Indexed Long-Term Repo	✓	✓	✓
Contingent Term Repo Facility	✓	✓	✓
Discount Window Facility	✓	✓	✓

(a) Note that the Funding for Lending Scheme and Emergency Liquidity Assistance are not part of the SMF.

(1) See Bank of England (2014).
(2) For an introduction to funding and liquidity risk for banks, see Farag, Harland and Nixon (2013).
(3) This risk was noted by the Financial Policy Committee in its June 2012 and June 2013 statements (www.bankofengland.co.uk/publications/Documents/records/fpc/pdf/2012/record1207.pdf and www.bankofengland.co.uk/publications/Documents/records/fpc/pdf/2013/record1307.pdf).
(4) See Bailey, Breeden and Stevens (2012).
(5) The Bank's sole shareholder is HM Treasury, so in turn, taxpayers would be liable if the Bank needed new capital.
(6) For a full list of assets in each category, see www.bankofengland.co.uk/markets/Documents/money/publications/summary_collateral.pdf.

Pre-positioning collateral

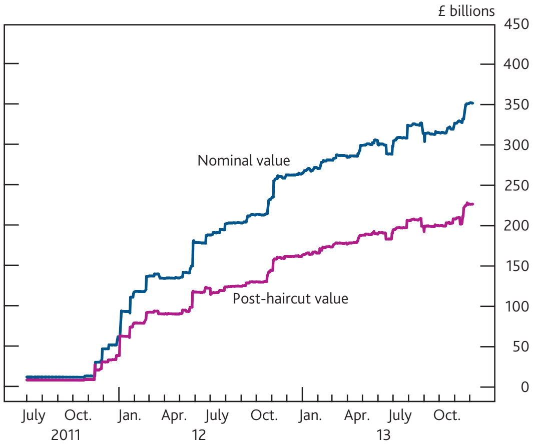
The Bank strongly encourages SMF participants to 'pre-position' a proportion of their total assets with the Bank of England to improve their ability to access central bank liquidity at short notice. Pre-positioning means delivering collateral to the Bank, but not using it straight away — it is contingency planning for a future need. In practice, this means that participants submit relevant signed documentation to the Bank's back office. The Bank then confirms when the loans have been pre-positioned. While the formal pre-positioning can take place intraday, the checking processes relating to the eligibility of portfolios of loans (collectively referred to as 'loan pools') that is required in advance of this can take several months to complete. By contrast, securities may be eligibility checked and pre-positioned within a day. This should be in advance of drawing down on a lending facility, as discussed in the box on page 194. So it is particularly beneficial to pre-position loan pools before a participant enters a period of stress.(1) It also provides both the Bank and the participant with certainty about the value that can be advanced against the collateral and allows the Bank to inform the participant of any preferences as to the order of delivery of different collateral.

Since April 2011, the Bank has accepted loan pools as collateral. Over time, the amount of loan pools pledged as collateral has increased substantially, as shown in **Chart 1**. This, in turn, has seen the total value of collateral pre-positioned with the Bank increase substantially. In part, this reflects the fact that participants no longer need to securitise their assets in order to access funding from the Bank — the securitisation process can be both costly and take several months to complete.(2) The smallest securitisations tend to be a few hundred million pounds in size, meaning that until loans were accepted by the Bank, only larger participants (who had these amounts of loans to securitise) were able to mobilise their loans to collateralise funding from the Bank.

The Bank encourages participants to shape their collateral into sufficient pools so that their funding needs can be collateralised by different tranches according to their liquidity needs and without excessive encumbrance. When an asset becomes encumbered, usually because it is collateralising an exposure, it cannot be withdrawn to raise funding elsewhere. So if a participant wants to draw down £500 million funding, but only has a loan pool after haircuts of £1 billion pre-positioned, the full £1 billion will become encumbered at the point of drawdown. It would be more efficient if that participant had, instead, pre-positioned two loan pools, each of £500 million, meaning that it would only need to encumber one of the £500 million loan pools to access the £500 million funding.(3)

Pre-positioning is a particularly beneficial form of preparation for a liquidity stress because unless a loan pool is drawn against lending from the Bank, it does not encumber a participant's balance sheet. For example, some participants may gradually increase the value of loans pre-positioned until they have a pool of a sufficient size to withdraw and use to launch a securitisation. If a large number of participants pre-position a proportion of their balance sheet, this has the potential to increase financial stability by improving their ability to withstand liquidity shocks.

