

Quarterly Bulletin

2015 Q1 | Volume 55 No. 1



BANK OF ENGLAND





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Topical articles



Investment banking: linkages to the real economy and the financial system

By Kushal Balluck of the Bank's Banking and Insurance Analysis Division.⁽¹⁾

- Investment banks play a key role in capital markets and contribute to the efficient functioning of financial markets. As demonstrated in the recent financial crisis, however, investment banks can create and propagate risks in the financial system given their scale, as well as the interconnected and complex nature of their activities.
- Recognising investment banks' systemic importance, a number of international regulatory initiatives have come into force since the onset of the recent financial crisis.

Overview

The main activities of retail or 'high street' banks, such as accepting savers' deposits, making loans and providing payment services, are well known. In contrast, the functions of investment banks are typically less well understood. **This article describes what investment banks do and highlights some of the risks that they can pose.** Along the way, it attempts to explain some of the terminology frequently used in relation to investment banking — from 'SPVs' and 'CDOs' to 'bid-offer spreads' and 'dark pools'.

Investment banks help organisations such as companies and government agencies to raise finance through capital markets. When a company wishes to borrow money by issuing a bond, for instance, investment banks can help match the company with investors. Investment banks also underwrite the issuance of shares or bonds — that is, they guarantee to provide finance at a pre-determined price when the shares or bonds are issued.

Investment banks trade in a wide range of financial instruments — including shares, government and corporate bonds, foreign exchange and commodities such as oil or precious metals, and related derivative instruments. For the most part, they carry out trades on behalf of their clients. Trading in financial instruments (via an investment bank) can help companies to manage their risks. Other clients for these trading services include retail banks, insurance companies, and financial institutions that manage savers' funds, such as pension funds and hedge funds. These trading services can contribute to the efficient functioning of financial markets, thereby serving the needs of end-investors in the real economy. That said, some trading activities, such as the 'proprietary trading' that investment banks carry out

for themselves (rather than on behalf of clients), may not provide such a clear benefit to market functioning.

Investment banks also bring risks to the financial system. With the trading assets of the ten largest banks summing to more than £5 trillion,⁽²⁾ the sheer scale of these banks' operations means that liquidity conditions in financial markets can be vulnerable to the failure of a single firm. In addition, the web of interconnections between investment banks and other financial institutions can act as a channel for the transmission of losses throughout the system, while the complexity of some of their activities also contributes significantly to risks in the global financial system.

Many of these risks crystallised during the recent global financial crisis when some of the largest global investment banks were taken over, bailed out using public funds or declared bankrupt after facing distress. And they remain relevant to financial stability in the United Kingdom, with all of the largest global investment banks having operations in London.

A number of regulatory initiatives globally have been implemented since the onset of the global financial crisis to correct the fault lines that contributed to it and to build a safer, more resilient financial system to serve the real economy. The Bank of England has a key role to play in working with other regulatory bodies globally to fully implement these measures and ensure that investment banking activities are conducted in a way that is safe and sound.

[Click here for a short video that discusses some of the key topics from this article.](#)

(1) The author would like to thank Theodore Agbandje-Reid, Andrew Feeney-Seale and Jean-Michel Mazenod for their help in producing this article.

(2) Based on the data shown on Table A on page 5.

Most people are familiar with the main functions of retail banks — sometimes referred to as ‘high street banks’. These include providing deposits and payment services, as well as making loans. In contrast, investment banks help companies, other financial institutions and other organisations (such as government agencies) to raise finance by selling shares or bonds to investors and to hedge against risks. Unlike retail banks, they do not directly serve households.⁽¹⁾ In addition, investment banks trade in shares, bonds and other assets with other financial market participants, such as insurance companies, pension funds and hedge funds.

All of the large global investment banks have a presence in London. These banks therefore contribute to UK economic activity, and help support the efficient functioning of the financial system. But investment banks also bring risks to the United Kingdom’s financial system. During the recent crisis, investment banks were criticised for their excessive risk-taking and their role in the creation and systematic mispricing of complex securities. Their activities generated risks which contributed to financial instability globally and in the United Kingdom.

To help manage these risks, investment banks are subject to regulation. In the United Kingdom, legal entities that have permissions to deal in investments are referred to as ‘investment firms’. Some investment firms are subject to prudential regulation by the Bank of England’s Prudential Regulation Authority (PRA) by virtue of their importance to the stability of the UK financial system.⁽²⁾ But investment banking operations are not exclusively carried out by investment firms and some entities that carry out investment banking activities are also PRA-regulated due to their retail banking activities. Investment banking activities in the United Kingdom can also be carried out by UK branches of foreign banks. In these cases, PRA regulation is limited and prudential responsibility lies with the home regulator.⁽³⁾ All financial firms and activities in the United Kingdom are also subject to conduct supervision by the Financial Conduct Authority (FCA). In addition, the Financial Policy Committee (FPC) at the Bank of England is charged with identifying, monitoring and taking action to remove or reduce systemic risks — including those created and propagated by investment banks.⁽⁴⁾

Table A shows the fifteen banking groups with the largest investment banking operations globally. While all of these banking groups provide investment banking services, most of them operate a universal banking model, providing other retail and corporate banking services — such as accepting deposits, making loans and facilitating payments — alongside their investment banking activities.

These groups are some of the largest and most systemically important banks globally and all of them have operations in the United Kingdom. These operations are regulated by both

Table A Banking groups with largest global investment bank activities at December 2013^(a)

Banking group	Trading assets, £ billions
JPMorgan	895
Goldman Sachs	683
Bank of America Merrill Lynch	665
Citigroup	625
Deutsche Bank	595
Morgan Stanley	564
Credit Suisse	511
Barclays	481
BNP Paribas	386
Société Générale	369
HSBC	351
Royal Bank of Scotland	347
UBS	256
Crédit Agricole	163
Mitsubishi UFJ	144

Sources: SNL Financial, published accounts and Bank calculations.

(a) Measured by trading assets. Trading assets are securities, commodities and derivatives held for trading. Derivatives have been adjusted for differences in accounting treatment. Reverse repos have been excluded.

the FCA and the PRA, and together dominate the provision of investment banking services here. They are also eligible for access to the Bank of England’s liquidity facilities through the Sterling Monetary Framework. The Financial Stability Board (FSB) designated all of them as global systemically important banks (G-SIBs).⁽⁵⁾ Their status as G-SIBs subjects these banking groups to higher prudential standards. They are required, for example, to have greater amounts of capital (that is, an additional capital buffer) to reduce the likelihood of their failure and protect the global financial system.

The first section of this article provides a summary of the services provided by investment banks. No prior knowledge of this type of financial institution is assumed. The second section then explains conceptually how the various functions of investment banks can serve the real economy through a number of channels, including via the financial system. A decomposition of the global revenues of some of the largest investment banks can be used to gauge the relative importance of these channels. Finally, the third section outlines the risks posed by investment banks and their activities, and summarises the regulatory initiatives agreed after the crisis to mitigate these risks. A short video explains some of the key topics covered in this article.⁽⁶⁾

(1) However, investment banks are often part of larger banking groups, which have other operations such as retail banking and wealth management that do serve households.

(2) See Bank of England (2013) for more detail on the designation of investment firms for prudential supervision by the PRA.

(3) See Bank of England (2014a) for more information on the PRA’s approach to branch supervision.

(4) For more details on changes to financial regulation in the United Kingdom following the recent crisis, see Murphy and Senior (2013).

(5) See Financial Stability Board (2013) for a full list of global systemically important banks.

(6) www.youtube.com/watch?v=eTqT0psuSjk.

What investment banks do: an overview

This section provides an overview of three types of services provided by investment banks. First, it describes investment banks' activities in 'primary capital markets' — those markets used by companies to raise finance by issuing shares and bonds to investors. Second, it explains their trading activities. These include buying and selling shares and bonds that have already been issued — that is, those trading in 'secondary markets' — but also writing derivative contracts for their clients. Finally, it describes the role that investment banks play in financial market infrastructure, and in markets where financial institutions borrow and lend cash or securities in 'secured', or collateralised, transactions.

Primary capital markets

Investment banks help companies and government agencies to access finance for investment or other expenditure by providing underwriting services, whereby the investment bank agrees to purchase, at a pre-determined price, any securities — equity shares and bonds — that are not taken up by investors. By doing this, the investment bank guarantees that the amount of financing that the client wants to raise will be available, and removes uncertainty and risk for the client. By helping companies and governments manage this risk, investment banks facilitate access to finance through capital markets. Corporate clients tend to be large companies that are required to disclose information to investors and can thus attract funding in capital markets, rather than rely on retail banks to lend to them. But investment banks serve smaller companies too. Investment banks also provide 'leveraged loans' directly to companies. These are loans to highly levered companies, sometimes to fund specific projects, including acquisitions. When underwriting large transactions or providing leveraged loans, investment banks sometimes form a 'syndicate' with other banks — a group that shares the risks by splitting the total amount loaned or underwritten between members.⁽¹⁾

Alongside their underwriting service, investment banks typically run a 'book building' process (they are known as 'book runners').⁽²⁾ During this process, they try to find investors who are willing to buy the securities that will be issued by their clients. They typically promote the issuance to investors in the run-up to an auction, where investors are invited to bid for the securities. Investment banks also sometimes carry out a 'due diligence' process — where they review a company's operations to ensure that they have not been misrepresented to investors — and help with the preparation of legal documentation for clients.⁽³⁾ The book-building service is crucial for matching up investors (the providers of capital or credit) with issuers (users of capital or borrowers of credit).

In addition to facilitating equity and debt issuance, investment banks play an important role in the process of securitisation, which can support the provision of credit in the real economy. Securitisation involves pooling together various types of debt such as mortgages, credit card loans, student loans or commercial real estate lending. These pools of loans are typically moved to a separate legal entity (or 'vehicle', known as a special purpose vehicle (SPV)) from which securities are issued to investors.⁽⁴⁾ The returns on these securities are dependent on the principal and interest repayments of the loans to which the securities are linked.

The most common role for investment banks in the securitisation process is to arrange the transaction. This involves structuring the securitisation into different 'tranches' or portions — each tranche issues a different security with its own risk and return profile, based largely on the order in which investors get repaid on the loan portfolio.⁽⁵⁾⁽⁶⁾ Investment banks also act as underwriter, whereby they undertake the book-building process. Finally, they can help the SPV to hedge its risks using financial instruments such as derivatives; provide a liquidity line (a facility that allows the special purpose vehicle to borrow cash); and offer administrative support services (such as cash management).

The primary purpose of securitisation is to repackage loans into a series of related securities that can easily be traded by investors — 'asset-backed securities (ABS)'. Like debt and equity securities, once ABS have been issued, they can be traded by financial market participants. The creation of a security allows a lender to easily transfer the risks and rewards from a set of loans to other investors such as other banks or asset managers. A lender may do this to improve its liquidity position, either by raising cash by selling existing loans for securitisation, or by using the ABS — which are more liquid than raw loans — as collateral against which to borrow cash. This, in turn, can support credit provision to the real economy: the knowledge that a lender may be able to sell ABS to other market participants in the event that it needs to raise cash means that the lender may be more likely to provide credit in the first place.

Securitisation gained prominence during the recent global financial crisis, when the opaque and complex nature of some

(1) See Gadanecz (2004) for a description of the loan syndication process.

(2) Investment banks sometimes facilitate the issuance of shares or bonds through book building without providing an underwriting service.

(3) This is the case for initial public offerings (IPOs), for example, where a client lists its shares on an exchange for the first time. Investment banks typically help companies to meet the exchange's rules.

(4) For a fuller explanation of how securitisation works, see Hull (2008), pages 536–40.

(5) For example, the most senior and safest tranche (so-called 'AAA' tranche) would typically have first recourse to the loans, and would earn the lowest return. The 'equity' tranche would typically be paid the remainder of the cash flows from the loans once all the more senior tranches have been paid.

(6) Arranging a securitisation transaction also involves arranging credit ratings for each tranche from credit rating agencies, helping to facilitate the documentation and securing the participation of third-party providers of services to the SPV. See Cetorelli and Peristiani (2012) for a fuller explanation of the role of banks in the securitisation process.

securitised products was associated with the large losses generated at many financial institutions. These risks are covered in the final section of this article.

Secondary markets and derivatives

Investment banks also provide market-making services (and are sometimes referred to as 'market makers'), whereby, at their clients' request, they buy and sell financial instruments that are already in issue — that is, instruments trading in secondary markets. By doing this, they add depth to the market and they improve the chances that a buyer or seller finds a counterparty to transact with, at a given price, thus providing 'market liquidity'.⁽¹⁾⁽²⁾ This is particularly important for trading in financial instruments such as corporate bonds, which are not traded via a central limit order book on an exchange (like companies' shares on the London Stock Exchange), but instead rely on investors contacting market makers for quotes. Investment banks provide these trading services to a range of clients in the financial sector, which are often described as 'institutional investors'. These are asset managers such as pension funds or hedge funds, which manage savings on behalf of individuals, as well as insurance firms, which manage large cash pools from their customers' premium payments and to cover products such as annuities.

The knowledge that securities can easily be traded in secondary markets reduces investors' risk of participating in primary issuances and holding securities for longer than they would like. If an investor knows that there is likely to be a liquid market that a bond can be sold into, then he or she would be more likely to buy it in the first place. In this way, trading activity supports the provision of finance in primary capital markets. Annex 1 provides further explanation of how investment banks provide market-making services.

As part of their trading services, investment banks also trade in derivatives with their clients. Non-financial companies can use derivative contracts to hedge their risks. Consider a UK-based manufacturer that exports goods to the euro area and sells them in euros, and suppose that the company is worried about the possibility of sterling appreciating *vis-à-vis* the euro — which would reduce its revenues in sterling terms. To protect itself against this risk, the company may buy GBP/EUR futures contracts that would yield a profit in the event of an appreciation of the pound against the euro and *vice versa*. In the case of futures, which are traded on-exchange, an investment bank could merely be facilitating the trade by providing access to the exchange. But investment banks predominantly write more bespoke derivative contracts, traded outside of centralised exchanges, for their clients. Retail banks also make use of derivative contracts to manage their risks. For example, a retail bank might issue a fixed-rate bond but prefer to pay out floating-rate interest payments in order to better match the cash flows on its loans and deposits.⁽³⁾

Investment banks provide some ancillary services alongside their market-making activities. For example, they produce research aimed at informing their clients about factors which may affect interest rates, exchange rates and the price of financial assets such as shares, corporate and government bonds and commodities such as oil or precious metals. They can also contribute to industry-wide benchmarks from which the prices of certain financial instruments are set. And they create indices based on the prices of a group of securities. These activities contribute to the institutional design of the financial industry through the creation of standards which are useful to participants. Indices, for example, allow investors to track the performance of the bonds or equities issued by one industry relative to other industries, or track the performance of a company relative to the rest of its sector.

Proprietary trading

Investment banks can also trade in secondary markets on their own account, rather than to serve clients. For example, many investment banks enhanced their revenues in the years prior to the crisis through 'proprietary trading': investing the bank's surplus cash reserves into high-yielding securities or derivatives. These were investments where traders bought or sold financial instruments with the aim of profiting from expected fluctuations in market prices. Banks disclose very little information on their proprietary trading activities, so it is difficult to gauge their magnitude, but the data available suggest that, relative to activities serving clients, they were not a large contributor to trading revenues even prior to the crisis, although they were a source of material losses during the crisis at certain banks.⁽⁴⁾

Unlike trading to facilitate market-making, the net benefit to the real economy of proprietary trading by investment banks is more open to debate. On the one hand, more trading in secondary markets improves market liquidity. But on the other hand, proprietary trading can leave investment banks vulnerable to large, potentially destabilising losses⁽⁵⁾ which may then impede their capacity to supply financial services. In addition, the existence of proprietary trading desks that aim to maximise returns on their trading portfolio may create conflicts of interest for investment banks when entering into trades with clients.⁽⁶⁾

(1) See Box 4 of the Bank's December 2014 *Financial Stability Report* for an explanation of the drivers of market liquidity; www.bankofengland.co.uk/publications/Documents/fsr/2014/fsrfull1412.pdf.

(2) Investment banks may be less willing to provide these services in stressed market conditions, where volatile market prices can bring about losses on their trading portfolios. See Benos and Wetherilt (2012).

(3) It would do this by using an 'interest rate swap'. See Annex 1 for a short description.

(4) For example, see United States Government Accountability Office (2011).

(5) See the Parliamentary Commission on Banking Standard's report on proprietary trading.

(6) Conflicts of interest also exist when investment banks provide underwriting and advisory services. Internal information barriers known as 'Chinese walls' are typically put in place to prevent traders from exploiting this information.

This activity has reduced considerably since the crisis as many investment banks shut down their proprietary trading operations in part as a result of regulatory changes.⁽¹⁾ These measures are discussed in the final section of the article.

Securities financing and providing infrastructure

Investment banks are key participants in the securities lending market.⁽²⁾ Securities lending is the temporary transfer of financial securities, such as equities and bonds, from a lender to a borrower. Investment banks may borrow securities on their own behalf or on behalf of other institutions such as hedge funds. For example, investment banks can borrow securities to meet customer demand when providing market-making services. And hedge funds may borrow securities via investment banks to sell them — so-called ‘short-selling’ — as part of their trading strategy.⁽³⁾ Lenders of securities are commonly referred to as ‘beneficial owners’. They are typically investors such as pension funds and insurance companies, and lend out securities to generate additional income on their asset portfolios. In their role as intermediaries, investment banks can help to match the beneficial owners and end-users of securities.

As well as arranging securities lending transactions, investment banks also facilitate transactions in repo markets. A repurchase agreement, or repo, is essentially a secured loan. An institution borrows cash by selling an asset, for example a government bond, which it later repurchases at a prearranged price. The counterparty has recourse to the bond as collateral until the repurchase date. Borrowers in repo markets are typically financial institutions seeking to finance their operations. By acting as middlemen, investment banks facilitate the provision of credit to financial institutions. Annex 2 on ‘The organisation of an investment bank’ provides further detail on the operations through which investment banks help to recycle securities in financial markets via securities lending and repo transactions (together termed ‘securities financing transactions’).

Major investment banks also play an important role in financial market infrastructure by providing clearing services to other financial institutions, including via central counterparties (CCPs).⁽⁴⁾ A CCP, or clearing house, is a financial institution that acts as a counterparty to numerous participants in financial markets to clear transactions. Investment banks are often direct members of CCPs, meaning that they are able to clear transactions with other members, but they also facilitate their customers’ access to CCPs through client clearing arrangements. These customers may not be eligible to join a CCP directly — or find the cost of joining prohibitively expensive — but nonetheless require access to central clearing to trade in financial markets. Financial institutions rely heavily on investment banks to provide these infrastructure services. In terms of the payments infrastructure, large banking groups often facilitate

electronic payments for their retail customers, or for smaller banks, but typically do not offer these services through their investment banking operations.

Table B shows a list of services provided by investment banks, as described above, alongside clients that frequently make use of these services.

Table B Investment banks’ activities and their clients

Investment bank activity	Clients
Underwriting and book building	Non-financial companies (mostly large ones) Government agencies Retail banks and other financial institutions
Trading in securities	Insurance companies Pension funds Asset managers such as hedge funds
Derivative trading	Non-financial companies Retail banks Asset managers such as hedge funds Insurance companies
Securitisation of loans	Retail banks Finance companies
Providing access to financial market infrastructure	Asset managers
Facilitating securities financing transactions	Asset managers (some of which act on behalf of pension funds and insurance companies)
Proprietary trading	–

Linkages to the real economy and the financial system

This section outlines how investment banks interact with agents in the real economy and the financial system and estimates the importance of different channels of service provision. It then explains how the provision of these services globally has changed in the years since the financial crisis.

Investment banks can contribute to the real economy in two ways. First, they can provide core financial services directly to companies and government agencies. And second, they can provide services to other financial institutions, which in turn provide core services to households, companies and public sector organisations. **Figure 1** illustrates these two channels.

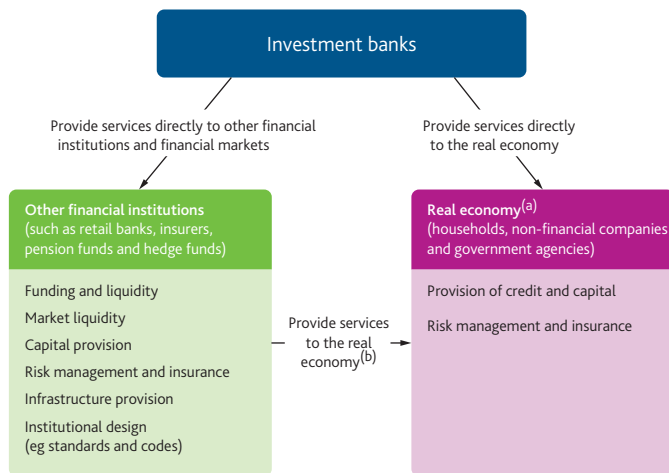
To understand the relative importance of these channels of service provision, it is helpful to be familiar with the structure of an investment bank. This varies across investment banks

(1) Although banks have closed many of their desks dedicated to proprietary trading, it is technically possible for traders on market-making desks to enter into these types of trades too.

(2) See Dive *et al* (2011) for a fuller explanation of the role of securities lending in supporting financial markets.

(3) Short-selling is used in a number of trading strategies. For example, an investor may think that an equity is overvalued and expects its price to fall. The investor would borrow and then sell the equity, with a view to buying it back later at a lower price, in order to make a profit from the price difference.

(4) See Nixon and Rehlon (2013) for a fuller explanation of how CCPs work and why they matter for the financial system.

Figure 1 Channels of service provision to the real economy

(a) Investment banks typically do not provide services to households directly.

(b) In addition to those listed in the purple box, other financial institutions also provide other services (such as payment services).

and can be complex, but at a broad level, investment banks are generally organised into three major divisions:

- (i) **Underwriting and advisory services** (or corporate finance), which helps companies and government agencies to raise finance through the issuance of equities or bonds in primary capital markets. It also provides advisory services, for example on mergers and acquisitions.
- (ii) **Sales and trading in equities**, which engages in trading activities in secondary markets in equities and related derivative instruments.⁽¹⁾
- (iii) **Sales and trading in fixed income, currencies and commodities (FICC)**, which engages in trading activities in secondary markets in bonds, foreign currency, commodities and related derivative instruments.

The sales and trading divisions are typically organised into 'desks', each of which trades financial instruments in a particular asset class. These operations can include market-making desks whose activities are aimed at clients and proprietary trading desks. Further information on the organisation of investment banks is available in Annex 2.

To quantify the relative importance of the service provision channels illustrated in Figure 1, one can look at the revenues that each sub-division generates, through fees (such as advisory and clearing fees) and bid-offer spreads,⁽²⁾ but also through interest on lending and securities financing activities. Figure 2 shows the revenues earned globally by sub-divisions of the major investment banks in 2013, and an estimated split of these revenues between what has been generated by serving agents in the real economy directly versus revenue from serving other financial institutions. It should be noted

that there is no direct mapping from revenues to the channels of service provision depicted in Figure 1. For example, while not estimated in this analysis, ideally when quantifying the benefits to the real economy of facilitating the issuance of a corporate bond, say, one would want to capture 'second-round' effects relating to the chain of expenditures that followed on from the issuance of the bond. In addition, not all sources of revenue shown in Figure 2 link directly to any one of the channels depicted in Figure 1.⁽³⁾ Even so, these data can give a broad sense of relative levels of service provision to the real economy — both directly and via the financial system.

This analysis suggests that, at a global level, investment banks contribute to the real economy mostly through the indirect channel of supporting the financial system. This is especially true in the sales and trading business — both in equities and FICC — where revenues are generated overwhelmingly through serving financial clients. Even in foreign exchange trading, which often serves non-financial companies seeking to hedge foreign currency risks, less than a quarter of revenue was estimated to have been generated by dealing with non-financial firms in 2013.

In contrast to sales and trading, the underwriting and advisory business mostly serves non-financial companies and government agencies directly. Around two thirds of the global revenues generated from issuances of shares and bonds were from clients outside the financial sector. And over 90% of advisory fees were generated from non-financial companies.

Global revenue data also offer an insight into the relative sizes of those operations. At an aggregate level, investment banks generate most of their global revenues through sales and trading, particularly through FICC. In 2013, FICC accounted for over half of total revenue, although revenues vary considerably each year. Of course, the distribution of revenues across divisions can differ considerably between investment banks, depending on the business model employed. For example, some investment banks may focus on particular asset classes, such as equities.

Investment banking services in recent years

The recent financial crisis has had a lasting effect on investment banks' trading activities. Most major global investment banks restructured their businesses as a result of their large losses during the crisis — in 2008 alone, aggregate trading losses in the UK banking system were over £30 billion — and regulatory measures taken after the crisis to make them less risky. By far the most significant shift has been in their trading operations.

(1) This division usually also provides ancillary services such as research.

(2) See Annex 1 on market-making for an explanation of the bid-offer spread.

(3) Revenues are not a perfect proxy for levels of activity as they can also be affected by changes in market prices.

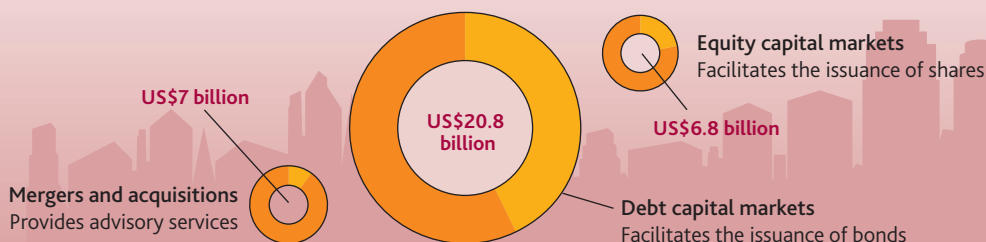
Figure 2 Global revenues at large investment banks in 2013

This figure shows the revenues earned globally by ten of the largest investment banks in 2013.^(a) The data are split across the various investment banking sub-divisions. It also estimates the split between revenues generated by serving agents in the real economy directly versus revenues generated by serving other financial institutions.^(b)

- Estimated share of revenue from service provision to the financial system
- Estimated share of revenue from direct service provision to the real economy
- No breakdown of revenue possible

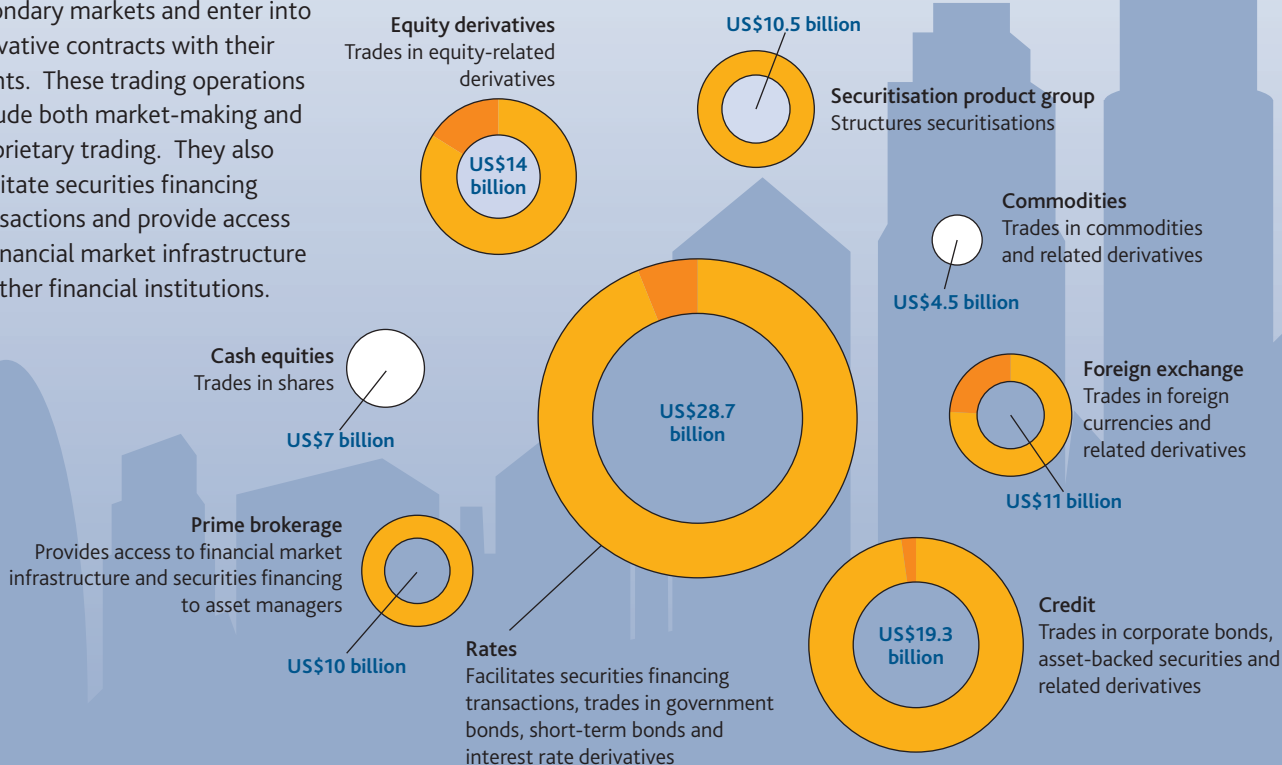
Underwriting and advisory

This division facilitates the issuance of shares and bonds by companies and government agencies through underwriting and book-building services. It also provides advisory services to companies.



Sales and trading

The sales and trading 'desks' buy and sell shares and bonds in secondary markets and enter into derivative contracts with their clients. These trading operations include both market-making and proprietary trading. They also facilitate securities financing transactions and provide access to financial market infrastructure to other financial institutions.



Overall revenues: around US\$140 billion

Around three quarters of this is estimated to come from service provision to the financial system, the remainder coming from direct service provision to the real economy.

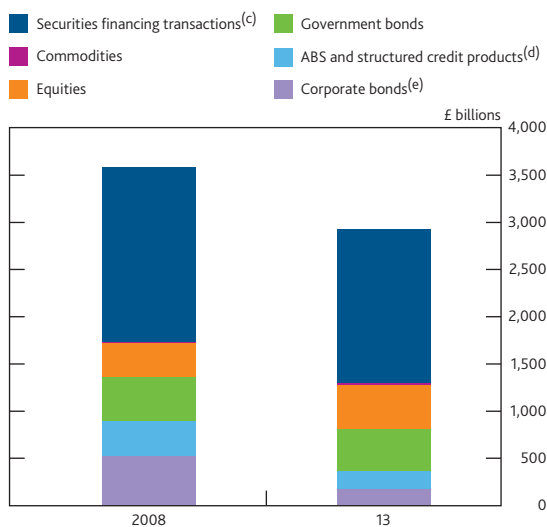
Sources: Bank for International Settlements, Coalition, Dealogic, Thomson Reuters and Bank calculations.

(a) Large investment banks as defined by Coalition. These are Bank of America Merrill Lynch, Barclays, BNP Paribas, Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, JPMorgan, Morgan Stanley and UBS.
 (b) Estimates of the proportion of revenue generated from the real economy and financial system for the underwriting and advisory businesses are from industry breakdowns of fees (non-financial and financial). For the sales and trading businesses, they are from derivative counterparties (non-financial and financial, excluding other investment banks). An assumption implicit in these estimates is that trading desks have the same client split for non-derivatives trading as for derivatives trading. 'Prime brokerage' and 'Securitisation product group' provide services to asset managers and lenders respectively, and therefore are assumed to generate all revenues through the financial system.

Secondary trading, derivatives and securities financing transactions

Chart 1, which compares trading-related assets at the peak of the crisis in 2008 to their 2013 levels, suggests that investment banks became less willing to hold large trading inventories in corporate bonds and securitised assets to facilitate trading. The amount of debt securities — corporate bonds, government bonds and securitised assets — held by the major global investment banks fell by over 40% during this period. Lower inventories, in turn, may have contributed to lower market liquidity after the crisis. In part, this may be due to a reduction in investment banks' risk appetite, although regulatory factors, such as higher capital requirements, may also have increased the cost of holding an inventory. But regulation has also improved investment banks' resilience, and this may result in them being a more stable source of liquidity.⁽¹⁾ Taken together, investment banks also had smaller lending portfolios through securities financing transactions in aggregate in 2013 than they did in 2008.

Chart 1 Large global investment banks' estimated assets held for trading and securities financing transactions^{(a)(b)}

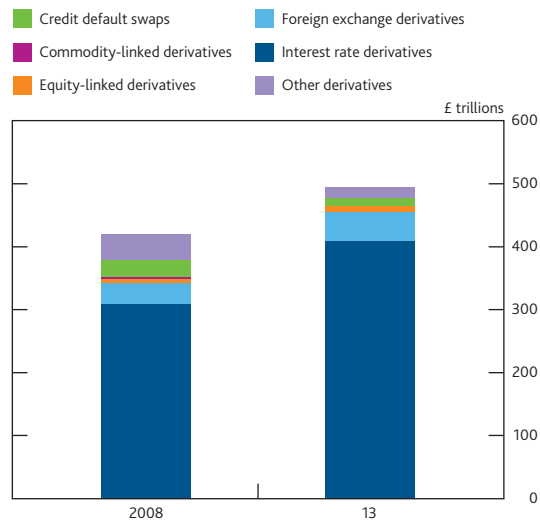


Sources: Published accounts and Bank calculations.

- (a) Sample as in Figure 2, with the addition of the Royal Bank of Scotland and exclusion of Deutsche Bank. 2008 data include assets held by investment banks that were acquired by these groups during the crisis.
- (b) Assets held for trading exclude derivatives.
- (c) Securities financing transaction assets are adjusted for differences in accounting standards between US and European banks. IFRS accounting standards are used for this chart.
- (d) Includes traded loans.
- (e) Includes money market instruments.

In contrast, activity in derivative markets has continued to grow since the crisis, albeit at a slower pace than it did prior to the crisis. **Chart 2** shows the aggregate notional amounts of open derivative trades — the face value used to calculate payments made on the derivative — outstanding at the end of 2008 and the end of 2013.⁽²⁾ It is impossible to know with certainty what has driven this increase, but it may be due to the long-term growth in the use of derivatives as they have become more popular for hedging risks. The rise could also reflect greater use of derivatives for speculative purposes. The notional values of derivatives have increased despite a recent

Chart 2 Notional values of banks' open derivative contracts^{(a)(b)}



Sources: Bank for International Settlements (BIS) and Bank calculations.

- (a) Amounts outstanding at end-2008 and end-2013.
- (b) Data from BIS exchange-traded derivatives statistics and surveys on OTC derivatives, available at www.bis.org/statistics/derstats.htm.

increase in the use of compression services, which cancel offsetting derivative trades, by investment banks.

Primary capital markets activity

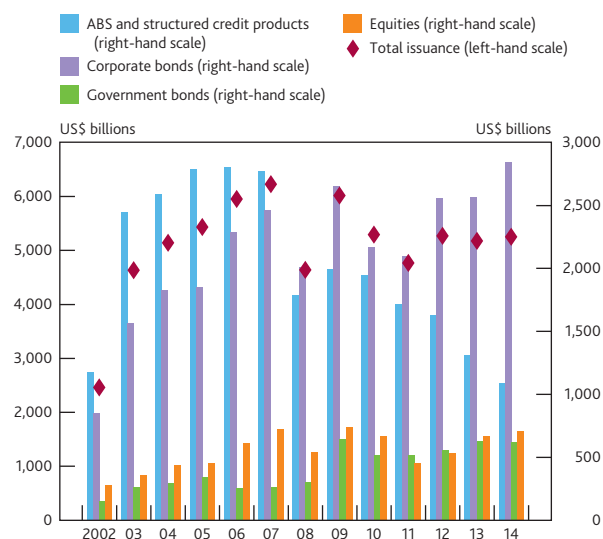
In contrast to their aggregate trading activities, investment banks' overall activity with respect to primary market issuance has remained high since the crisis. The red diamonds in **Chart 3** show that global investment banks facilitated the issuance of around US\$5.2 trillion worth of securities in 2014 — which was roughly the same amount as the average figure for the pre-crisis period from 2003–07.

That said, the aggregate figures mask notable changes in the composition of primary issuance in capital markets. For instance, post-crisis issuance of corporate bonds and government bonds has grown considerably. In the case of corporate bonds, this might reflect a tightening in credit conditions and a preference for debt financing among non-financial companies due to low global interest rates since the crisis. Levels of government borrowing, meanwhile, have risen as fiscal positions deteriorated following the global recession.

Issuance of ABS and structured credit products (more complex securitisations) has fallen since the crisis, however. Lower issuance of securitised products may be due to the stigma that investors have attached to these securities since the crisis,

- (1) See Section 3 and Box 4 of the Bank's December 2014 *Financial Stability Report* for more information on risks relating to market liquidity; www.bankofengland.co.uk/publications/Documents/fsr/2014/fsrfull1412.pdf.
- (2) Because payments on derivatives between counterparties are based on small percentages of the notional value, notional values are much larger than the values that banks hold on their balance sheets (which reflect the amounts that they are owed, or owe, on derivative contracts). But, unlike balance sheet values, notional values do not change as a result of movements in market prices, and therefore offer a better quantitative measure of activity levels.

Chart 3 Primary issuance facilitated by the large global investment banks^{(a)(b)}



Sources: Dealogic and Bank calculations.

- (a) Data show the proceeds of issuances where a major global investment bank is listed as one of the book runners. For ABS and structured credit products, proceeds exclude the value of tranches retained by issuers.
 (b) Sample as in Figure 2, with the addition of Royal Bank of Scotland. Pre-crisis data include issuance facilitated by investment banks that were acquired by these groups during the crisis.

together with alternative sources of cheap funding for banks, such as loans from central banks. A recent discussion paper by the Bank of England and the European Central Bank sets out proposals to revive securitisation markets by encouraging securitisation structures that are simple, transparent and robust.⁽¹⁾ A joint paper between the Basel Committee on Banking Standards (BCBS) and the International Organization of Securities Commissions (IOSCO) also sets out criteria to assist the financial industry's development of simple and transparent securitisation structures.⁽²⁾

Risks posed by investment banks and regulatory initiatives to minimise them

This section explains the risks that investment banks and their activities pose to the stability of the financial system. The International Monetary Fund, Bank for International Settlements (BIS) and Financial Stability Board have jointly developed a framework for assessing systemic risks in banking. This is the framework used for identifying global systemically important banks (G-SIBs). Some of the key factors from the framework — banks' **complexity**, their **interconnectedness**, their **size** and the **lack of readily available substitutes** or financial infrastructure for the services that they provide — are key determinants of risk and are considered below. While these are presented as separate factors, they often jointly explain the risks that manifest themselves in practice.

Many of the risks that investment banks' activities pose crystallised during the recent crisis.⁽³⁾ This led to severe solvency and liquidity problems for the investment banks themselves, but also knock-on effects for the markets in which

they operated and other parts of the financial system and the economy more broadly.⁽⁴⁾ Regulatory initiatives that have been introduced in response to the crisis in order to reduce these risks are summarised at the end of the section.

(i) Complexity

Investment banking activities can be complex. The three indicators used in the G-SIB framework to measure complexity — the notional amounts of derivatives traded 'over the counter' (that is, off-exchange), the value of assets held that are difficult to price due to their illiquidity (so-called 'level 3' assets), and the total value of securities held — are all more heavily linked to investment banking activities than to retail banking services. For example, the fifteen largest investment banks in Table A account for nearly 90% of the notional amounts of all open derivative contracts globally, as measured by the BIS.

The recent financial crisis illustrated this complexity. Some investment banking products, particularly the more esoteric structured products, are difficult to price. The risks associated with holding some of these financial instruments can therefore be poorly understood. This can lead to periods in which these instruments are systematically mispriced, as happened with structured credit products, such as collateralised debt obligations (CDOs) prior to the crisis. These were widely considered to be low-risk instruments despite the low-quality ('sub-prime') loans that backed them.⁽⁵⁾ A CDO is a vehicle that invests into securities such as corporate bonds and ABS, and repackages them to issue related securities. Like ABS, CDOs have a tranche structure, with each tranche issuing an instrument with its own level of risk and return.

Several factors were behind the mispricing of CDOs. The ability of lenders to sell their loans to securitisation vehicles reduced their incentives to screen out less creditworthy borrowers when advancing loans, as the original lenders would not bear much of the ultimate losses. This created a wedge between the underlying quality of the securities and investors' perception of their riskiness. Moreover, the investment banks that facilitated the securitisation of these loans and sold them to investors systematically underestimated the riskiness of the underlying loans, partly because of the assumption that property prices would be unlikely to fall across all US states at the same time.⁽⁶⁾ Consequently, investment banks and investors took large write-downs on CDOs once US house

(1) See Bank of England and European Central Bank (2014).

(2) See Basel Committee on Banking Standards and International Organization of Securities Commissions (2014).

(3) See Gorton and Metrick (2012) for a fuller discussion on the crisis.

(4) For an introduction to bank solvency and liquidity crises and implications for the stability of the financial system, see Farag, Harland and Nixon (2013).

(5) This was particularly true of the senior 'AAA' tranches.

(6) Market participants relied heavily on credit rating agencies to provide credit ratings on these securities. Their models systematically underestimated the correlation between the performance of loans across the United States. See US Senate Permanent Subcommittee on Investigations (2011) for further details.

prices began to fall and it became apparent that CDOs had been considerably mispriced.⁽¹⁾

Investment banks can also create complexity in the system through some of their less transparent trading operations. This can include the operation of 'dark' trading venues (so-called 'dark pools'). These are private venues for trading securities. Participants trade anonymously so as not to reveal large orders that may move market prices against them in the open market, such as public exchanges. Investment banks can also trade in these dark venues, sometimes through arbitrage-seeking algorithms. They also use algorithms to match trades between market participants. The opacity of these systems and algorithms make it difficult for financial market participants and regulators to identify the risks that may arise from them. There may be risks to market liquidity from potential errors in algorithms, for example, and these risks may be exacerbated by the lack of transparency.

(ii) Interconnectedness

Interconnectedness in the financial system, for example through interbank lending, can create a channel for the transmission of losses between financial institutions, including investment banks. The most direct channel of contagion is 'counterparty credit risk' — the risk that insolvent institutions cannot repay their debts and thus impose losses on other institutions to whom they have outstanding obligations. Investment banking activities such as derivative trading and securities financing transactions can create large intra-financial exposures. For example, in June 2014, over 80% of investment banks' global derivative exposures were to other financial institutions, including 40% to other investment banks. These exposures are typically collateralised, however, and this significantly reduces the risk of a direct loss from the failure of a counterparty.

But problems can nonetheless arise through other channels of contagion, such as market liquidity effects. Faced with a severe shock, market participants may withdraw from financial markets, which can impair functioning, and further amplify the shock. This mechanism was evident during the crisis. Credit losses from sub-prime loans generated enough uncertainty among financial market participants to impair wholesale funding markets, which many institutions — including investment banks — relied on for funding. Severe stress in these markets put liquidity pressure on investment banks, particularly since investors were wary of lending to institutions that may have held sub-prime securities. The combination of credit losses from sub-prime loans coupled with low levels of capital and difficulty in accessing funding markets caused some investment banks to fail.

Contagion also arises via market channels because of the procyclical nature of collateralised transactions. Consider, for instance, a scenario in which asset prices — and hence

collateral values — are falling. In response to such conditions, investment banks may be forced to post additional collateral to a counterparty to cover minimum 'margin' requirements (collateral requirements to cover exposures on outstanding trades), and may use up their reserves of cash or liquid assets in doing so. In volatile trading conditions, this could be compounded by market participants increasing their minimum margin requirements. Given the size of investment banks' derivative and securities financing transaction exposures as a proportion of their balance sheet, this interconnectedness channel can represent a material risk to their viability.⁽²⁾

The procyclical nature of collateralisation creates risk in the financial system beyond the distress or failure of investment banks. In the above scenario, falling collateral values may force investment banks to make margin calls, that is, to collect additional collateral from their counterparties. In this situation, their actions to reduce their own risks may cause their counterparties to sell off some of their assets in order to be able to post collateral. A fire sale of assets by counterparties on a large scale could cause a sharp dislocation in asset prices. This would in turn affect other institutions, which may themselves be using these assets as collateral to access funding.⁽³⁾

(iii) Size and substitutability

Investment banks' trading functions tend to operate on a large scale. This is partly because there are network and information economies of scale to providing market-making services. Those banks with many clients can more easily source securities that are sought after by investors. They can also find offsetting trades more easily by matching clients up with each other. Large providers of liquidity can also observe trade flows. This helps them to anticipate client trades and adjust their inventories, and manage their risks accordingly. For these reasons, investment banks often run very large trading operations.

This can pose risks to the financial system, however, since it can mean that market liquidity is concentrated in just a few big banks. A sudden withdrawal of any major investment bank's market-making services, due to its distress or failure, could cause the financial markets that it operates in to function less effectively.⁽⁴⁾ Substantial shares of these markets are based in the United Kingdom: 70% of global trading in international bonds, for instance, and nearly half of all interest rate derivatives traded over the counter (OTC).

(1) Alongside the potential for large losses, complex instruments can introduce more uncertainty in the system about asset valuation. This can cause market participants to retrench and consequently reduce market liquidity.

(2) Of course, to some extent, this risk would be mitigated by the fact that an investment bank will also receive margin from counterparties on transactions where it is owed money.

(3) See Stein (2013) for a discussion of the economics of fire sales in securities financing transactions.

(4) See Duffie (2010) for more information on the consequences of the failure of a large investment bank.

The bankruptcy of Lehman Brothers — a US investment bank with large trading activities — in September 2008 offered an example of how this risk can materialise. After the bankruptcy was filed, Lehman's counterparties largely closed out their derivative positions where they were 'in-the-money', that is, where Lehman owed them. By doing this, they retained the collateral which Lehman had posted, which they subsequently sold off. The simultaneous sell-off of these assets depressed market prices. Although numerous factors were at play at the height of the crisis, the mass sell-off of collateral is thought to be one of the contributing factors to the market dislocations which followed the failure of the investment bank. Closing out derivative positions was not a straightforward process. Disputes about amounts owed — largely due to difficulties in agreeing prices in illiquid markets — led to delays in the process, which may have exacerbated the deterioration in market functioning.⁽¹⁾ In addition, the failure of Lehman Brothers contributed to uncertainty in financial markets about the creditworthiness of counterparties. This led many participants to retrench their activities significantly. While the scale of the investment bank contributed to the market dislocation, factors such as the interconnectedness of institutions through financial markets were also relevant.

This concentration of market activity in a few institutions also opens up the possibility of market manipulation. In recent years, many investment banks have been investigated in relation to alleged or actual acts of misconduct relating to their trading activities. Such manipulation erodes trust in financial markets and discourages investors from participating in them. In light of these findings, the Bank is conducting a review on the fairness and effectiveness of markets, jointly with HM Treasury and the FCA.⁽²⁾ The FCA also recently announced a separate review into competition and pricing practices in investment banking.⁽³⁾

The failure of a large investment bank can also cause widespread financial instability because of its importance to financial market infrastructure. For instance, if an investment bank became insolvent, the removal of its clearing services would require all financial institutions that had been reliant on the investment bank to migrate to another provider. These institutions would be unable to trade in financial markets in the interim. An insolvent investment bank could also impose losses on CCPs if the collateral that it posted did not cover money owed through its open positions. Losses would then be passed on to other financial institutions that were members of the CCPs in question.⁽⁴⁾ Large, system-wide losses and multiple bank failures could threaten the solvency of CCPs which, given their systemic importance, would have very significant spillovers for the rest of the financial system.⁽⁵⁾ In the United Kingdom, the Bank of England is responsible for the supervision of CCPs and for their resolution in the event of failure.

Risks can also arise because of the size of some investment banks' holdings of their clients' assets through their prime brokerage services.⁽⁶⁾ In the event of the failure of an investment bank with large prime brokerage and repo operations, unwinding these collateralised transactions and returning assets to clients can be time consuming and disorderly. Again, this was demonstrated by the failure of Lehman Brothers in 2008. Prime brokerage customers could not access their assets if they were not in a segregated account, and were unable to recover the value of these assets immediately if Lehman had lent them out or used them as collateral in a separate transaction. The situation was exacerbated by the failure of Lehman's European subsidiary to comply with the Financial Services Authority's rules on client assets. At the end of 2014, Lehman's European subsidiary had still not returned all of its clients' assets. New rules on client assets have now reduced this risk.⁽⁷⁾ But the inability of Lehman's clients to access these assets undermined their liquidity positions and in some cases threatened their solvency. In particular, highly levered firms, such as hedge funds, faced difficulties in exiting their loss-making positions.

Regulatory reforms

The systemic importance of large banking groups with investment banking operations has been widely recognised by various regulatory initiatives since the recent crisis. In the immediate aftermath of the crisis, G20 countries committed to a fundamental reform of the financial system, co-ordinated by the FSB. Many of the policy reforms being led by the FSB — improving the resilience of financial institutions, ending 'too big to fail', and reforming OTC derivative markets — are directly relevant to investment banks.⁽⁸⁾ In the United Kingdom, post-crisis reform included the creation of the Prudential Regulation Authority and the Financial Policy Committee at the Bank of England. The rest of this section summarises some of the key regulatory reforms aimed at mitigating the risks discussed above. A box entitled 'Regulatory changes and investment banks' expands on this topic.

A major focus of the regulatory reforms has been the resilience of banking groups, including those with large investment banks, to shocks. For example, internationally agreed standards set by the Basel Committee on Banking

(1) See Fleming and Sarkar (2014) for a detailed description of the failure resolution of Lehman Brothers.

(2) For more information on the Fair and Effective Markets Review, see www.bankofengland.co.uk/publications/Pages/news/2014/140.aspx.

(3) See www.fca.org.uk/news/fca-to-investigate-competition-in-investment-and-corporate-banking-services-following-review-of-wholesale-markets.

(4) Clearing members are required to contribute to default funds, which are drawn on in the event of material losses at the CCP.

(5) See Nixon and Rehlon (2013).

(6) See Annex 2 for a description of the activities typically undertaken by the prime brokerage operation.

(7) For example, in the United Kingdom, prime brokers are now required to report details on client assets regularly to their clients. And the return of client assets in resolution has been facilitated by the introduction of the Special Administration Regime. See Gracie, Chennells and Menary (2014).

(8) See Financial Stability Board (2014a) for more information on FSB-led reforms.

Standards (BCBS) around banks' capital resources have been enhanced, especially for the most systemically important banks. New requirements to hold liquid assets to meet potential outflows have also been introduced. Together, these reforms have improved banking groups' ability to absorb losses and to withstand a sudden outflow of funding — factors which caused some of them to fail during the recent crisis.

Regulatory initiatives since the crisis have also sought to improve the resolvability of banking groups, including those with investment banks, in order to ensure that large banks can fail in a more orderly manner without systemic consequences and without recourse to public funds. This was not possible during the crisis. Some distressed investment banks such as Merrill Lynch and Bear Stearns were subsumed by other banks. But universal banks such as Citigroup, Royal Bank of Scotland and UBS had to be offered state support. Since then, cross-border efforts have been made through the FSB to develop resolution plans in the case of the failure of a G-SIB. Several countries, including the United Kingdom, have implemented legislation to introduce resolution regimes for dealing with the failure of financial institutions without requiring the use of public funds.⁽¹⁾ In the United Kingdom, the Bank of England now has legal powers to resolve banks and investment firms.⁽²⁾

The structures of financial markets and banking groups have undergone reform, too. Higher standards of transparency and reporting were introduced in financial markets, so that risks arising in these markets could be observed and dealt with by regulators. Rules mandating investment banks to clear their derivative trades via CCPs, rather than bilaterally, have reduced interconnectedness in the banking sector and the associated risks. In the United States, the Volcker Rule has prevented banking groups from undertaking proprietary trading activities.⁽³⁾ In the United Kingdom, legislation has been passed to ring-fence banking groups' core retail banking activities from their investment banking activities.⁽⁴⁾ This aims to protect the provision of core retail banking services to the economy from risks associated with global investment

banking. Incentives for investment banks to manage their risks properly have also been addressed through pay structures and changes to securitisation requirements.

Conclusion

The largest investment banks globally are part of major banking groups. They operate in several countries, including the United Kingdom, where they provide services that are important to the real economy and the financial system. Their services are important to companies that seek finance through the issuance of bonds and equity to investors. They also intermediate in secondary financial markets and allow financial and non-financial companies to manage their risks and their assets by doing so. These activities can contribute to the efficient functioning of financial markets which support the real economy. Investment banks also play a major role in the provision of financial infrastructure.

But these activities are also associated with risk. Globally, investment banks are large providers of critical services to the rest of the financial system. The distress or failure of an investment bank can have a large systemic impact. It could also lead to contagion to the rest of the financial system due to the highly interconnected nature of their services. The complexity of investment banks' operations also contributes significantly to risks in the global financial system.

A number of regulatory initiatives globally have been implemented since the onset of the global financial crisis to correct the fault lines that contributed to it and to build a safer, more resilient financial system. The agreement of these standards for banks is substantially complete, but further work is required to ensure that they are implemented fully, to monitor new risks, build mutual trust and further facilitate international co-operation. The Bank of England has a key role to play in working with other regulatory bodies globally to fully implement these measures and ensure that investment banking activities are conducted in a way that is safe and sound.

(1) In the United Kingdom, legislation has been introduced through the Banking Act 2009, the Financial Services (Banking Reform) Act 2013 and the Bank Recovery and Resolution Order 2014.

(2) See Gracie, Chennells and Menary (2014) for more on the Bank of England's approach to resolving failed institutions.

(3) See www.federalreserve.gov/bankinforeg/volcker-rule/default.htm for more details.

(4) See www.gov.uk/government/news/banking-reform-act-becomes-law for more details.

Regulatory changes and investment banks

This box provides an overview — but not an exhaustive list — of some of the regulatory changes that were introduced after the crisis to minimise the risks from investment banking activities, and from the large banking groups which provide them. Three broad classes of regulatory reforms are discussed: improvements in bank resilience; resolution of bank failure; and structural changes to financial markets and banking groups.

Improving bank resilience

After the financial crisis, the BCBS developed an internationally agreed package of reform measures, known as 'Basel III', to strengthen the resilience of the banking sector.⁽¹⁾ This package included requirements for banks to have larger reserves of capital to absorb losses, as well as liquid assets to meet potential outflows. For globally systemic banks, capital requirements are more than ten times higher than pre-crisis standards. These measures have improved the resilience of investment banks that operate in a banking group. For example, market risk⁽²⁾ now attracts larger capital requirements for banking groups. This is particularly relevant for investment banks. Banking groups are also required to have more capital reserves against securitised instruments and derivative exposures. The BCBS is considering further changes to the treatment of the trading book for regulatory purposes to further strengthen the regime. In addition to these changes, the enhanced capital framework has also recognised the systemic importance of large banking groups, and placed higher capital requirements on them.

Together with these capital measures, the BCBS agreed requirements on liquid assets that banks will have to hold to meet potential outflows as a result of a shock. This 'liquidity coverage ratio' aims to mitigate the risks that banking groups — including those with investment banking operations — face liquidity problems in adverse market conditions, when wholesale funding markets may become impaired, as they did during the crisis.⁽³⁾

In the United Kingdom, the PRA ensures that banking groups — including those with investment banking operations — meet these rules, and that they adopt a risk appetite that is consistent with the PRA's objective to promote the safety and soundness of the firms it regulates. Firms' adherence to their risk appetite is monitored by drawing together various evidence: for the higher-impact banks, for instance, supervisors conduct reviews, including on-site, of risk and risk controls in a particular area of business. They also undertake analysis of business models, based on internal data and interviews with management, in order to understand how banks seek to make money — including reliance on income from their proprietary trading operations.

Resolution of bank failure

The introduction of legal powers to resolve banks and investment firms, together with efforts to co-ordinate plans for the failure of global banks between regulators, have improved the resolvability of investment banks. In the United Kingdom, the Special Resolution Regime was introduced in 2009 to give the Bank of England and HM Treasury legal powers to resolve banks in an orderly way. These powers were subsequently strengthened and widened in scope. In November 2014, the FSB published a proposal to require G-SIBs to hold adequate amounts of loss-absorbing equity and debt instruments to facilitate their resolution in the event of failure.⁽⁴⁾ This will help resolution authorities, including the Bank of England, to resolve large banking groups without using public funds.

In addition, new derivative protocols developed by the International Swaps and Derivatives Association (ISDA) and agreed by major banks will help the resolution of failed investment banks with large derivative trading operations. The new protocol includes a provision for a temporary suspension of the right to close out derivative contracts for counterparties of a bank that is in resolution proceedings.⁽⁵⁾ This should help to avoid a repeat of the mass close-out of derivatives and sell-off of collateral seen after the failure of Lehman Brothers, and the associated market dislocation.

Structural reforms in financial markets

Alongside structural reforms such as the Volcker Rule (discussed in the main text of the article) and ring-fencing measures imposed on banking groups, post-crisis regulatory work has also focused on structural issues in the financial system. This has included measures to reduce the risks caused by the interconnected nature of the banking system. In the EU, the European Market Infrastructure Regulation (EMIR) mandates investment banks to clear their OTC derivative trades with CCPs, rather than bilaterally.⁽⁶⁾ Investment banks have also made greater use of trade compression services that allow them to cancel their offsetting derivative trades, thus reducing their gross exposures. These changes have resulted in a less interconnected banking sector, where investment banks have exposures with CCPs, rather than each other. CCPs have themselves improved their risk management standards through tougher margining requirements. The risk of

(1) For more information about Basel III, see www.bis.org/bcbs/basel3.htm.

(2) Market risk is the risk of losses in positions arising from movements in market prices. This is further explained in Annex 1.

(3) See Bank of England (2014b) for more information. Another regulatory measure introduced by the BCBS was the Net Stable Funding Ratio (NSFR), which requires banks to maintain a stable funding profile in relation to the composition of their assets.

(4) See Financial Stability Board (2014b) for a consultative document on total loss-absorbing capacity.

(5) For more information, see www2.isda.org/news/major-banks-agree-to-sign-isda-resolution-stay-protocol.

(6) See www.fca.org.uk/firms/markets/international-markets/emir for an overview of EMIR.

investment banks taking credit losses from each other should therefore diminish materially, but liquidity risks from margining will remain and risk in the financial system will be concentrated in CCPs. In the United Kingdom, resolution tools have been introduced to allow the Bank of England to resolve failed CCPs in an orderly manner while providing continuity of critical services.⁽¹⁾

Reforms to financial markets have not been limited to clearing. Trading in securities and derivatives has been made more transparent and open. For example, in both Europe and the United States, legislation has been passed to transfer the trading of standardised derivative contracts to exchanges or electronic platforms. In addition, reforms were agreed in Europe to limit trading in dark pools. Investment banks also have to report their trades to trade repositories.⁽²⁾

In the United States and the EU, regulation has addressed the poor incentives that lenders had prior to the crisis to adequately assess the risks associated with a loan that is due to be securitised. Legislation now requires banks that securitise their loans to hold a proportion of the securitised

products on their own balance sheet such that they retain a material economic interest in the instruments that are issued to investors.⁽³⁾

Finally, post-crisis reforms are improving the incentives of senior management at banks to manage risks appropriately. This is being done by promoting practices such as the introduction of 'malus' and 'clawbacks', which enable banks to reduce or claim back bonuses awarded to staff if it subsequently becomes apparent, even some years later, that excessive risk was taken or there was a failure of risk management.⁽⁴⁾ This is particularly relevant for investment banks, where a large proportion of remuneration has been in the form of variable pay.

(1) See Bailey (2014) for more information.

(2) In the United States, this has been done by mandating the use of regulated swap execution facilities (SEFs). In the EU, the Markets in Financial Instruments Directive II (MiFID II) has made changes to market structure and reporting requirements.

(3) Both the Dodd-Frank Act in the United States and the Capital Requirements Regulation (CRR) in the European Union mandate the original lender to retain 5% of the value of the assets that have been securitised.

(4) See Bank of England (2014c) for a policy statement on clawbacks.

Annex 1

Market-making at an investment bank

Market makers provide a market for investors to trade in by standing ready to buy and sell financial instruments continuously. They buy financial instruments at a 'bid' price and sell them at a higher 'offer' price, thereby allowing them to make a profit from the bid-offer spread on each transaction. These market-making activities are often referred to as **dealing**, which is why investment banks are sometimes called 'dealer banks'.

When making markets in securities such as equities or bonds, an investment bank will acquire and sell the securities in this way. For example, if a pension fund approaches an investment bank because it wants to sell UK government bonds, the appropriate desk will buy them at the 'bid' price.

Market-making desks do not generally want to run significant **market risk**, which is the risk of losses in positions arising from movements in market prices.⁽¹⁾ Consequently, the desk will aim to sell the government bonds relatively quickly, but it may be left with some bonds on its books temporarily. A by-product of trading is therefore that the investment bank holds an **inventory**.

If a client approaches the investment bank to buy a security, the security may be available from its inventory. If it is not, the appropriate desk will have to source the security from other financial institutions that hold them. It can do this by buying the securities or borrowing them in return for other securities or cash.

Making markets in derivative instruments is different. A **derivative instrument** (or 'derivative') is a contract between two counterparties that derives its value from the value of an underlying entity. The underlying entity can be a security such as a share or a bond, a physical asset such as gold, an index of securities or other assets, an interest rate or an exchange rate. The underlying entity is often called just the 'underlying'. Some common variants of derivative contracts are:

- (i) **Forwards and futures:**⁽²⁾ these are contracts between two parties to buy or sell an asset or enter a transaction at a future date at a price specified today.
- (ii) **Options and warrants:** these are contracts that give the owner the right, but not the obligation, to buy or sell an underlying security at a pre-determined price, sometimes on a specific date.
- (iii) **Swaps:** these are contracts between two counterparties to exchange cash flows over a period of time or on a specific date based on the underlying value of exchange rates, interest rates or securities or other assets. Two types of swaps are particularly common: (a) interest rate swaps where cash flows are based on an agreed fixed interest rate versus a variable or 'floating' interest rate and (b) currency swaps where two counterparties exchange aspects (principal and interest payments) of a loan in one currency for equivalent aspects of a loan in another currency.

When trading in derivatives, investment banks need to stand ready to write a contract for a client at the appropriate price. Like with securities, the price will include a margin so that the investment bank can make a profit on its trades.

Dealing in derivatives also gives rise to significant market risk, such as the risk of the value of the underlying entity moving such that the bank stands to make a loss on the trade (known as the trade being 'out-of-the-money'). Like with securities, the market-making desks will attempt to neutralise the market risk by entering into an opposite trade so as only to profit from the bid-offer spread without running too much risk. They can also do this by assessing the risks that they run on an entire portfolio at an aggregate level and enter derivative trades to minimise those risks (this is known as '**portfolio hedging**'). They often enter these trades with other investment banks, often via an **inter-dealer broker**. However, entering into many hedging trades may be costly, and may erode the bid-offer spread. Traders therefore need to carefully balance the costs and risks of trading in securities and derivatives against the rewards.

Trading in derivatives also opens investment banks to counterparty credit risk — the risk that their clients who are out-of-the-money do not pay the investment bank the money that they owe when it falls due at the end of the contract, for example due to insolvency or liquidity problems. This risk is typically managed through margining requirements.

(1) In this particular example, the investment bank runs the risk that the bonds held reduce in value.

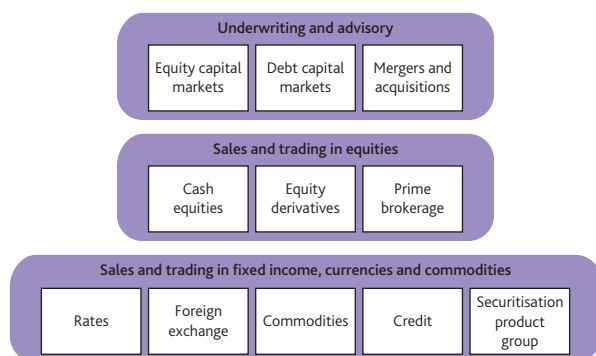
(2) Futures are forward contracts that are standardised and are traded on a centralised exchange.

Annex 2

The organisation of an investment bank

A stylised organisational structure of an investment bank is illustrated in **Figure A1**. This annex provides more information on the activities of the sub-divisions shown below.

Figure A1 Organisational structure of an investment bank



The 'underwriting and advisory' part of the investment bank is usually structured in three sub-divisions. **Equity capital markets (ECM)** and **debt capital markets (DCM)** are divisions that facilitate the issuance of equity and debt securities respectively for their clients seeking to raise finance. For large deals, an investment bank may form a 'syndicate' with other investment banks to share the risks of facilitating the transaction. The third sub-division is the advisory division, often referred to as **mergers and acquisitions (M&A)**. This part of the investment bank offers legal and financial expertise to firms engaging in mergers or acquisitions. Investment banks earn fees on each of these activities.

Investment banks' sales and trading activities — both in equities and in fixed income, currencies and commodities (FICC) — consist primarily of market-making activities in securities and derivative instruments, but can also include proprietary trading activities. Trading services are provided by 'desks' staffed by traders in the sales and trading divisions. The organisation of trading operations varies across investment banks, but it is usual to have a dedicated desk for each major asset class traded by the bank.

In sales and trading in equities, a '**cash equities**'⁽¹⁾ desk deals in straightforward equity securities. Although a large proportion of equity trading is done on dedicated exchanges such as the London Stock Exchange, investment banks play a role in equity markets by dealing with large investors such as pension funds and insurance companies. Large investors benefit from building relationships with investment banks by being offered the opportunity to buy shares in primary equity issuances. Although this link between the trading and underwriting arms exists, rules on 'insider dealing' forbid the traders to use information from the banks' underwriting or advisory business

to make gains. Investors are also offered ancillary services such as research on the performance of certain shares by the investment banks' analysts. By buying equities in large quantities from an investment bank (or selling to it), large investors can in theory keep their costs down by not disclosing their large orders to the market. This is sometimes achieved by trading in 'dark pools', which are private, anonymous exchanges set up by investment banks. Trading in derivative contracts linked to equities are provided by an '**equity derivatives**' desk.

Also within sales and trading in equities is a business known as **prime brokerage**⁽²⁾ or prime services. Primarily aimed at financial institutions such as hedge funds, prime brokerage businesses typically lend cash to institutions against collateral (this is known as margin lending). These institutions then use this cash to enter into further financial transactions that could earn returns. The investment bank earns interest on the cash that it lends, but can also supplement its revenues by lending the securities that it holds as collateral in securities lending markets.⁽³⁾ Investment banks also provide services that allow financial institutions to access financial market infrastructure to transact in financial instruments through prime brokerage.

Sales and trading in FICC houses trading desks that deal in other asset classes. The broad classes are:

- (i) '**rates**', where desks trade in sovereign debt securities, money market instruments (such as commercial paper — short-term bonds that companies use for funding purposes) and derivatives related to interest rate risk such as interest rate swaps. The 'rates' area of the investment bank sometimes includes desks that facilitate repos and securities lending transactions. Like market-making desks, these desks intermediate between market participants. They often do this by running a matched book business where they enter into securities financing transactions at their clients' request.⁽⁴⁾
- (ii) '**foreign exchange**', made up of desks that trade in foreign currencies and related derivatives.
- (iii) '**credit**', made up of desks that deal in corporate bonds (debt instruments issued by private corporations), ABS and structured credit products (more complex securitised instruments) and credit derivatives.

(1) 'Cash' refers to the fact that the desk trades securities and not derivative products.

(2) Although prime brokerage activities often sit in the equity trading part of major investment banks, prime brokers do not deal exclusively in equity products.

(3) This is known as rehypothecation.

(4) Consider, for example, a retail bank that approaches an investment bank to borrow cash in a repo transaction, using sovereign bonds as collateral. The relevant desk would complete the transaction, and charge the retail bank an interest rate. It would then lend out the bonds to another client against cash and make a return on the spread between the lending and borrowing rates. The desk's book is 'matched' because the investment bank lends out the securities that it borrows and *vice versa* (but not necessarily at the same maturity).

- (iv) '**commodities**', made up of desks that deal in commodities such as oil and precious metals and related derivatives.

Finally, another sub-division of FICC is the '**securitisation product group**'. This business securitises loans made by banks or other financial institutions and sells the securities to investors. The investment bank makes a return by charging a fee for its services or making a margin on the sale of securitisations to the investors relative to the value of the 'raw' loans.

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Desperate adventurers and men of straw: the failure of City of Glasgow Bank and its enduring impact on the UK banking system

By Richard Button and Samuel Knott of the Bank's Financial Stability Strategy and Risk Directorate, and Conor Macmanus and Matthew Willison of the Bank's Prudential Policy Directorate.⁽¹⁾

- City of Glasgow Bank was the largest commercial banking failure in the United Kingdom prior to the recent financial crisis and arguably shaped the future structure of the UK banking system.

Overview

'It was a calamity so unlooked for, so huge and disastrous, that it riveted men's gaze and made their hearts stand still' — Wilson (1879).

In 1878, City of Glasgow Bank (CGB) was one of the largest banks in the United Kingdom. Following a loss of confidence by providers of wholesale funding, CGB turned to other Scottish banks for liquidity assistance. But they refused after their investigations uncovered fraud and mismanagement.

Losses had been fraudulently concealed in CGB's published accounts. This partly reflected a decline in the standards of CGB's management during the 1870s, until all that was left were 'mediocrities and men of straw'. These '**men of straw**' colluded with the bank's largest creditors, whose speculative business investments saw them described at the time as '**gangs of desperate adventurers**'. The bank was deeply insolvent largely due to losses on exposures to this small group of borrowers. Several of the firm's management were sent to prison.

Following the failure of the bank, losses fell entirely on shareholders because they had unlimited liability, which required them to cover any shortfall of assets relative to liabilities. The losses incurred were very large: the value *per share* of the first call on shareholders to cover losses would have been almost two fifths of the annual earnings of a solicitor and over four times the annual earnings of a teacher. Public sympathy led to the establishment of a relief fund for the bank's shareholders.

The wider financial implications of the failure were reduced because depositors and other creditors were shielded from losses by the unlimited liability of CGB's shareholders. But

the failure may have intensified existing liquidity problems in the banking system, and there were some knock-on effects to the real economy.

The failure of CGB led to significant and enduring changes to the UK banking system, including **a move away from unlimited liability banking** and a requirement that banks be externally audited. The impact of these changes and the experience of the crisis arguably contributed to **a merger wave that resulted, by 1920, in a concentrated system of large banks similar to the one we recognise today** and to banks increasing the share of their balance sheets consisting of more liquid, lower-risk assets.

There are a number of parallels between the CGB episode and current policy debates. These include: the importance of banks having sufficient loss-absorbing capacity to contain the wider costs of distress; the need to prevent banks having large and concentrated exposures; the value of effective audit and disclosure requirements; and the benefits of holding banks' senior management to account.

Studying the past can help to ensure that historical insights are incorporated into risk assessment and structural policy today. Banking and regulation have changed significantly over time but the underlying causes of crises have a habit of repeating themselves.

[Click here for a short video that discusses some of the key topics from this article.](#)

(1) The authors would like to thank Maxwell Green, Perttu Korhonen, Casey Murphy, Shahid Nazir and John Turner for their help in producing this article.

The collapse of the City of Glasgow Bank (CGB) in October 1878 was the largest commercial banking failure in the United Kingdom prior to the recent financial crisis.⁽¹⁾ At the time it was reported as the largest banking disaster to have occurred in the United Kingdom or overseas.⁽²⁾ The repercussions of its failure went well beyond the impact on its stakeholders. It had an impact on the structure and governance of the UK banking system that endures today and it contains lessons relevant for current policy debates.

The purpose of examining this and other historical episodes is to build understanding of financial stability and crises, and to document and disseminate this knowledge to a wider audience. This will help to ensure that historical insights are incorporated into risk assessment and structural policy, helping the Bank of England (hereafter 'the Bank') to meet its financial stability objective.⁽³⁾ Banking and regulation have changed significantly over time but the underlying causes of crises have a habit of repeating themselves.

The first section of the article outlines why CGB failed. The second section analyses the impact of the failure on CGB's stakeholders, including depositors and banknote holders, shareholders, directors and the wider banking system. The third section examines the move away from unlimited liability banking that followed CGB's failure and its contribution to the evolution of the UK banking system. The final section discusses some lessons policymakers can learn from CGB's failure. A short video explains some of the key topics covered in this article.⁽⁴⁾

The failure of City of Glasgow Bank

CGB was established in 1839. It was part of a wave of bank formation that saw 16 Scottish banks established between 1825 and 1840.⁽⁵⁾ By the 1870s, CGB had grown to have the third largest branch network in the United Kingdom.⁽⁶⁾

As was common at the time, CGB's shareholders had unlimited liability. Shareholders in an unlimited liability company are jointly liable to cover a company's debts. This means that if the value of a company's assets falls below the value of its debts, shareholders are called to inject additional funds to cover the gap. Thus, unlike shareholders in a limited liability company, shareholders in an unlimited liability company can lose more than their initial investment.

The discovery of a capital shortfall

In June 1878, CGB's published balance sheet showed few signs of trouble and the directors reported a healthy dividend. CGB reported equity (assets minus liabilities) of around £1.5 million, equal to around 13% of assets, suggesting that it had adequate equity capital to absorb any losses that might reasonably occur.⁽⁷⁾ In spite of its apparent health, by September 1878 rumours had started to circulate about CGB — investors in wholesale funding markets became unwilling to finance any more of the bank's debt. When CGB approached

other Scottish banks for liquidity support, these banks insisted on an independent examination of its accounts as a precondition for assistance. This revealed that CGB had large exposures to a small number of weak borrowers. The Scottish banks refused support and CGB was forced to close its doors (Figure 1).⁽⁸⁾

Figure 1 A contemporary illustration of the stoppage of the City of Glasgow Bank



Source: *The Graphic*, 12 October 1878 (courtesy of Look and Learn).

The directors of CGB appointed a firm of chartered accountants to further investigate the bank's financial condition. After revaluing assets and liabilities, the accountants concluded that liabilities exceeded assets by £5.2 million (Chart 1).⁽⁹⁾ Losses were three times greater than reported equity and were equivalent to around 0.5% of UK nominal GDP in 1878. The bank was deeply insolvent.

Sources of losses

CGB's capital shortfall had been covered up by fraudulent accounting. The value of its liabilities were understated, and the value of its assets were overstated to conceal losses incurred on loans and investments (Chart 2) — these misstatements artificially boosted CGB's reported equity.

CGB's lending was highly concentrated — four borrowers accounted for three quarters of total loans. The reputation of some of these borrowers was poor. One newspaper described them as 'gangs of desperate adventurers'.⁽¹⁰⁾ They were heavily involved in overseas trade, particularly in East India

(1) See page 88 of Turner (2014).

(2) See *The Times*, 31 December 1878.

(3) The Parliamentary Committee on Banking Standards (2013) also recognised the importance of financial history in their recommendation that 'The PRA should ensure that supervisors have a good understanding of the causes of past financial crises so that lessons can be learnt from them'.

(4) www.youtube.com/watch?v=FOU0eA03S2c.

(5) See page 119 of Cameron (1995).

(6) See page 84 of Turner (2014).

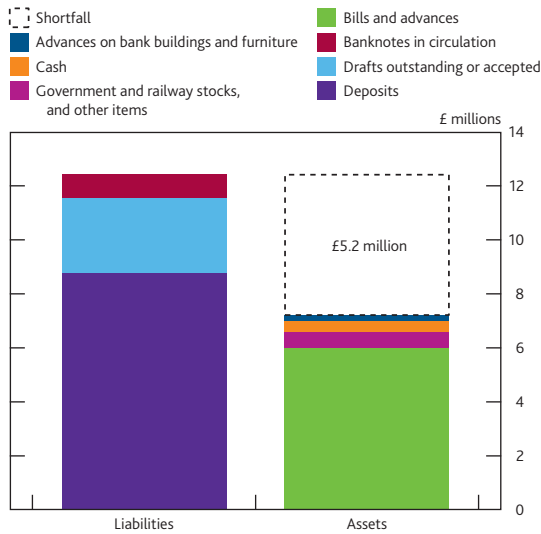
(7) Further details on the loss absorbercy of bank capital can be found in Farag, Harland and Nixon (2013).

(8) See pages 218–20 of Kerr (1908).

(9) See page 285 of Rosenblum (1933).

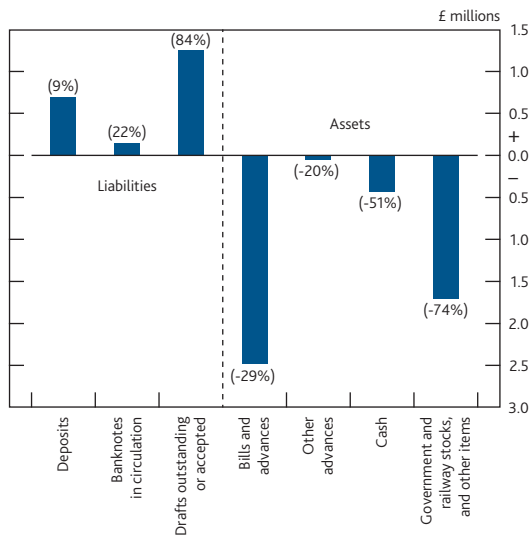
(10) See *The Times*, 31 December 1878.

Chart 1 City of Glasgow Bank's balance sheet as of 1 October 1878 according to the accountant's report



Sources: Wallace (1905) and Bank calculations.

Chart 2 Extent to which assets and liabilities were over and understated on City of Glasgow Bank's balance sheet^(a)

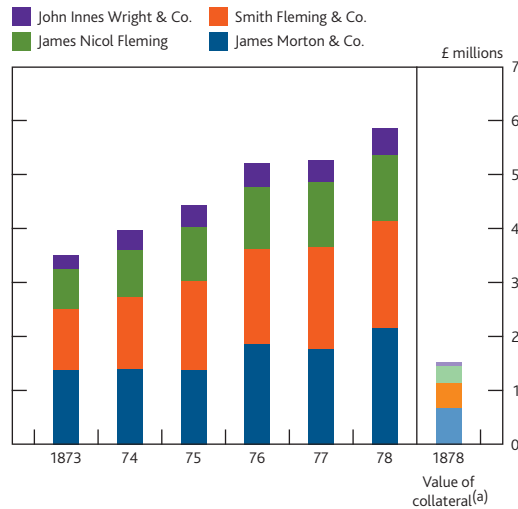


Sources: Wallace (1905) and Bank calculations.

(a) The values in parentheses show the degree to which liabilities and assets were understated and overstated, respectively on 1 October 1878.

and Australasia. CGB's exposures to these borrowers had existed for some years. For example, CGB had been supporting one of the borrowers — James Morton & Co. — since at least the mid-1860s.⁽¹⁾ By 1878 these exposures were close to £6 million, or about four times CGB's reported equity capital, and there was a £4.3 million deficit between the exposures and the value of collateral held against them (Chart 3). The accountant's report on CGB pointed out that 'no attempt had been made to value the securities held in reference to these four assets... which are entered in the security ledger at sums which appear to have been indicated by the debtors themselves'.⁽²⁾

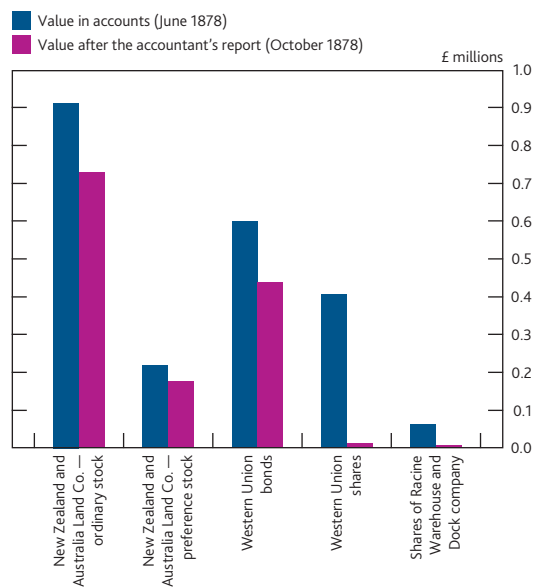
Chart 3 City of Glasgow Bank's large exposures



Sources: Wallace (1905) and Bank calculations.