Chart 1 The nominal and post-haircut value of pre-positioned loans over time(a)(b)



Sources: Bank of England and Bank calculations.

(a) Note that although loan pools became eligible in April 2011, the first pool was not pre-positioned until July 2011.
(b) Post-haircut values exclude the 5 percentage point DWF haircut for lending against gilts.

Pre-positioning delivers a number of additional benefits to participants. It allows them to access the Funding for Lending Scheme (FLS),(4) which was launched by the Bank and HM Treasury in July 2012 and is designed to incentivise banks and building societies to increase their lending to the UK real economy by providing them with a cheaper source of funding. In addition, in advance of implementation of the Basel III Liquidity Coverage Ratio, which will require banks to hold a stock of highly liquid assets to meet their needs in a 30-day liquidity stress scenario, the PRA currently allows banks and building societies to count the drawing capacity from the Bank's Discount Window Facility for up to 40% of their required holdings of liquid assets (subject to their meeting certain conditions).(5)(6) Finally, a recent change to the Bank's operations means that participants are now able to use pre-positioned Level C collateral in Indexed Long-Term Repo (ILTR) operations.

Loan collateral now makes up the majority of all pre-positioned collateral, as shown in **Chart 2**.

(1) See Fisher (2012).
(2) For a recent discussion on securitisation, see Bank of England and European Central Bank (2014).
(3) In practice, because the post-haircut value of loan pools fluctuates and participants have to meet margin calls whenever the value decreases by more than £25,000, many participants will leave excess collateral with the Bank to reduce the number of potential margin calls.
(4) For more information on the FLS, see Churm *et al* (2012).
(5) See Basel Committee on Banking Supervision (2013).
(6) See www.bankofengland.co.uk/publications/Pages/news/2013/099.aspx.

Pre-positioning securities collateral

In order to borrow from the Bank, participants must be able to provide the Bank with securities or loans to collateralise the borrowing. As outlined in this article, when participants pre-position loan pools, they become aware of how much they can borrow against the collateral. However, because participants may deliver securities on the day of borrowing, they may not always know how much they can borrow in total from the Bank unless they have already eligibility checked their entire portfolio.

The Bank of England will check the eligibility of any security submitted to it by an SMF participant. This helps with the participant's liquidity planning by letting them know which securities in their portfolio they can use to raise funds at the Bank.(1) The Bank is looking at ways to provide all participants with a list of securities that have been checked and deemed eligible.

This will not, however, be a complete list of all the securities that the Bank of England would be prepared to take: it only reviews securities that participants submit for review. So if a security is not on this list, it does not mean that it is ineligible; it may be that the Bank has yet to review its eligibility. In this case, a participant wishing to pre-position this security should first check the security against the Bank's guidance for eligibility prior to submitting it to the Bank for eligibility checking.(2)

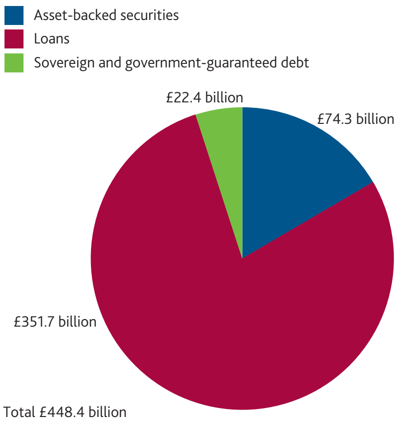
The Bank has decided not to publish a complete securities eligibility list for Level B and C assets. Reviewing the complete universe of these securities would create a big operational burden, for potentially little benefit. In addition, the Bank knows from its discussions with market participants that a fully public list of which securities do and do not meet central bank eligibility criteria can create a sharp division in market liquidity and pricing of central bank eligible, versus ineligible securities. So an approach that saw the Bank publishing a complete list of eligible securities could lead to market participants relying on the central bank to make decisions on creditworthiness. For this reason, this eligibility information is restricted to SMF participants only.

In common with loan pools, where the Bank does not believe that it can manage the risks of the collateral through appropriate valuation and haircuts, it will not make that security eligible. At present, failing to meet the Bank's transparency criteria is the most common reason for a security to be deemed ineligible. Since end-November 2011, to be eligible, any ABS must have publicly available loan-level information; transaction documentation; a transaction overview; standardised monthly investor reports; and a cash-flow model that shows the order in which cash is distributed to the different ABS note holders. The Bank introduced these requirements to improve transparency in the market, thus enabling potential investors in ABS to undertake their own credit analysis of these assets, instead of relying solely on marketing materials and ratings agency reports.

The Bank updates the value of securities on a daily basis, based — where possible — on the most recent market prices. This means that the value of the drawing capacity can change over time.

(1) Note that the Bank has ultimate discretion in how much to lend to a participant and so even if a participant has a certain amount of collateral pre-positioned with the Bank, there is no guarantee that the Bank will lend against that full value.
(2) More information on the Bank's collateral eligibility criteria can be found at www.bankofengland.co.uk/markets/Pages/money/eligiblecollateral.aspx.

Chart 2 Breakdown of all collateral pre-positioned at the Bank(a)



Sources: Bank of England and Bank calculations.

(a) Data as at 31 December 2013.

Risk managing loan pools

This section discusses in more detail the three ways that the Bank manages the financial risks associated with the loan collateral that it takes:

- Eligibility — whether or not it accepts a participant and/or an asset as collateral;
- Valuation — what level it prices an asset at; and
- Haircuts — what proportion of the Bank's valuation of an asset the Bank will lend against.

This section also shows the range of haircuts that the Bank has applied to different loan pools pre-positioned with it.

These risk management tools are designed to identify financial risks in the collateral and the level of uncertainty inherent in the assessment of these risks. In addition, this process is designed to eliminate 'binary' risks that are all or nothing in their nature, meaning that if they crystallise, they could prevent the Bank from realising any value from part or all of the loan pool. Throughout this review process, the Bank liaises closely with both the participants in question and their supervisors at the PRA, with the aim of minimising risks to the Bank's balance sheet.

Eligibility of participants and residential mortgage loan pools

Before a participant can pre-position collateral with the Bank for use in the ILTR, Contingent Term Repo Facility and/or DWF, it must be a member of the SMF, and have signed up to the DWF (that is, become a DWF participant). This entails the participant meeting the Bank's operational and legal requirements for participating in the DWF. The participant seeking to pre-position a loan pool — and the loans in that pool — are analysed using the Bank's internal credit assessment framework. The Bank has internal committees comprised of staff from different areas of the Bank with different areas of expertise that review participant and loan pool eligibility. This process includes seeking the views of relevant experts at the PRA.

When a participant wishes to be able to access funding from the Bank against loan collateral, it must first pre-position the collateral with the Bank. Before a participant pre-positions a loan pool, the Bank will undertake an extensive due diligence process, which includes an in-depth review of the participant and the loans in question in order to understand and mitigate the risks and uncertainties associated with accepting these loans as collateral. A key part of this is a site visit by staff from the Risk Management Division to the participant in order to meet members of the participant's management team and to build a qualitative understanding of its business.

To be eligible, loans must be governed by the laws of England and Wales, Scotland or Northern Ireland. However, its 'centre of main interest' (COMI) does not need to lie in the United Kingdom.(1) In cases where the COMI lies overseas, the loans in question would require participants to provide local legal counsel on the enforceability of the loans in that jurisdiction. Put simply, this means that the Bank does not only lend against loans to UK corporate borrowers located in the United Kingdom.

The collateral eligibility assessment element of the pre-positioning process comprises four parts, which can take place concurrently, and the Markets area of the Bank liaises closely with relevant supervisors at the PRA throughout this review process. First, the Bank reviews the participant's lending practices, encompassing their internal policies, controls around underwriting and servicing arrangements, as well as an overall assessment of the business as a whole. Second, the Bank compiles statistics on the major risk characteristics of a proposed loan pool — including the borrower, the purpose of the loan, the value of the loan and its repayment characteristics.(2) Third, the participant's legal advisers undertake a review of the legal terms that the loans in the proposed loan pool have been written under to ensure that the collateral can legally be transferred to the Bank and that once this is done, the Bank is able to enforce the terms. This legal review is in turn analysed by the Bank's legal advisers. Finally, a data audit carried out by an external firm is used to verify the existence, ownership and quality of loans, and to offer assurance on the quality of the participant's systems and processes. This is important because the Bank relies on the participant's data in order to accurately assess and monitor the loan collateral — any errors or omissions in the data could impair the Bank's ability to risk manage the loan pool.