(a) Value of collateral as estimated on 1 October 1878 in the accountant's report.

Chart 4 Estimates of City of Glasgow Bank's losses on selected foreign assets



Sources: Bank of England, Wallace (1905) and Bank calculations.

CGB also made losses on its direct investments in foreign assets, notably land in Australia and New Zealand, and US railways (in the form of investments in the Western Union railway company). These investments contributed around a further £1 million of losses, shown in Chart 4 by the sum of the differences between the magenta and blue bars.⁽³⁾

(1) See page 470 of Checkland (1975).

(2) See page 467 of Wallace (1905).

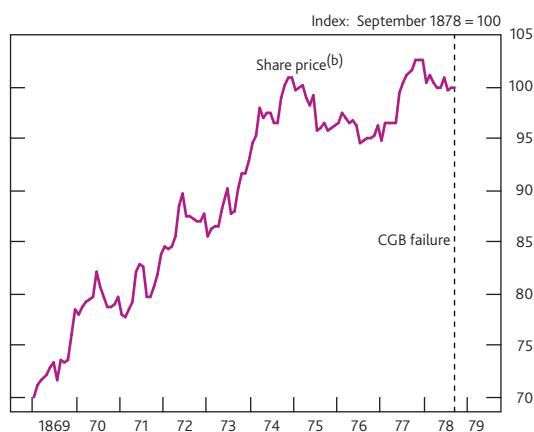
(3) Monitoring of overseas exposures was not always straightforward at the time. For example, following the failure of CGB, the manager of the New Zealand Land Company had to catch a boat back to the United Kingdom to deliver information about the company's properties following speculation in the press about the position of the firm (*The Times*, 28 October 1878).

The standards of CGB's management had declined during the 1870s, with some of the more capable board members departing. This left, according to Checkland (1975), 'only mediocrities and men of straw', which were heavily indebted to their own bank. One theory is that large concentrated exposures were allowed to build up because of the close relationship between CGB's directors and some of the borrowers. For example, James Nicol Fleming had been one of CGB's directors until he was asked to resign in 1876 due to the size of his debts to the bank.⁽¹⁾ The weak financial position of the bank may also have played a role by limiting its ability to absorb losses, and forcing it to continue to support failing borrowers.⁽²⁾

Immediate reaction to the failure

The collapse of CGB came as a shock. The falsification of its accounts meant that on most common measures of financial strength, the bank had appeared broadly in line with its peers. CGB's share price did not fall significantly in the run-up to its failure, shown by the magenta line in **Chart 5**, which suggests that investors did not anticipate the bank's failure. That said, Kerr (1908) claims that there had been considerable selling pressure on CGB's share price but the bank had propped up its share price by buying its own shares.⁽³⁾

Chart 5 City of Glasgow Bank's share price in the run-up to its failure^(a)



Sources: International Center for Finance at Yale School of Management and Bank calculations.

(a) The share price data are from the Investor's Monthly Manual, available at <http://som.yale.edu/faculty-research/our-centers-initiatives/international-center-finance/data/historical-financial-research-data/london-stock-exchange>.

(b) Based on share price for last business done in each month. The share price series is normalised to equal 100 in September 1878.

Moreover, there were concerns about CGB's financial strength in some banking circles. For example, Clapham (1944) argues that CGB was held in 'ill-repute among well-informed and honest bankers for years before the final collapse' and Cameron (1995) reports how concerns about a potential crisis at CGB had been reported to the Treasurer of the Bank of Scotland as early as 1871. But the general public were largely unaware of these rumours. And as a result, the sudden failure of CGB, coupled with it being one of the largest Scottish banks, caused panic. A quote from Kerr (1908) sums up the

mood: 'The announcement of the suspension of the City of Glasgow Bank... had a paralysing effect throughout the business community, and feelings of alarm and distrust arose among the general public'.

Impact on stakeholders

CGB's failure was quickly contained, for three main reasons. First, other Scottish banks continued to accept CGB banknotes and to provide services to CGB depositors. Second, depositors and creditors were shielded from losses by the unlimited liability of CGB's shareholders. And third, CGB's problems were perceived to be unique to it.

While depositors and note holders were paid in full, CGB's shareholders suffered large losses. Its directors faced trial and eventually served prison sentences. And the UK banking system and real economy is thought to have suffered some spillover effects. The rest of this section considers each of CGB's main stakeholders in turn.

Depositors and note holders

CGB had a deposit base of £8.5 million, the third largest branch network in the United Kingdom and, like a number of other Scottish banks, issued its own banknotes.⁽⁴⁾ The Banking Act of 1845, which extended the 1844 Banking Act to Scotland, had restricted the issuance of banknotes to those banks that had established note issues before that date. This made note issuance a highly profitable activity, and acted as a barrier to entry to banking more generally, as new banks did not have access to this business line.⁽⁵⁾ Maintaining confidence in the note issuance was therefore a priority for the other Scottish banks, and they chose to continue to accept notes issued by CGB. They did this in part because the panic that followed the earlier failure of another Scottish banknote issuer, the Western Bank of Scotland in 1857, had only abated after other banks guaranteed that Western's note holders would not suffer losses. The unlimited liability of CGB's shareholders is also likely to have given the other Scottish banks confidence that they would not be exposed to losses.

The actions of other Scottish banks also helped to limit the impact on depositors. They allowed CGB depositors (except those who were shareholders) to transfer their deposits, making some funds immediately available, which meant that

(1) See page 255 of Forbes Munro (2003).

(2) See *The Times*, 31 December 1878.

(3) However, fluctuations in CGB's share price — shown by the differences between its highest and lowest prices recorded in a calendar month — did not increase as one might expect if there had been consistent selling pressure.

(4) Some banks still issue their own banknotes. Three banks in Scotland, as well as four in Northern Ireland, are authorised to issue banknotes. Under the Banking Act 2009, those banks are required to fully back their note issuance with ring-fenced, risk-free assets. Bank of England banknotes, UK coin, or funds held in ring-fenced accounts at the Bank of England can act as backing assets. This requirement gives holders of these commercial banknotes a similar level of protection to Bank of England note holders. See Naqvi and Southgate (2013) for more details.

(5) See page 24 of French (1985).

CGB deposit holders continued to have access to the payments system.⁽¹⁾ They also took over much of CGB's branch network.⁽²⁾

Shareholders

As well as wiping out the value of the capital shareholders had already invested, the failure of CGB also left shareholders with additional losses. This was because shareholders had unlimited liability, which meant they were legally liable to cover the shortfall between CGB's assets and liabilities.

Losses fell unevenly across shareholders, most of whom were members of the public. The liquidators of CGB made two calls on shareholders to cover the shortfall. The first was in November 1878 for £500 per share. But as only one third of shareholders were able to meet this call in full, a second call was made in April 1879 for a further £2,250 per share. The inability of poorer shareholders to meet their obligations meant that almost three quarters of the total shortfall was paid by the one third of shareholders who were able to meet the first call in full as well as contribute towards the second call.⁽³⁾ This reflected the size of the calls. The value per share of the first call alone would have been almost two fifths of the annual earnings of a solicitor or barrister — a highly paid occupation — and over four times the annual earnings of a teacher.⁽⁴⁾

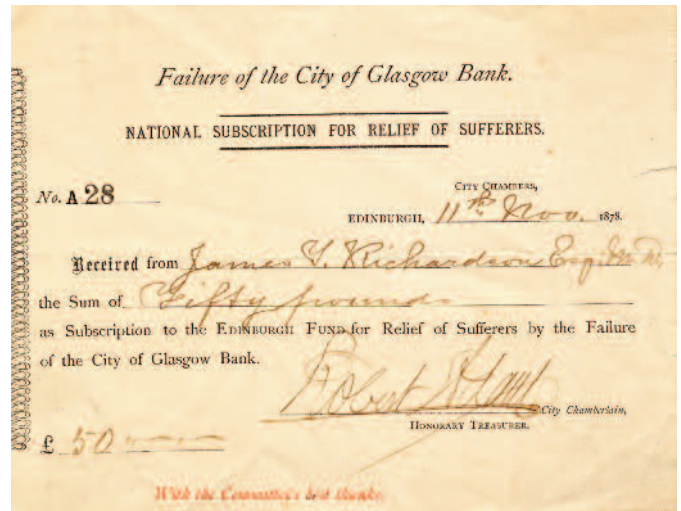
The scale of the losses incurred by CGB meant that the calls faced by shareholders were significantly larger than those seen in previous unlimited liability bank failures.⁽⁵⁾ But despite this there were few reports of shareholders absconding or seeking to conceal their assets to avoid paying their debts. On the contrary, there appears to have been a strong feeling that claims should be honoured with many shareholders reported as travelling to Glasgow to personally deliver funds to the liquidators. French (1985) attributes this to the religious nature of Scotland in the 19th century.

The suffering and financial burden placed on shareholders was widely covered in the press. Coverage typically portrayed the shareholders as socially vulnerable and financially ruined investors, with small shareholdings.⁽⁶⁾ The public were reported as viewing the failure of CGB and the impact on its shareholders as a national tragedy.⁽⁷⁾ Public sympathy led to fund-raising events for CGB shareholders, including the establishment of a relief fund, which received £379,670 in donations by 1882⁽⁸⁾ (Figure 2), and even a public recital of the works of Shakespeare.⁽⁹⁾

Caledonian Bank

One name to appear on the list of CGB shareholders was Caledonian Bank, a small bank from the north of Scotland. It had taken £400 of CGB shares as security for an advance to a Pitlochry whisky distillery. It had eventually become the registered holder of the shares, and therefore liable as a CGB

Figure 2 A donation to the relief fund for City of Glasgow Bank shareholders



Source: © CSG CIC Glasgow Museums Collection.

shareholder.⁽¹⁰⁾ In spite of Caledonian's efforts at reassurance, its shareholders began to sell their shares. To prevent its shares being sold to less wealthy investors who would be less able to provide capital support to Caledonian, which in turn could reduce the bank's ability to meet the calls on CGB shareholders, the liquidators of CGB forced Caledonian to cease trading.

Caledonian's ultimate liability as a result of CGB's failure was only £11,000 (less than 5% of capital and reserves) and it was able to reopen in June 1879. But, in total the stoppage was estimated to have cost an additional £62,970 — the bank never fully recovered and was eventually taken over by the Bank of Scotland in 1907.⁽¹¹⁾

Directors

The manager, secretary and a number of CGB's directors were arrested in mid-October 1878. The trial elicited great interest from the general public and was heavily reported by the press (Figure 3). The official record of the trial states that: 'The trial of the City [of Glasgow] Bank directors ranks, in the estimation

(1) See page 86 of Turner (2014).

(2) The bulk of CGB's branch network, and staff, were taken on by Royal Bank of Scotland (see page 141 of Cameron (1995)).

(3) See page 147 of Lee (2012).

(4) This is based on nominal annual earnings for different occupations in 1881 (see page 153 of Mitchell (1988)).

(5) See Table 5.6, page 119, of Turner (2014) for the values of calls on shareholders in previous bank failures.

(6) See page 143 of Lee (2012).

(7) See page 19 of French (1985).

(8) This would have represented just over 7% of the total shortfall at CGB. To put it into context, the amount raised was around 5% of the total expenditure on the relief of the poor in the whole of England and Wales in 1878 (see page 605 of Mitchell (1988)).

(9) See page 149 of Lee (2012).

(10) See page 12 of French (1985).

(11) See pages 166–68 of Cameron (1995) and page 12 of French (1985).

Figure 3 A contemporary illustration of the trial of the directors of City of Glasgow Bank



Source: *The Graphic*, 25 January 1879 (courtesy of Look and Learn).

of the layman, if not of the professional lawyer, as probably the most important which has taken place in Scotland'.⁽¹⁾

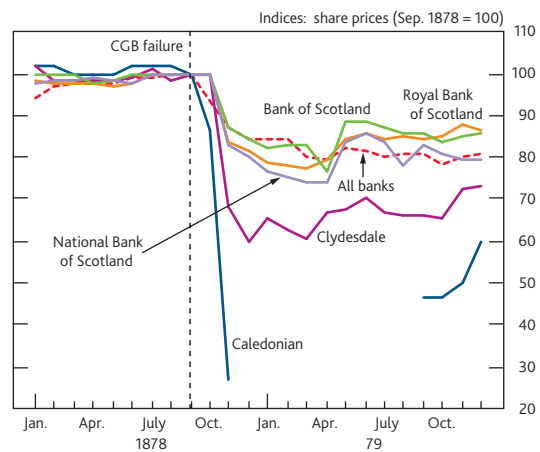
The bank's general manager and one of its directors were found guilty of falsifying CGB's balance sheets and were given 18-month prison sentences. Five other directors were found guilty of publishing balance sheets that they knew to be false and were imprisoned for eight months.⁽²⁾ This was only the second imprisonment of directors of a British joint stock bank.⁽³⁾⁽⁴⁾ Despite this, the sentences were reported by *The Economist* to be 'inadequate' and 'leaving a lot of dissatisfaction behind, with questions asked as to why the defendants did not receive the harshest penalty available under the law'.⁽⁵⁾

Wider banking system and real economy

Contagion to the wider Scottish banking sector was relatively limited. While the share prices of other banks did fall significantly during 1878–79 (Chart 6), the only bank closure as a direct consequence of CGB's failure was the aforementioned Caledonian.⁽⁶⁾

However, the failure of CGB had some wider effects on the Scottish economy. The losses resulting from the failure of the

Chart 6 Bank share prices around the failure of City of Glasgow Bank^{(a)(b)(c)}



Sources: International Center for Finance at Yale School of Management and Bank calculations.

- (a) The share price data are from the Investor's Monthly Manual, available at <http://som.yale.edu/faculty-research/our-centers-initiatives/international-center-finance/data/historical-financial-research-data/london-stock-exchange>.
- (b) Based on share prices for last business done in each month. Each share price series normalised to equal 100 in September 1878.
- (c) The All banks series is based on the sum of the share prices of all banks listed within each issue of the Investor's Monthly Manual (which includes all banks listed on the London Stock Exchange, including ones from outside the United Kingdom).

bank contributed to an increase in the value of bankruptcies in Scotland in the years following CGB's failure.⁽⁷⁾ Due to the size and international focus of CGB, effects were also felt further afield, including in London and India where the firms belonging to a number of CGB's larger creditors were forced to close.⁽⁸⁾ And there were reports of firms with Glasgow connections finding it difficult to obtain credit due to the stigma that CGB's failure attached to the city itself.⁽⁹⁾

There were also some strains in the banking system elsewhere in the United Kingdom during the same period. Provincial banks in England and Wales faced depositor withdrawals and losses on loans to industrial borrowers and there were some bank failures (notably the West of England and South Wales District Bank in December 1878).⁽¹⁰⁾ Some reports suggested that confidence in the sector was shaken to an extent not seen since the major banking crisis that occurred in 1825.⁽¹¹⁾

Liquidity problems may have intensified after the failure of CGB but it appears that problems started before then. In the first half of 1878, deposits held at banks had begun to fall

(1) See page 1 of Wallace (1905).

(2) See page 85 of Turner (2014).

(3) A joint stock company is a business concern with shares that can be traded among investors.

(4) In 1858, some of the directors of the Royal British Bank were imprisoned. In addition to these custodial sentences, one banker had been hanged for forgery half a century earlier (page 310 of Clapham (1944)).

(5) © The Economist Newspaper Limited, London (February 1879).

(6) Some of the falls in other banks' share prices may have been due to CGB shareholders selling their holdings of other banks' shares in order to raise the funds they needed to meet the calls on CGB shareholders (see page 27 of French (1985)).

(7) See page 695 of Mitchell (1988).

(8) See page 254 of Forbes Munro (2003).

(9) See page 253 of Forbes Munro (2003).

(10) See page 507 of Collins (1989).

(11) *The Times*, 31 December 1878.

while the Bank of England’s liabilities had started to increase.⁽¹⁾ Thus, difficulties in the wider banking system cannot be attributed entirely to CGB’s failure. Moreover, the problems in the banking system occurred at a time when economic conditions in the United Kingdom were weak. Economic growth had been low in the years preceding CGB’s failure and the economy contracted between 1878 and 1879.⁽²⁾ Unemployment was increasing during the same period⁽³⁾ and the number of bankruptcies increased in 1878.⁽⁴⁾ But the economy then recovered quickly, growing strongly between 1879 and 1880.⁽⁵⁾

Bank of England

Perhaps reflecting CGB’s poor credit quality, the Bank of England did not provide liquidity support. However, it raised Bank Rate in October 1878. It did so because, following the Bank Charter Act of 1844, the Bank was required to back its note issuance with gold. During a liquidity crisis in the banking system, demand to withdraw gold from the Bank could increase, which would put at risk the backing of the note issuance. An increase in Bank Rate would have reduced demands to withdraw gold. The increase was reversed a month later, suggesting that liquidity problems in the banking system were short-lived.

The enduring impact of the failure of CGB on the UK banking system

The failure of CGB had a profound and enduring impact on the British banking system, particularly on the nature of bank shareholders’ liability.

Shareholder liability in the UK banking sector

The severe financial problems faced by CGB shareholders were widely attributed to the fact that they had an unlimited liability to cover the bank’s debts. At the time of CGB’s failure, there was a mixture of banks operating under unlimited liability and limited liability (whereby shareholders were not liable to cover a failed bank’s debt and hence could not lose more than their equity investments). This is shown in Table A alongside a third category, reserve liability, which is discussed later in this section.

Table A Number of British banks operating under different liability regimes^{(a)(b)}

	1849	1869	1889
Limited liability ^(c)	5	47	45
Unlimited liability	141	89	2
Reserve liability	–	–	77

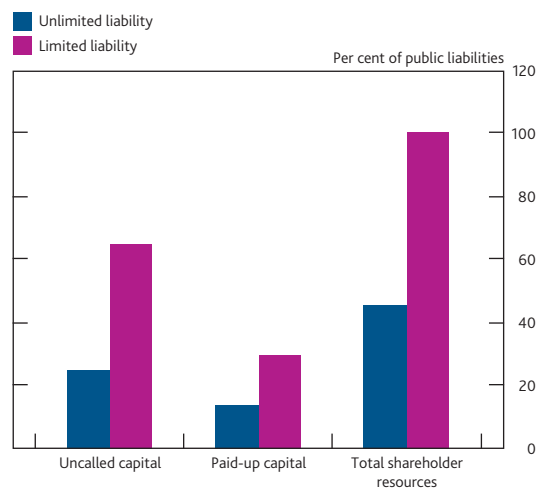
Sources: Acheson, Hickson and Turner (2010) and Bank calculations.

(a) The data are taken from Table 1, page 250, in Acheson, Hickson and Turner (2010).
 (b) The sample includes banks from England, Ireland, Scotland and Wales.
 (c) This category groups together banks that had limited liability under a state charter (Bank of England, Bank of Ireland, Bank of Scotland, British Linen Bank and Royal Bank of Scotland) and joint stock banks incorporated with limited liability.

The right for companies to incorporate with limited liability had been liberalised during the 19th century. It was extended to banks in 1858.⁽⁶⁾ But established banks had been reluctant to adopt limited liability because unlimited liability enabled them to reassure depositors and note holders that they would not face losses on their claims. Individual banks might also have been reluctant to switch to limited liability unilaterally in case it put them at a disadvantage when trying to compete for deposits.⁽⁷⁾

Depositors valued shareholders having unlimited liability. Banks that were incorporated with limited liability tended to have higher levels of capital than unlimited liability banks (Chart 7) because limited liability provided less protection for depositors. But capital levels of both unlimited and limited liability banks were both much higher than capital levels of banks today.

Chart 7 English banks’ capital levels in 1874^{(a)(b)(c)}



Sources: Turner (2014) and Bank calculations.

(a) The bars show mean values of capital as a percentage of public liabilities. Public liabilities consist of deposits and notes in issuance.
 (b) The chart is shown for a sample of 30 unlimited liability banks and 33 limited liability banks.
 (c) Paid-up capital is equity capital that had been invested in the banks. Uncalled capital is equity capital that could have been called at the discretion of a bank’s management. Total shareholder resources consists of paid-up capital, uncalled capital and reserves (such as retained earnings).

Criticisms of unlimited liability

A criticism of unlimited liability made in the 19th century was that the protection it gave depositors and note holders could be eroded in periods of bank distress. This reflected the view that the downside risks of holding unlimited liability shares in a failing bank were so high that only those with nothing, or

(1) See page 520 of Collins (1989).
 (2) This can be seen in estimates of real GDP, on page 60 of Solomou and Weale (1991).
 (3) This is the percentage unemployed in certain trade unions; see page 122 of Mitchell (1988).
 (4) See page 695 of Mitchell (1988). The value of bankruptcies spiked up in England and Wales in 1878, although the same did not happen in Scotland.
 (5) See page 60 of Solomou and Weale (1991).
 (6) See pages 134–36 of Hunt (1936). Prior to 1858, a bank needed a state charter to operate with limited liability. There were five banks with such charters (Bank of England, Bank of Ireland, Bank of Scotland, British Linen Bank and Royal Bank of Scotland).
 (7) See page 31 of Crick and Wadsworth (1936).

very little, to lose would be willing to continue to hold them, leading to wealthy shareholders offloading their shares to less wealthy investors. These less wealthy investors would be less able to meet any capital calls made on shareholders. George Rae, a prominent writer about banking during the period, described how 'Men of wealth and position would gradually sell out' with unlimited liability reduced to 'a husk without its kernel'.⁽¹⁾ There were fears that CGB's failure would strengthen this process of unravelling in future episodes of bank distress.

There is, however, no strong evidence for this unravelling process having taken place, either before or following the failure of CGB. Acheson and Turner (2008) show that the proportion of shareholders of major Scottish banks — including CGB — that were low wealth, based on their occupation, was low before the failure of CGB and did not increase immediately after its failure.⁽²⁾

This may have been due to some banks having arrangements in place to stop transfers of shares to less wealthy investors. All share transfers had to be approved by directors of banks, who themselves typically held large shareholdings and as a result had strong incentives to prevent shares passing to the less wealthy. And wealthy shareholders' incentives to sell their holdings of bank shares — including when problems started to appear at a bank — might have been weakened by the fact that they could remain liable for a bank's debts. A shareholder in Scotland was liable for debts incurred during the time they were a shareholder if the current shareholders were unable to cover the losses, whereas in England and Ireland a shareholder remained liable for three years after they had sold their shares.

The move to reserve liability

The magnitude of CGB shareholders' losses caused banks operating with unlimited liability to seek to change their liability regimes. But the reluctance to switch to limited liability remained.

The Companies Act 1879 introduced a different liability concept, reserve liability. Under reserve liability a shareholder would be liable to meet a bank's debt in the event of bankruptcy only up to some fixed multiple of his or her investment in shares. Reserve liability, together with uncalled capital (additional capital that a bank's management could request from shareholders while it was still operating as a viable business) meant that debt holders' claims were still partially protected. But reserve liability implied that the amount an individual shareholder could lose was capped and not as dependent on other shareholders' wealth.

The number of banks operating under reserve liability grew rapidly after 1879 and the number of unlimited liability banks declined (Table A). In 1885, under reserve liability, the

amount of capital that could be called from a UK bank's shareholders was on average close to two times their paid-up capital, and over three times their paid-up capital if uncalled capital is also taken into account.⁽³⁾ This meant that, on average, a shareholder could face losses of around £3 for every £1 of equity they had invested.

Greater concentration

The end of unlimited liability also contributed to other significant structural changes to the British banking system. Unlimited liability tended to limit the size of banks. Investors would be reluctant to become shareholders in a large bank since the larger balance sheet of such a bank could expose them to greater losses. In addition, the mechanisms to prevent shares transferring to less wealthy shareholders, such as directors vetting all share transfers, would become more costly or impractical in a large bank with a large shareholder base.

These protective mechanisms tended to result in shareholders being located near to a bank's headquarters. Local shareholders were easier for directors to vet and were in a better position to monitor the bank. But this limited the set of potential investors a bank could attract if it wished to expand. CGB fitted this pattern, with the vast majority of shareholders based in Scotland, including over 400 in Glasgow and around 300 in Edinburgh (Figure 4). By contrast, there were only around 20 London-based shareholders.

Limiting liability removed these barriers to the emergence of larger banks, contributing to a wave of bank mergers in the late 19th and early 20th century. Accompanying that wave was a reduction in both reserve liability and uncalled capital (see the box on pages 32–33).

External audits of banks

The fraud at CGB led other banks to move to reassure shareholders of the strength of their balance sheets by voluntarily adopting external audits.⁽⁴⁾ This subsequently became a requirement of all banks under The Companies Act 1879.

More conservative balance sheet composition

The failure of CGB, and the move away from unlimited liability, may also have made banks more conservative when choosing the composition of their balance sheets in the following decades and into the early part of the 20th century. The share of English and Welsh banks' assets consisting of liquid, low-risk assets jumped up in 1879 and then continued

(1) See Letter 34, pages 248–49 of Rae (1885).

(2) See Table 1 on page 241 of Acheson and Turner (2008).

(3) See Table 5.9 on page 127 of Turner (2014).

(4) See page 479 of Checkland (1975) and pages 41–42 of Walker (1998). See also Sowerbutts, Zimmerman and Zer (2013) for a discussion about how bank disclosures have changed in more recent times.

Figure 4 Location of City of Glasgow Bank shareholders^(a)

Sources: University of Glasgow Scottish Business Archive and Bank calculations.

(a) This map shows location data for around 97% of CGB's 1,819 shareholders. Around 0.5% of shareholders were based overseas, location data for the remaining 2.5% was unavailable.

on an upward trend until the end of the 19th century.⁽¹⁾ By the end of the century, the liquid assets share was a little over 40%, whereas it had been just under 30% in 1878. The share of bank assets consisting of loans to industry correspondingly fell during this period.

These trends suggest that banks became more conservative by reducing their exposure to liquidity risk (by holding larger buffers of liquid assets) and to credit risk (by lending less to riskier corporate borrowers). But any impact that the failure of CGB had on banks' risk appetite was clearly not as permanent as the other effects described above.

Policy lessons

The Bank pursues its objective to maintain financial stability through a number of different roles. The Prudential Regulation Authority (PRA), as part of the Bank, is responsible for the microprudential regulation of deposit-takers, insurers and major investment firms. Through the setting of standards and supervision, the PRA aims to promote the safety and soundness of the firms it regulates, and — in the case of insurers — contribute to the protection of policyholders. The Bank also has a statutory objective to protect and enhance the stability of the financial system of the United Kingdom. The Financial Policy Committee (FPC) contributes to meeting this objective by taking actions to remove or reduce systemic risks.

While the banking system looked quite different in 1878 from today, it is nonetheless possible to draw a number of lessons

from the failure of CGB for both the safety and soundness of individual firms and the resilience of the system as a whole.

Safety and soundness of individual firms

First, banks can run into difficulties when they make significant investments outside of their core fields of expertise. In CGB's case this was true for investments overseas, which they could not adequately assess or monitor. A more recent example is the investments made in the years running up to the recent financial crisis by a number of firms in asset-backed securities that were subsequently found to be of lower quality than the firms had anticipated.

Second, large exposures to individual borrowers can undermine the resilience of banks. A large proportion of CGB's losses can be traced back to its loans to a small number of counterparties. Today, policymakers recognise the risks posed by large exposures and impose regulations to limit the values of banks' exposures to single counterparties. The Basel Committee on Banking Supervision has recently published a set of standards for large exposures regulation.⁽²⁾

Third, problems can occur at banks if audit and disclosure requirements are ineffective. The fraud at CGB led to legislation requiring external auditing of banks. Following the recent crisis, there have also been efforts to improve banks' disclosures and their external audits. These include recommendations made by the Enhanced Disclosure Task Force⁽³⁾ — an industry body initiated by the Financial Stability Board — and proposals from the PRA to improve further the relationship between external auditors and supervisors of PRA-authorized firms, such as written reporting to the PRA by the auditors of the largest UK deposit-takers as part of the statutory audit cycle.⁽⁴⁾

Fourth, bank resilience is supported by senior management being accountable for their behaviour. Members of CGB's senior management and board faced trial for their behaviour, which may have deterred similar behaviour at other banks. The benefits of holding individuals to account are recognised by policymakers today. Following recommendations from the Parliamentary Commission on Banking Standards in this area, the PRA and Financial Conduct Authority (FCA) have recently proposed measures to ensure individuals working at UK banks, building societies, credit unions and PRA-designated investment firms are held to account for their behaviour.⁽⁵⁾

(1) Evidence for the changes in the composition of banks' balance sheets can be found in Table A.6 from pages 269–71 of Collins and Baker (2003).

(2) See Basel Committee on Banking Supervision (2014).

(3) See Enhanced Disclosure Task Force (2012).

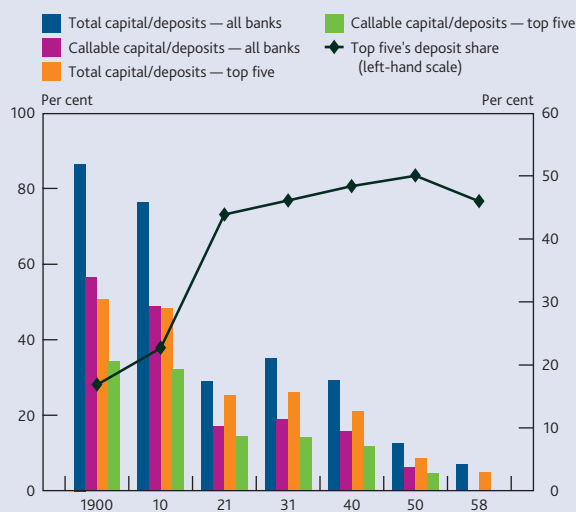
(4) See Bank of England (2015).

(5) See PRA and FCA (2014).

Amalgamation in the British banking system

Between 1879 and 1920, the UK banking system became significantly more concentrated, driven by a series of mergers. The largest five banks increased their share of deposits from just below 40% in 1910 to over 70% in 1921 (**Chart A**). Today, the largest six banks in the United Kingdom hold around 75% of sterling household deposits.

Chart A Concentration and capital ratios in the British banking system 1900–58^{(a)(b)(c)}



Source: Turner (2014).

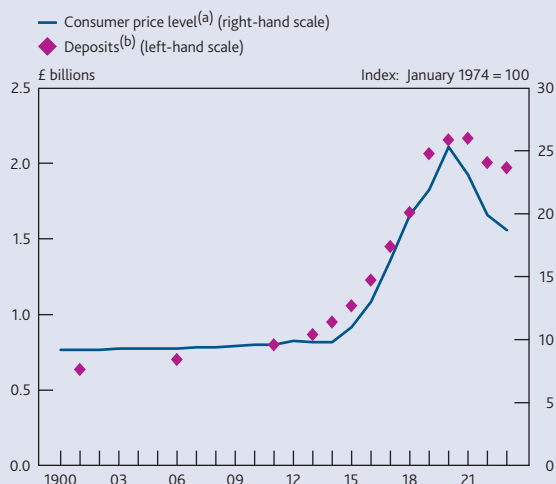
- (a) Total capital consists of paid-up capital, shareholder reserves, reserve liability, and uncalled capital. Callable capital consists of reserve liability and uncalled capital.
 (b) Mean capital ratios are shown.
 (c) The years for which data are shown match those shown in Table 5.10 in Turner (2014).

Several factors were behind this development. First, there was a perception that the needs of industry were better served by larger banks.⁽¹⁾ Within the banking industry, some drew comparisons with the banking systems in other economies — in particular, with Germany — where larger banks were perceived as more likely to be able to support larger industrial companies in the aftermath of the First World War than smaller British banks were.⁽²⁾ Second, larger banks operating over bigger geographical areas might have been better able to direct surplus bank deposits in certain regions of the country towards regions where the demand for loans exceeded deposits.⁽³⁾ And third, the move away from unlimited liability meant that shareholders had less reason to fear the potentially larger losses these banks could incur.

Accompanying amalgamations in the banking system were decreases in banks' ratios of capital relative to deposits (**Chart A**). Upon merging, banks tended to reduce the values of reserve liability and uncalled capital. Paid-in (or called) capital ratios fell, too. Lower levels of capital might also have facilitated bank mergers if, for a given level of dividends, a smaller capital base increased a bank's share price, better enabling it to purchase other banks.⁽⁴⁾

Larger banks may have been perceived as safer (perhaps because they were considered more diversified), enabling them to operate with lower capital ratios than smaller banks. Throughout this period, the largest five banks had lower ratios of total capital and callable capital (reserve and uncalled capital) to deposits than smaller banks (**Chart A**). But other factors also contributed to the decline in capital ratios. The decline in bank capital relative to deposits was particularly strong in the 1910s, with one explanation being that high inflation during and immediately following the First World War pushed up the value of bank deposits while banks did not adjust their capital levels at the same pace (**Chart B**).

Chart B Inflation and bank deposits 1900–23



Sources: ONS and Sykes (1926).

- (a) Available at www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?cid=CDKO&dataset=mm23&table-id=3.6. The index is calculated on an annual basis before June 1947 and on a monthly basis from then onwards. It is normalised to equal 100 in January 1974.
 (b) Deposits (including notes issuance) of joint stock banks and private banks in England shown on page 108 of Sykes (1926).

The decline in reserve liability and uncalled capital might have reflected larger banks tending to have greater numbers of shareholders.⁽⁵⁾ This may have increased the cost of vetting share transfers and administrating the process of making calls on shareholders to inject additional capital. Larger banks might also have deemed calling additional capital from shareholders during a crisis impractical, in case the call aggravated rather than lessened the crisis. This was a view held by some Bank of England staff by the 1930s.⁽⁶⁾ Reserve liability and uncalled capital finally disappeared in the British banking system in the 1950s.

This merger wave came to an end after the government set up the Treasury Committee on Bank Amalgamations in 1918. The

(1) See page 40 of Crick and Wadsworth (1936).

(2) See pages 75–76 of Sykes (1926).

(3) See page 221 of Sykes (1926).

(4) See page 102 of Sykes (1926).

(5) For example, the mean number of shareholders for a bank in the top five increased from around 17,102 in 1910 to around 53,305 in 1921 (see Table 3.4, page 45 of Turner (2014)).

(6) See page 132 of Turner (2014).

Committee considered that any of the benefits associated with bank mergers had probably been exhausted, since any further mergers would probably be between banks already operating in the same regions (and hence the scope to improve the distribution of surplus bank deposits to lending opportunities discussed above would be far smaller). The Committee raised concerns about the falls in bank capital that had occurred around mergers, and the risk that mergers were reducing competition or could even lead to a monopoly bank that would undermine the Bank of England's position. It

proposed that future amalgamations in the banking sector should require government approval.⁽¹⁾ To avoid this level of government intervention, the big five banks accepted that the Treasury and the Bank of England would control any future mergers — no mergers involving these banks were permitted until the 1960s.⁽²⁾

(1) The full report of the Treasury Committee on Bank Amalgamations is reproduced on pages 218–27 of Sykes (1926).

(2) See page 46 of Turner (2014).

Resilience of the system

Fifth, the risk that an individual bank failure triggers a systemic crisis can be reduced by having mechanisms in place to enable the system to cope with such a failure.

Other Scottish banks were willing to continue to accept CGB notes and provide services to CGB depositors because they knew that all of the losses would fall on CGB's shareholders due to their unlimited liability. This support reduced the risks of a wider run on Scottish banks and a breakdown of the payments system. Today, policymakers are putting in place resolution regimes to ensure the provision of core banking activities and services, such as payments, are not disrupted by bank failures⁽¹⁾ and are proposing to require global systemically important banks (G-SIBs) to have sufficient capacity to absorb losses and recapitalise without recourse to taxpayer funds.⁽²⁾

Sixth, bank failures can have long-lasting effects on the behaviour of surviving banks. Following CGB's failure, banks shifted towards holding a greater share of liquid assets. This shift persisted for at least a couple of decades and may have reduced the supply of credit to the real economy. This is consistent with recoveries from financial crises taking longer

than recoveries from recessions without financial crises (Jordà, Schularick and Taylor (2013)).

Seventh, bank failures and financial crises can affect the long-term structure of the banking system. The failure of CGB hastened the demise of unlimited liability banking. This arguably contributed to a wave of mergers in the UK banking sector in subsequent decades that led to far higher levels of concentration. The structure of the banking system may morph again following the recent crisis and regulatory reforms introduced since the crisis. Some structural change could be beneficial for financial stability, as well as for competition.⁽³⁾ But policymakers should remain alert to changes that have unintended and undesirable consequences.

The CGB episode highlights the lessons that policymakers can learn from previous incidents of financial instability. At both the UK and international level, authorities have taken steps since the crisis to mitigate some of the problems that have reoccurred over time. However, the reform agenda is ongoing and policymakers will need to remain vigilant to risks as they arise.

(1) See Gracie, Chennells and Menary (2014).

(2) See Financial Stability Board (2014).

(3) The PRA has a secondary objective to facilitate effective competition. When making general policies the PRA will, while advancing its primary objectives, so far as reasonably possible, facilitate effective competition in relevant markets (see www.bankofengland.co.uk/publications/Pages/other/prasupervisoryapproach.aspx).

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Capital in the 21st century

By Andrew Haldane and Rachana Shanbhogue of the Bank of England and Professors Orazio Attanasio of University College London, Timothy Besley of the London School of Economics, Peter Lindert of the University of California, Davis, Thomas Piketty of the Paris School of Economics, and Jaume Ventura of Universitat Pompeu Fabra.

- On 19 December 2014, the Centre for Economic Policy Research and the Bank of England hosted a discussion forum based around Thomas Piketty's book, *Capital in the twenty-first century*, with a number of economists from academia, public sector bodies and private sector institutions.
- Four speakers presented research on various issues relating to inequality, including: access to education; wealth and taxation policy; and the role of governance and institutions.
- This article presents each speaker's key arguments, and includes a summary of the open-floor debate that followed.

Overview

Inequality has risen within many advanced and emerging market countries. In the United Kingdom and the United States, the share of income that goes to the top 1% of earners has doubled since the 1980s, and their share of overall wealth has also risen over this period (Piketty (2014)). These trends and their public policy implications have been increasingly analysed by academics and policymakers. From a central bank perspective, inequality can affect the fragility of the financial system and growth in the economy.

On 19 December 2014, the Centre for Economic Policy Research and the Bank of England hosted a discussion forum on *Capital in the twenty-first century*, with its author, **Thomas Piketty**, Professor of Economics at the Paris School of Economics.⁽¹⁾

At the event, four speakers presented research on a number of aspects of inequality.

Peter Lindert, Professor of Economics at the University of California, Davis, discussed the sources of inequality from an economic history perspective. Historical accidents can render economies more equal, and public policies are key to ensuring that they stay equal over time. A successful education policy is one of the key common factors among those countries that currently have relatively low inequality.

Orazio Attanasio, Professor at University College London, presented on the intergenerational transmission of inequality, based on research with Richard Blundell, Professor of Political Economy at University College London.

UK cohort data suggest that there is a strong correlation between the cognitive development of five-year old children and their subsequent earnings as adults. Since parental income influences children's development, this result suggests that inequality can be passed down from one generation to the next.