In some cases where the loans in a pool have been written under highly standardised terms and conditions and so the legal risks associated with the loan pool are assessed to be very low ('vanilla' pools), the Bank modifies some of the four tests outlined above. A loan pool must meet certain criteria in order to be considered 'vanilla'. For instance, it must contain only owner-occupied loans that have been written under a limited number of standard mortgage terms, and must have been originated by the participant and not contain any unusual features (which could include equity release or flexible loan features).

Once all four of these reviews of a loan pool have been completed, the Bank's collateral committee will review the information and take a view on (i) participant eligibility (for the asset class in question); (ii) loan pool eligibility; and (iii) the haircut to be applied. If the Bank does not believe that the risks identified in its review process can be adequately captured by a haircut, it may reject the participant and/or the loan pool.

Reasons for ineligibility of loan pools

The Bank works with participants to help them to shape loan pools such that any risk management concerns the Bank may have can be addressed in a way that allows the participant to access the funding it requires. As such, it is rare for the Bank to reject a loan pool, although it may request the removal of certain loans from a loan pool if it does not think they can be

(1) A person or company's 'centre of main interests' or 'COMI' describes the jurisdiction with which that person or company is most closely associated. Often a company's COMI is the same as its jurisdiction of incorporation, but a number of additional factors are relevant, including, among others: (i) the location of the bodies responsible for the management and supervision of the company; (ii) the location of the registered office; and (iii) the location from which the management decisions of the company are taken.
(2) Borrower details are suitably anonymised so that the participant and the Bank comply with the Data Protection Act 1998. The Bank also exercises its usual obligations of handling sensitive data.

adequately risk-managed. In cases where a loan pool has not been accepted, there is usually a number of contributing factors that have led to the judgement that the pool cannot be effectively risk-managed. Such factors have included:

- Excessive uncertainty around the quality of the collateral, such as when a participant has insufficient management information meaning that the Bank is unable to monitor the ongoing performance of the loans to its satisfaction or there are serious doubts about the accuracy of the data that a bank has provided;

- excessive 'wrong-way' risk; and

- 'binary' risks, for example if the underlying loans had not been written under robust legal agreements, then if a risk should crystallise, the Bank may be unable to take possession of the entire value of all of the loans in the pool if the SMF participant were to default.

Valuation of residential mortgage loan pools

Valuation is an important risk management and policy tool. If the valuation is set too high, there is the risk that the Bank will lend more against the asset than — in the event of a participant's default — it could achieve by either selling the asset or holding it to maturity. But if the valuation is set too low, the Bank will limit the amount of funding it provides to a participant, potentially hampering its policy goals of monetary and financial stability.

There are a number of different valuations that can be applied to an asset. These include:

- **Market value** — the value that an asset is trading at in a liquid market. But when risk managing loan collateral, the Bank does not consider the market value, since loans are not normally liquid in private markets.

- **Nominal value, or the 'face value' of the loans** — that is, the outstanding principal amount left to repay.

- **Stressed value of the loans** — the estimated fundamental value of loans in the event of a severe real economy and/or financial market downturn taking into account factors such as declining house prices.

As described in the rest of this section, the Bank uses both nominal and stressed values as part of its risk management process for loan pools. By comparison, the Bank's preferred method for valuing securities is to use market value (subject to a haircut) where possible.

Haircuts on residential mortgage loan pools

The Bank does not lend an amount equal to the full value of the collateral that it takes, but instead sets a 'haircut' on the collateral. In the case of loan collateral, the haircut is the difference between the nominal and (lowest) stressed value of the loans. If a participant defaulted, the Bank would need to sell this collateral to make good any potential loss (or be prepared to hold this collateral to maturity). The value of the collateral could decrease in between the time that the Bank accepts it and when the participant defaults or, alternatively, the collateral could have been overvalued to begin with. So the haircut is designed to mitigate the risk of loss arising from the value of the collateral declining in the market, or due to the credit fundamentals of mortgages in the pool significantly deteriorating over the time that the Bank holds them on its balance sheet. Together, the product of the valuation and (1-the haircut on collateral) make up the amount that the Bank will lend against a loan pool.

The Bank is conservative in its lending in order to avoid any unnecessary risk to public funds in pursuit of its monetary and financial stability objectives. As such, it takes a prudent approach to valuing and setting haircuts on loan collateral, driven in part by the wrong-way risk associated with taking these assets, as participants are more likely to want to access funding from the Bank at times of market stress. **The approach outlined below is designed solely for the purpose of determining haircuts in a prudent and conservative way on existing loan pools offered as collateral, based on adverse scenarios for credit losses.**

This conservative approach allows the Bank to set 'through-the-cycle' haircuts, meaning that they will not increase systematically in the downswing of the business cycle. Therefore, when participants are informed of the post-haircut value of the collateral, they will know how much funding they can draw against that loan pool even in times of severe stress, which helps with their liquidity planning.

Use of models in setting haircuts on residential mortgage loan pools

The haircut on a loan pool typically consists of the credit loss haircut, which is designed to cover the credit risk associated with the loan pool, alongside additional haircuts to mitigate risks that are not captured by the Bank's models. For residential mortgages, the Bank sets a base level for the credit loss haircut using its credit stress model and its cash-flow model. The methodology is a two-stage process: the first stage assesses the quality of the loan pool and forecasts losses using the credit model; the second stage runs a number of stress scenarios to estimate the behaviour of (and cash flows associated with) the loans in the pool, using the cash-flow model to calculate a net present value of cash received over the lifetime of each loan.

In the first step, the credit model is used to forecast borrowers' ability and willingness to service their mortgages, and based on these, derive a probability of default (PD). The credit model uses the loan-level information provided by the participant to estimate the borrower's PD. In the model, a key determinant of the PD is the loan to value (LTV) ratio: the greater the equity a borrower has in a property, the greater the likelihood of them continuing to repay the loan. Another key factor that is assumed to impact the PD is the affordability of the loan. Taking loan repayments relative to the borrower's income as one such metric of affordability, the model assumes that the higher this metric is, the higher the probability of a borrower being unable to meet their repayment obligations over the lifetime of the loan. The PDs used in the credit model are calibrated by Bank staff using these measures of ability and willingness to make mortgage payments.

This model-derived PD can be overridden (typically increased) if the loan demonstrates certain other risk characteristics such as if the borrower has an adverse credit history and/or the loan in question is interest-only. The credit model calculates a PD for every loan in the pool and uses these results to estimate a weighted average PD for the whole loan pool.

The credit model also calculates estimates of the losses on each loan in the event that they default — the 'loss given default' (LGD).[(1)] This calculation takes the outstanding balance on the loan and an up-to-date valuation of the property and then applies a significant fall in this valuation in order to replicate a stressed economic scenario. The calculation also considers other risk factors, such as whether a loan is interest-only or the borrower is in arrears on the loan, as well as the costs associated with selling the property. The recovery value for each loan is then used in the cash-flow model to forecast recoveries in the event that a loan defaults.

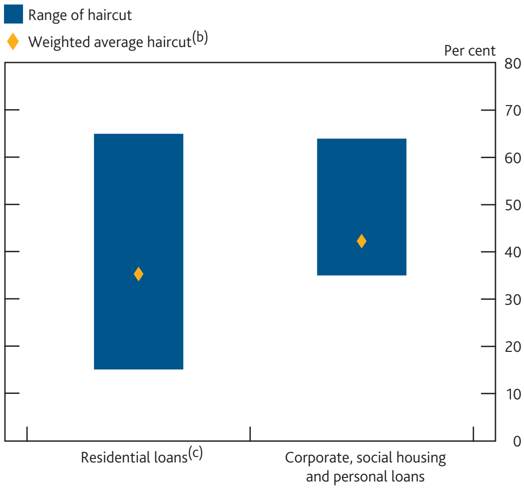
In the second step, the cash-flow model takes outputs from the credit model and uses them to forecast the different repayment profiles on every mortgage in a loan pool under a range of hypothetical economic stresses, recognising that the capital and interest repayments made by borrowers on their mortgages will vary depending on the nature of the stress. The Bank then discounts the value of these cash flows back to their present value. Taken together these give a stressed value of the entire loan pool: the difference between the face value of the underlying loans and this stressed value is the base haircut on the pool, as implied by the credit and cash-flow models.