Jaume Ventura, Professor at Universitat Pompeu Fabra, discussed inequality and macroeconomic models. A key challenge for macroeconomists is to build models that can explain the trends in inequality. Capital may have a 'bubble' component, which grows in line with anticipated capital gains. Empirical studies suggest that, on average, capital gains accounted for about 40% of the increase in capital to income ratios across countries between 1970 and 2010.

Timothy Besley, Professor at the London School of Economics, discussed how inequality can shape policy. Liberal democracies tend to have tax systems that rest on the notion that the rich accept taxation in return for secure and well-enforced property rights. But, in the worst case, that contract can be undermined by inequality.

This article briefly considers the links between inequality and central bank objectives, before presenting each speaker's key arguments and a summary of the open-floor debate that followed. **The views expressed do not necessarily represent those of the Bank of England, the Monetary Policy Committee or the Centre for Economic Policy Research.**

(1) Further information on the event is available at www.cepr.org/3562.

Introduction

Inequality has risen within many advanced and emerging market countries. In the United Kingdom and the United States, the share of income that goes to the top 1% of earners has doubled since the 1980s, and their share of overall wealth has also risen over this period (Piketty (2014)). These trends have prompted academics and policymakers alike to re-examine the evolution of inequality and explore its implications (for example, Yellen (2014) and Carney (2014)).

Inequality can have a bearing on a central bank's objectives. It can affect the fragility of the financial system and growth in the economy.⁽¹⁾ A cross-country study by the International Monetary Fund, for example, suggests that lower income inequality delivers faster and more durable growth, and that most redistributive policies have benign direct growth effects.⁽²⁾ It is also possible that the interaction between rising inequality and cheap credit led to the rise in asset prices, and the expansion in banks' balance sheets, that culminated in the financial crisis (for example, Rajan (2010) and Kumhof and Rancière (2010)).

On 19 December 2014, the Bank of England and the Centre for Economic Policy Research (CEPR) hosted a discussion forum on *Capital in the twenty-first century*, with its author **Thomas Piketty, Professor of Economics at the Paris School of Economics**. Four speakers presented research on four distinct aspects of inequality (see page 36). This was followed by an open-floor discussion with Professor Piketty and the speakers. Participants included a range of economists from private sector financial institutions, academia, public sector bodies and industry associations.

This article sets out a summary of the issues discussed at the event. Box 1 comprises excerpts from the introduction to Professor Piketty's *Capital in the twenty-first century* and provides some historical context on trends in the distribution of wealth. Boxes 2 to 5 present each speaker's key arguments. The article also includes a summary of the debate that followed at the event. The discussion was conducted under the 'Chatham House Rule', so opinions expressed by participants are not attributed to individuals. **Neither the summary of the discussion nor the arguments set out in Boxes 1 to 5 necessarily represent the views of the Bank of England, the Monetary Policy Committee or the CEPR.** Further information relating to the event, including video clips featuring Professors Piketty, Besley and Lindert, is available on Vox, the CEPR's policy portal.⁽³⁾

Education, wealth and governance: some issues discussed at the forum

This section presents each of the speakers' key arguments at the discussion forum in stand-alone boxes (see Boxes 2 to 5),

as well as a summary of the ensuing discussion with participants.

Much of the discussion was focused on identifying the key influences on inequality over the past, and hence what form possible remedial policies should take. This section is organised around the three broad themes that were identified: the quality of, and access to, education; wealth and taxation policy; and the role of governance and institutions.

The quality of, and access to, education

As Professor Lindert discusses (Box 2), historical accidents can render economies more equal, and public policies are key to ensuring that they stay equal over time. He identifies a successful education policy as one of the main common factors among those countries that currently have relatively low inequality.

Several speakers raised the importance of equal access to university education, citing the example of the United States where unequal access to university education had been associated with the rise in inequality (Box 2). That had occurred despite a significant expansion in higher education numbers in the 20th century, which had largely been focused on families towards the top end of the income distribution.

But a strong case was also made for improvements to education at a much earlier stage. Professors Attanasio and Blundell (Box 3) find, using UK cohort data, that there is a strong correlation between the cognitive development of five-year old children and their subsequent earnings (and health) as adults. In fact, Attanasio and Blundell cite earlier research (Feinstein (2003)) which suggests that children from less well-off socio-economic backgrounds with relatively low development scores are less likely to catch up with other children as they grow older, while richer children's development scores tend to catch up. So the parental environment clearly matters, meaning that inequality tends to be passed along generations. There was general agreement with the conclusion that policy interventions aimed at young children from less well-off backgrounds could have long-run inequality effects.

As Attanasio and Blundell discuss, differences in levels of education matter for the level of inequality. But they cannot explain the recent *increase* in income inequality. This suggested that particular skills were being relatively more highly remunerated than in the past, rather than these skills having become more unequally distributed (Box 3). Some participants suggested that growth in the incomes of the top 1% of earners was likely to reflect their ability to bargain for higher wages.

(1) See Haldane (2014).

(2) See Ostry, Berg and Tsangarides (2014).

(3) See www.voxeu.org/article/capital-21st-century.

Wealth and taxation

A key challenge for macroeconomists is to build models that can explain the trends in inequality that have been identified by Piketty (2014). One observed trend is the rise in the wealth to income ratio in advanced economies since the 1970s.

Professor Ventura (Box 4) argues that capital has a fundamental component, which is the part that could be called 'productive' capital, but also a 'bubble' component. This latter part grows in line with anticipated capital gains. He cites findings from Piketty and Zucman (2014), which finds that, on average, capital gains accounted for about 40% of the increase in capital to income ratios across countries between 1970 and 2010. This figure would be even higher were the 2008 financial crisis excluded from the sample.

Participants raised the importance of distinguishing between different kinds of capital. For example, homeownership had typically been less concentrated than other forms of wealth (Saez and Zucman (2014)), which could suggest less inequality. The increased availability of credit may have reduced frictions and lowered inequality in the longer term. But some argued that inheritance still often played an important role, passing inequality on from one generation to the next, and that rises in house prices could disadvantage younger generations if they had to rely on their labour income to afford a home.

Governance and institutions

The discussion turned to the importance of good governance and robust institutions for lowering inequality. For instance, a number of participants argued that, while globalisation may have been one aspect of the rise in inequality within advanced economies, only individual countries' institutional settings could explain why the rise in inequality had been far greater in the United Kingdom and the United States than in countries such as Germany or Sweden.

But inequality, in turn, shapes policy. As Professor Besley discusses (Box 5), liberal democracies tend to have tax systems that rest on the notion that the rich accept taxation in return for secure and well-enforced property rights. In the worst case, however, that contract can be undermined by inequality: those with deep pockets can 'capture' the state, and shape its policies and institutions.

Professor Besley argues that electorates' values can and do shift over time, which can lead to consensus on issues that were previously thought unworkable. One example was the consensus in favour of a National Health Service after the Second World War. Some participants felt that the lack of international institutions with strong democratic foundations meant that tackling inequality, perhaps through a global or regional taxation policy, was harder. But others suggested that it was possible for norms to shift, even at the global level. One example was recent international measures to reduce the extent of tax evasion.

Box 1

Putting capital in the 21st century in context — Thomas Piketty

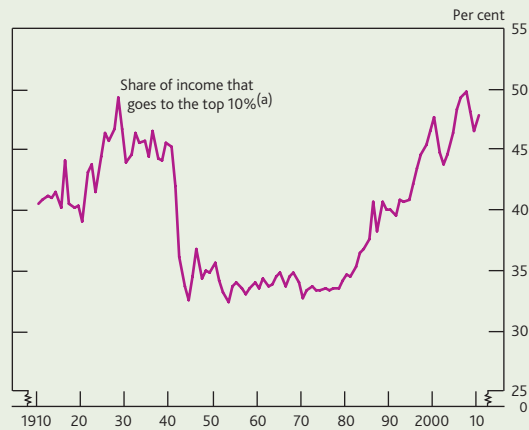
This box comprises excerpts from the Introduction to Piketty (2014).⁽¹⁾

The distribution of wealth is one of today's most widely discussed and controversial issues. But what do we really know about its evolution over the long term? Do the dynamics of private capital accumulation inevitably lead to the concentration of wealth in ever fewer hands, as Karl Marx believed in the nineteenth century? Or do the balancing forces of growth, competition, and technological progress lead in later stages of development to reduced inequality and greater harmony among the classes, as Simon Kuznets thought in the twentieth century? What do we really know about how wealth and income have evolved since the eighteenth century, and what lessons can we derive from that knowledge for the century now under way?

Modern economic growth and the diffusion of knowledge have made it possible to avoid the Marxist apocalypse but have not modified the deep structures of capital and inequality — or in any case not as much as one might have imagined in the optimistic decades following World War II. When the rate of return on capital exceeds the rate of growth of output and income, as it did in the nineteenth century and seems quite likely to do again in the twenty-first, capitalism automatically generates arbitrary and unsustainable inequalities that radically undermine the meritocratic values on which democratic societies are based. There are nevertheless ways democracy can regain control over capitalism and ensure that the general interest takes precedence over private interests, while preserving economic openness and avoiding protectionist and nationalist reactions.

Since the 1970s, income inequality has increased significantly in the rich countries, especially the United States, where the concentration of income in the first decade of the twenty-first century regained — indeed, slightly exceeded — the level attained in the second decade of the previous century (Chart A). It is therefore crucial to understand clearly why and how inequality decreased in the interim. To be sure, the very rapid growth of poor and emerging countries, especially China, may well prove to be a potent force for reducing inequalities at the global level, just as the growth of the rich countries did during the period 1945–1975. But this process has generated deep anxiety in the emerging countries and even deeper anxiety in the rich countries. Furthermore, the impressive disequilibria observed in recent decades in the financial, oil, and real estate markets have naturally aroused doubts as to the inevitability of the 'balanced growth path' described by

Chart A Income inequality in the United States



Source: Piketty (2014).

(a) Includes capital gains.

Solow and Kuznets, according to whom all key economic variables are supposed to move at the same pace.

In a way, we are in the same position at the beginning of the twenty-first century as our forebears were in the early nineteenth century: we are witnessing impressive changes in economies around the world, and it is very difficult to know how extensive they will turn out to be or what the global distribution of wealth, both within and between countries, will look like several decades from now. The economists of the nineteenth century deserve immense credit for placing the distributional question at the heart of economic analysis and for seeking to study long-term trends. Their answers were not always satisfactory, but at least they were asking the right questions. There is no fundamental reason why we should believe that growth is automatically balanced. It is long since past the time when we should have put the question of inequality back at the centre of economic analysis and begun asking questions first raised in the nineteenth century.

For far too long, economists have neglected the distribution of wealth, partly because of Kuznets's optimistic conclusions and partly because of the profession's undue enthusiasm for simplistic mathematical models based on so-called representative agents. If the question of inequality is again to become central, we must begin by gathering as extensive as possible a set of historical data for the purpose of understanding past and present trends. For it is by patiently establishing facts and patterns and then comparing different countries that we can hope to identify the mechanisms at work and gain a clearer idea of the future.

(1) See www.hup.harvard.edu/features/capital-in-the-twenty-first-century-introduction.html. Thomas Piketty (thomas.piketty@psemail.eu) is Professor at the Paris School of Economics.

Box 2

Where has modern equality come from? Lucky and smart paths in economic history — Peter Lindert⁽¹⁾

In the wake of war and political upheaval, countries across a number of continents found their incomes more equal in the 1970s than had been true of their grandparents' generation in the 1910s. Of today's rich democracies, some have succeeded in sustaining relatively equal distributions of income, while the United States and others have famously drifted towards higher inequality for a third of a century.

The welfare states of Northern Europe are a well-known success story of achieving greater income equality and lower poverty rates. Their tax systems are not much more tilted towards taxing top incomes than are the tax systems of lower-spending rich countries. Rather, these welfare states tend to achieve their progressivity — that is, redistribution towards those with lower market incomes — on the social expenditure side by delivering greater transfers as a share of household income to those with lower incomes.⁽²⁾

But has equality been attained in any way other than through annual redistribution? As it happens, there is a smaller group of countries where people's incomes are relatively equal *before* taxes and transfers. They are the 'Pacific Four': New Zealand and three high-income East Asian countries, Japan, Taiwan and Korea.

These countries have had relatively equal income distributions both before and after taxes, as indicated by low Gini coefficients — a commonly used indicator of inequality⁽³⁾ — relative to other countries (see Annex 1).

The sources of relative equality in New Zealand are relatively less clear, so the following discussion focuses on the experiences of Japan, Taiwan and Korea. All three East Asian countries had a set of 'lucky' accidents that reduced top privileges at different dates before 1980.⁽⁴⁾ These countries maintained that equality by implementing a set of smart policies. They have kept inheritance tax rates steady, unlike the United States and Britain. Such taxation gives each new generation of adults a more equal start.⁽⁵⁾ They have also maintained relative equality in pay by restricting immigration. Finally, and most importantly, they have developed a successful education system, which is discussed further below.

Young people in these countries have been offered equal opportunity to gain skills, which has increased the supply of skills and held down wages for skilled jobs in these countries. As a result, adult populations in the East Asian countries have attained as many years of schooling, on average, as have

adults in other advanced economies. And something about their education systems seems to deliver high achievement, as measured by OECD test scores (Annex 1). How such outcomes were achieved is not obvious; the share of national income spent on public education is not particularly high in Japan or Korea.⁽⁶⁾ By contrast, a puzzling inefficiency in delivering education seems to be one of the reasons that the United States, the United Kingdom and Canada have experienced rising income inequality since the 1970s. All three countries spend high shares of GDP on public education, yet they have turned in mediocre test scores. That inefficiency, especially in the United States, may have limited the supply of skills and widened the gap between earnings for different types of jobs.

Thus Japan, Korea, and Taiwan have come up with a policy package that has kept household final incomes nearly as equal as the European welfare states, after all taxes and transfers.

Thomas Piketty (2014) implies that it is possible to have a more egalitarian redistribution without compromising the level or growth of GDP. The era in which the top tax rates on income and inheritance were at their peak in Britain, France, Germany and the United States was also the era in which those countries enjoyed their fastest growth in GDP per capita.⁽⁷⁾ The econometric evidence continues to favour his view on the growth issue.⁽⁸⁾ And historical cross-country experience does not suggest that there is evidence that real-world countries face a trade-off between efficiency and equity — either when becoming a welfare state, or for countries that equalise market incomes.

(1) See also Lindert (2014). Peter Lindert (phlindert@ucdavis.edu) is Professor of Economics at the University of California, Davis.

(2) See Kato (2003) and Lindert (2004) Volume 1, Chapter 10.

(3) See, for example, World Bank (2014). Ginis based on household surveys tend to understate inequality at the top. This bias has been corrected for three of the Pacific Four (with the exception of Taiwan). In all four cases, however, the available estimates seem to capture a relatively equal distribution within the lower 90% ranks, a view tentatively supported by comparisons with data on wage inequality (Atkinson (2008)).

(4) Japan had equality-improving shocks in two waves: in the late 19th century and then in 1937–52. In Korea's case, the combination of colonisation and war meant that wealth accumulation had to start all over. Inequality in Taiwan was similarly initially restrained by occupation.

(5) As Thomas Piketty (2014) discusses, the rise of inequality in the Anglosphere since the 1970s could relate to reductions in top tax rates on inheritances (and income).

(6) Comparable UNESCO data do not exist for Taiwan.

(7) Piketty (2014), Chapter 14.

(8) See, for example, Ostry, Berg and Tsangarides (2014), or Lindert (2004), Chapters 10 and 18.

Box 3

Human capital and inequality in the United Kingdom — Orazio Attanasio and Richard Blundell⁽¹⁾

People's earnings are determined by their skills (or 'human capital'), and the price, or wages, of those particular skills. The rise in earnings inequality over the past few decades could reflect rising inequality in either the level of skills or in wages.⁽²⁾

Cohort studies offer a unique opportunity to understand these drivers of inequality. These studies follow a group of respondents over a long period of time, and record a wide range of their characteristics at regular intervals. The National Child Development Study (NCDS), for example, has followed its respondents since their birth in 1958, and collects information on things like their health, earnings and educational attainment every five years.

Surveys like this can be used to assess the relationship between earnings as an adult and three sets of variables: some development indicators from when the individual was aged 10–11; some family background variables; and the individual's educational attainment. Annex 2 shows summary results from two regressions using results from the NCDS. Column 1 relates individuals' earnings in 2008 — when they were 50 years old — to their family background; column 2 considers the relationship between earnings and a wider set of factors, including childhood development indicators, family background and educational attainment.

The evidence suggests that differences in parental background and childhood development can explain a significant part of the differences in individuals' subsequent earnings as adults. Column 1 shows a positive relationship between parental income and earnings as an adult. Children with parents in the highest income quintile tended to go on to earn more as adults, and the asterisks indicate that this relationship is statistically significant. But when additional factors are included in the analysis, the effect of having richer parents becomes statistically insignificant, as shown in column 2. Instead, indicators of child development and educational attainment are positively correlated with earnings, as signified by the positive (and statistically significant) coefficients reported in column 2.

These results suggest a possible mechanism through which parental background operates: children develop early and their development is strongly influenced by parental background. This hypothesis is consistent with existing evidence on child development, namely that differences in

childhood development persist, and can explain differences in lifetime labour earnings.

Given the importance of early development, the next step is to look at how inequality in indicators of development has evolved over time. The evidence indicates that while differences between children from the richest and poorest backgrounds exist, they have not changed materially over time. In 1970, for example, differences in standardised measures of cognitive development of children of the richest and poorest quintiles equalled almost one standard deviation. The difference between the richest and poorest children was virtually identical in the 2000 cohort.

So inequality in early development has neither deteriorated, nor has it improved substantially over time. This suggests that increases in income inequality seem to have been driven by differences in the 'prices' or returns to skills. Indeed, the wages of people with higher educational qualifications has been rising.⁽³⁾ Individuals with certain skills might be able to achieve very high remuneration because of specific innovations in technology, or they might be able to capture rents.

These trends have left those with low skills in an increasingly poor lifetime position. This suggests that it is not just the top 1% that is of interest. There are dramatic differences between the bottom 20% and the rest in a variety of outcomes such as health, happiness and child development. It is therefore important to focus sufficiently on the poor and on the design of appropriate policies to reverse their situation and that of their children.

Well-designed policy interventions, such as pre-school educational programmes, have already been shown to have strong and important effects. Mounting evidence indicates that such policies can be effective in reducing these inequalities, as the work of Feinstein (2003), for instance, shows. Well-designed interventions in the early years can have long-lasting impacts.⁽⁴⁾ These could reverse the decline in earnings opportunities and well-being for the less advantaged in society.

(1) Orazio Attanasio (o.attanasio@ucl.ac.uk) is Professor at University College London. Richard Blundell (r.blundell@ucl.ac.uk) is Professor of Political Economy at University College London. The views presented in this box are part of ongoing research.

(2) Inequality in earnings could also reflect a rise in the covariance between inequality in wages and inequality in skills.

(3) See, for example, Belfield *et al* (2014).

(4) For examples of policies with long-run impacts see Heckman, Pinto and Savelyev (2013), Campbell *et al* (2014) and Chang *et al* (2014).

Box 4

The metamorphosis of wealth in the 21st century — Jaume Ventura⁽¹⁾

Thomas Piketty's book provides a sharp long-term view of capitalism with a strong focus on the evolution of wealth and inequality. One of its central concerns is the long-term evolution of the wealth to income ratio. In the early 20th century, the wealth to income ratio was around 600%–700% in the United Kingdom, France and Germany, and around 300%–400% in the United States and Canada. This ratio fell dramatically in the European countries to reach the same level as the North American ones by the middle of the century. Since the late 1970s, however, the ratio has been increasing everywhere. That raises a number of important questions. Is this trend going to continue? Will the wealth to income ratio return to the high European levels of the early 20th century? And what are the implications of the increase in this ratio for inequality?

Piketty (2014) uses a well-known model of capital accumulation developed by Robert Solow in the 1950s. All wealth is assumed to take the form of productive capital. Under standard assumptions, this model predicts that the economy will settle at a steady state in which the wealth to income ratio equals the saving rate divided by the GDP growth rate. Piketty argues that the saving rate is likely to remain fairly stable, but that the GDP growth rate will decline, largely due to a reduction in population growth. The conclusion is that the wealth to income ratio will continue to rise in the future.

A natural first question to ask is whether the assumptions embedded in the textbook model are robust. Capital accumulation models developed in the late 1980s and early 1990s have shown that the growth and saving rates cannot be treated independently. Many of these models predict that the economy may not settle on to a single 'steady-state' path: indeed, a number of simple and reasonable extensions of the textbook model lead either to multiple steady states (Caballero, Farhi and Hammour (2006)), or to large, cyclical swings in economic activity (Day (1982)).

One element of the textbook model that is particularly limiting is the assumption that all wealth is productive capital. This seems to be incorrect both in theory and in practice. For at least 30 years, some formal models have shown that the value of existing assets such as equities or real estate — in other words, wealth — contain both a 'fundamental' and a 'bubble' component. The fundamental component is the value of the productive capital that is embedded in these assets.⁽²⁾ The bubble component is the additional value that is obtained by reselling the asset. The bubble component is like

a pyramid scheme: market participants are willing to purchase the asset at a high price only because they expect future market participants to do so, and this generates capital gains.

How important is this bubble component? Most macroeconomists would accept that the recent evolution of wealth cannot be accounted for by a model that focuses only on the fundamental component. Piketty and Zucman (2014) find that capital gains account for about 40% on average of the 1970–2010 increase in wealth to income ratio, and this figure would have been substantially larger if the financial crisis had been excluded. Back-of-the-envelope calculations by Carvalho, Martin and Ventura (2012) also show that most of the recent fluctuations in US wealth are due to the bubble component.

Wealth may have been productive capital in the past. But it is now a mix of productive capital and 'bubble', defined as the anticipation of capital gains. This metamorphosis of wealth raises important questions. What drives the bubble component of wealth? How does the bubble component affect investment, growth and welfare? Macroeconomics must answer these questions in order to face the challenge from Piketty's work.⁽³⁾

(1) Jaume Ventura (jventura@crei.cat) is Professor at Universitat Pompeu Fabra.

(2) That is, the net present value of the cash flows generated by these assets.

(3) Martin and Ventura (2014) provide tentative answers to these questions.

Box 5

State capacities and inequality —

Timothy Besley⁽¹⁾

High levels of inequality can skew the priorities of the state towards the interests of the rich. This makes it harder to build a ‘common interest’ state, that is, one that serves the interests of the many, not the few (Besley and Persson (2011)). While the classical theory of political economy of redistribution suggests that citizens in the middle of the income distribution will be decisive in choosing the level of redistributive policy,⁽²⁾ empirical analysis finds limited support for that idea.

In particular, while the theory predicts that greater inequality should be associated with more redistribution, all else equal, the raw data suggest that countries with more inequality have lower marginal tax rates.⁽³⁾

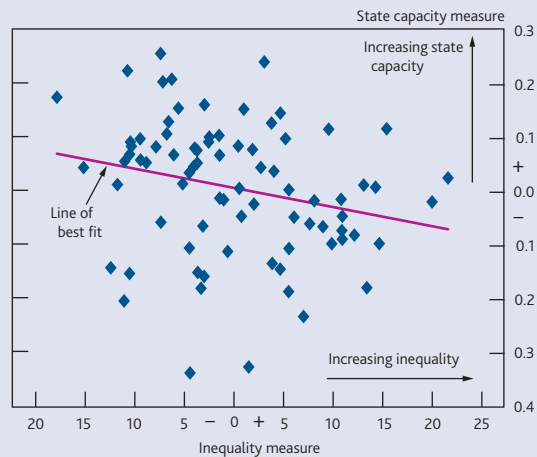
Responding to the challenge of high and rising inequality requires an understanding of the forces that shape the state and its capacities to deliver on behalf of its citizens. There are three dimensions to state capacity in modern states: **legal capacity**, which underpins law and regulation; **fiscal capacity**, which underpins broad-based and progressive taxation; and **collective capacity**, which underpins the provision of goods and services that a pure market-based system might fail to deliver efficiently and equitably. Each of these can be influenced by inequality. For example, the rich tend to prefer strong legal capacity, but weaker fiscal capacity. States where economic elites are powerful can lead to political pressure being applied to reduce fiscal capacity, for example by keeping open loopholes which make tax avoidance easier. Rules which govern residence and requirements to declare worldwide income are particularly relevant for the rich, as are those surrounding the taxation of capital income.

A small ‘club’ of modern states, mostly in Europe, have over the past 200 years developed these capacities to high levels. The development of legal capacity underpins fundamental equalities — justice, for instance, and universal access to markets. They have also developed the market by protecting property rights and providing predictable conditions for private investment and contracting. Tax systems are rule-based and rest on notions of fairness in which the rich should accept taxation in exchange for security and broad principles rather than arbitrary imposition of taxation. Effective states have also developed systems of provision of collective goods, especially health care, pensions, education and support for the poor.

Besley and Persson (2011) argue that high levels of state capacities stem from the development of cohesive institutions that encourage the state to operate in the interests of the

many rather than the few (among other factors). High levels of economic inequality can create a friction in this process. One way to look at this is to examine the relationship across countries between state capacity and the Gini coefficient, a measure of income inequality. Higher inequality (as signified by a higher Gini coefficient) tends to be associated with lower levels of state capacity, as shown by the downward-sloping line in **Chart A**.

Chart A Inequality and state capacity: cross-country evidence^(a)



(a) Uses the index of state capacity reported in Besley and Persson (2014). These results are conditioned on the level of income per capita in 2000 and executive constraints up to 2000 as two variables which might be thought to be strongly correlated with state capacity. Inequality measure is based on the Gini coefficient.

Responding to inequality therefore requires a systematic understanding of how high levels of inequality can influence the state’s capacity to act. That also calls for a better grasp of how people develop norms and values with shared obligations towards fellow citizens, and how those change over time. For example, the period following World War II saw some profound policy changes, such as the founding of the National Health Service in the United Kingdom and moves throughout the developed world towards the promotion of educational opportunity (particularly in higher education) as well as legislation to limit discrimination against minorities and women.

Economic studies of redistributive taxation have yet to take on board these distinctions fully and the political economy discussion has only recently begun to reflect these concerns.⁽⁴⁾

(1) Timothy Besley (T.Besley@lse.ac.uk) is Professor at the London School of Economics.

(2) See, for example, Romer (1975), Roberts (1977) and Meltzer and Richards (1981).

(3) This is based on top statutory income tax rates in the 1990s for the 67-country sample in Gordon and Young (2005) and the Gini coefficient from Deininger and Squire (1996).

(4) There is a small but expanding literature on these topics, such as Shayo (2009).

Annex 1

Income inequality and educational attainment across countries^(a)

	Income inequality before taxes and transfers ^(b)	Income inequality after taxes and transfers ^(b)	Student test scores ^(c)
Welfare states ^(d)	42.9	26.4	505
Pacific Four ^(e)	34.9	30.5	532
Other ^(f)	44.5	33.3	506
United Kingdom	47.4	35.7	502
United States	46.9	37.3	492

Sources: OECD Programme for International Student Assessment, Standardized World Income Inequality Database (Solt (2014)) and author's calculations.

- (a) Figures for country groups show simple averages across countries.
 (b) Income inequality is represented by Gini coefficients, based on household surveys. A Gini coefficient measures the extent to which the income distribution in an economy deviates from a perfectly equal distribution: a coefficient of 0 indicates perfect equality, while a coefficient of 100 indicates perfect inequality. The table shows data for 2010.
 (c) Simple averages of mathematics, reading and science test scores given to fifteen year olds in randomly sampled school districts. Scores are scaled so that the average test score across OECD countries for mathematics in 2003 was 500, with a standard deviation of 100; the OECD-average test score for reading in 2000 is 500, with standard deviation 100; and the OECD-average test score for science in 2006 is 500, with standard deviation 100. The table shows data for 2012.
 (d) Comprises Austria, Belgium, Denmark, Finland, France, Germany, Netherlands, Norway and Sweden.
 (e) Comprises Japan, Korea, New Zealand and Taiwan.
 (f) Comprises Australia, Canada, Greece, Ireland, Italy, Portugal, Singapore, Spain and Switzerland.

Annex 2

Explaining the earnings of adult males in the United Kingdom in 2008

Dependent variable:	Regression (1)	Regression (2)
Earnings at age 50^(a)		
Indicators of childhood development		
'Cognitive' factor at age 11		0.0816***
'Non-cognitive' factor at age 11 ^(b)		0.0480***
Parental background: family income at age 10		
Family income in top 20%	0.192***	0.0842
Individual's highest qualification in 2008		
4–5 GCSEs or equivalent ^(c)		0.0309
2 or more A levels or equivalent ^(d)		0.138***
Higher education ^(e)		0.285***

Source: Attanasio and Blundell, ongoing research.

- (a) Results are based on male respondents to the 1958 NCDS (1,690 observations). The dependent variable is gross log weekly pay in 2008, when respondents were aged 50. Dummy variables for family income in the second, third and fourth quintiles were also included. *** denotes statistical significance at the 0.99 threshold.
 (b) This factor is derived from the Bristol Social Adjustment Guide (BSAG) z-score in the NCDS.
 (c) National Vocational Qualification 2.
 (d) National Vocational Qualification 3.
 (e) National Vocational Qualification 4–5.

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The Agencies and 'One Bank'

By David England, Andrew Hebden, Tom Henderson and Tom Pattie of the Bank's Inflation Report and Agency Intelligence Division.⁽¹⁾

- The Bank's Agents have had a long-standing role to provide economic intelligence for monetary policy purposes. Increasingly the Agents have also been gathering intelligence to inform financial stability policy.
- Developments in credit conditions and property markets are examples of issues relevant to both monetary and financial stability policy that the Agents are particularly well placed to provide information on.

Overview

The Bank of England's Agencies have had a long-standing role to provide economic intelligence to the Monetary Policy Committee (MPC), principally through regular meetings with businesses to take the temperature of the UK economy. In recent years the Agents have also been increasing the amount of intelligence gathered and synthesised on behalf of the Bank's financial stability functions. The development of that part of the Agents' work has been given added impetus by the creation of the Financial Policy Committee (FPC) and the Prudential Regulation Authority (PRA), and the 'One Bank' approach subsequently set out in the Bank's Strategic Plan.⁽²⁾

The Agents meet with some 9,000 contacts a year across a range of sectors. In so doing they have access to a deep pool of business intelligence. Some of that is relevant to both monetary and financial stability policy — particularly non-financial companies' reports on the availability of finance. The Agents can also focus on contacts in key sectors that have been a source of risk to financial stability in the past, such as property markets.

The intelligence gathered is synthesised and communicated internally for the purposes of monetary and financial stability policy, including through presentations to the Bank's policy committees and in regular internal notes. The Agents' intelligence is shared externally through the publication on the Bank's website of the *Agents' summary of business conditions* and the Agents' national scores.

Two examples of where Agencies have provided intelligence that has informed both monetary and financial stability policy over the past couple of years are on corporate credit conditions and the housing market.

In their reporting of credit conditions, a particularly useful aspect of Agency intelligence has been on new forms of non-bank finance, such as peer-to-peer lending and crowdfunding, given the limited data available on those markets. Another focus has been the increasing need among smaller suppliers for working capital finance due to a lengthening of their larger customers' payment times, and an associated increase in the use of so-called 'supply chain finance'.

Agents gather intelligence on the housing market from a wide range of contacts including house builders, estate agents, financial advisors, surveyors, conveyancers and mortgage brokers and lenders. That information has been particularly useful in tracking the changing conditions in the housing market over the past two years, including in house building, regional variations in housing market activity, and the effects of regulatory change.

External representation of the Bank is also a key part of the Agencies' role. This includes through presentations to business audiences on both the *Inflation Report* and the *Financial Stability Report*. And the Agencies also host regional visits by policymakers from the MPC, FPC and PRA Board.

(1) The authors would like to thank Simon Caunt, Tim Pike and Pamela Wright for their help in producing this article.

(2) For more details on the Strategic Plan see www.bankofengland.co.uk/about/Pages/strategicplan/default.aspx.

The Bank of England's twelve Agencies⁽¹⁾ have provided economic intelligence to the Monetary Policy Committee (MPC) since its inception in 1997, although representatives in the regions and countries of the United Kingdom have been providing the Bank with economic intelligence, in one form or another, since as far back as 1930. The Agencies gather that intelligence principally through regular meetings with business contacts to gauge UK economic conditions. They also help to explain monetary policy to business audiences — for example, by providing regular briefings on the *Inflation Report*.⁽²⁾ But, alongside those key roles, in recent years the Agents have been increasing the amount of intelligence gathering and representational work undertaken on behalf of the Bank's financial stability functions. The development of that part of the Agents' work has been given added impetus by the creation of the Financial Policy Committee (FPC) and the Prudential Regulation Authority (PRA), and the One Bank approach subsequently set out in the Bank's Strategic Plan (see the box opposite).

This article sets out the Agencies' wider work across the Bank's functions. It looks firstly at the representative work undertaken by the Agencies on behalf of the Bank, before setting out the process of business intelligence gathering and reporting. It then focuses on two case studies of Agency work that have informed both monetary and financial stability policy.

One Bank representation

The Agents undertake a wide range of representational activities that help promote businesses' understanding of Bank policy and can also help gauge the effectiveness of policy communications.⁽³⁾ The Agents' work has expanded in recent years to include a greater element of financial stability policy representation.

In particular, the Agents host visits by MPC, FPC and PRA Board members, providing opportunities for both formal speeches and informal discussions with business contacts. For example, in 2014, the Agencies hosted 46 formal visits of MPC, FPC and PRA Board members. Another key part of the Agents' representational work is providing or hosting presentations on the *Inflation Report* and the *Financial Stability Report* to regional business audiences. Agents also facilitate briefings by staff across the monetary policy, macroprudential policy and prudential regulation areas. The number of attendees at presentations given or hosted by the Agents totalled around 20,000 in 2014.

A key part of this representational work is gathering feedback offered by business contacts on the communication of the Bank's policies. That information can help gauge the extent to which the Bank's policies are understood and are having the

Recent changes to the Bank of England and the creation of 'One Bank'

In April 2013, the Bank of England experienced its most important institutional and functional changes in a generation, as the Government introduced wholesale changes to the UK regulatory landscape in response to failings in pre-crisis arrangements.⁽¹⁾ This regulatory reform resulted in the Bank gaining significant new responsibilities, including: microprudential regulation of insurers, deposit-takers and major investment firms, through the creation of the PRA; macroprudential regulation of the financial system as a whole, through the creation of the FPC; and supervision of some critical financial market infrastructure providers.

Following those changes, the Bank undertook a major strategic review of its operations, and on 18 March 2014 launched its Strategic Plan for the next three years.⁽²⁾ That Plan is aimed at transforming the institution to take full advantage of the Bank's expanded policy responsibilities. It creates a single, unified institution — One Bank — that will maximise its impact by working together across all its functions. At the core of the Strategic Plan lies a shared vision for the Bank, embodied in a new mission statement: promoting the good of the people of the United Kingdom by maintaining monetary and financial stability. The Plan sets out how the Bank will be guided in everything it does by its mission statement and its commitment to a diverse and talented workforce, analytic excellence, outstanding execution and openness and accountability.

(1) See Murphy and Senior (2013).

(2) For more details on the Strategic Plan see www.bankofengland.co.uk/about/Pages/strategicplan/default.aspx.

expected effect on business conditions. For example, feedback from the Agency network has been crucial in gauging contacts' understanding of forward guidance and its effect on their businesses.

The Agencies also facilitate consultation across the Bank with the wider business community. For example, the Agents played a key role in the consultation process leading up to the decision to introduce polymer bank notes, helping to arrange focus group meetings around the country to gather feedback on the new notes. More recently, the Agents have also assisted

(1) The Bank has Agencies for Central Southern England, the East Midlands, Greater London, the North East, the North West, Northern Ireland, Scotland, the South East & East Anglia, the South West, Wales, the West Midlands and Yorkshire & the Humber. For more detail about individual Agencies see www.bankofengland.co.uk/monetarypolicy/Pages/agencies/default.aspx.

(2) See Eckersley and Webber (2003) for more details.

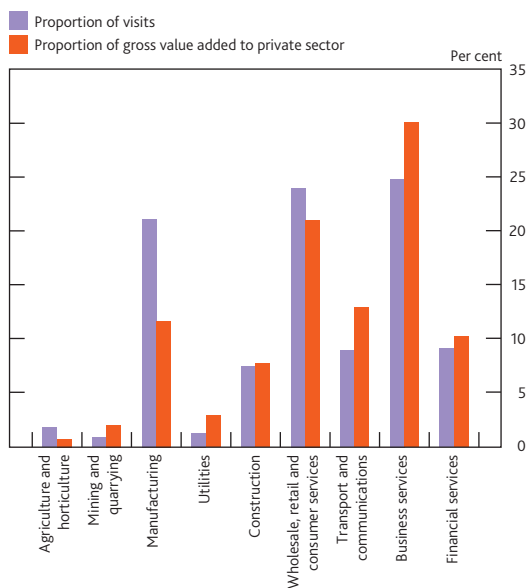
(3) In addition, the Agents play a major part in helping to judge the Bank of England and *The Times* 'Target Two Point Zero' Interest Rate Challenge for schools and colleges. For more details see www.bankofengland.co.uk/education/Pages/targettwopointzero/default.aspx.

with the Fair and Effective Markets Review,⁽¹⁾ arranging meetings for the review team with corporate treasurers.

Economic and financial intelligence gathering

Although representation is an important part of the Agents' work, their primary role is the gathering of business intelligence. Agents undertake some 5,500 company visits a year across a range of sectors, broadly in line with those sectors' contributions to UK economic output (**Chart 1**). These visits are supplemented by panel discussions with some 3,500 businesses. The Agents' meetings take place across all regions and countries of the United Kingdom and allow in-depth discussions with contacts on business conditions, including the credit conditions they face as well as their output and pricing. As such, they provide a deep pool of information that can inform both monetary and financial stability policy. Aside from providing a source of information that is more timely than many economic, and some financial, statistics, this intelligence can shed light on key puzzles facing both monetary and financial policy makers.⁽²⁾

Chart 1 The Agents' contact visits: sectoral composition^(a)



Sources: Bank of England, ONS and Bank calculations.

(a) Proportion of company visits and gross value added are both measured as a share of private sector totals in 2014.

While the majority of the Agents' contact visits are with non-financial companies (**Chart 1**), the Agents also meet a range of financial companies. These meetings are distinct from and complementary to those undertaken by other parts of the Bank such as the Market Intelligence function and the PRA. The Agents' discussions are aimed primarily at understanding the economic and financial conditions faced by contacts and their business plans, often at a local level, rather than conditions in, and the operation of, specific wholesale markets. And, while Agents meet contacts from financial firms regulated by the PRA, the Agents' meetings are explicitly

not of a supervisory nature. There is, however, information sharing between the Agents and Market Intelligence and the PRA to prevent possible duplication, and contacts are made aware that anything said to an Agent that bears on regulatory matters will be shared with the PRA.

After each meeting, a confidential record of the discussion is produced, summarising the key points across demand and output, supply, costs and prices and credit conditions. This provides the main source material for the synthesising and reporting of intelligence. Where relevant, Agents also assign individual company visit scores to the information gained from the meeting, which are collated in an internal database, allowing for additional quantitative analysis of the intelligence.⁽³⁾

In addition to their regular intelligence gathering, from time to time the Agents undertake surveys of contacts on specific issues.⁽⁴⁾ These are generally on issues that relate to monetary policy — such as investment or pay — rather than issues of direct interest to financial stability policy, given that these surveys need to apply across a broad base of contacts to generate a sufficient sample of respondents. But some surveys will inform the work of both committees, such as Agents' surveys of credit conditions facing non-financial companies.