Additional determinants of the haircut

As discussed above, LTV ratios and the affordability of loans are two key determinants of the haircut on a loan pool. But due to the Bank's non-mechanistic approach to setting haircuts, loan pools with similar quantitative characteristics may have very different haircuts. The Bank also applies additional haircuts (not derived from its credit and cash-flow models) where it thinks that the models have not adequately captured the risks owing to specific factors affecting a particular loan pool. Reasons for applying additional haircuts could include concentration risk, where a small number of loans account for the majority of the value of a loan pool.

Average haircuts on residential mortgage loan pools are lower than on pools of corporate, social housing and personal loans as shown in **Chart 3**. At present, only secured corporate loans have been pre-positioned[(2)] and, the assets that they are secured against — such as commercial property — have greater uncertainty over their value than the assets securing residential mortgages, and therefore a potentially lower recovery value in the event of a counterparty default. That said, some corporate entities may have a lower probability of default than certain classes of residential mortgage borrowers, leading to a lower haircut on selected commercial pools. This is particularly true of loans to registered social landlords, which are regulated entities and are eligible to receive grants and so are more likely to be able to service their debt in an economic downturn.

Chart 3 Haircuts applied to pre-positioned loan portfolios[(a)]



Sources: Bank of England and Bank calculations.

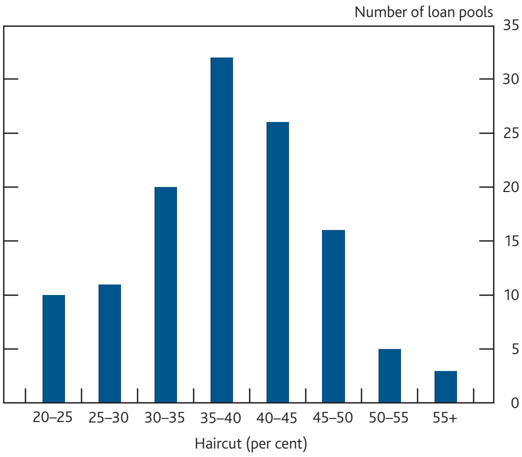
(a) Data as at 31 December 2013.
(b) Weighted by nominal value of loan portfolios, before haircuts are applied.
(c) Excludes social housing loans.

The modal haircut on residential mortgage loan pools is between 35%–40%, as illustrated by **Chart 4**. This means that for these loan pools, the participants will be able to borrow 60%–65% of the value of the loan pool.

At first glance, this may appear higher than the haircuts on an equivalent residential mortgage-backed security (RMBS), the base haircuts for which lie between 12%–24%.[(3)] But it is worth noting that a number of additional haircuts apply on RMBS collateral delivered to the Bank: a 5 percentage point

(1) Together, the PD and LGD can be multiplied together to calculate an expected loss. Expected losses are discussed in the article 'Credit spreads: capturing credit conditions facing households and firms' in this edition of the *Quarterly Bulletin* and in Button, Pezzini and Rossiter (2010).
(2) Although unsecured commercial loans are also eligible.
(3) See www.bankofengland.co.uk/markets/Documents/money/publications/summary_haircuts.pdf.

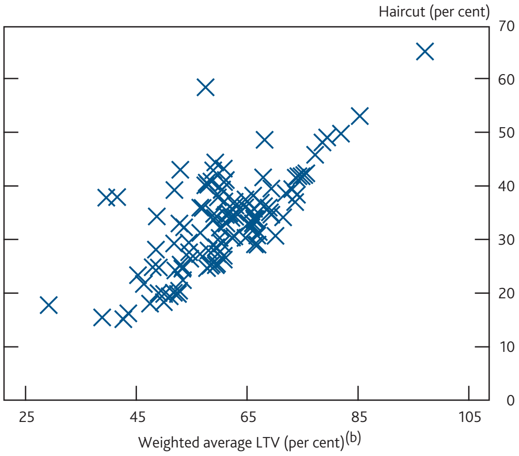
Chart 4 The distribution of haircuts applied to residential mortgage loan pools[(a)]



Sources: Bank of England and Bank calculations.

(a) Data as at 31 December 2013.

Chart 5 Weighted average LTV ratios and haircuts on residential mortgage loan pools[(a)]



Sources: Bank of England and Bank calculations.