Regular economic and financial reporting

Agents' intelligence is collated and synthesised to provide briefing to inform both monetary and financial stability policy, as illustrated in **Figure 1**. Central to this process is that the Agencies use the intelligence gathered from businesses in their region or country to produce regular confidential economic reports, covering developments in demand and output, supply, costs and prices and credit conditions. Agents also produce quantitative assessments of economic conditions across similar categories — the Agents' national scores (see box on page 51). These scores are separate to, but informed by, the company visit scores made after individual meetings. The Bank publishes an overview of the economic and financial intelligence from the Agents' reports in the *Agents' summary of business conditions*, which also contains summaries of the Agents' special surveys, and the Agents' national scores.⁽⁵⁾

(1) The Fair and Effective Markets Review was established by the Chancellor in June 2014 to conduct a comprehensive and forward-looking assessment of the way wholesale financial markets operate, help to restore trust in those markets in the wake of a number of recent high profile abuses, and influence the international debate on trading practices. For more details see www.bankofengland.co.uk/markets/Pages/fmreview.aspx.

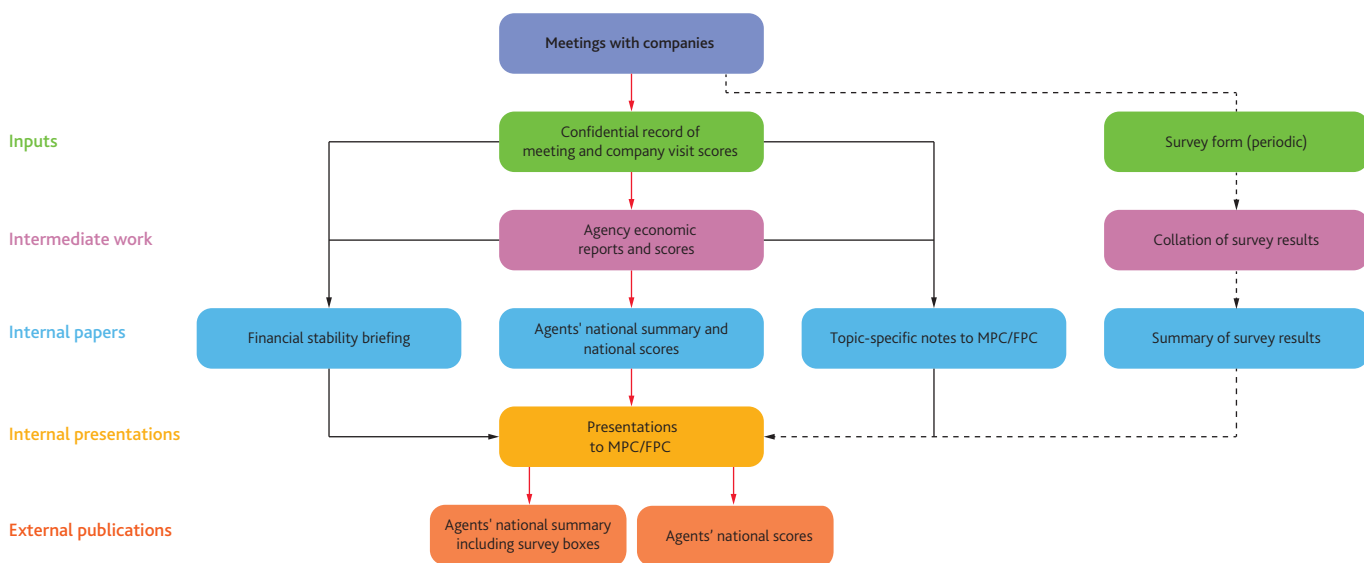
(2) For more details on the interactions between monetary policy and macroprudential policy see Shakir and Tong (2014).

(3) See Relleen *et al* (2013). Company visit scores are distinct from, but inform, the published Agents' national scores for the economy as a whole. The Bank has made available a dataset of historical company visit scores, suitably anonymised, for the purposes of economic research. See www.bankofengland.co.uk/research/Pages/onebank/datasets.aspx.

(4) See Belsham, Caunt and Duff (2012) for further details and examples from earlier surveys.

(5) See www.bankofengland.co.uk/publications/Pages/agentssummary/default.aspx.

Figure 1 A stylised picture of the use of Agency intelligence



In addition to the *Summary*, the Agents produce regular briefing notes on financial stability issues for policymakers. And across their work for both monetary and financial stability policy, Agents have been undertaking deeper intelligence gathering and analysis on specific topics. This can be through targeted groups of meetings with contacts, the analysis of company visit scores or using the extensive database of company meeting records to analyse a particular issue in more depth.

Drawing on that range of material, the Agents give a presentation to the MPC as part of the regular ‘Pre-MPC’ meeting in which Bank staff brief the Committee on economic and market developments. An Agent also provides a presentation of the results of any special surveys focused on a particular topic, when relevant, as part of that meeting. Where joint briefing meetings are held of both the FPC and MPC, the Agents will generally give a presentation that focuses on areas that are of direct interest to both committees.

Case studies of use of Agency intelligence

Among the aspects of work that are relevant to both monetary and financial stability policy, the Agents have focused on developments in two key areas over the past couple of years: corporate credit conditions and the housing market. This section sets out some of that analysis as ‘case studies’ of Agents’ work that has been used right across the Bank.

Corporate credit conditions

Agents’ monitoring of corporate credit conditions intensified in the wake of the financial crisis. The Agents have regularly reported on credit conditions in the *Agents’ summary of business conditions* and have conducted special surveys of

credit conditions. In their internal work, the Agents have tracked credit conditions in more granular detail — from the perspective both of the borrowers and providers of corporate finance.⁽¹⁾

Part of the Agents’ monitoring of corporate credit conditions has been through the production of a heatmap, which summarises the Agents’ assessment for small, medium and large non-financial businesses (**Chart 2**). The heatmap, constructed based on the judgements of the Agents, shows how overall credit availability has eased across firm sizes since 2012. This is broadly consistent with the picture provided by lenders in the Bank of England’s *Credit Conditions Survey*.⁽²⁾

Chart 2 Agents’ assessment of corporate credit availability^(a)

	2011		12		13			14			
	Oct.	Dec.	Aug.	Dec.	June	Sep.	Dec.	Mar.	June	Sep.	Dec.
Small	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Yellow
Medium	Orange	Orange	Orange	Orange	Orange	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Large	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	Green	Green	Green
Overall	Orange	Orange	Orange	Orange	Orange	Yellow	Yellow	Yellow	Yellow	Yellow	Green

(a) This mapping is based on individual Agencies’ national assessments of corporate credit availability, weighted by the gross value added of their regions or countries. The greater the intensity of red, the tighter credit availability; the greater the intensity of green, the looser credit availability. Yellow indicates normal conditions. Includes bank and non-bank credit.

(1) For the Bank’s latest assessment of credit conditions see the February 2015 *Inflation Report*; www.bankofengland.co.uk/publications/Documents/inflationreport/2015/feb.pdf and the December 2014 *Financial Stability Report*; www.bankofengland.co.uk/publications/Documents/fsr/2014/fsrfull1412.pdf.

(2) See Butt and Pugh (2014) for a description of how the Bank captures credit conditions in its measures of credit spreads, which are used in forming the MPC’s central macroeconomic projections.

Agents' national scores

Each month, the Bank's twelve Agencies make quantitative assessments of economic conditions for 25 variables covering demand, output, labour market conditions, capacity, and costs and prices. These assessments, the Agents' scores, provide a numerical measure of conditions at a national level, as seen from the Agents' respective countries and regions. They are then aggregated into national scores, weighted by regional contributions to UK gross value added. The scores act as a useful quantitative summary of the intelligence gathered by the Agents. The scores, however, will only be useful if they broadly track trends in the economy: in other words, they should be well-correlated, on average, with official data.

This box provides a simple review of the scores by comparing them to equivalent official data published by the Office for National Statistics (ONS). The results indicate that many scores are consistent with UK economic trends.⁽¹⁾

The scoring scale

The score for each variable ranges from +5 to -5. For the majority of variables, +5 indicates a rapidly rising level, 0 indicates an unchanged level and -5 indicates a rapidly falling level. Most scores compare the level of the variable in the past three months with that in the same period a year earlier. The scores of some variables, such as recruitment difficulties and capacity utilisation, instead reflect conditions relative to normal. Here, 0 indicates normal conditions, and a score of +5 or -5 indicates extreme conditions. In the cases of capacity utilisation, employment and investment intentions, scores are forward-looking, over the coming six, six and twelve months respectively. Wherever possible, the Agents' scoring is calibrated against ONS data.

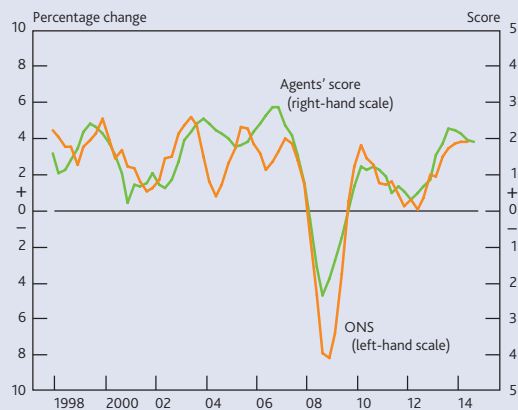
Comparing the scores with official data

Although correlations vary across the scores, on average the Agents' scores appear to track trends in the economy reasonably well. For example, **Chart A** shows a composite score for private sector output tracking the broad trends closely. With Agents' scores available ahead of ONS data releases, that indicates that Agents can provide a useful early steer on the pace of economic activity.

Chart B lists the correlation coefficients in order of strength, comparing ONS data with the Agents' scores. A majority of the scores have a correlation coefficient of over 0.7, indicating a strong degree of comovement. Some of the highest correlations are for output measures for key sectors of the economy, such as business services and manufacturing output. Correlations in pricing for those sectors are also very high, although retail goods price inflation has the highest correlation of any individual score.

In a limited number of cases, the correlations with ONS data are weak. There are a number of possible explanations for

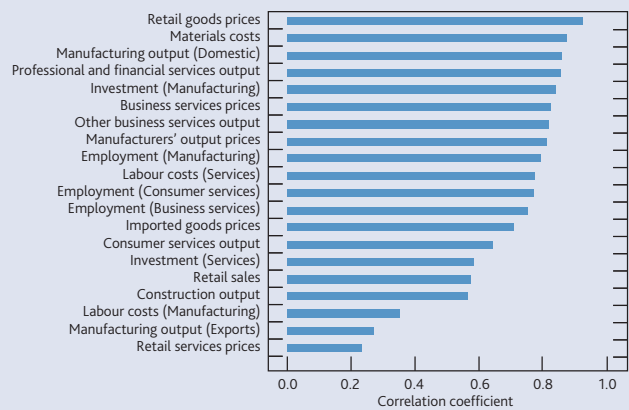
Chart A Measures of private sector output^(a)



Sources: Bank of England, ONS and Bank calculations.

(a) Output and Agents' scores measure the change in the past three months relative to a year earlier. The scores are a mix of turnover and volume measures. Data are shown on a quarterly frequency; the Agents' score for 2015 Q1 uses February data, the latest available.

Chart B Correlations with comparable ONS data^(a)



Sources: Bank of England, ONS and Bank calculations.

(a) Sample periods over which correlations are measured vary depending on the availability of ONS data and Agents' scores. In all cases a period of at least nine years is available. Correlations shown are with contemporaneous ONS data, other than for forward-looking scores where the highest correlations with lagged data are shown. Depending on ONS data availability, quarterly or monthly series are used.

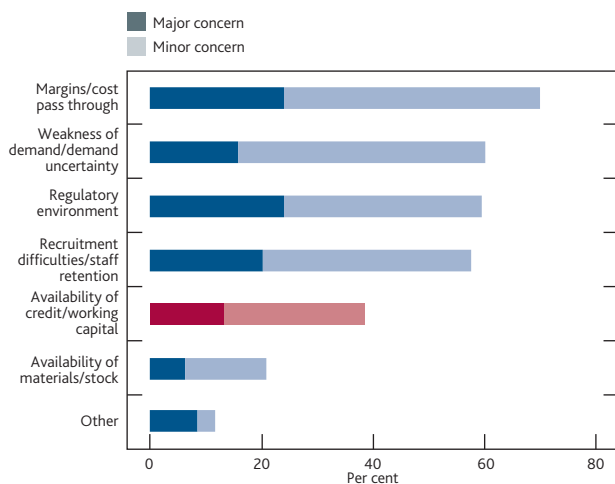
those low correlations. Series that are volatile, or where production is concentrated among relatively few companies, such as manufacturing exports, are more difficult to capture. There can be differences in definitions between the Agents' score and ONS data, such as in the sectoral comparisons of labour costs per employee with ONS data for average weekly earnings, which excludes some elements of non-wage labour costs. In the case of retail services prices in particular, a lack of variation in the series over time may also contribute to a low correlation.

A high correlation with ONS data at all times is not an aim in itself. For example, earlier vintages of the official data for investment in the period 2011 to 2013 were much weaker than indicated by Agents' investment intention scores. Over time, the ONS data for investment during this period have been revised up so that they are now more in line with the Agents' scores.

(1) See Dwyer (2008) for a fuller review of the properties and usefulness of Agents' scores.

The picture of improving credit availability was also reflected in the results of Agents' special surveys on credit conditions that were run in the spring of 2012, 2013 and 2014. One aspect where information from the Agents has added to other sources of information is in assessing how important an issue credit conditions are to contacts relative to other factors affecting their businesses. By 2014, credit conditions were said to be well down the list of contacts' key concerns (Chart 3), in contrast to the general impression from Agents' meetings in 2012 and much of 2013.

Chart 3 April 2014 Agents' survey: key concerns for contacts



Non-bank finance

One aspect of credit conditions where Agents' insights have been particularly useful is on developments in non-bank finance, parts of which are less well covered by data and survey evidence than bank finance.

Agents have reported how the ease with which large companies have been able to raise finance, relative to smaller firms, over the past couple of years has been supported by the strong availability of capital market finance — often at very low rates. In part, contacts attributed this to investors' appetite for purchasing riskier assets, such as corporate bonds, as they sought higher returns in a continuing low interest rate environment. For some larger commercial property companies, the increasing availability of non-bank finance meant that they were able to refinance away from bank debt, in some cases strengthening their balance sheets in the process.

Evidence on large firms' use of finance from capital markets is widely available, but evidence on markets for finance available to smaller companies is harder to come by. One focus for Agency intelligence has been on how the market for lending to small and medium-sized companies has responded to limitations in the availability of bank finance. In particular, Agents have tracked the expansion of new forms of non-bank finance, such as peer-to-peer lending and crowdfunding.⁽¹⁾

Agency intelligence has indicated that while the absolute value of funding provided by these platforms has been low, their growth has been fast. Contacts note that the rapid and simple application and decision-making processes makes these sources attractive, albeit with lending often at a higher cost than bank finance. Some have reported using such finance effectively as a bridging loan that can be replaced when they obtain cheaper bank lending. But many contacts that have used such borrowing have done so more than once and/or plan to use it again.

Although demand for finance has continued to be subdued among smaller businesses overall, some companies have reported an increasing need for working capital finance, as large customers have lengthened the time taken to pay for goods and services delivered. There have been increasing reports, however, of arrangements being set up whereby large customers help their smaller suppliers meet that financing need, albeit at a price, through the use of so-called 'supply chain finance'. These arrangements often involve a lender extending credit to a small supplier, but secured against the larger customer, whose credit quality would normally be much the stronger of the two.

Future plans

As part of plans to track credit conditions over the longer term, Agents have been trialling the formal scoring of credit conditions, as for other economic variables. This has been done by measuring credit availability relative to normal (a similar approach to that taken for capacity utilisation and recruitment difficulties). Some time will be required to assess the time-series properties, but the Agents intend to publish these scores on a regular basis alongside their other national scores in due course.

The housing market

Developments in the UK housing market can have implications both for the macroeconomy and for financial stability. A direct macroeconomic impact was illustrated during the 2008/09 recession, when a 40% fall in private sector housing investment accounted for about 40% of the decline in GDP.⁽²⁾ Financial stability risks can emerge when developments in the housing market are associated with rising levels of household indebtedness. At higher levels of debt, households are more likely to encounter mortgage payment difficulties in the face of shocks to income or interest rates. This could pose direct risks to the resilience of the UK banking system. It could also pose indirect risks via its impact on economic stability, as highly indebted households might react

(1) See also 'An update to estimates of external finance for UK businesses' in *Trends in Lending*, October 2014; www.bankofengland.co.uk/publications/Documents/other/monetary/trendsoctober14.pdf.

(2) For more details see 'Macroeconomic implications of the housing market' on page 20 of the November 2013 *Inflation Report*; www.bankofengland.co.uk/publications/Documents/inflationreport/2013/ir13nov.pdf.

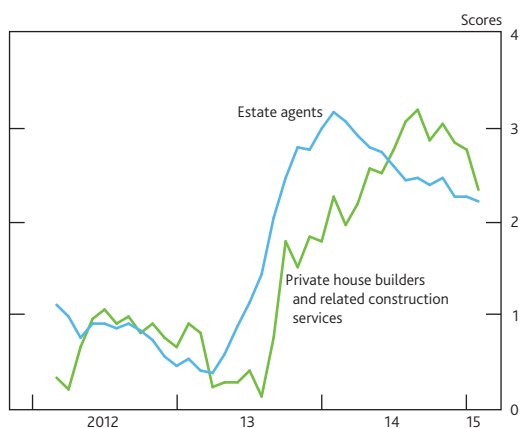
by cutting spending sharply in order to maintain their mortgage payments.⁽¹⁾

Following a prolonged period of weakness after the financial crisis, housing market activity picked up markedly during 2013 and the first half of 2014, reflected in higher levels of transactions and significant increases in house prices in some areas. Agents have covered the housing market in the *Agents' summary of business conditions* for many years, drawing on regular meetings with a range of contacts, including house builders, estate agents, financial advisors, surveyors and mortgage brokers and lenders. But given the monetary and financial policy implications of the housing market recovery, the Agents intensified their intelligence gathering in this area, including on house building and regional variations. As the housing market subsequently eased during 2014, contacts offered views on the possible drivers of that slowing, including the potential effects of regulatory change.⁽²⁾

A recovery in house building

One macroeconomic aspect that Agents focused on was the response of house building to the recovery in demand. During 2013 Agents noted a pickup in activity from house builders who began to develop more sites — many of which they had owned since the pre-crisis period — and acquire new ones. This was increasingly reflected in the company visit scores for house building output which began to rise sharply, following an increase in estate agents' turnover scores (**Chart 4**).

Chart 4 Company visit scores for housing-related turnover^(a)



(a) Based on company visit scores data that measure turnover for the past three months relative to a year earlier. The chart shows six-month moving averages for these data series.

As the recovery developed during 2013, Agency intelligence also provided early warning of supply constraints, including shortages of labour and materials, which began to lead to significant cost inflation for developers. For example, contacts were highlighting the specific issue of brick shortages before the issue received significant coverage in the media, and subsequently provided insights into how suppliers were responding to that challenge, for example by restarting

mothballed brick kilns. For smaller house builders, meanwhile, access to finance remained a challenge and many were unable to deliver the increase in output that was being demanded in the market.

Regional variations

The Bank sets monetary and macroprudential policy for the United Kingdom as a whole. However, the implications of housing market developments for policymakers depend to some extent on the degree to which they are confined to particular areas. While there was a pickup in the UK housing market overall during 2013 and early 2014, the rate of price and activity growth differed markedly between regions. For example, central London started seeing extremely sharp house prices rises that outpaced the rate of inflation in the wider South East, where prices have traditionally moved more closely in line with the capital. While house prices also started to increase in other areas, contacts reported to Agents that the recovery in prices was much weaker in some areas, particularly in Northern Ireland and parts of northern England. Contacts also noted that, although transaction levels had picked up across the United Kingdom, activity was often still significantly below pre-crisis levels.

The Agency network has sought to complement other sources of information on regional housing market developments by the production of regular heatmaps, focusing on aspects for which data are not readily available. For example, Agents have been monitoring indicators of behaviour associated with an overheating market, such as 'sealed bids' (where a buyer places an offer on a property without knowledge of what others have bid) and 'gazumping' (where a vendor accepts an offer from one buyer but subsequently accepts a higher offer from another party). As an illustration, heatmaps for May and October 2014 show how the frequency of reports of those behaviours decreased for a number of areas over that period, consistent with a widespread cooling in the housing market (**Figure 2**).⁽³⁾

Regulatory change

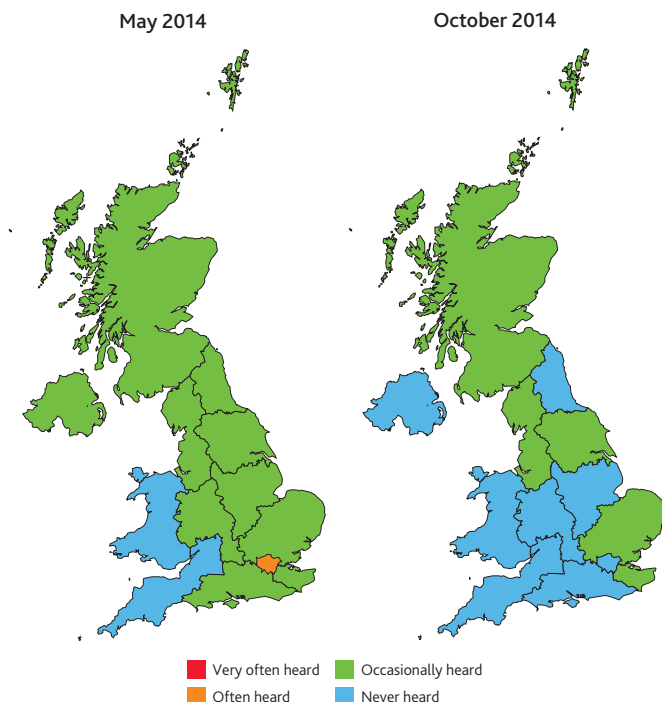
April 2014 saw the implementation by the Financial Conduct Authority of the Mortgage Market Review (MMR), which provided new regulations governing conduct in the mortgage market. The changes had significant implications for lenders, borrowers and intermediaries as they required a more thorough assessment of affordability prior to a mortgage being offered. In the run-up to the implementation of the new

(1) See also Bunn and Rostom (2014).

(2) For the Bank's latest assessment of the housing market and the effect of regulatory changes on the sector see the February 2015 *Inflation Report*; www.bankofengland.co.uk/publications/Documents/inflationreport/2015/feb.pdf and the December 2014 *Financial Stability Report*; www.bankofengland.co.uk/publications/Documents/fsr/2014/fsrfull1412.pdf.

(3) Evidence from Agents of regional variation in the slowing of housing market activity during 2014 was also noted on page 24 of the December 2014 *Financial Stability Report*; www.bankofengland.co.uk/publications/Documents/fsr/2014/fsrfull1412.pdf.

Figure 2 Agents' heatmap for frequency of reports of 'gazumping' or 'sealed bidding'^(a)



(a) 'Gazumping' is where a vendor accepts an offer from one buyer but subsequently accepts a higher offer from another party. 'Sealed bids' are where a buyer places an offer on a property without knowledge of what others have bid.

regulations there was uncertainty about what effect they would have on the market, both in the short and long term.

Agents' intelligence provided a key means of insight into the early impact of the MMR. For example, estate agents and financial advisors often painted an alternative perspective of the practical implications of its implementation to that offered by the major banks and building societies. While it was clear that some lenders and intermediaries had brought their practices in line with the new regulatory framework well ahead of the April deadline, others had been less prepared. This resulted in some teething problems with IT systems and staff training that created delays. Other contacts highlighted an increase in the time required for lenders to conduct interviews with borrowers, some of whom were now unable to get mortgages of the size they had anticipated. Contacts reported that these operational problems were contributing to slower housing market activity during 2014 Q2.

As housing transactions slowed, Agents' intelligence gathering switched towards the extent to which the effects of the MMR might be permanent or temporary. The Agents held in-depth discussions with more than 40 contacts in August 2014, to gain a better understanding of recent housing market developments and the effects of regulatory changes. Contacts reported that, overall, the operational impact from the implementation of the MMR had been addressed by lenders. However, contacts suggested that, as a result of MMR, underwriting standards would remain tighter than they had

been during the pre-crisis period over the long term. This would especially be the case for certain groups such as the self-employed or those with irregular incomes.

The Agents also asked contacts about the implications of the FPC's recommendations in June 2014 regarding the interest rates banks should use when testing mortgage affordability and the proportion of lending at higher loan to income ratios.⁽¹⁾ These recommendations were made to insure against the risk of a marked loosening in underwriting standards and the possibility of a further significant rise in the number of highly indebted households. Contacts of the Agents expected that the FPC recommendations would contribute to a tightening of underwriting standards over the longer term for some lenders, but they reported limited immediate impact on housing market activity. Those findings were broadly in line with the FPC's expectations, although the Committee has also noted that a signalling effect from the recommendations might have encouraged some lenders and borrowers to move away from higher-risk mortgages.⁽²⁾

Conclusion

Agents have a key representational role across the breadth of the Bank's work, most notably through arranging regional visits for senior Bank policymakers to meet and speak to business contacts across the country. Feedback from businesses can help the Bank to gauge the effectiveness of policies and their communications.

The core of the Agencies' work is, however, the gathering of business intelligence on behalf of the Bank. Agents meet a range of business contacts and generate economic and financial intelligence that can inform the work of the MPC, FPC and the PRA. While traditionally the Agencies' role has focused on providing economic intelligence to the MPC, the network has increasingly been developing its financial stability capacity and expertise.

Two examples of where the Agencies can provide 'One Bank' intelligence are on corporate credit conditions, in particular from the 'demand side' of finance, and on the housing market, given the network's extensive set of house building, estate agent, surveyor, conveyancing and mortgage market contacts. That intelligence has already been of value for the Bank.

(1) These included amending the affordability test introduced as part of the MMR to state that lenders should assess whether borrowers could still afford their mortgage if Bank Rate were to be 3 percentage points higher than at the origination of the loan. A cap was introduced stating that no more than 15% of any in-scope lender's total number of new residential mortgages should be at or greater than 4.5 times the borrower's income.

(2) See page 51 of the December 2014 *Financial Stability Report*; www.bankofengland.co.uk/publications/Documents/fsr/2014/fsrfull1412.pdf.

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Self-employment: what can we learn from recent developments?

By Srđan Tatomir of the Bank's Structural Economic Analysis Division.⁽¹⁾

- Self-employment has become an important feature of the UK labour market, accounting for around a third of the growth in employment since 2010. Developments in self-employment — and the reasons behind them — can provide information on the overall degree of spare capacity in the labour market which, in turn, can influence wages and inflation.
- While cyclical factors have played a role, much of the recent increase in self-employment reflects longer term trends — such as an ageing workforce — that began before the recession and are, therefore, unlikely to reflect additional slack above what is already captured by staff estimates.

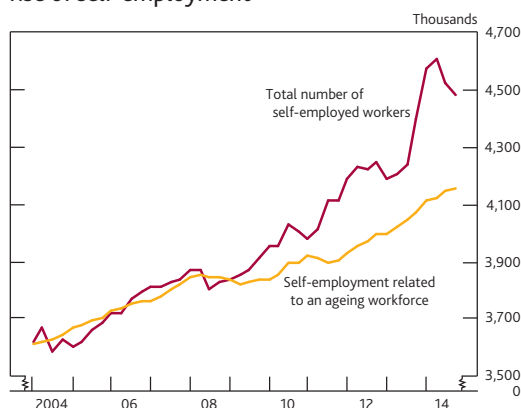
Overview

Self-employment has become an increasingly important feature of the UK labour market, with the latest data suggesting that around 15% of the workforce is self-employed. Increases in self-employment have accounted for around a third of the increase in employment since 2010.

What happens to self-employment could reflect the overall degree of spare capacity in the labour market which, in turn, can influence wages and inflation. It is therefore important to understand the extent to which recent increases in self-employment are a response to the recession: if increases in self-employment mainly reflect workers who are temporarily self-employed, while looking for jobs in companies, then this would be a form of **'hidden' unemployment**. Or it could be that self-employed workers are earning some income but would like to work a lot of additional hours, indicative of **underemployment**. Either of these scenarios would suggest a greater degree of spare capacity in the economy than would otherwise be the case.

The data suggest, however, that much of the rise in self-employment since 2008 is likely to reflect longer-term trends that began before the crisis. These include industrial and technological changes and demographic trends: the ageing of the workforce, for example, can account for around half of the increase since 2004 (see **summary chart**). Growing self-employment among female workers, alongside increasing female participation in the labour force, has also contributed to a rising self-employment rate in the population.

Summary chart The role of an ageing workforce in the rise of self-employment



Sources: Labour Force Survey and Bank calculations. See the footnote to Chart 6 on page 61.

While the recession may have pushed some workers into self-employment where they otherwise might have been unemployed, there is little evidence to suggest this was a major factor in the rise of self-employment: across different sectors, job losses have not been well correlated with subsequent increases in self-employment. Moreover, most self-employed workers are not looking for a job.

Although there is some evidence of underemployment among self-employed workers, this has been broadly similar to what employees have experienced. Moreover, to the extent that self-employment increases are mostly due to structural factors, this is not likely to represent additional slack above what is incorporated in Bank staff estimates of spare capacity within the labour market.

(1) The author would like to thank Chris Jackson and Philip King for their help in producing this article.

The inflation outlook depends in part on the level of aggregate demand relative to the economy's capacity to produce goods and services. The presence of spare capacity, or slack, is likely to reduce price pressures whereas very intensive use of productive capacity is likely to increase them. In forming a view on the amount of slack, the Monetary Policy Committee assesses a range of indicators. One key indicator is employment: an increase in the number of people employed is likely to facilitate an increase in the quantity of goods and services produced and can reduce the degree of spare capacity in the economy. Other things equal, higher employment, and lower unemployment, are likely to lead to greater upward pressure on wages, and so firms' costs. Employment consists of both people employed by businesses (employees) and the self-employed. The proportion of workers that are self-employed has increased over the past few decades and now accounts for almost 15% of the workforce.

One of the key features of the UK labour market during and since the recession has been the relative strength in employment. During 2008–09 the economy experienced a sharp contraction in output but employment fell by much less.⁽¹⁾ Since 2010 the number of workers in employment has grown by 1.9 million, much of which occurred during periods of subdued economic growth. Growth in self-employment accounted for around a third of that increase.

An important question for monetary policy is the degree to which the self-employed are really occupied in production or whether they are under-utilised and so represent spare capacity in the labour market.⁽²⁾ For example, some people become self-employed because they have chosen to start businesses to create new products and services. By contrast, others might become self-employed out of necessity in order to avoid unemployment. These have different implications for the degree of spare capacity and hence inflationary pressures.

The first section of this article gives a brief overview of developments in spare capacity in the United Kingdom since the recession and outlines how to interpret changes in self-employment in this context. The second section describes self-employment in more detail, and sets out some of the factors that are likely to have determined longer-run trends in self-employment — such as regulation and technological change — as well as distinguishing between 'push' and 'pull' factors. Finally, the third section assesses to what extent more recent changes in self-employment reflect spare capacity.

Setting the scene: the evolution of spare capacity in the United Kingdom since the recession

Spare capacity in an economy can be thought of as the additional output that could be produced without creating inflationary pressures. Once spare capacity has been absorbed, companies are likely to see faster growth in costs for any additional expansion of output, which will in turn put upward pressure on their prices.

Spare capacity can exist within companies, if they are using their resources (capital or labour) below normal rates of intensity. Spare capacity can also be present within the labour market if the number of people who are underemployed or out of work is unusually high. Within the labour market, spare capacity can take a number of forms. In addition to those that are classified as unemployed, some people, even though they would like to work, may leave the labour market altogether if they become discouraged about their prospects of finding a job. Furthermore, some people in employment may wish to work more hours, such as part-time workers that would like a full-time job. The presence of such slack is likely to restrain wage growth, and hence inflationary pressures.⁽³⁾

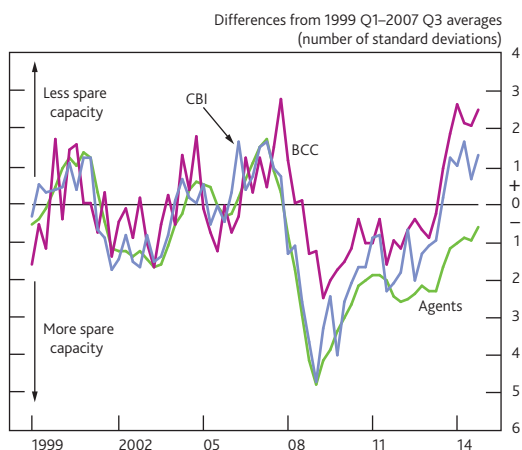
The recession led to a large increase in spare capacity in the UK economy. Survey measures of capacity utilisation showed a sharp fall in 2008–09 (**Chart 1**) — indicating that spare capacity within firms had increased sharply. These surveys estimated the amount of slack within firms to have narrowed somewhat by 2010 and, after remaining relatively flat, narrowed further as output picked up again in 2013. Averaging across the measures shown in **Chart 1**, spare capacity within firms appeared to have returned to roughly normal levels by the end of 2014.

The evolution of spare capacity within the labour market is believed to have followed a broadly similar pattern. Bank staff estimate that the degree of slack in the labour market initially increased in 2008–09. This is shown in **Chart 2** by the movements in three indicators: the unemployment rate rose above its estimated medium-term equilibrium; the rate of participation in the labour market fell below its estimated medium-term trend; and so did the average number of hours worked. The extent of slack suggested by the participation and unemployment gaps remained broadly stable for a period since then, before narrowing in late 2012 and early 2013, respectively. However, average hours began increasing,

(1) See Faccini and Hackworth (2010).

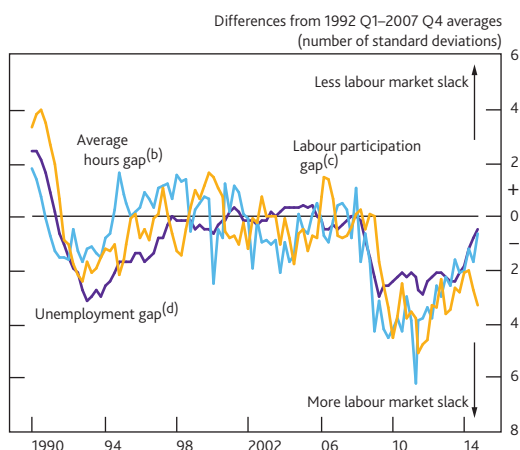
(2) See April 2014 MPC minutes; www.bankofengland.co.uk/publications/minutes/Documents/mpc/pdf/2014/mpc1404.pdf.

(3) For a more detailed discussion of spare capacity see the box 'Assessing the degree of spare capacity' on page 29 of the May 2014 *Inflation Report*; www.bankofengland.co.uk/publications/Documents/inflationreport/2014/ir14may.pdf.

Chart 1 Survey indicators of capacity utilisation^(a)

Sources: Bank of England, British Chambers of Commerce (BCC), Confederation of British Industry (CBI), CBI/PricewaterhouseCoopers, ONS and Bank calculations.

(a) Measures are produced by weighting together surveys from the Bank's Agents (manufacturing and services), the BCC (non-services and services) and the CBI (manufacturing, financial services, business/consumer/professional services and distributive trades) using nominal shares in value added. The surveys are adjusted to have a mean of zero and a variance of one over 1999 Q1 to 2007 Q3. The BCC data are non-seasonally adjusted.

Chart 2 Components of labour market slack^(a)

Sources: ONS (including the Labour Force Survey (LFS)) and Bank calculations.

- (a) The final data points are Bank staff estimates for 2014 Q4.
 (b) Percentage difference between Bank staff estimate of the medium-term equilibrium level of average weekly hours worked and average weekly hours worked.
 (c) Difference between the participation rate and Bank staff estimate of the medium-term equilibrium participation rate, which has been adjusted for the estimated impact of LFS sampling volatility in 2014 Q2 and 2014 Q3.
 (d) Difference between Bank staff estimate of the medium-term equilibrium unemployment rate and the unemployment rate.

relative to their estimated trend, in the beginning of 2012. The February 2015 *Inflation Report*⁽¹⁾ discusses recent developments in indicators of spare capacity.

Why do trends in self-employment matter?

Understanding the factors behind the increase in self-employment is important because different explanations have different implications for monetary policy.⁽²⁾

For instance, some of the increase in self-employment could reflect 'hidden' unemployment where it acts as a temporary option for individuals to work a limited number of hours as an alternative to unemployment but who would prefer jobs in

companies. Alternatively, the self-employed might be earning some income but would like to work additional hours, indicative of **underemployment**. This could be particularly evident among those who have become newly self-employed and are looking to establish a customer base or those seeking to save enough for their approaching retirement. In these cases, self-employment could be associated with a degree of spare capacity related to cyclical demand conditions in the economy.

But an increase in self-employment could also reflect more persistent, structural, factors that lead large numbers of individuals to choose to become freelancers or set up businesses (or both). Such factors could include long-term demographic trends or industrial and technological changes that started before the recession. Such increases in self-employment are less likely to reflect additional spare capacity than those associated with a deficient cyclical demand for labour.

Self-employment in the United Kingdom: some broad historical trends

Before considering the changes in self-employment since the 2008–09 recession and what these mean for spare capacity and monetary policy, this section introduces self-employment in more detail. It explains how self-employment might arise from 'push' or 'pull' factors and discusses broad trends in self-employment in the United Kingdom over the past few decades. It also considers some of the structural factors that can influence the level of self-employment over time.

Self-employment can take many forms and generally offers workers more autonomy than working as an employee. People are considered self-employed if they run their own business and are responsible for its success or failure. The most common forms of self-employment are:

- (i) **Sole traders.** A person who works on their own account. An example would be a plumber who works as a sole contractor, or a freelancing journalist.
- (ii) **Partnerships.** Two or more people who own and run the business. Consultancies or accounting practices are common examples of partnerships.
- (iii) **Limited liability companies.** This is a registered company and has at least one shareholder. Directors, who are self-employed, own shares in the business and run the company.

(1) Available at www.bankofengland.co.uk/publications/Pages/inflationreport/2015/feb.aspx.

(2) See April 2014 MPC minutes; www.bankofengland.co.uk/publications/minutes/Documents/mpc/pdf/2014/mpc1404.pdf.

Cyclical factors affecting self-employment

Changes in economic conditions can affect the incentives for people to become self-employed, in different ways. On the one hand, people can be 'pulled' into self-employment because of economic prosperity, if they think the benefits of self-employment will be higher than those associated with being an employee. Those leaving jobs to start their own companies are one example. Another example might be employees seeking more flexibility as independent consultants and advisers. One might expect such cyclical 'pull' factors to increase self-employment the most when the economy is growing rapidly. On the other hand, people can also be 'pushed' into self-employment due to economic adversity. Difficulties in finding a job might push unemployed workers and those in need of supplementary household income to become self-employed. This might give them the opportunity to earn additional income by selling goods and services to firms and households (see Blanchflower (2007)). 'Push' factors might increase self-employment the most when the economy is performing poorly and unemployment is high.

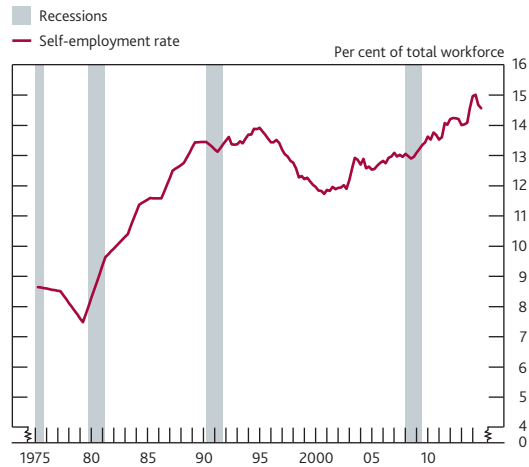
In the United Kingdom, the self-employment rate has increased since the late 1970s but has not been closely correlated with economic growth. This is perhaps because both 'push' and 'pull' factors play a role at the same time and can work in opposite directions. As the economy enters a recession more people might be pushed to enter self-employment, but fewer people are pulled into starting their own businesses. Then, as the economy begins to grow, those drivers are likely to reverse.

During the early 1980s recession, the self-employment rate rose and, in fact, continued rising after the recession ended⁽¹⁾ (Chart 3). As the economy contracted in the early 1990s, the self-employment rate fell before recovering. During the 2008–09 recession, the prevalence of self-employment in the labour force briefly fell. But it has increased since 2010 throughout periods both of subdued growth (such as from 2010 to 2012) and stronger growth (such as from 2013 to 2014).

Structural factors affecting self-employment over the long run

In addition to cyclical factors, there are a number of structural factors that affect people's decisions about whether to become self-employed. For example, the prevalence of self-employment in the workforce will be shaped by the tax code and regulation. For example, in 1995 Inland Revenue changed the taxation rules in the construction industry to reduce tax avoidance. This may have resulted in as many as 200,000 self-employed workers reclassifying themselves as employees by 1997 and could have lowered the self-employment rate by around 0.7 percentage points (see Freedman (2001)).⁽²⁾ Another important example is the change in corporation tax in April 2002 that eliminated tax on

Chart 3 The self-employment rate in the United Kingdom^(a)



Source: ONS (including the LFS).

(a) Data from 1975 to 1991 are not seasonally adjusted and have been interpolated to quarterly frequency.

the first £10,000 of company profits and allowed directors of small companies to save income tax by taking their salaries as profits. This increased the incentives to become self-employed. Correspondingly, the number of self-employed workers had increased sharply by the end of 2003, particularly in the finance and insurance industries (see Lindsay and Macaulay (2004)). More recent and upcoming reforms include the Enterprise Guarantee Scheme, the New Enterprise Allowance and the Onshore/Offshore Intermediaries legislation, all of which may affect incentives to become self-employed.

Technological change may also influence the rate of self-employment in the economy. Many of the costs of starting a business (such as equipment and advertising), relative to other goods and services, have been falling over time.⁽³⁾ This trend has been driven by the use of information, communication and technology products.⁽⁴⁾

For example, with internet commerce now widespread, it is much cheaper to set up an online business and there is less need for traditional bricks and mortar stores. Networking software, meanwhile, has facilitated easier matching of self-employed workers with customers interested in their goods or services. For example, online marketplaces (such as eBay or Airbnb) and mobile applications (such as the transport ordering service Uber) help sellers find customers. In many industries, the nature of the production process has also been

(1) This is thought to be due to a number of factors such as financial deregulation and easier access to credit, labour market policies to support unemployed workers in becoming self-employed, outsourcing and sub-contracting, and possible tax avoidance (see Meager and Bates (2004)).

(2) A similar but smaller effect could have been introduced by IR35 legislation in 2000. This discouraged workers from becoming self-employed if they were effectively working as employees for one company.

(3) Karabarounis and Neiman (2014).

(4) See Oulton (2012).

changing. Globalisation and an emphasis on costs have led many companies to contract parts of their supply chain out to other firms. Breaking down the production process into many distinct tasks may have also made it easier for new firms to bid for contracts and produce parts or provide advice. This could have also increased self-employment.

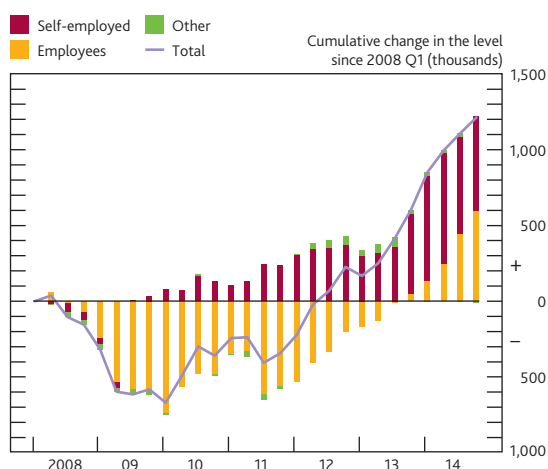
Individuals' preferences may also play a role, especially since self-employment can, in principle, be a relatively flexible form of employment. That could mean that it is appealing to particular types of workers who may wish to vary the hours they work, for example. As the composition of the UK population changes over time, that could also lead to changes in self-employment. For example, older people tend more often to be self-employed than younger people.

Overall, there are many factors that affect the rate of self-employment in the economy, both cyclical and structural. And it is difficult to assess what might be behind the recent rise in self-employment by looking at the aggregate data alone. More granular data on demographics and sectors can provide some insights. These are considered in the following section.

Understanding recent developments in UK self-employment

Since the start of the recession, self-employment has increased by around 600,000. This represents almost a third of the growth in employment since 2010 (Chart 4). The increase in self-employment occurred both in periods of subdued and stronger output growth.

Chart 4 Change in total employment since 2008 Q1^(a)



Source: LFS.

(a) The 'Other' category includes those in government-supported training and employment programmes as well as unpaid family workers.

This section discusses why self-employment might have increased since 2008 and what that implies for the degree of spare capacity in the economy. It draws on data from the

Labour Force Survey (LFS) which collects detailed information from households on their employment circumstances. The section first assesses the extent to which long-term trends could have accounted for the rise in self-employment. It then considers whether factors related to the recession matter. For example, evidence that self-employment in fact reflects 'hidden' unemployment would imply a greater margin of spare capacity than otherwise, as would the extent to which self-employed workers would prefer to work many more hours than they presently do. These are discussed in turn. Finally, this section considers data on self-employment income and what information that may reveal about spare capacity (and hence inflationary pressures) in the economy as a whole.

The impact of longer-term trends

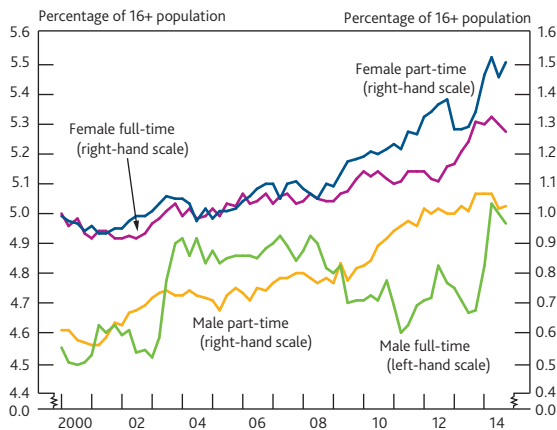
Structural factors typically influence self-employment over a relatively long period of time largely independently of the cyclical state of the economy. Increases in self-employment that are driven by long-term trends are likely to be composed of people who were 'pulled' into self-employment as a result of changes in technology, industrial structure or personal preferences, and tax/regulatory incentives.

A large part of the increase in self-employment since 2008 does indeed seem to reflect trends that began before the recession. The first is a trend increase in the female self-employment rate in the population (Chart 5). Part of this rise could reflect the desire to maintain a 'work-family balance' and 'flexibility of hours', which are among some of the most important reasons cited by women choosing self-employment according to a study by Hughes (2006).⁽¹⁾ Around half of female self-employment tends to be concentrated in services such as 'Professional and scientific' and 'Administrative and support', and the public sector. Most of the increases in female self-employment since 2008 occurred in these sectors.

In contrast, full-time male self-employment did not exhibit a particular long-term trend although the aggregate rate conceals differing developments across sectors. For example, industries such as 'Information and communications technology', 'Professional and scientific' and 'Administrative and support' have accounted for a rising share of male self-employment while the shares of other sectors, such as manufacturing or 'Wholesale and retail', have been declining over the past decade. While the general trend for full-time male self-employment has been roughly flat, the variation from 2008 onwards can largely be accounted for by variations in the number of self-employed in construction, particularly among lower-skilled workers.

(1) Based on a survey of self-employed Canadians in 2000, Hughes (2006) also reports that men place more of an emphasis on 'challenge' and 'prospects of more money'. All surveyed self-employed workers tend to value 'independence/freedom' the most. For a more detailed discussion, see Dawson, Henley and Latrielle (2009).

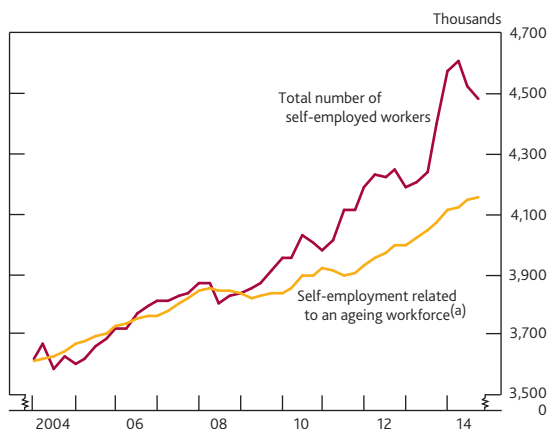
Chart 5 Self-employment rates by gender and working status



Sources: LFS and Bank calculations.

The second key trend is the ageing workforce. Older workers are more likely to be self-employed than younger workers. This is perhaps because they have accumulated more knowledge or experience to start businesses. Or it could be because they prefer the greater flexibility that self-employment offers (Blanchflower (2007)). The orange line in **Chart 6** illustrates what would have happened to the number of self-employed workers if self-employment rates for different age groups remained constant, with only the workforce age structure changing, since 2004. It suggests that around half of the increase in self-employment, shown in the orange line, over the past ten years has been associated with the ageing of the workforce.

Chart 6 The role of an ageing workforce in the rise of self-employment



Sources: LFS and Bank calculations.

(a) The orange line illustrates the effect of an ageing workforce on the level of self-employment in the United Kingdom. It is constructed by multiplying the number of workers in each age group by the proportion of workers who were self-employed in that same age group in 2004.

In summary, long-term trends such as the rising rate of female self-employment in the population and the ageing of the workforce can explain much of the increase in self-employment seen since 2008. Correspondingly less of the increase, therefore, seems likely to relate directly to the

cyclical state of the economy, including the possibility that some of the increase in self-employment really represents hidden unemployment.

How much of the increase in self-employment is really 'hidden' unemployment?

Long-term trends do not account for all of the increase in self-employment, though, and so some of the rise could reflect hidden unemployment. Evidence that workers have been 'pushed' into relatively un-intensive self-employment due to a lack of employee jobs could be indicative of hidden unemployment. This would imply that there is more spare capacity in the economy than standard measures would suggest. In other words, it would imply that there is a large pool of relatively unoccupied labour resources available to be put to productive use as the demand for goods and services increases. This section explores the relationship between the recession and self-employment in more detail.

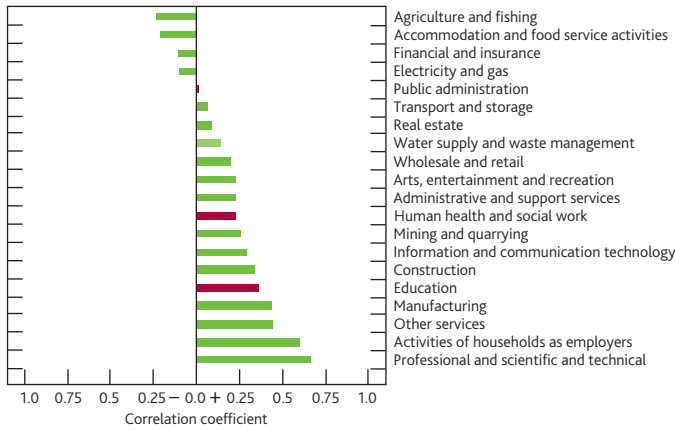
The relationship between job losses and increasing self-employment

In the public sector, employment fell by 900,000 between 2010 Q1 and 2014 Q3. Those who were made redundant could have decided to become self-employed. If that was the case, one would expect a negative relationship between changes in the number of employees and the number of self-employed. Overall, **Chart 7** shows there is little evidence of such negative correlation in industries most likely to reflect the public sector (highlighted in red). In 'public administration', falls in the number of employees have no correlation with increases in self-employment in the same quarter.⁽¹⁾ In 'Human health and social work' and 'Education' this correlation was actually positive. Regional data suggest that a negative relationship between changes in public sector employment and changes in self-employment was a bit stronger in some regions such as London, the East, the South East and the North West. Data on labour market flows indicate that around a quarter of the overall increase in self-employment since 2010 could be due to changes in public sector employment, assuming all of the increase in net flows from the public sector into self-employment was a result of redundancies. But this is likely to be an upper bound as some public sector workers could have become self-employed anyway.

In the private sector, a negative correlation between changes in self-employment and employee jobs is present only in a handful of sectors such as 'Agriculture and fishing' and 'Finance and insurance'. But these sectors account for a small part of the overall increase in self-employment. Since 2008,

(1) Of course, there may be a lag between the time a worker leaves a job and becomes self-employed. However, the results shown in **Chart 7** do not substantially differ for various lags between changes in self-employment and changes in employees in each sector.

Chart 7 Correlations between quarterly changes in the number of employees and self-employed workers by sector^(a)



Sources: LFS and Bank calculations.

(a) The correlations refer to SIC2007 sectors and are calculated for contemporaneous quarters over the 2008–14 period.

increases in self-employment have often been mirrored by increases in employees (and *vice versa*).⁽¹⁾ Overall, it is not clear from these data that increases in self-employment have tended to be associated with a lack of employee jobs.

There is also specific information in the LFS about whether respondents were made redundant in the previous three months. **Chart 8** shows that the number of those who became self-employed following redundancy has not increased much since 2008. The number did spike up in early 2009 but the average during 2008–14 was only slightly higher than the pre-2008 period average. Again, this suggests there is limited evidence of a relationship between employee job losses and increases in self-employment.

Chart 8 The number of self-employed workers that had recently been made redundant



Sources: LFS and Bank calculations.

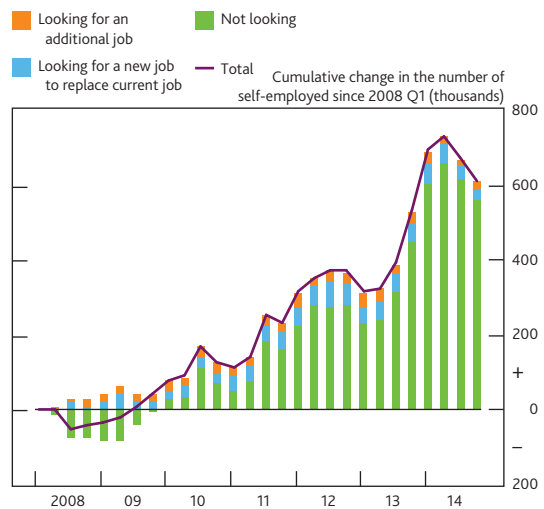
Evidence on self-employment as a temporary status

The suggestion that increases in self-employment might really represent hidden unemployment would be strengthened if

there was evidence that self-employment had become more of a temporary state. For example, if there has been a rise in the number of self-employed people reporting that they were looking for additional work or an increase in those who leave self-employment for jobs within companies then that could be suggestive of a degree of some underemployment, or slack, among the self-employed.

There is limited evidence to suggest that there have been large increases in this form of hidden unemployment. **Chart 9** shows that the number of self-employed workers who are looking for an additional or new job has increased slightly since 2008. But it has only accounted for around 9% of the overall increase in self-employment; the majority has been among those who are not looking for alternative work. Overall, the proportion of those self-employed that were interested in other work was around 4% at the end of 2014 and was actually a few percentage points lower than the proportion of employees looking for another job.

Chart 9 Self-employment decomposed by job seeking status^(a)



Sources: LFS and Bank calculations.

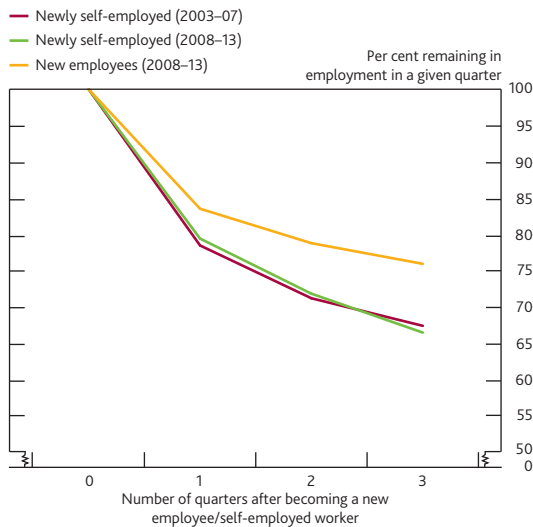
(a) Refers to LFS questions on whether respondents are looking for different or additional jobs and the type of work they are looking for.

Another way is to look at what people do soon after becoming self-employed. An increase in the proportion of newly self-employed workers moving back into jobs within companies might be indicative of the self-employed status representing unemployment in disguise.

The data do not, however, suggest that workers who became self-employed after 2008 were more likely to move back into jobs than those who became self-employed before the recession (**Chart 10**). In general, the proportion of newly self-employed who remain self-employed falls over time.

(1) However, it is possible that some redundant employees then became self-employed in a different sector.

Chart 10 Proportion of newly self-employed workers remaining in employment over time



Sources: LFS and Bank calculations.

After three quarters, around a third of the newly self-employed leave self-employment with about half of those moving to jobs as employees while the other half becoming inactive or unemployed. These proportions have changed little compared with before the recession.⁽¹⁾ Furthermore, the proportion of the newly self-employed who stay in self-employment is not far below the proportion of new employees who stay in employment after a year.

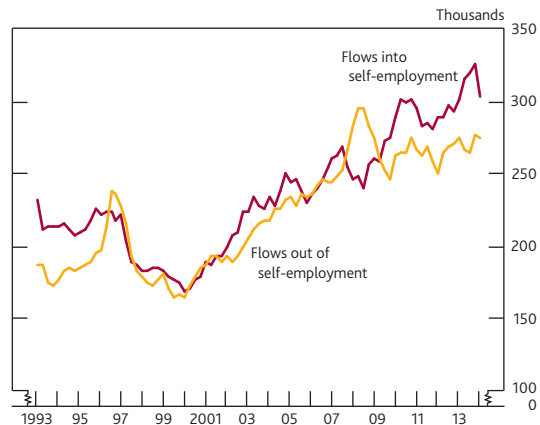
So far, the evidence suggests that of the increase in self-employment since 2008 the majority has not happened as a consequence of economic necessity. Instead, people seem to have been voluntarily choosing to become self-employed. Survey evidence corroborates this. A survey by RSA/Populus suggests that close to 60% choose self-employment to 'have more freedom' and around 70% of respondents in a Resolution Foundation (RF)/Ipsos Mori survey who became self-employed since the recession stated that 'self-employment' is their preference.⁽²⁾ Nonetheless, both studies by the RSA and the Resolution Foundation suggest around a quarter of respondents have become self-employed in the past five years out of necessity.

Postponing retirement?

While the decision to *enter* self-employment appears in large part not to be closely related to the recession, the decision to *leave* (or outflow from) self-employment could have been affected by cyclical factors. If some workers, particularly those shortly due to retire, have postponed leaving self-employed work then this could explain some of the increase in self-employment.

Part of the increase in self-employment can be attributed to relatively lower outflows (Chart 11).⁽³⁾ It is possible that the recession has resulted in wealth losses which may have led to

Chart 11 Flows in and out of self-employment^(a)



Sources: LFS and Bank calculations.

(a) Changes in the number of self-employed workers implied by longitudinal data above may be different to changes measured by cross-sectional data. This is due to methodological differences (see ONS (2011) for more details).

some self-employed workers choosing to work longer in order to boost their retirement income.

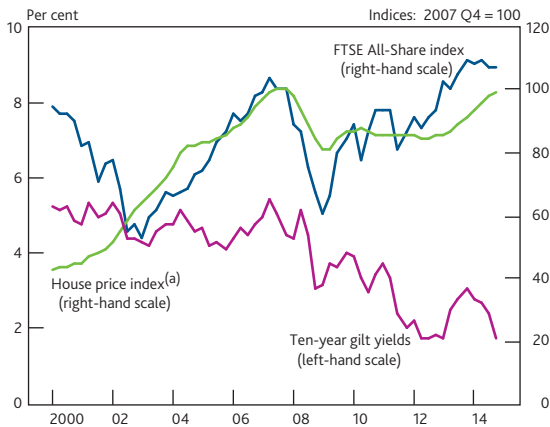
Asset prices fell substantially following the financial crisis and it took the FTSE All-Share index five years to recover while house prices still remain slightly below pre-crisis levels (Chart 12). Interest rates remain low and the cost of buying an annuity, that is, a stream of pension income, remains higher than before the crisis.⁽⁴⁾ Furthermore, the weakness in self-employment income since 2008 may have led to older workers choosing to work longer to save the same amount. According to a Saga survey carried out in 2014, around a third of older workers do not feel confident enough to retire.⁽⁵⁾ But the LFS data suggest that only 2.6% of older self-employed workers are looking for additional work so it is unclear whether there is spare capacity among these workers.

On balance, there appears to be limited evidence of hidden unemployment among the self-employed: although there has been a small increase in the number of self-employed workers looking for other work, most of those who are self-employed appear content with their choices.

Underemployment: desired and actual hours worked

Another way of assessing spare capacity is to look at underemployment. For example, people who are self-employed might like, and have the potential, to work

(1) Since 2008, those newly self-employed who leave self-employment are slightly more likely to end up unemployed. But this increase is relatively small.
 (2) The Populus survey is a survey of microbusinesses and was commissioned for the RSA report on self-employment (see Delloit (2014)). Ipsos surveyed self-employed adults for Resolution Foundation's research on self-employment (see D'Arcy and Gardiner (2014)).
 (3) D'Arcy and Gardiner (2014) estimate that around a third of the increase in self-employment is due to a lower outflow rate. In contrast, a study by the ONS (2014) suggests most of the increase is because fewer people are leaving self-employment than in the past.
 (4) Annuity rates are closely related to long-term gilt yields. The lower the long-term gilt yield, the more expensive it becomes to buy a given stream of pension income.
 (5) The survey was conducted as part of Saga's September 2014 Employment Report.

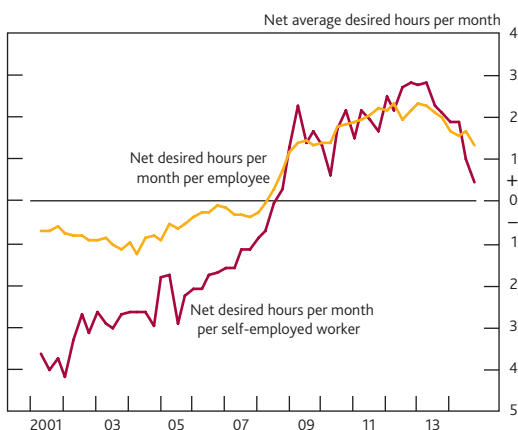
Chart 12 Asset values and long-term gilt yields

Sources: Bank of England and Bloomberg.

(a) The house price index is an average of Nationwide and Halifax price indices.

more hours than they actually do. This spare capacity can be used up as the economy recovers before inflationary pressures build.

The LFS asks people about the hours they would like to work. The difference between that and their actual hours is a measure of underemployment — that is, spare capacity. Before 2008, workers on average worked more hours than they wanted to and this reversed after the recession (**Chart 13**). But since 2008 the actual hours worked by self-employed workers do not indicate an unusual degree of underemployment relative to employees. On average, the self-employed worked 1.3 hours more per week than employees in 2014. The number of additional hours the self-employed have wanted to work has, on average, been similar to what employees have reported. Moreover, as the economy started growing strongly in 2013, this has fallen more sharply for the self-employed. Overall, the increase in net desired hours since 2008 among the self-employed only accounts for around a tenth of the increase in overall net

Chart 13 Average net desired hours^(a)

Sources: LFS and Bank calculations.

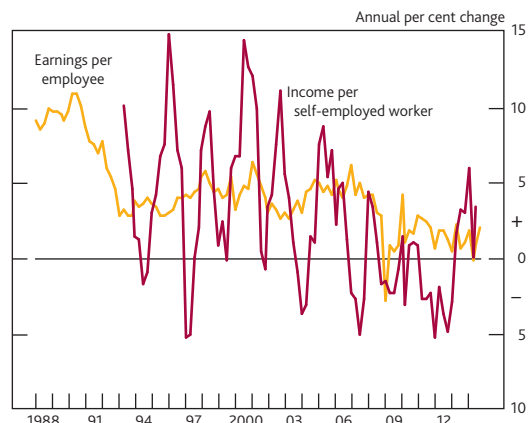
(a) Average net desired hours are calculated as the difference between the sum of all additional hours workers want to work and the sum of hours they wanted to decrease, divided by the number of workers.

desired hours. This degree of underemployment among self-employed workers is already captured by Bank staff estimates of spare capacity within the labour market.

Insights from self-employment income data

In principle, developments in income could provide a more direct indication of self-employed workers' activity and, therefore, how much spare capacity there might be. Income from self-employment might be weak if people are looking for a job within a company or want to work a lot of additional hours. Even if the hours worked reported by the self-employed have remained reasonably strong, they may generate less output if a significant amount of time is spent soliciting work and pitching projects. This is likely to be cyclical as it can take more effort to obtain business during periods of weak economic growth, which would show up in the economic data as weaker productivity.

On the face of it, there is some evidence that earnings for the typical self-employed worker fell more sharply than for employees. **Chart 14** suggests self-employment income fell sharply in the recession and was around 7% lower in 2012 than in 2008. Although it appears to have recovered somewhat since 2013, it is unclear to what extent lower income from self-employment may reflect the impact of spare capacity or weaker productivity among self-employed workers.

Chart 14 Growth in self-employment income compared to employees' average weekly earnings growth^(a)

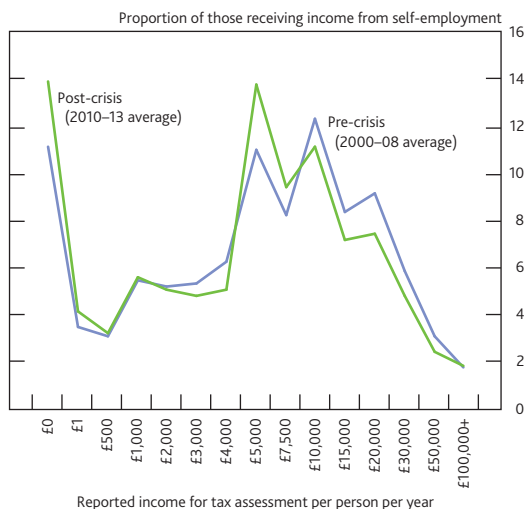
(a) Self-employment income shown above is mixed income based on the quarterly national accounts data. It includes HMRC data up to 2013 Q2. The rest is imputed, based on average weekly earnings (AWE) data for employee earnings and self-employment data from the LFS. Earnings per employee are based on the historical AWE series prior to 2000.

Moreover, it is difficult to interpret recent movements in self-employment income for a number of reasons. First, income from self-employment can be difficult to measure. The LFS does not ask about the income of self-employed workers. Tax returns are submitted to Her Majesty's Revenue and Customs (HMRC) with a twelve-month lag, which means that recent changes have to be estimated. Also, since income is self-reported there is scope for income data to be misstated.

Second, self-employment income can also be difficult to interpret due to compositional effects and volatility. Since around 2004, for example, self-employment income growth has mostly been lower than total employee earnings growth. Much of this wedge may therefore not be cyclical, and may be due to structural changes such as increases in self-employment among workers whose level and/or growth of income might be less than for the average self-employed worker. This would pull down on average income growth. Income from self-employment is also more volatile than employees' earnings growth. This is perhaps unsurprising given that self-employed workers take on more risk and their incomes may behave more like company profits than wages.

An important compositional change affecting income measurement is that the rise in self-employment in recent years appears to have been concentrated, on average, in relatively lower income workers. **Chart 15** shows that the proportion of self-employed workers earning between £5,000 and £7,500 per year has increased since 2008. This could be suggestive of spare capacity to the extent that these lower income workers also prefer to work additional hours. But this also might, to an extent, reflect a growing prevalence of lower income, less intensive self-employment that occurred before the recession. There has also been an increase in those reporting almost no income from self-employment. This is difficult to interpret as the HMRC data also captures employees who earn some additional income outside their main job, from freelancing.⁽¹⁾

Chart 15 Distribution of self-employment income^(a)



Sources: HMRC and Bank calculations.

(a) Self-employment income is defined as reported profits minus losses and capital allowances.

Furthermore, the implications of falls in self-employment income growth for inflationary pressure will depend crucially on the underlying reasons for weaker income. On the one hand, to the extent that there is underemployment among the self-employed, workers could increase their hours without

causing strong upward pressures on other workers' pay and/or prices of the goods and services the self-employed offer. On the other hand, falls in self-employment income growth could reflect persistently lower productivity, with workers unable to produce as much output as previously for a given amount of hours. In this case, increases in hours would result in upward pay and price pressures. There are many reasons for the weakness of labour productivity in the United Kingdom and a more detailed explanation of the 'productivity puzzle' is provided in Barnett *et al* (2014).

Overall, it is hard to draw firm conclusions from self-employment income data. Income from self-employment seems to have weakened since 2008 but it is unclear what might have caused this. While changes in income appear to be more cyclical for self-employed workers than for employees, the data are also volatile and influenced by compositional changes.

Conclusion

Self-employment has become an increasingly important feature of the UK labour market. Self-employment now accounts for almost 15% of the UK workforce, and growth in self-employment has accounted for a third of the increase in employment since 2010. Developments in self-employment can affect the overall degree of spare capacity in the labour market which, in turn, can influence wages and inflation. An important question, therefore, is to what extent the increase in self-employment since 2008 is a cyclical response to the recession.

There appears to have been a cyclical effect on the hours self-employed workers desire to work. But the data do not suggest anything particularly unusual relative to employees. Declines in self-employment income since 2008 do appear to be more cyclical for self-employed workers than for employees, but it is hard to draw firm conclusions from the data.

Instead, the data suggest that overall, much of the rise in the number of self-employed workers since 2008 is likely to reflect trends that began before the recession. Structural factors such as changes in the composition of the workforce and technological change may have, over a longer period of time, led people to choose to move into self-employment. While the recession may have pushed workers into self-employment as an alternative to unemployment, there is little evidence to suggest this was a major factor in the rise of self-employment. Outflows from self-employment, compared to inflows, have remained relatively flat and this might be affected by older workers' retirement decisions.

(1) Employees who earn additional income from freelancing do not appear in the LFS as self-employed unless freelancing is their main activity or source of income.

To the extent that most of the increase in self-employment can be accounted for by structural factors, the cyclical effects are not likely to represent any additional slack above what is incorporated in Bank of England staff estimates of spare capacity within the labour market.

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Flora and fauna at the Bank of England

By Jennifer Adam, Curator of the Bank of England Museum.

An exhibition at the Bank of England Museum explores the surprising menagerie that can be found adorning the Bank's buildings and banknotes.

The City of London can be seen as the quintessential urban environment — a centre of business and commerce rather than somewhere that one would expect to find inspiration from the natural world. Yet within the Square Mile there are a surprising number of green spaces, with the Bank's own Garden Court providing one such unexpected oasis. Moreover, there is a menagerie of sorts inside the Threadneedle Street building itself: from the lions that guard the Bank's gates and can be seen on the mosaic floor in its entrance hall (Figure 1) to the bees — historically a symbol of industry and co-operation — which adorned banknotes throughout the 19th and 20th centuries (Figure 2), these creatures reveal important aspects of the Bank's image and ethos over the centuries. Indeed Bank officials might even find themselves discussed in avian terms: are they a dove or a hawk? Or perhaps even an owl?

This article provides an overview of some of the themes featured in the Bank of England Museum's Spring 2015 exhibition, *Flora and Fauna*.⁽¹⁾ The exhibition examines the symbolic meaning of plants and animals that appear within the design of the Bank building, on banknotes and in depictions of the Bank over the years. It will also look at a number of real-life creatures that have contributed to life at the Bank. This display will provide an opportunity to see aspects of the Bank's architecture not generally accessible to the public, as well as artworks and artefacts not usually on display.

Symbols of safety and soundness

Despite initial impressions, today's Bank of England is actually a relatively modern building, designed and built between 1925 and 1939 by the architect Sir Herbert Baker, who was assisted in the decoration of the Bank by the sculptor Sir Charles Wheeler. Wheeler's scheme echoed the Neo-Classical themes that Baker's predecessors, including Sir John Soane,⁽²⁾ had brought to the original Bank of England buildings, while bringing to the project his own distinctly modern style of classicism. The Bank's decoration



Figure 1 Lion mosaic at the Bank's Entrance Hall.



Figure 2 Vignette of Britannia that featured on banknotes in 1855; beehive to the left.

(1) *Flora and Fauna at the Bank of England* will be open on the 23 March 2015 and run until Autumn 2015. The Bank of England Museum is open 10:00–17:00 on weekdays (see the Bank's website for special opening hours). Admission is free of charge.

(2) Sir John Soane, one of the most distinguished architects of 18th century London, was Architect and Surveyor of the Bank of England between 1788 and 1833. His tenure at the Bank of England was one of his most important roles, which he called 'the pride and boast of my life.'



Figure 3 Threadneedle Street, main door.



Figure 4 Test print for the 1957 £5 note.

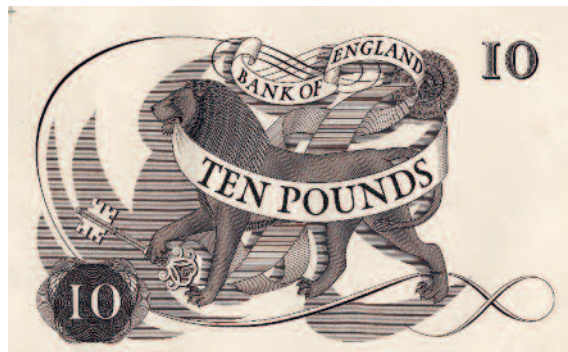


Figure 5 Test print for the 1964 £10 note.

follows the tradition of using design as a way of symbolically warding off bad spirits, in order to inspire the visitor with confidence in the strength and integrity of the institution.

Inspiring confidence

One of the first sights to greet visitors to the Bank are the magnificent sculpted lions adorning its great bronze doors (Figure 3). Wheeler's lions guard each of the portals into the Bank, on Threadneedle Street, Princes Street, Bartholomew Lane, and the two gates on Lothbury. Such lions are part of an ancient artistic tradition: they invoke the awe of the onlooker, conjuring the strength of these mighty beasts to defend a place and ward off evil intent. Their frequent depictions around the Bank, sculpted on doorways, handles, railings and decorative relief, echo ancient depictions of lions as protectors of treasure. Indeed the mosaic floor of the Bank's entrance lobby, designed by Russian artist Boris Anrep,⁽¹⁾ copies the form of the lions that guarded the gates of the ancient Greek city of Mycenae, with two lions standing either side of a single column (Figure 1). As symbols of strength, nobility and integrity they lend their power to protect not only the Bank's buildings but also its banknotes, appearing on banknote designs from the 1950s and 1960s. That said, some depictions are more imposing than others: the symbolism of a mighty lion holding the keys to the Bank on the 1957 £5 note (Figure 4) is quite clear, whereas his counterpart on the 1964 £10 note looks almost friendly (Figure 5). As well as lions, a number of other fierce creatures feature within the Bank's walls. The Court Room was originally designed by architect Sir Robert Taylor in the 1760s and features griffins and snakes which serve a similar apotropaic function (that of warding off evil or bad luck), with several copied from designs from ancient Greece and Rome. Snakes also appear in the form of the caduceus (Figure 6), a sacred attribute of the Roman god Mercury, known not only as the deity of messengers, but also of commerce and trade.

As well as using images of imposing beasts to ward off evil intent, Classical art and architecture also made use of plant designs as a way of conveying positive attributes such as solidity, integrity

(1) Anrep also designed mosaic floors that can be seen at the National Gallery, Tate Britain and Westminster Cathedral.



Figure 6 Caduceus design on Court Room ceiling.



Figure 7 Mosaic borders of laurel leaves, on the ground floor of the Bank's Threadneedle Street building.

and virtue. Sir John Soane continued this tradition in his designs for the Bank during the peak of the Neo-Classical revival of the 1700s and 1800s, a tradition further honoured by Sir Herbert Baker's artists and craftsmen in the decoration of the new Bank in the 1930s. Anrep's mosaics include designs relating to banking and finance surrounded by borders of laurel (see Figure 7) olive, and oak. These draw on ancient associations of victory and peace (laurel), wisdom (olive) and solidity and strength (oak). By combining the grandeur of this decoration with the dramatic scale of the Bank's building, Baker and his designers created a sense of permanence and authority within the fabric of the institution itself.

Reflecting the Bank's remit to serve the public good

While attributes of security, reliability and permanence remain important to the image of any central bank, the Bank of England's public service remit is also reflected in aspects of design around the building. Animals add a symbolic element to a portrait in the Bank's Parlours⁽¹⁾ (Figure 8), of William Paterson, whose scheme formed the basis for the Bank of England's foundation in 1694. Below the portrait is a relief of a pelican feeding her young: the pelican was thought to feed its offspring with its own blood, thereby becoming a symbol of self-sacrifice and the service of others. This sentiment is underscored by Paterson's motto — *'sic vos non vobis'* — which comes from a verse attributed to the Roman poet Virgil, conjuring the image of bees working for the benefit of others, not themselves: *'sic vos non vobis mellificatis apes'*, 'thus not for yourself do bees make honey'.

Indeed bees appear as a symbol more than once. In 1855 the Bank began issuing notes featuring a new vignette of Britannia⁽²⁾ designed by Daniel Maclise. In Maclise's vignette (Figure 2), the pile of coins that Britannia was guarding in the first version of the Bank's seal has morphed into the form of a domed beehive. In this case bees appear as a symbol of industriousness and co-operation — values which the Bank sought to emphasise in 1855, and that remain important today.

Comment and satire

So far, the plants and animals discussed here have been symbols that, in one way or another, the Bank has adopted for itself. But what of depictions made by others? Financial markets are sometimes characterised as 'bulls' or 'bears', and entire economies might be described as 'dragons' or 'tigers'. For the Bank, some of the most striking — and comic — commentary consists of representations of its leading officials in animal form, with Bank figures particularly scrutinised for

(1) The Bank's Parlours can be seen on a small number of open days each year. In 2015 these will be 4 and 11 July and 19 and 20 September. Please see the Bank's website for further information.

(2) Britannia, a female allegorical figure representing Britain, was adopted as the Bank's symbol and seal by the Bank's first Court of Directors in July 1694



Figure 8 Bust of William Paterson in the Bank's Parlours; the pelican is below the bust.

'dovish' or 'hawkish' outlooks on monetary policy.⁽¹⁾ When asked by the *Yorkshire Post* as to whether she saw herself as a dove or hawk, Deputy Governor Minouche Shafik looked to broaden the options: 'I asked my children this question and they said, 'Mummy, you should say you're an owl....' Look at the data, try and be wise.'⁽²⁾ The avian metaphors were extended further in the November 2014 *Inflation Report* press briefing when Governor Mark Carney was asked whether he was perhaps a loon⁽³⁾ — referring, of course, to the water bird that appears on Canadian dollar coins (Figure 9).

Though not so recent, one of the sharpest such commentaries can be seen in a 1998 cartoon by Richard Cole,⁽⁴⁾ with the nine members of the MPC each characterised as a different creature, from doves and hawks to squawking parrots. Then-Governor Eddie George is shown as the owl at the centre (Figure 10). Such creatures of satire must take their own place within the Bank's menagerie.



Figure 9 Canadian 'loonie' dollar. Courtesy of the Currency Museum, Bank of Canada.



Figure 10 Richard Cole, 'Make your mind up time? That's strictly for the birds.' Reproduced courtesy of Richard Cole.