(a) Weighted average across loans in a given loan pool, by value.
(b) Data as at 31 December 2013.

haircut if the security is model-priced, a 5 percentage point haircut if the security is issued by the SMF participant that is also delivering it to the Bank (akin to a bank delivering a pool of loans it originated) and wrong-way risk haircuts if the bank delivering the RMBS plays additional roles in the deal, such as providing the swap. In addition, RMBS will incorporate credit enhancement, which is additional protection for the RMBS note holders if some or all of the borrowers of the underlying mortgages were to default.[(1)] One example of credit enhancement is overcollateralisation, where there is more collateral backing the RMBS than the value of notes in issue. This generates greater cash flows than are needed to service the coupon payments on the debt. This is something that a portfolio of unsecuritised loans does not benefit from.

Given the calibration of the Bank's risk models, it is unsurprising that in general, the lower the LTV, the lower the haircut. This can be seen in **Chart 5**, although this is not a perfect relationship, as mentioned, for a number of reasons. It is more difficult to observe a strong relationship between affordability metrics and haircuts, since the majority of loan pools demonstrate similar affordability metrics. This largely reflects the fact that most pools comprise a large number of loans that vary by affordability, but this variation typically averages out across pools of loans.

Setting haircuts on other loan pools (including commercial loans)

Due to the less standardised nature of commercial loans, the Bank uses a different approach to set haircuts. The Bank does not, in general, have a preference for residential mortgage assets over other assets, but its due diligence of the latter is necessarily more onerous because the uncertainty around these risks is greater due to the more bespoke nature of the terms commercial loans are written under, as discussed later in this section.

For these asset classes, the Bank has calculated a range of expected losses to determine a haircut on the loan pool. As shown in **Table B**, different asset classes are assumed to have different PDs and LGDs, which in turn will affect the size of the haircut. Broadly speaking, private finance initiative and social housing loan pools have the lowest average base haircuts, while commercial real estate, auto loans (for car purchases) and personal loans have some of the highest average base haircuts. While for residential mortgage loan pools, PDs and a range of different LGDs are important inputs into the cash-flow model, the expected loss output for other loan pools is not a straightforward multiplication of the PD with the LGD.

Table B Relative PDs and LGDs for different asset classes[(a)]

Asset class	Probability of default	Loss given default
Private finance initiative loans	Low	Low
Social housing loans	Low	Low
Loans to large corporate entities	Low	Medium
Auto loans	Medium	High
Personal loans	Medium	High
Loans to small and medium-sized enterprises	High	Medium
Commercial real estate loans	High	Medium

(a) Based on conservative Bank estimates.

Bank staff reviewed a range of data sources and studies to set PDs and LGDs for the different asset classes, placing most weight on UK-specific data and studies with a long-run history covering several business cycles.[(2)] Information from counterparties on their own default history was also input into Bank staff's judgement on where to estimate LGDs. The Bank then sets haircuts designed to cover these ranges of expected losses. However, while the Bank's modelling of residential

(1) For more information on credit enhancement, see Breeden and Whisker (2010).
(2) These included default and recoveries data from the ratings agencies as well as academic and industry research and empirical evidence.

mortgages calculates PDs and LGDs resulting in a range of estimates given the fundamental characteristics of the pool, for commercial loan pools the Bank uses conservative point estimates for LGDs and PDs within pre-agreed ranges.

Many of the factors that the Bank considers when assessing commercial loans are the same as for residential mortgage ones, although some are more significant when assessing commercial loan pools. For example, exposures to a single borrower tend to be much greater in a commercial loan pool than a residential mortgage one. This is because while a residential loan pool may consist of tens of thousands of loans, a commercial loan pool tends to consist of a smaller number of loans, each of a higher value. So the impact of one loan defaulting in a commercial pool is likely to be much greater than in a residential loan pool. This risk is offset to some extent if there is collateral backing the loan, especially since the collateral will typically be more diversified than the (individual) borrower.

In addition, underwriting may also be performed on a more individual basis for corporate loans than for residential mortgages. Many participants make use of models to mass underwrite residential mortgage and personal loans under their standard lending policy. By contrast, commercial lending may be done by teams with specialist knowledge in a particular sector. They can use this expertise, alongside building strong relationships with their borrowers, to structure facilities in a way that attempts to manage the risks appropriately.