- (1) Commentators use the term 'hawk' to describe a policymaker that places a tighter focus on maintaining low inflation as the top priority for monetary policy. By contrast, a 'dove' puts a relatively greater weight on other factors such as the outlook for unemployment, when making their policy decisions.
- (2) Interview with the *Yorkshire Post*, 25 September 2014: www.yorkshirepost.co.uk/business/business-news/exclusive-bank-of-england-won-t-risk-recovery-says-minouche-1-6859496.
- (3) The Governor was asked if he was a loon at the 12 November 2014 *Inflation Report* press conference — see for example this *Times* article: www.thetimes.co.uk/tto/business/industries/banking/article4266105.ece.
- (4) This cartoon was originally published in the *Daily Telegraph*, 16 August 1998. The original artwork appeared in the Bank of England Museum's exhibition 'Cartoons and Caricatures' (May–December 2013). See 'The Old Lady of Threadneedle Street', *Bank of England Quarterly Bulletin*, Vol. 53, No. 2, pages 137–46, available at www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2013/qb130205.pdf.



Figure 11 GE Hicks, 'Dividend Day at the Bank of England'.

Working plants and animals

As well as their symbolic uses, animal and plants have had a very real role in serving (and protecting) the Bank. In the painting 'Dividend Day at the Bank of England' by George Elgar Hicks, the presence of a terrier and a cat might intrigue — but were actually a form of 19th century vermin control (Figure 11). Watchdogs and carriage hounds are common features in paintings and engravings of the Bank throughout the 18th and 19th centuries. Dogs still play an active role in maintaining protection and security in the area, although these days this responsibility falls to the City of London Police, with the specialist dog section assisting in searches for explosives or drugs, for instance. There has also been an association with the City of London Police Mounted Unit: in 2006 one of its horses was named Ariel, after the sculpture of the same name above the Bank's Tivoli Corner.⁽¹⁾

There is also an association between the plant world and the security of currency that reaches beyond pure symbolism and into practical design. In the 18th century, printers in New Jersey experimented with forms from the natural world, copying the unique patterns of leaf veins in the hope that they could provide an inimitable security feature (Figure 12). Though they eventually proved possible to forge, the move towards complex printed forms was an important step in protecting currency against counterfeiting. This would develop into the complex mechanical guilloche patterns that have appeared on later note designs.⁽²⁾ In the 20th century, designers also used complex plant-inspired banknote designs to confound counterfeiters by including deliberate errors. The flowers of the 1957 £5 note contain secret marks specifically used by Bank clerks to

(1) This sculpture by Sir Charles Wheeler is above the Princes St-Lothbury corner of the Bank. It became known as Ariel after the 'Spirit of the Air' in Shakespeare's *The Tempest*, and was conceived of by the sculptor as representing the dynamic spirit of the Bank carrying credit and trust around the world.

(2) A complex pattern of intersecting curved lines used to protect against forgery, created using a machine called a geometric lathe. The patterns created in this way are a more complex form of the designs that can be made using a children's toy called a spirograph.



Figure 12 New Jersey banknote, with leaf design. Courtesy of the Trustees of the British Museum.



Figure 13 Secret marks on the 1957 £5 note.

identify forgeries: counterfeiters might omit a seemingly random dot (Figure 13) or mistakenly continue an apparently broken line without realising that these would be the marks that would reveal their forgery. In fact, the very material used for Bank of England banknotes — paper made from a special cotton-linen blend — is itself a plant product. The combination of banknote material and inks create a unique feel which has long been a key way to verify authenticity and protect against counterfeiting.⁽¹⁾ Flora and fauna will again feature on banknotes with the issue of the new polymer £10 in 2017 featuring Jane Austen, the design of which includes horses and deer in the grounds of Godmersham Park.

The Bank's Garden Court

In common with many such green spaces within the City of London the Bank's Garden Court is actually the site of a former churchyard. When the Bank moved to Threadneedle Street in 1734, the site immediately to the west of the building had been occupied by the Church of St Christopher le Stocks since medieval times. It had been one of the first churches to be rebuilt by Sir Christopher Wren following the Great Fire of 1666.

Wren's Church was marked for demolition in 1781, when the Bank expanded westwards and acquired the site. Yet it was a condition of the Act of Parliament that allowed for the demolition of the church that the churchyard could not be built over, and so the new west wing of the Bank of England, completed by Sir Robert Taylor in 1785, enclosed the old churchyard within the Bank's site as a new 'Garden Court'. So it remained until Sir Herbert Baker rebuilt the Bank in the 1920s: while Baker retained the notion of a garden courtyard, its location was shifted slightly to the east, to the central north-south axis of the new building. Garden Court thereby remained in name, but in reality this meant the deconsecration of the churchyard, exhumation of several burials which had remained in situ⁽²⁾ and the removal of the great imposing lime tree standing at the centre of the courtyard. The Bank's Collections include a number of objects carved from the wood of the lime tree after it had been felled, including a book bound within two lime-wood covers.

Today's Garden Court is visible to visitors arriving at the Bank, through the windows of the Threadneedle Street lobby (Figure 14). The four mulberry trees in the courtyard allude to the earliest paper money, produced in China in the 7th century and printed on paper made of beaten mulberry bark (Figure 15). Yet the planting is practical as well as symbolic: the horizontal root structure of the mulberry allows the trees to grow safely above the Bank's vaults.

(1) Information about modern day banknote security measures can be found on the Bank's website, at www.bankofengland.co.uk/banknotes/Pages/current/default.aspx.

(2) Once the remaining graves in the Garden Court had been exhumed, the remains of the deceased were moved to Nunhead Cemetery and either reinterred, or placed in the crypt.



Figure 14 The Bank's Garden Court today.

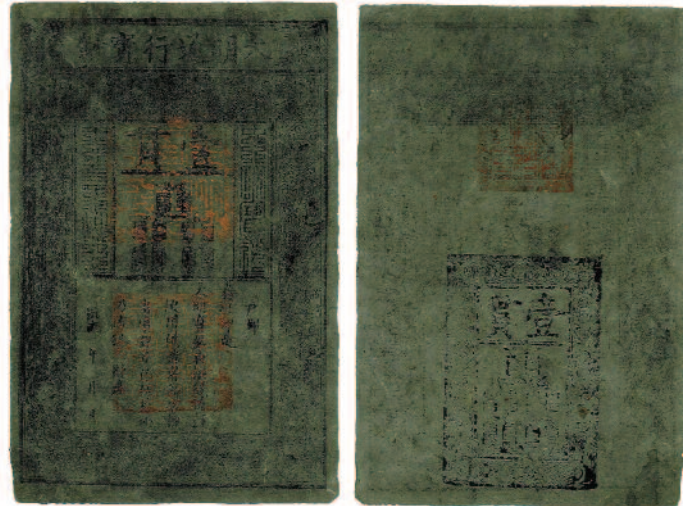


Figure 15 Early Chinese banknote (Ming dynasty, 14th century), from the Bank's collections.

The quietude of the Garden Court creates a haven for wildlife: it has recently provided a home for nesting pairs of a rare bird species: black redstarts. These birds favour stony ground for their nests, and although they thrived in the city during the post-war period when there were many suitable urban nesting sites, they are now a protected species, with fewer nesting pairs in the United Kingdom than there are of ospreys or golden eagles. London provides important habitat for the birds, with up to a third of their British population thought to be nesting in the capital. Black redstarts found a welcoming home in the Garden Court, and their distinctive call has also been heard in the streets and avenues between Moorgate and Old Broad Street.

The breadth of material within this exhibition reveals an unexpectedly rich array inspired by the natural world. A diverse menagerie can be found within the Bank's walls if one looks closely, with creatures great and small in both real and symbolic form. This latest exhibition will open on the 23 March 2015 at the Bank of England Museum. Admission is free of charge, but visitors are reminded: please do not feed the animals!

Recent economic and financial developments



Markets and operations

- Short-term interest rates fell across advanced economies. A large number of central banks eased policy in the review period, reflecting concerns about domestic growth and the risk of disinflation, especially in light of falls in the price of oil.
- The European Central Bank (ECB) announced that it would extend its asset purchase programme to include sovereign bonds. The Governing Council plans to purchase €60 billion of private and public assets per month until it sees 'a sustained adjustment in the path of inflation'.
- Market-implied measures of inflation expectations fell materially. The fall may partly have been due to concerns about the outlook for global growth. But there were additional idiosyncratic factors at play in the United Kingdom and the United States.
- Sterling appreciated materially towards the end of the review period, mostly due to a rise against the euro following ECB loosening. Options markets had started to price in currency volatility around the time of the UK general election.
- Risky asset prices rose following the announcement of ECB sovereign bond-based quantitative easing.

Overview

A large number of central banks loosened policy during the review period, reflecting both concerns about domestic growth and the risk of disinflation — especially in light of precipitous falls in the price of oil. As a result, there were broad-based declines in international market interest rates, including in the United Kingdom.

Contacts noted that in the February 2015 *Inflation Report* the Monetary Policy Committee (MPC) stated that it could expand the Asset Purchase Facility or cut Bank Rate further towards zero were downside risks to materialise. But contacts thought that the next move in policy would be a tightening. Contacts pointed to the fact that the MPC anticipated that inflation would be above target at the end of the forecast horizon under the assumption that Bank Rate progressed according to what was implied by the market curve.

Medium-term market-implied inflation expectations declined in the United Kingdom, the United States and the euro area. In part, that was thought to reflect a deterioration in the outlook for global growth. And in the case of the euro area, there were some concerns about the ability of the European Central Bank (ECB) to bring inflation back up to its

target. Idiosyncratic factors related to market structure were also likely to have been important in the United Kingdom and United States.

The sterling exchange rate index rose significantly during the review period. That was primarily the result of an appreciation against the euro, which had experienced considerable downward pressure since the announcement of a sovereign bond purchase programme by the ECB. Market participants anticipated that uncertainty surrounding the outcome of the upcoming UK general election could cause some volatility in the price of sterling, and this was evident in forward-looking measures of currency volatility.

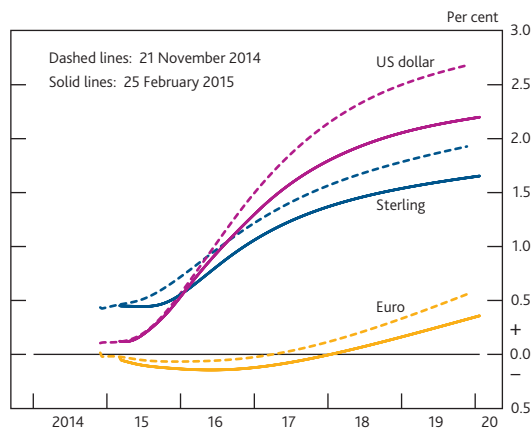
Equity price indices touched record highs and euro-area markets performed particularly strongly following the announcement of further loosening by the ECB. In the corporate bond market, meanwhile, there was an increase in spreads around the start of the period, in part due to the impact of lower oil prices on corporates with exposure to the energy sector. That rise subsequently reversed, due to both a modest uptick in oil prices and the anticipated effects of ECB quantitative easing.

In discharging its responsibilities to ensure monetary and financial stability, the Bank gathers information from contacts across a range of financial markets. Regular dialogue with market contacts provides valuable insights into how markets function, and provides context for the formulation of policy, including the design and evaluation of the Bank's market operations. The first section of this article reviews developments in financial markets between the 2014 Q4 *Quarterly Bulletin* and 25 February 2015. The second section goes on to describe the Bank's own operations within the Sterling Monetary Framework and other market operations.

Monetary policy and interest rates

Short-term market interest rates fell across advanced economies during the review period (**Chart 1**). A large number of central banks eased monetary policy, reflecting concerns about domestic growth, the risk of disinflation and, in some cases, to maintain foreign exchange pegs. Some central banks viewed lower oil prices as supportive of growth, but others were concerned about the impact of the fall in the oil price on inflation, given wider disinflationary trends.

Chart 1 Instantaneous forward interest rates derived from overnight index swap (OIS) contracts^(a)



Sources: Bloomberg and Bank calculations.

(a) Instantaneous forward rates derived from the Bank's OIS curves.

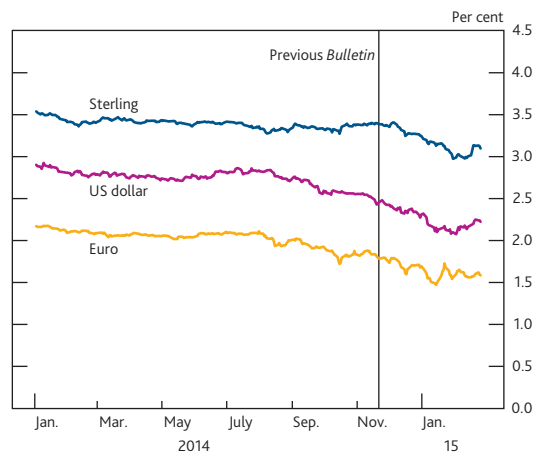
Perhaps most notably, the European Central Bank (ECB) announced a programme of large-scale sovereign bond purchases. At its January meeting, the ECB Governing Council announced that it would extend its asset purchase programme, buying €60 billion of private and public sector assets per month. Asset purchases are expected to continue until the end of September 2016, or until 'a sustained adjustment' is seen in the path of inflation, consistent with the ECB's aim of inflation below, but close to, 2% over the medium term. The size and potential open-endedness of the programme exceeded market expectations and contributed to a reduction in euro-area government bond yields. Sentiment was also supported by the conclusion of an interim agreement, reached in February, on Greece's Economic Adjustment Programme (originally agreed in 2010 with the European

Union, ECB and International Monetary Fund), following Syriza's victory in the parliamentary election.

Contacts typically attributed declines in UK rates to international developments, particularly in the euro area. The February 2015 *Inflation Report* was thought to be broadly in line with market expectations. In the *Report* the Monetary Policy Committee noted that the scope for further cuts in Bank Rate had increased because the United Kingdom's banking sector is operating with substantially more capital now than it did in the immediate aftermath of the crisis. Contacts noted that the possibility of a further reduction in Bank Rate had been a more frequent topic of investor discussion following the *Report*, but they continued to expect the next change in Bank Rate to be an increase.

Despite policy easing by many central banks, market-implied measures of medium-term inflation expectations fell over the review period (**Chart 2**). The fall was thought to have been, in part, due to concerns about the outlook for world economic growth. But other factors were also at play.

Chart 2 Selected five-year inflation swap rates, five years forward^(a)



Sources: Bloomberg and Bank calculations.

(a) Forward swap rates derived from the Bank's inflation swap curves.

Particularly in the United States, implied long-term inflation rates have been correlated with those at shorter horizons, which in turn are sensitive to changes in oil prices (see the box on page 78 for a brief discussion of recent moves in the price of oil). And analysis by the Federal Reserve suggests that some of the fall in implied inflation rates may have resulted from falls in inflation risk premia — the compensation demanded by investors for bearing inflation risk.⁽¹⁾

In the United Kingdom, contacts suggested that the apparent resilience of implied inflation rates during the latter part of 2014 was at least in part due to stronger demand for inflation

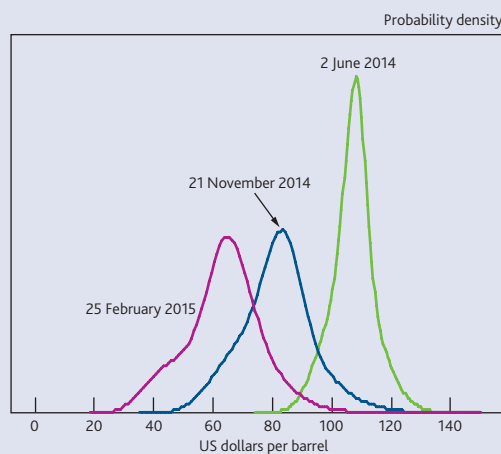
(1) *Federal Reserve Board Monetary Policy Report*, 24 February 2015.

Recent moves in the price of oil

Over the review period there was a 23% fall in the price of oil, with the Brent front-month oil contract reaching an intraday low of around US\$45 in mid-January. The bulk of the decline followed the decision of members of the Organization of Petroleum Exporting Countries (OPEC) not to reduce supply at their November meeting. Contacts had expected OPEC to cut supply in response to sharp price falls during the second half of 2014, and so push the price of oil back up. But in the event, OPEC signalled that it would no longer adjust supply to keep prices stable, instead choosing to maintain market share and allow market prices to fluctuate according to fundamental factors.

The change in OPEC's reaction function has created uncertainty about the future price of oil. Evidence from options markets suggests that there is now considerably more risk priced into the future level of the price of oil than prior to the shift in strategy by OPEC (**Chart A**).

Chart A Option-implied distributions for the price of oil three months ahead^(a)



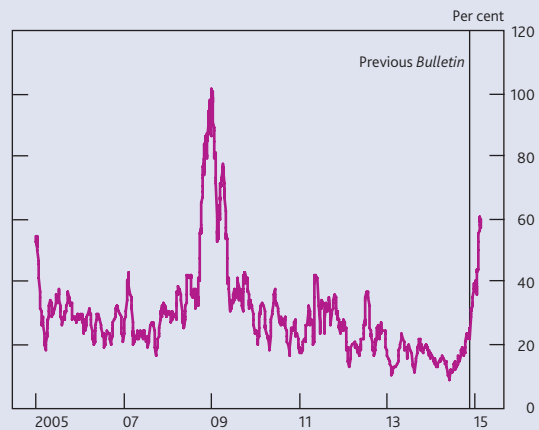
Sources: Bloomberg and Bank calculations.

(a) Calculated from options on Brent crude oil.

In addition, contacts report that the apparent change in OPEC's reaction function has caused market participants to pay more attention than in the past to oil market data as a leading indicator of changes in price. And there is tentative evidence to suggest that oil prices have recently become a little more sensitive to surprises in US crude oil inventories data than over the past couple of years.

Moreover, contacts report that the price of oil has been moving sharply even on days when there may have been very little fundamental news. And oil price volatility has picked up considerably (**Chart B**). Contacts cite a number of potential factors which may have contributed to heightened volatility.

Chart B Realised volatility of Brent oil price^{(a)(b)}



Source: Bloomberg.

(a) Annualised rolling standard deviation of log returns estimated over the 30 most recent trading days' closing price.

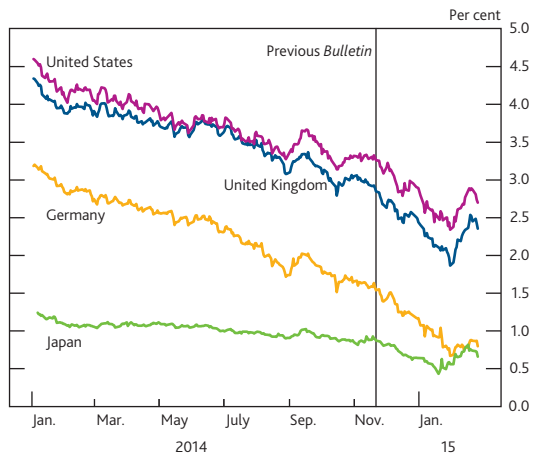
(b) Brent oil refers to the ICE Brent crude oil front-month futures contract.

Most importantly there continues to be uncertainty around the future supply of oil, not just associated with the reaction function of OPEC, but also that of other oil producers, most notably of US shale oil. In addition, a reduction in the capacity of investment banks to intermediate between buyers and sellers was thought to be exacerbating price moves. Contacts also suggested that demand from institutional investors, such as pension funds, which, in the past, would have tended to increase when prices had fallen to attractive levels, had become less of a stabilising influence. Such 'real money' investors have become less prevalent participants in the market in recent years, due, in part, to an increase in the correlation of the asset class with other types of financial asset.

protection from investors seeking to hedge long-term liabilities (such as defined benefit pension funds). They also noted that there had been relatively low issuance of inflation-linked bonds by the Debt Management Office during much of the period. These factors had both ceased to exert as much upward pressure on implied inflation rates from around the beginning of the year.

Contacts had been surprised by the size of recent declines in UK long-term interest rates, with yields on long-dated gilts briefly falling to historic lows (**Chart 3**). Contacts suggested that the subsequent reversal of some of that decline reflected a recognition by investors that the earlier falls had gone further than was justified by macroeconomic news, along with some upwards surprises in data.

Chart 3 Selected five-year government bond yields, five years forward^(a)



Sources: Bloomberg and Bank calculations.

(a) Forward yields derived from the Bank's government liability curves.

As had occurred over year-end in 2013, there was a marked decline in sterling overnight rates on the last trading day of 2014. But the falls were smaller than in the previous year, which contacts suggested reflected improvements in planning for year-end. Activity in euro and US dollar markets was also orderly relative to the previous year-end.

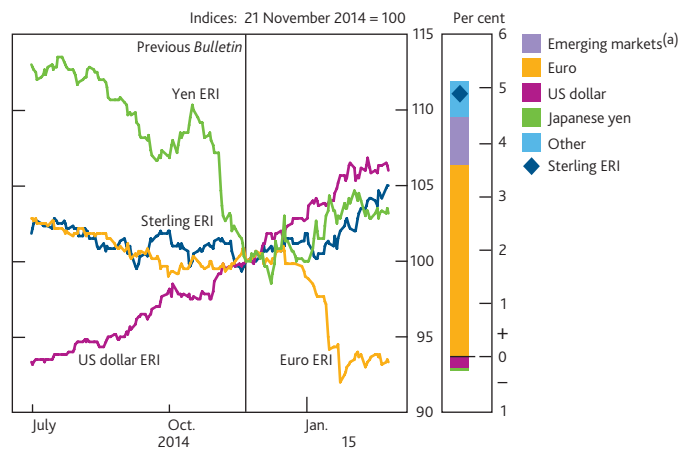
The Japanese government bond market exhibited unusually high volatility over the review period. Yields fell in late 2014 following an increase in the pace of government bond purchases by the Bank of Japan, and reached record lows in January 2015 (**Chart 3**). A large proportion of these moves reversed in the following weeks, with contacts reporting a withdrawal of demand from certain investors, such as insurers and pension funds, which would not buy bonds at yields lower than the cost of their guaranteed liabilities.

Foreign exchange

Sterling was broadly stable for much of the review period, but appreciated materially from the start of the year (**Chart 4**),

reflecting a sizable rise against the euro. Contacts reported that participants in the foreign exchange market remained focused on macroeconomic and policy divergence between major advanced economies. Consistent with that view, the US dollar effective rate index (ERI) increased by 6% over the review period and there was thought to remain a strong consensus around the strength of the currency. Meanwhile, the euro ERI fell by 7%, with part of that move coming after the announcement of quantitative easing (QE) by the ECB.

Chart 4 Selected exchange rate indices (left-hand side) and contributions to changes in the sterling ERI since 21 November 2014 (right-hand side)



Sources: Bloomberg, European Central Bank, Thomson Reuters Datastream and Bank calculations.

(a) The emerging market currencies in the narrow sterling ERI are: Chinese renminbi, Czech koruna, Indian rupee, Polish zloty, Russian rouble, South African rand and Turkish lira.

A number of other central banks lowered policy interest rates over the review period, in some cases into negative territory. Some foreign exchange strategists suggested that negative interest rates may be having a more powerful impact on exchange rates than was previously thought, as investors were reluctant to hold assets with a negative nominal yield, or move into longer-maturity ones, thereby encouraging cross-border flows. It was suggested that this mechanism might amplify the impact of ECB asset purchases on the currency compared with similar past programmes adopted by other central banks when yields were not as low.

In a surprise decision in mid-January, the Swiss National Bank (SNB) removed the ceiling on the exchange rate between euro and Swiss franc, allowing the domestic currency to appreciate. Contacts thought that the SNB decision was prompted by concerns about the likely scale of foreign currency intervention required to keep the Swiss franc from rising above the ceiling in future, given the widely anticipated monetary policy easing by the ECB. Although the change in SNB policy came as a surprise, contacts were nonetheless shocked by the speed and scale of the exchange rate moves that followed. The Swiss franc appreciated by 14% against the euro on the day of the decision, while the intraday range was several times

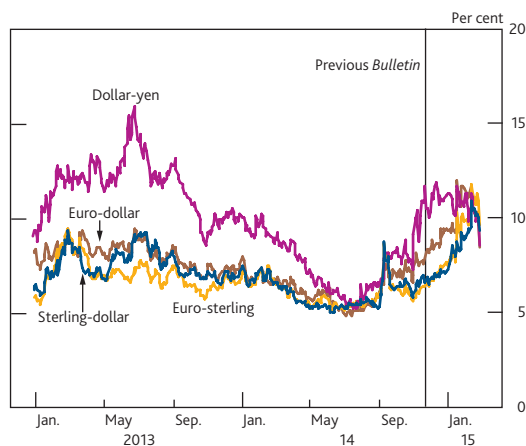
that number — market participants continue to debate over the highest value of the franc traded during the day. In part, the severity of the moves was a reflection of the fact that many market participants had thought that the peg was credible, so some were wrong-footed by the shift in policy. But changes in market structure may also have contributed to the disorderliness.

Electronic platforms have become much more prevalent in the foreign exchange market in recent years, and now account for more than half of all spot currency trades. Following the SNB announcement, banks reportedly switched off electronic trading platforms as quickly as possible — some faster than others — with some dealers temporarily pulling quotes for all currencies. It only required one or two of the large players to switch off their electronic platforms for liquidity to disappear altogether, given the close interlinkages in the foreign exchange market. Once prices returned, algorithmic traders left with open positions placed their offers at the level of the previous bid, ‘chasing’ the price downwards.

Contacts also suggested that a relative lack of experience among ‘voice’ traders and reduced appetite to hold risk among traditional intermediaries, had contributed to a reduction in willingness of traders to step in to a falling market, compared with the past. Liquidity in foreign exchange options markets remained impaired following the episode, as participants reassessed the prospects for further shocks to affect trading conditions.

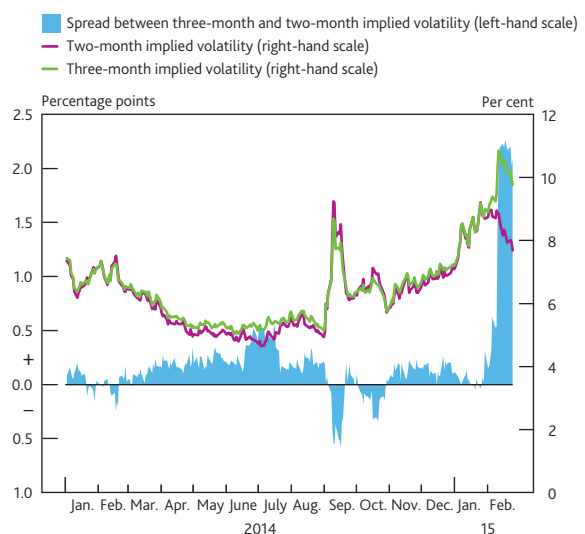
The combined effect of all of these developments in the foreign currency market was to cause a marked increase in foreign currency implied volatility (**Chart 5**). Looking ahead to the UK general election in May, strategists thought that sterling was likely to become more volatile ahead of the vote, in light of uncertainty surrounding the result. That was already being reflected in option prices, with a growing wedge between three-month volatility (options covering the date of

Chart 5 Three-month option-implied volatility of foreign exchange rates



Source: Bloomberg.

Chart 6 Option-implied volatility of sterling-dollar exchange rate



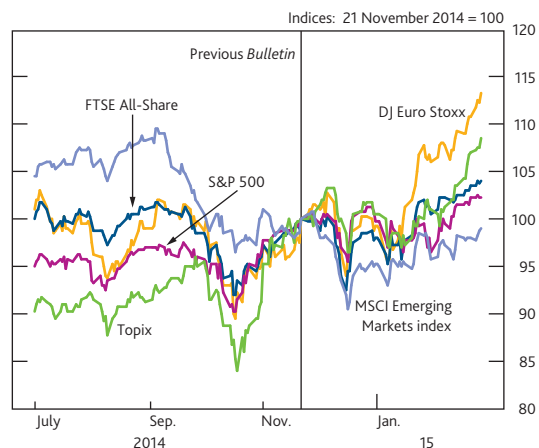
Sources: Bloomberg and Bank calculations.

the election) and two-month volatility (**Chart 6**). Moreover, uncertainty was being reflected in option prices further ahead of the vote than in the case of the Scotland referendum, and to a greater extent than prior to the 2010 general election.

Corporate capital markets

Developed-market equity indices increased over the review period as a whole (**Chart 7**). There was a marked outperformance of the Euro Stoxx index, however, which increased by 12%, in large part due to the announcement of expanded QE by the ECB. Contacts reported that US investors in particular had been increasing their exposure to euro-area equities, having previously been relatively ‘underweight’ on that region in portfolio allocations.

Chart 7 International equity indices^{(a)(b)}



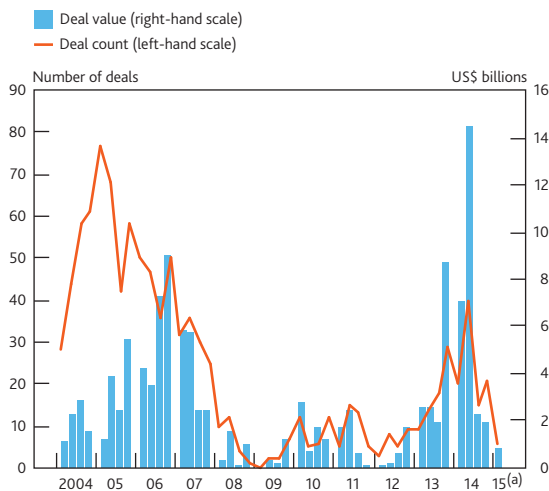
Sources: Bloomberg and Bank calculations.

- (a) Indices are quoted in domestic currency terms, except for the MSCI Emerging Markets index, which is quoted in US dollar terms.
 (b) The MSCI Emerging Markets index is a free-float weighted index that monitors the performance of stocks in global emerging markets.

Equity market implied volatility was elevated towards the end of 2014 and around the start of 2015, reflecting a combination of monetary policy developments, geopolitics — especially negotiations surrounding international financial support for Greece — and the marked fall in the price of oil. But volatility has since fallen back to close to its previous low levels.

Perhaps reflecting heightened volatility around the start of the year, primary issuance in the UK equity market was light during the review period (Chart 8). Contacts noted that uncertainty associated with the upcoming general election in May might tend to limit the number of initial public offerings during the first half of the year. In contrast, European equity issuance had been fairly buoyant, despite events in Greece, sentiment having been supported by ECB policy action.

Chart 8 Total value and number of initial public offerings by UK firms



Source: Dealogic.

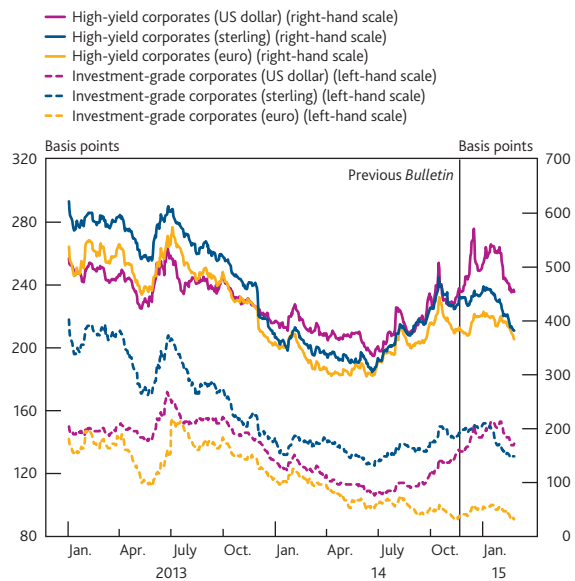
(a) Data up to 25 February 2015.

In the corporate bond market, spreads had been rising in the second half of 2014, but began to decline from around the beginning of this year (Chart 9). Broadly similar moves were observed in both the investment-grade and high-yield markets. The rise in corporate bond spreads is likely to have been partly due to the decline in the price of oil, with indices affected according to constituent companies' exposure to lower energy prices. The impact of this was especially evident in the US high-yield index. Recently, high-yield spreads have fallen back, following the stabilisation in the price of oil. Also, contacts reported that corporate bond spreads had declined as a result of anticipated spillovers from the ECB asset purchase programme.

Bank funding markets

Overall, UK bank funding costs declined a little over the review period (Chart 10). Contacts thought that the announcement last year relating to the total loss-absorbing capacity (TLAC) proposal by the Financial Stability Board had contributed to a

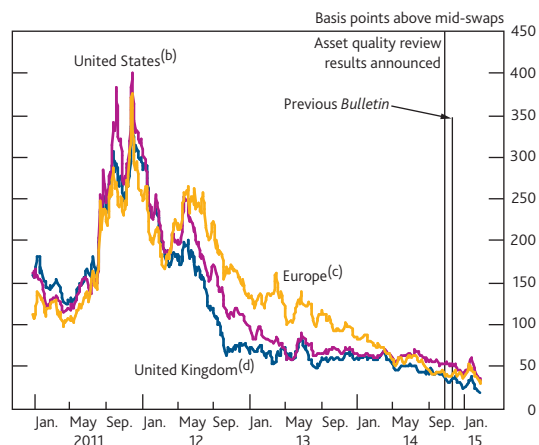
Chart 9 International corporate bond option-adjusted spreads



Source: BofA Merrill Lynch Global Research.

widening in spreads between debt issued by the holding companies and operating companies of global systemically important banks (G-SIBs). This may reflect reduced expectations of government support and the view that, in cases in which G-SIBs operate with a holding company structure, debt issued by holding companies would in future be written down before that issued by operating companies. Contacts anticipated heavy capital issuance by affected banks this year.

Chart 10 Indicative senior unsecured bank bond spreads^(a)



Sources: Bloomberg, Markit Group Limited and Bank calculations.

- (a) Constant-maturity unweighted average of secondary market spreads to mid-swaps of banks' five-year senior unsecured bonds, where available. Where a five-year bond is unavailable, a proxy has been constructed based on the nearest maturity of bond available for a given institution and the historical relationship of that bond with the corresponding five-year bond.
- (b) Average of Bank of America, Citi, Goldman Sachs, JPMorgan Chase & Co., Morgan Stanley and Wells Fargo.
- (c) Average of Banco Santander, BBVA, BNP Paribas, Cr dit Agricole, Credit Suisse, Deutsche Bank, ING, Intesa, Soci t  G n rale, UBS and UniCredit.
- (d) Average of Barclays, HSBC, Lloyds Banking Group, Nationwide, Royal Bank of Scotland and Santander UK.

In Europe, bank funding costs declined further. Rating downgrades of the holding companies of a number of European lenders by Standard and Poor's (S&P) had little impact on bank credit spreads. In part, that was because the downgrades had largely been expected. But contacts also noted that the market now relies less heavily on external ratings than it has in the past. That was because many investors have relaxed rules that would previously have caused these downgrades to require automatic sales of affected securities.

Operations

Operations within the Sterling Monetary Framework and other market operations

This section describes the Bank's operations within the Sterling Monetary Framework (SMF) over the review period, and other market operations. The level of central bank reserves is determined by (i) the stock of reserves injected via the Asset Purchase Facility (APF); (ii) the level of reserves supplied by operations under the SMF; and (iii) the net impact of other sterling ('autonomous factor') flows across the Bank's balance sheet.

Operational Standing Facilities

Since 5 March 2009, the rate paid on the Operational Standing Deposit Facility has been zero, while all reserves account balances have been remunerated at Bank Rate. As a consequence, average use of the deposit facility was £0 million in each of the November, December and January maintenance periods. Average use of the lending facility was also £0 million.

Indexed Long-Term Repo open market operations

The Bank conducts Indexed Long-Term Repo (ILTR) operations as part of its provision of liquidity insurance to banks, building societies and broker-dealers. These typically occur once every calendar month. During the review period, the Bank offered a minimum of £5 billion via six-month ILTR operations on 9 December 2014, 6 January 2015 and 10 February 2015 (Table A).

Over the quarter, and in line with recent quarters, the aggregate level of reserves supplied by the Bank through QE remained in excess of the level that would otherwise be demanded by market participants. Usage of the ILTR therefore remained limited (Chart 11).

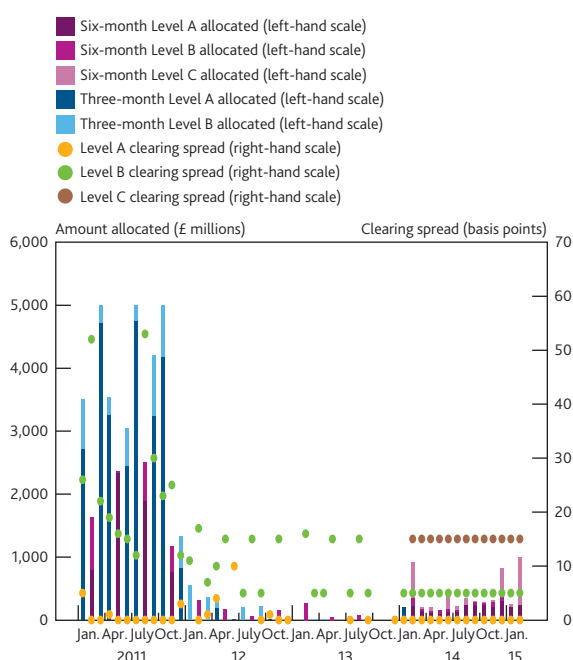
Contingent Term Repo Facility

The Contingent Term Repo Facility (CTRF) is a contingent liquidity facility, designed to mitigate risks to financial stability arising from a market-wide shortage of short-term sterling liquidity.⁽¹⁾ The Bank judged that, in light of market conditions, CTRF auctions were not required in the review period.

Table A Indexed Long-Term Repo operations

	Total	Collateral set summary		
		Level A	Level B	Level C
9 December 2014 (six-month maturity)				
Minimum on offer (£ millions)	5,000			
Total bids received (£ millions)	830	310	60	460
Amount allocated (£ millions)	830	310	60	460
Clearing spread (basis points)		0	5	15
6 January 2015 (six-month maturity)				
Minimum on offer (£ millions)	5,000			
Total bids received (£ millions)	260	215	0	45
Amount allocated (£ millions)	260	215	0	45
Clearing spread (basis points)		0	n.a.	15
10 February 2015 (six-month maturity)				
Minimum on offer (£ millions)	5,000			
Total bids received (£ millions)	1,000	240	5	755
Amount allocated (£ millions)	1,000	240	5	755
Clearing spread (basis points)		0	5	15

Chart 11 ILTR reserves allocation and clearing spreads^(a)



(a) Where there has not been any allocation to a collateral set, no clearing spread is marked.

Discount Window Facility

The bilateral on-demand Discount Window Facility (DWF) is aimed at banks experiencing a firm-specific or market-wide shock. It allows participants to borrow highly liquid assets in return for less liquid collateral in potentially large size and for a variable term. The average daily amount outstanding in the DWF in the three months to 30 September 2013, lent with a maturity of more than 30 days, was £0 million.

(1) Further details are available at www.bankofengland.co.uk/markets/Pages/money/ctrf/default.aspx.

Other operations

Funding for Lending Scheme

The Funding for Lending Scheme (FLS) was launched by the Bank and HM Treasury on 13 July 2012. The initial drawdown period for the Scheme ran from 1 August 2012 until 31 January 2014. The drawdown period for the FLS extension opened on 3 February 2014 and will run until 29 January 2016. The quantity each participant can borrow in the FLS is linked to their lending to the UK real economy, with the incentives skewed towards supporting small business lending.⁽¹⁾

The Bank publishes quarterly data showing, for each group participating in the FLS extension, the amount borrowed from the Bank and the net quarterly flows of lending. During the three months ending 31 December 2014, fourteen of the 38 groups participating in the FLS extension made drawdowns totalling £8.5 billion. Participants also repaid £0.4 billion from the first stage of the FLS. This took outstanding aggregate drawings under the Scheme to £55.7 billion.⁽²⁾

US dollar repo operations

On 23 April 2014 in co-ordination with other central banks and in view of the improvement in US dollar funding conditions, the Bank ceased the monthly 84-day US dollar liquidity-providing operations. The current timetable for the seven-day operations will continue until further notice. The network of bilateral central bank liquidity swap arrangements provides a framework for the reintroduction of US liquidity operations if warranted by market conditions. There was no use of the Bank's US dollar facilities during the review period.