Where appropriate, the Bank's risk management staff also review the cumulative default performance for loans of different vintages within pools. This can be a useful indicator of whether underwriting standards have changed — a trend of progressively higher cumulative default rates, for example, could suggest a relaxation in underwriting standards. However, where a long back-history of these data is not available — because a participant is newly established or has only recently started to conduct a certain type of lending, say — Bank staff will seek alternative evidence of the likely performance of these loans and the uncertainty around their performance, so that in most cases participants are still able to use this collateral to raise funding from the Bank.

As discussed in the section on residential mortgages, Bank staff then use judgement to determine whether to apply additional haircuts to capture risks that are not accounted for in the base haircut. The Bank reaches a decision about the eligibility of a loan pool, and if accepted, communicates its haircut to the participant and works with them to formally pre-position the loan pool.

Ongoing monitoring of loan pools and participants

Once a participant has pre-positioned loan collateral, the Bank undertakes a range of ongoing monitoring, designed to identify changes in loan pool composition, origination standards and other factors with a bearing on the performance of current and future loans. The Bank undertakes this monitoring of both loan pools that have and have not been drawn against, in the latter case to ensure that participants can draw against loan pools at any time. This is becoming an increasingly important part of the Bank's work on collateral given the value of loans that are now pre-positioned; this figure stood at £351.7 billion at the end of 2013.

The Bank regularly checks that the post-haircut value of collateral pre-positioned exceeds the amount of any funding advanced by the Bank. As loans mature, the value of collateral held by the Bank decreases as household and corporate borrowers repay their loans — this cash is held by the SMF participant that wrote the loan and is not passed on to the Bank. If the haircut value of the collateral no longer exceeds the value advanced by the Bank, it will make a margin call for the participant to post more collateral with the Bank. However, such occurrences are rare with respect to loan pools as participants tend to have a number of loan pools of different sizes pre-positioned with the Bank. Participants can therefore notify the Bank to use a larger loan pool to collateralise their borrowing, thus meeting the margin call and unencumbering the smaller loan pool. In addition, the Bank frequently re-runs its credit and cash-flow models to update its valuations and haircuts of the evolving loan pools. The Bank reviews its haircut methodology regularly to ensure that it remains fit for purpose.

The Bank also conducts periodic reviews of the lending and risk management policies and practices employed by participants. This involves, at a minimum, requiring participants to re-submit their due diligence questionnaire, highlighting changes to existing policies. The Bank will also conduct additional site visits, and apply additional monitoring where required for prudent risk management.

The Bank monitors data for trends across participants in order to identify any emerging risks common to some or all pre-positioned loan pools. An example of such monitoring is reviewing the cost of borrowing for different asset classes, as an increased cost of borrowing can signal increased credit risk in that sector. This monitoring allows the Bank to perform useful peer analysis by identifying any deterioration that suggests a participant is weakening, such as a marked rise in the number of loans in a pool entering arrears. As part of this process, staff review changes in haircuts as a result of monthly data sent in by participants. This allows the Bank to monitor changes to the loan pool and changes to key risk indicators in the pool, such as changes in concentration in the loan pool and an update of the LTV ratio.

Conclusion

The Bank stands ready to provide liquidity to a wide range of banks and building societies, for a variety of maturities against a wide range of collateral. But in providing this important liquidity insurance, the Bank must limit the financial risks to its balance sheet in order to protect public funds. It does this by assessing collateral for eligibility and, when accepted, the Bank applies conservative valuations and haircuts to this collateral. But it is also important that the Bank behaves predictably and so by pre-positioning collateral with the Bank, participants become aware of their drawing capacity for times of stress and can incorporate the use of Bank of England facilities into their contingency planning.

The Bank's due diligence process for residential mortgage loan pools uses credit and cash-flow modelling, alongside qualitative analysis. The non-mechanistic nature of this work, in particular the key role played by an analysis of the uncertainty surrounding collateral valuation, means that haircuts on loan pools with similar LTV and affordability metrics can have markedly different valuations and haircuts. The review process for loans to businesses covers similar issues to those for loans to households, but because the former are written under more bespoke terms, the Bank's due diligence of these loans is necessarily higher due to the greater uncertainty of these risks.

The Bank works to ensure that its liquidity insurance facilities offer wide access, while balancing that with the need for prudent risk management. As such, the Bank periodically reviews the case for, say, expanding its list of eligible collateral to include a new asset class.

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