Bank of England balance sheet: capital portfolio

The Bank holds an investment portfolio that is approximately the same size as its capital and reserves (net of equity holdings, for example in the Bank for International Settlements, and the Bank's physical assets) and aggregate cash ratio deposits (CRDs). The portfolio consists of sterling-denominated securities. Securities purchased by the Bank for this portfolio are normally held to maturity, though sales may be made from time to time, reflecting, for example, risk or liquidity management needs or changes in investment policy. The portfolio currently includes around £5.4 billion of gilts and £0.3 billion of other debt securities.

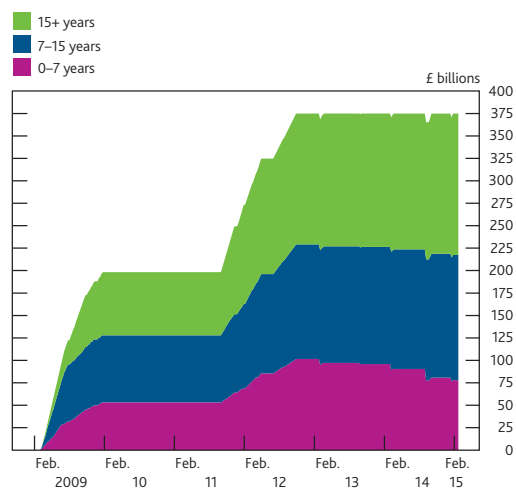
Asset purchases

Alongside the publication of the *Inflation Report* on 12 February 2014, the Monetary Policy Committee announced that it intends to maintain the stock of purchased assets, including reinvesting the cash flows associated with all maturing gilts held in the APF, at least until Bank Rate has been raised from its current level of 0.5%. In line with this, the cash flows associated with the redemption of the January 2015 gilt owned by the APF were reinvested. Reinvestment operations took place in the week beginning 26 January 2015.

Gilts

The total stock of gilts outstanding, in terms of the amount paid to sellers, was £375 billion, of which £77.9 billion of purchases were made in the 3–7 years residual maturity range, £139.5 billion in the 7–15 years residual maturity range and £157.5 billion with a residual maturity of greater than 15 years (Chart 12).

Chart 12 Cumulative gilt purchases by maturity^{(a)(b)}



(a) Proceeds paid to counterparties on a settled basis.
(b) Residual maturity as at the date of purchase.

Gilt lending facility⁽³⁾

The Bank continued to offer to lend some of its gilt holdings via the Debt Management Office (DMO) in return for other UK government collateral. In the three months to 31 December 2014, the daily average aggregate value of £1,080 million of gilts was lent as part of the gilt lending facility. Average daily lending in the previous quarter was £1,693 million.

Corporate bonds

There were no purchases of corporate bonds during the review period. Future purchase or sale operations will be dependent on market demand, which the Bank will keep under review in consultation with its counterparties in the Corporate Bond Scheme.⁽⁴⁾ The Scheme currently holds no bonds.

Secured commercial paper facility

The Bank continued to offer to purchase secured commercial paper (SCP) backed by underlying assets that are short term and provide credit to companies or consumers that support economic activity in the United Kingdom.⁽⁵⁾ No purchases were made during the review period.

(1) Further details are available at www.bankofengland.co.uk/markets/Pages/FLS/default.aspx.

(2) Further details are available at www.bankofengland.co.uk/markets/Pages/FLS/extensiondata.aspx.

(3) For more details on the gilt lending facility see the box 'Gilt lending facility' in the *Bank of England Quarterly Bulletin*, Vol. 50, No. 4, page 253; www.bankofengland.co.uk/publications/Documents/quarterlybulletin/mo10nov.pdf.

(4) More information can be found in the Market Notice at www.bankofengland.co.uk/markets/Documents/marketnotice130627.pdf.

(5) The SCP facility is described in more detail in the Market Notice available at www.bankofengland.co.uk/markets/Documents/marketnotice120801.pdf.

Report



Big data and central banks

By David Bholat of the Bank's Advanced Analytics Division.⁽¹⁾

1 Introduction

On 2 and 3 July 2014, the Bank of England hosted an event titled 'Big Data and Central Banks'. The event was organised by the Advanced Analytics and the Statistics and Regulatory Data Divisions, under the umbrella of the Bank's Centre for Central Banking Studies (CCBS). Its purpose was to discuss the IT estate, analytical techniques, governing arrangements, and strategic objectives central banks are developing around 'big data', that is, data sets that are granular, high frequency and/or non-numeric. Invited speakers from central banks and financial regulatory bodies addressed around 50 Bank staff and approximately 25 delegates from foreign central banks.⁽²⁾

The purpose of this report is to articulate the motivations for the event, key themes emerging from it, and explain why big data is likely to become of increasing importance to central banks in the years ahead. The report proceeds as follows. The first section explains how the event fits with other activities at the Bank aimed at expanding its data sources and enhancing its data analysis capabilities. Relevant related activities include a predecessor CCBS event, the creation of the Bank's Data Lab and Data Community, and, most significantly, the release of the Bank's Strategic Plan. The second section then summarises presentations made at the event. The event was held under Chatham House Rule meaning opinions are not attributed to identifiable speakers. So rather than recap each individual presentation, this report instead identifies major themes emerging across them. Among these themes are the benefits for central banks in having standardised granular data, the importance of legal considerations in enabling and constraining the scope of granular data collections, and the development of inductive analytical approaches to complement deductive approaches that traditionally have held sway in central banks. The report then concludes by speculating that big data might not only change how central banks operate, it also might be transforming how financial firms and other economic agents do business. To the extent that this transformation is occurring, it is important for central banks to understand how big data is changing the structure of the economy in ways that might impact monetary and financial stability, as well as economic growth and employment.

2 Background

One standard definition of big data is that it is data displaying one or more of the following characteristics:

- (1) These data are high volume, often because data are reported on a granular basis, that is, item-by-item, for example, loan-by-loan or security-by-security.⁽³⁾
- (2) These data are high velocity, because these data are frequently updated and, at the limit, collected and analysed in real time.
- (3) These data are qualitatively various, meaning they are either non-numeric, such as text or video, or they are extracted from novel sources, such as social media, internet search records or biometric sensors.

Judged by this definition, the Bank of England traditionally has not dealt much with big data. Data volume historically has been low because its primary sources have been summary financial statements and aggregate statistics compiled by the Bank's Statistics and Regulatory Data Division and the Office for National Statistics. Data velocity also has been slow because these statistics and financial statements are reported in the main at most on a quarterly frequency and revised with lags. And although the Bank does have a history of gathering qualitative data through surveys and interviews with external contacts, overall the variety of data has been minimal because most formal analysis undertaken in the Bank uses structured data sets, that is, numeric data stored in relational databases, ie row and column format.

(1) Views expressed are those of the author and do not necessarily reflect those of the Bank of England. The author wishes to thank Nat Benjamin, Evangelos Benos, David Bradnum, Chris Cai, Jason Cowan, Nick Davey, Liz Dixon Smith, John Finch, Joanne Fleming, Jeremy Franklin, Julie Gallagher, Hannah Garrett, David Gregory, Andy Haldane, Gill Hammond, Gary Hiller, Charlotte Hogg, Sujit Kapadia, Tom Khabaza, Perttu Korhonen, Chris Lovell, Emma Murphy, William Penwarden, Lyndsey Pereira-Brereton, Julia Rangasamy, Paul Robinson, Mark Robson, Pedro Santos, Nick Vaughan, Ged Walls and Steve Webber for their contributions in making the CCBS event and this report possible.

(2) Delegates included central bankers from Austria, Canada, Chile, Croatia, the Czech Republic, the European Central Bank (ECB), Germany, Ireland, Israel, Italy, Mexico, the Netherlands, Norway, Poland, Russia, Serbia, Sweden, Switzerland, Thailand and the United States.

(3) Often the number of observations in the data set comes close to covering the full population

More recently, however, the Bank has been one of the leading central banks when it comes to research using higher volume, higher velocity and qualitatively more various data sets. For example, McLaren and Shanbhogue (2011) used Google data as an indicator of UK labour and housing market conditions. Benos and Sagade (2012) used equity transaction data to understand the consequences of high-frequency trading on stock markets, while Benos, Wetherilt and Zikes (2013) used transactional trade repository data to investigate the structure and dynamics of the UK credit default swap market. And both Davey and Gray (2014) and Merrouche and Schanz (2009) used high-value, high-velocity payment systems data to analyse banks' intraday liquidity management.

The steady increase in research done by the Bank using big data in part reflects its greater availability. This is because the financial crisis of 2007–08 prompted a number of statutory and supervisory initiatives that require greater disclosure by financial firms of their data to central banks and regulators. These include the reporting of firms' large exposures on a counterparty-by-counterparty basis on Common Reporting (COREP) templates; security-by-security reporting of insurers' assets mandated by Solvency II scheduled to come into force in 2016; and the reporting of transactional derivatives data as required by European Market Infrastructure Regulation. Such granular data became more readily available to the Bank of England after it assumed supervisory and regulatory responsibilities last year with the establishment of the Prudential Regulation Authority.

Consequently the Bank hosted an event in 2013 titled 'The Future of Regulatory Data and Analytics'. Its focus was on how to best integrate the Bank's new supervisory and regulatory data collections with existing statistical compilations. Much of the discussion at the event centred on developing a new post-crisis data strategy for central banks, prefiguring the Bank's new Strategic Plan (Bank of England (2014)). Although the Strategic Plan has many facets, one of its major points of emphasis is data. This is particularly evident in the three strategic initiatives that fall under the 'Analytical Excellence' pillar. The 'One Bank Research Agenda' initiative commits the Bank to supplying new data sets to the public in order to crowd-source solutions to challenging policy questions.⁽¹⁾ The 'New Approach to Data and Analysis' initiative created an Advanced Analytics Division with the objective of establishing a centre of excellence for the analysis of big data. And the 'One Bank Data Architecture' initiative is to be overseen by the first Chief Data Officer in the Bank's history, with the goal of integrating data across the Bank, partly through the enforcement of metadata standards to ease information sharing.⁽²⁾

Since announcing these strategic initiatives, the Bank has made strides toward their achievement. Three milestones are worth highlighting. The first is the establishment of a

Data Lab. The Lab is a room in the Bank with computers that are uploaded with state-of-the-art IT tools. Bank employees who visit the Lab are supported by a small team of IT experts who help them store, manipulate, visualise and analyse granular and unstructured data. A second and related development is the formation of a new Bank-wide Data Community. The Data Community is a group that organises fora for staff about big data issues, including monthly seminars, a new Bank intranet site with information on novel ways staff can use data, and a Data Art Gallery event exhibiting examples of innovative approaches for visualising data. Finally a third key milestone was the convening of the 'Big Data and Central Banks' event. More information about that event follows in the next section.

3 CCBS event

An increasing number of events about big data are being organised at universities and by private sector bodies. But central banks bear a unique set of legal powers, media and legislative scrutiny, and public responsibilities that make their use of big data different from that in other kinds of organisations. Hence the focus for this year's CCBS event was on 'Big Data and Central Banks', with emphasis on the conjunction. Unlike other big data themed events, its focus was less on the cutting edge of what is possible with big data, and more on highlighting what is being done already by central banks and financial regulatory authorities.⁽³⁾ Big data was thus invoked in relative rather than absolute terms.

The event took place over two days. The first day consisted of three panels bookended by two speeches. The three panels examined in turn each of the three traits — volume, velocity and variety — associated with big data. Unlike many big data related events where only analytical results are presented, panellists were advised not to smooth over legal, technical or operational challenges they had encountered. Instead panellists were encouraged to highlight these challenges so other participants could learn from them. In advance of the event, panellists were sent a set of key questions intended to elicit presentations covering their big data projects end to end. These questions are reproduced in the appendix. They may be useful prompts for others thinking through the details of planning big data projects.

The second day was split in two. During the first half, participants were introduced to the topic of data mining. Data mining refers to a methodology, tools and set of algorithms used to detect patterns in data sets. Three families of algorithms were highlighted:

(1) www.bankofengland.co.uk/research/Pages/onebank/datasets.aspx.

(2) Bholat (2013) recaps the predecessor event.

(3) Compare with the ECB's recent workshop on using big data for forecasting and statistics: www.ecb.europa.eu/events/conferences/html/20140407_call_international_institute_of_forecasters.en.html.

- Classification algorithms such as decision trees and neural networks used to make predictions.
- Segmentation algorithms such as clustering methods used to find groups within data.
- Association algorithms used to analyse linkages between different attributes in data.

Following the data mining tutorial in the morning, the second half of the day started with another panel session. While the first three panels focused on one-off big data projects, or spotlighted unusually innovative areas of central banks using big data, the focus of the fourth panel was on delivering enterprise-wide change in the way data is managed and used across an entire central bank. As a corollary, the focus of this panel was less on how big data approaches can help central banks analyse their external environment, and more on how these approaches can help central banks improve the efficiency of their internal operations; for example, through smart document management systems that proactively push content to staff based on their past reading preferences. The key questions posed to speakers on this panel are also in the appendix.

Following the fourth panel, a moderated roundtable took place to give event participants the chance to reflect on lessons they had learned over the two days. The event then concluded with a speech made by one of the Bank's executives.

Granular data

One recurring theme raised during the event was the benefits to central banks in having access to granular data from financial firms. As noted earlier, central banks typically have collected aggregate data from firms using reporting returns structured like standard financial statements. These returns tend to translate end-user requirements literally. For example, an end-user might request data on firms' liquid assets, defining that term as deposits and government securities with original maturities less than one year. A regulatory return might then be sent to firms containing a field for reporting a single 'liquid assets' figure, as defined by the end-user. However, liquidity is a notoriously fluid concept. Assets that ordinarily might be sold with minimal loss to the seller may no longer be so under changed conditions; for example, if the credit profile of the issuer of the securities held by financial firms has changed. Furthermore, the definition of liquid assets can vary across analysts and central bank areas. For example, some end-users might conceive of shares held in money market funds as liquid assets, while others might not. To the extent that each conception of liquid assets gives rise to discrete data collections, multiple returns might have to be filed by financial firms, even though the data reported is highly repetitive except at the margin. Yet the duplication of reported data can

still leave data gaps since the aggregated nature of the figures precludes end-users from drilling down and asking more detailed questions as circumstances require. For example, if an end-user needs to assess whether government securities held by a firm are issued by the central government or municipal authorities. Circumstances might then require the costly *ad hoc* collection of this data from firms at short notice.

An alternative approach to multiple returns is to collect granular data once. A number of speakers at the CCBS event advocated this approach. A representative view was that different returns often specify varying consolidation bases, valuation methods, accounting conventions, definitions and report at different frequencies, making it difficult to stitch data together. When one speaker's country suffered a financial crisis, it was discovered that the aggregate data available to the central bank was incomplete and incompatible for pinpointing financial fragilities. This prompted the central bank to introduce exposure-by-exposure reporting. According to the speaker, such granular data now makes possible the coherent mapping of the banking system, enabling the central bank to better spot systemic risk and manage it with macroprudential policy.

The idea that analysing microdata makes it easier to discover macro-patterns might appear paradoxical at first glance. On the contrary, it might make intuitive sense to think that having more data would make it harder to identify the wood from the trees. To paraphrase information economist Herbert Simon, a wealth of information might create a poverty of attention, leading to worse decision-making (quoted in Haldane (2013)). However, a number of speakers noted that granular data becomes analytically tractable if overlaid with visual analytic tools. Instead of eyeballing millions of rows and columns of granular data, end-users are able to quickly picture the data at different units of analysis, drilling down to identify granular fault lines which might be otherwise concealed at an aggregate level.⁽¹⁾

The benefits in gaining access to granular data might not only accrue to central banks. They also may accrue to the financial firms central banks regulate. For instance, one central banker noted that by having access to the granular detail on loans pre-positioned by firms with central banks as collateral, this may result in reduced haircuts and thus cheaper emergency liquidity for firms because central banks can then better judge the quality of the underlying loans against which they are lending.

However, greater data granularity in itself is not a panacea. If granular data collections are introduced unevenly across a central bank and managed in end-user silos, then the organisation runs the risk of reproducing the inconsistencies

(1) Flood *et al* (2014) provides an overview of some of these tools.

and inefficiencies of the current approach of collecting aggregate data using multiple returns. According to one speaker, one way to prevent this from occurring is to harmonise and enforce common definitions of granular data attributes across the organisation. In loan-by-loan databases, common attributes include the original value of the loan, the currency in which it is denominated, its purpose, outstanding balance, original and residual maturity, the repayment schedule, the interest rate, the reference rate (if applicable), and information on financial firms' counterparties, such as the income of the obligor, their domiciled country, and credit rating.

Legal considerations

As the foregoing list of attributes indicates, existing granular data sets collected by some central banks tend to have good coverage of information on counterparties and contracted cash flows. However, one area where the scope of these collections could be extended is in capturing more detail on legal terms and conditions. Even apparently minor legal provisions can have major systemic consequences. Consider the recent Greek sovereign debt crisis. The absence of collective action clauses that would have permitted bondholders to write down Greece's outstanding debt with binding effect on credit minorities, coupled with the fact that most of the bond issues named Greek courts as arbitrators in case of dispute, are key factors explaining the ECB's decision to purchase Greek sovereign debt (Grant *et al* (2014)). More generally, key clauses in financial agreements which central banks may want to capture include provisions limiting personal liability, creditors' ranking in bankruptcy proceedings, breach of contract and default triggers, and protective covenants.⁽¹⁾

However, several speakers at the CCBS event observed that embracing big data did not necessarily require that central banks enlarge their data collections. For these speakers, the key task facing central banks is not getting more data. Rather they argued that it is doing more with the data central banks have already. One speaker cited payment systems data as a good example. Historically, these real-time data have been used to monitor operational risks. For example, by looking at the data, central banks might observe that a payment system is too reliant on a small number of settlement banks. The central bank might then address this excess concentration by inviting indirect participants accessing the payment system through these settlement banks to become direct participants (Finan, Lasosa and Sunderland (2013)). But this same data also can be useful for other purposes. For example, these data might be used to monitor the settlement behaviour of individual firms. Such information might provide a timelier indicator of firms' liquidity position than liquid assets figures submitted on regulatory returns. Payment systems data also might be linked with other data to achieve new insights. For example, payments data might be blended with loan-by-loan

mortgage origination data to identify shortfalls in mortgage repayments much sooner than those shortfalls are reported as arrears by firms in their quarterly financial disclosures.

Indeed, blending data gives central banks a 'third way' between the false dichotomy of either buying all their data from external parties or building all data-capture systems in-house. For example, one speaker presented an analysis of a country's housing market that blended different data sets — some proprietary, others open source, others still purchased from commercial vendors. The combined data set contained mortgage origination information blended with up-to-date information on property prices and obligors' credit scores from credit rating agencies. The speaker noted that the value of this combined data set was greater than the sum of its individual parts. At the same time, because each part had been collected by an organisation with a comparative advantage in its provision, the speaker claimed that the cost-benefit calculus had been optimised.

However, there are technical and legal obstacles to blending different data sets. The technical obstacle is that data are often stored in different formats so it can be laborious to transform them into a common technical type. The legal obstacle is that the use of data collected by central banks is sometimes restricted only to those purposes explicitly expressed in legislation. That might mean, for example, data collected for supervisory purposes may have restrictions on its use by monetary economists situated in a different part of the central bank, even though the data might be useful for secondary purposes. One speaker argued that these types of legal strictures should be relaxed if central banks are to achieve economies of scope when collecting data and so also reduce the regulatory reporting burden borne by financial firms. In a similar vein, another speaker felt more multilateral agreements were needed to allow greater cross-border sharing of data between regulators. The speaker noted that although their central bank has access to highly granular data on the domestic counterparty exposures of their banks, it does not have access to similarly detailed data on the exposures of these domestic banks to foreign counterparties.

New approach to data and analysis

If these types of technical and legal obstacles to sharing and blending data can be overcome, the resulting quantitative increase in data might add up to a qualitatively new approach for analysing the economic and financial system (Varian (2014)). In recent decades, the dominant analytical approach inside central banks has been deductive. A deductive approach starts from a general theory and then seeks particular data to evaluate it. Suppose an analyst starts

(1) An example of a protective covenant prohibiting certain behaviour is a negative pledge. A negative pledge prohibits an obligor from pledging specified assets to other creditors.

by positing an accounting identity that the product of the quantity of money (M) and its velocity (V) is equal to the product of the price level (P) and expenditures on goods and services in the economy (Q).⁽¹⁾ If the analyst further assumes that the velocity of money is stable, then an increase in money might be hypothesised to result in inflation.⁽²⁾ The analyst might then seek to test the validity of the theory using money and price data over a particular period of time.

An alternative research strategy is induction. An inductive approach starts from data and then seeks to generate theoretical explanation of it. Induction may mitigate confirmation bias, that is, the tendency to seek data which confirms *ex-ante* assumptions. For instance, one speaker at the event noted that many commentators have simply assumed that the recent wave of defaults in US sub-prime mortgages was caused when adjustable rate mortgages reset to a higher level. According to the speaker, however, careful analysis of granular mortgage data actually revealed that subprime mortgage defaults spiked before their initial, so-called 'teaser' rate expired.

Of course, deduction and induction are ideal types. In reality, explanatory approaches are always mixed.⁽³⁾ Nevertheless, the reason why a more self-consciously inductive approach was advocated by some event participants is that the recent crisis punctured many previously dominant deductive models which purported to explain how economies and financial systems work universally. So in the aftermath of the crisis, a space has emerged for a form of induction called abduction. In other words, inferring the best explanation for a particular puzzle given patterns in the data, without pretence to making generalisable theoretical claims. Hence why some commentators have read the new emphasis on big data as 'an epistemological change' for economics from 'a science based on the notion of the mean and standard deviation from the 'normal' to one based on individual particularity' (Taylor, Shroeder and Meyer (2014)).⁽⁴⁾

4 Conclusion

This report has summarised the Bank's recent 'Big Data and Central Banks' event and placed it within the context of the organisation's new strategic approach to data analysis. In brief, and to paraphrase one event participant, the new approach involves a shift in tack from analysing structured, aggregated sample data collected with a specific set of questions in mind, to analysing data that is more heterogeneous, granular and complete such that these data are fit for multiple purposes. Throughout the report, emphasis has been placed on the ways bigger and better data might enhance the Bank's analytical toolkit and improve its operational efficiency, with the end goal being to promote the good of the people of the United Kingdom by maintaining monetary and financial stability.

Viewed in isolation, central banks' increasing interest in big data might be viewed as a conjunctural phenomenon, that is, as a response to the recent financial crisis. However, viewed more broadly, it appears instead to reflect a more fundamental structural shift toward the exploitation of big data by other economic agents (Bholat (2013)). This broader embrace of big data has both supply and demand sources. On the supply side, increases in the volume, velocity and variety of data have been driven by technological advances that have increased storage capacity and processing power while lowering costs. And on the demand side, there is increasing interest from economic agents in understanding how analysis of their data might enhance productivity and profits (Bakhshi, Mateos-Garcia and Whitby (2014), Brown, Court and McGuire (2014) and Einav and Levin (2013)).

To date, big data tools and techniques have had less of an impact on financial services than they have had on other sectors of the economy such as the information and communications industry. However, the situation appears to be changing rapidly. Some of the largest and most established banks are now taking a fresh look at their customers' transactional data to tailor their customer offer and to enhance early detection of fraud (Davenport (2014)). At the same time, some of the new 'challenger' financial services providers are using innovative risk models that exploit novel sources of data like social media (King (2014)). Taken in sum, these developments may have a positive impact on financial stability over the long term if they improve the financial decisions made by firms and their counterparties. But there are also nearer-term risks if early adopters of big data significantly disrupt the business models and profitability of incumbent firms. The impact of big data on the wider economy may be similarly double-edged. While it might boost productivity and lower costs, it may also alter the productive structure of the real economy and wealth distribution in ways that are difficult to forecast and measure (Rifkin (2014)). Given the possible pace and depth of these changes, central banks likely will need to make further advances to 'nowcast' (Bell *et al* (2014)) the economy, building on existing initiatives to exploit timelier data on prices, employment and output.

In sum, big data is likely to become a topic of increasing interest to central banks in the years ahead. This is because it is likely to change both the internal operations of central banks, and transform the external economic and financial systems central banks analyse.

(1) The equation of exchange: $MV = PQ$.

(2) The quantity theory of money.

(3) For instance, the way data are measured and the metadata categories used to record them are laden with theoretical assumptions, and the causal interpretation of correlated data is always made with some priors in mind. For a different perspective and stronger argument for induction see Anderson (2008).

(4) Mullainathan (2014) provides concrete examples of inductive and abductive approaches to economic analysis.

Appendix

Key questions for first three panels

Background

- 1 Briefly describe the nature of the data, eg the number of observations and the attributes.
- 2 If relevant, how is metadata developed and maintained?
- 3 How frequently is the data received?
- 4 Who are the main users of the data?
- 5 Why was a big data approach more appropriate than a conventional data approach?
- 6 If applicable, what other information is blended with this data?

Processes and problems

- 7 What have been the main operational and/or analytical problems encountered?
- 8 How much has this big data project cost or saved the organisation?
- 9 Who can access this data and under what conditions?
- 10 How is data quality checked?
- 11 What procedures exist to deal with non-reporting or the misreporting of data?

Technology

- 12 How is the data stored?
- 13 How is the data secured?
- 14 What hardware and software is used?
- 15 How was the hardware and software chosen?

Analysis and results

- 16 What analytical techniques are used on the data?
- 17 If applicable, how is the data visualised?
- 18 Briefly describe some of the main analytical results from exploiting the data.
- 19 How has the data enabled better policy decisions?

Key questions for fourth panel

- 1 Why was a new approach to data required?
- 2 What criteria determine whether data is purchased or directly collected by the central bank?
- 3 How is data integrated across the organisation?
- 4 How have staff's skills been developed to deal with big data?
- 5 What strategies were used to get senior leadership buy-in around big data?
- 6 What data governance arrangements exist in the organisation?
- 7 What have been the main legal and security issues encountered?

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Summaries of working papers



Evaluating the robustness of UK term structure decompositions using linear regression methods

Summary of Working Paper No. 518 Sheheryar Malik and Andrew Meldrum

The term structure of interest rates on government bonds, commonly known as the 'yield curve', relates time to maturity to the average return, or yield, of a bond over its life. If investors were unconcerned about the risk of changes to interest rates over the investment period, the yield would equal the average expectation of the UK Monetary Policy Committee's short-term policy rate, Bank Rate, over the lifetime of the bond. This is because investors can choose between buying a long-term bond or investing in a series of short-term bonds and the expected returns on the two strategies must be equal to rule out the possibility of risk-free, or arbitrage, profits. This is sometimes known as the 'pure expectations hypothesis' of the yield curve. In practice, however, investors are risk-averse and demand a premium in the form of a higher expected return for investing in long-term bonds. This additional expected return is often known as the 'term premium'.

Both components of yields — expectations of future policy rates and term premia — contain useful information for policymakers. Expectations of future policy rates reflect investors' views about how the economy will evolve and how monetary policy will respond. Term premia can provide a guide to how uncertain investors are about the future and their attitudes towards that risk. Unfortunately, the two components cannot be observed separately and we need models of the yield curve in order to obtain a decomposition. That introduces uncertainty because we cannot be sure that we have a good model or that we have estimated the true parameter values for any given model.

The most commonly used vehicle for decomposing government bond yields over the last decade has been the 'Gaussian no-arbitrage affine term structure model' (ATSM). These make assumptions about the variables that affect yields, known as 'pricing factors', and how those factors behave over time. These pricing factors are often assumed to be principal components of bond yields. The models further impose theoretical restrictions on the yield curve to rule out the possibility that investors can make risk-free, or arbitrage, profits from investing in different maturity bonds. We first demonstrate that four (rather than the usual three) pricing factors are required to achieve a good fit to the yield curve and to match standard specification tests. This is consistent with recent studies of US data. Term premia turn out to be countercyclical — ie they are higher in relatively bad economic times — which is intuitive, since the compensation investors require for risk is likely to rise during those bad times. They are also increasing in the amount of uncertainty about future inflation. Again, this is intuitive, since investors are likely to require more compensation for risk if there is greater

uncertainty about the real value of the returns they will receive on bonds.

One problem is that we typically only have quite short samples of data with which to estimate how the factors in the model behave. This increases the possibility that we obtain biased or imprecise parameter estimates. We therefore explore the robustness of our decompositions. For example, our benchmark sample period starts in May 1997 to reduce the possibility of changes in the model parameters (associated with the granting of operational independence to the Bank of England at that time) causing biases in the estimates of term premia. Extending the sample back to October 1992, when inflation targeting was introduced, makes only a small difference to the estimated premia. But in longer samples the term premium estimates are typically lower, which is a result of the much higher average levels of policy interest rates over that sample: for a given bond yield today, if the model forecasts that the policy rate will revert back to a higher average level in future, then this must equate to a lower term premium.

We show that long-maturity term premium estimates are not materially affected if we apply standard statistical techniques for correcting for small sample bias in the parameter estimates, which suggests that such biases are not a substantial concern for our data set. Moreover, including additional macroeconomic variables as factors does not have a large impact on long-maturity premia. On the other hand, introducing information on expectations of future policy rates from surveys of professional economists (a common way of providing these models with more information about how interest rates behave over time) results in long-maturity term premium estimates that are significantly different from our benchmark model at times. However, there is evidence from standard tests that a model that includes surveys is misspecified; and the resulting estimates of term premia are no longer countercyclical or significantly related to the uncertainty about future inflation.

One drawback with ATSMs is that they do not impose non-zero nominal interest rates. When bond yields are substantially above zero, this does not matter, because the probability of negative rates implied by these models is very small. But when yields have been low, as in recent years, this may lead to misleading results. One popular recent approach has been to modify ATSMs so that the short rate is non-negative. Using one of the possible techniques for estimating such a model, we show that the impact of allowing for the zero lower bound on long-maturity term premia is likely to be fairly small, which is consistent with previous results for the United States.

Long-term unemployment and convexity in the Phillips curve

Summary of Working Paper No. 519 Bradley Speigner

The relationship between wage growth and unemployment is a key trade-off concerning monetary policy makers, as labour costs form a critical part of the inflationary transmission mechanism. One important question is how the composition of the unemployment pool, and specifically the share of long-term unemployment, affects that trade-off. Detachment from the labour force is likely to increase with unemployment duration, so that the long-term unemployed search less actively for jobs and therefore exert less downward pressure on wages. If so, short-term unemployment may pull down on wage inflation more than long-term unemployment does. In this situation, policymakers might anticipate a period of high wage growth if short-term unemployment starts to fall to low levels even if the long-term unemployment rate remains elevated.

But there may be complications arising from the integral dynamics of unemployment. In this paper it emerges that the estimated disinflationary effects of long-term unemployment hinge on whether or not wage growth becomes less sensitive to unemployment as the latter rises — a form of non-linearity. One reason why the negative relationship between wages and unemployment might become flatter at high levels of unemployment is that workers may tend to resist cuts in their nominal wages. When unemployment is low, wage growth tends to be high as firms compete for a scarce pool of resources. But due to worker resistance to wage cuts the reverse might not hold to the same extent, with a relatively large increase in unemployment needed to reduce wage growth during a recession.

Why does this non-linearity matter for the measured effect of long-term unemployment on wage growth? It is because long-term unemployment inevitably lags behind movements in short-term unemployment as it takes time for the new unemployed to move into the long-term category. So high

levels of long-term unemployed are only associated with lengthy periods of high unemployment. A flattening off of the relationship between wages and unemployment at high levels of unemployment would then imply that long-term unemployment does little to reduce wage inflation further. The apparently different effects of short and long-term unemployment on wage inflation could therefore be merely as a result of timing rather than labour market detachment among the long-term unemployed.

By modifying statistical models of labour market dynamics to incorporate this insight, this paper finds that there appears to be much less difference between the short and long-term unemployed in terms of their marginal influence on wage behaviour than is suggested by the recent literature. When the non-linearity described above is not taken into account, estimation results corroborate the finding already established in the literature that it is predominantly the short-term unemployed that matter for wage inflation. Long-term unemployment in this specification tends to have no statistically significant effect on wage inflation. When the non-linearity is taken into account, long-term unemployment has a much larger effect on wage inflation. For some of the specifications considered, the data fail to reject the hypothesis that short and long-term unemployment rates have equal effects on inflation. In some instances, the models even suggest that long-term unemployment creates more of a drag on wage growth than short-term unemployment does, all else equal. Statistical uncertainty makes it difficult to draw a very precise conclusion, but the results in this paper caution against excluding long-term unemployment from estimates of aggregate labour market slack as is suggested by much of the recent literature. Both the short-term unemployment rate and the long-term unemployment rate are likely to contain useful information for judging the degree of wage pressure in the economy.

A forecast evaluation of expected equity return measures

Summary of Working Paper No. 520 Michael Chin and Christopher Polk

Central banks pay close attention to movements in equity prices, as they can have important implications for the real economy. For example, increases in equity prices may increase the value of individuals' investments and pensions, and can lower firms' cost of financing new projects, and these effects can lead to increases in aggregate consumption and investment. Understanding why equity prices have changed is also important. An investor who holds a firm's equity is entitled to a share of the profits that the firm generates in the immediate and distant future. In theory, this investor is therefore willing to pay a price for that equity that reflects expectations of these future cash flows (which are often dividend payments). At the same time, however, the equity price will not exactly equal the total expected future sum of dividends, since in general investors dislike having to wait for dividend payments, and also need to be compensated for the possibility that dividends rise and fall depending on the future state of the economy. As a result, when evaluating the price of an equity, investors discount expected dividends by an additional amount reflecting the return on a safe asset and a premium for risk, which is the expected return.

At the aggregate level, expected returns are important equity market indicators, as they summarise the attitudes toward risk of a range of investors. But they cannot be observed directly, and one needs a model to estimate them. In theory, these expected return estimates should be able to forecast actual future returns on the stock market to an extent. Academics and practitioners have devoted substantial effort to testing whether equity returns are indeed predictable, often using variables such as dividend-price and price-earnings ratios. Successes in this area have, in general, been attributed to the ability of a forecasting measure to capture expected returns. Put another way, the better the measure of expected return, the better that estimate should be at forecasting future returns.

Our paper focuses on two competing measures of expected returns, and examines their ability to forecast returns on the equity market. The first is estimated using Campbell's 1991

vector autoregression (VAR) model, a simple statistical model that describes the relationship between short-term returns and a range of other variables. These short-term dynamics can be used to make predictions about returns over longer horizons, and we use these as one measure of expected returns. The second measure is estimated using an adaptation of Gordon's 1962 dividend discount model (DDM). This approach directly models investor dividend expectations using analyst survey measures, and then solves for the expected return as the difference between these expectations and the equity price. We examine the ability of these measures to forecast future returns in a range of tests. In addition to the two models, we also consider a selection of popular variables used to forecast returns, and ask whether the expected return estimates forecast better compared to these predictors.

We use UK and US data to examine the forecasting performance of the range of variables over short and long forecast horizons (from three months to three years). We initially consider each forecasting variable individually, and run thorough statistical tests of their predictive power. Here, we find that the DDM and VAR expected return measures perform well, whereas the more traditional predictors do not. In a related test, we compare the relative accuracy of the expected return measures to the traditional predictors, and find that the former generate much smaller errors when predicting returns. Finally, we consider how these predictors would have done in 'real time', where we imagine we had to generate forecasts on a month-by-month basis using only information available to us at the time of making each forecast. Previous work has found that forecasting performance is often very weak under these test conditions. In fact, in many cases, it has been shown that one can achieve better forecast performance by simply using the past average return on the market to predict its future direction. In contrast, we show that our expected returns estimates perform better compared to this simple rule, in particular when forecasting returns at longer horizons, which is strong evidence in favour of the approaches we consider.

Do contractionary monetary policy shocks expand shadow banking?

Summary of Working Paper No. 521 Benjamin Nelson, Gabor Pinter and Konstantinos Theodoridis

Was monetary policy an important driver of financial intermediaries' balance sheet dynamics in the run-up to the global financial crisis? Should monetary policy have been 'leaning against the wind' of the rapid build-up in financial sector leverage that preceded the crisis — including that in the shadow banking sector? A popular narrative is that low US interest rates post-2001 fuelled leverage growth and prepared the ground for the global calamity of 2007–08. And as a result, it is argued, monetary policy should have been tighter, particularly because its effects extend beyond the reach of more targeted regulatory tools, 'getting in all the cracks'.

This paper contributes to the literature related to this debate in two ways. First, we document evidence pertaining to the effects of monetary policy surprises on the balance sheet growth of financial intermediaries, distinguishing their effects on commercial banks from those on entities in the shadow banking sector. Using vector autoregressive models (statistical models consisting of a set of dynamic linear regressions) we find that the contribution of monetary policy shocks on asset growth in the financial sector as a whole has been small. Less than 10% of the variation in the quarterly asset growth of US commercial and shadow banks over the period 1966–2007 was accounted for by monetary surprises. In the period since 2001, unexpectedly loose monetary policy contributed little to the balance sheet expansion of US financial intermediaries.

Second, in line with intuition, we find that surprise monetary contractions tended to reduce the asset growth of commercial banks. But in contrast to the conventional view, we find that surprise monetary contractions tended to expand shadow bank asset growth, rather than reduce it. We find this 'waterbed effect' to be robust across a number of model

specifications and assumptions regarding the identification of monetary policy shocks. And using our estimated shock series, we find corroborative evidence that securitisation activity tends to rise following monetary contractions. We shed light on this empirical finding by extending a standard monetary dynamic stochastic general equilibrium model (a structural economic model that derives a dynamic system of equations from microeconomic optimisation theory) to include a commercial and a shadow banking sector. The model can replicate the waterbed effect we find in the data.

Taken together, these findings highlight potential challenges associated with using monetary policy to lean against financial sector activity in pursuit of financial stability goals. First, the size of the monetary policy response needed to curtail rapid commercial bank asset growth would be large relative to the non-systematic component of US policy rates observed in the past. Second, the tendency for there to be leakages through securitisation activity casts doubt on the idea that monetary policy can usefully 'get in all the cracks' of the financial sector in a uniform way. Our results suggest that the sign of the monetary response needed to lean against financial sector leverage varies with the component of the financial sector in question.

Instead, both points tend to reinforce the case made elsewhere for the development of regulatory tools that address the build-up of leverage in the regulated sector more directly than monetary policy does, and which extend oversight to the parts of the shadow banking sector that are most prone to excessive risk-taking. That would leave monetary policy to retain its relative focus on addressing the consequences of nominal rigidities in goods and labour markets.

Global liquidity, house prices and the macroeconomy: evidence from advanced and emerging economies

Summary of Working Paper No. 522 Ambrogio Cesa-Bianchi, Luis F Céspedes and Alessandro Rebucci

In this paper, we compare house price behaviour in advanced and emerging market economies using a new and comprehensive quarterly data set that we assembled for this purpose. Covering 33 emerging and 24 advanced economies from 1990 to 2012, this allows us to compare the time-series properties of house prices as well as their relation with a small set of macroeconomic and financial variables.

We first document a new set of stylised facts for emerging markets, showing that house price inflation tends to behave like consumption growth, which like housing services is largely non-tradable internationally. By comparison, equity prices behave more like GDP, which has a much larger tradable component. We show that in emerging markets house price inflation is higher, more volatile, less persistent and less synchronised across countries than in advanced economies. We also show that house price inflation is more correlated with capital flows in emerging markets.

Led by this latter fact, we then build an empirical model of house prices and capital flows in which we can identify an exogenous change to a specific component of total flows, namely 'global liquidity'. Global liquidity, which we interpret in a broad sense as the international supply of credit, was a quantitatively sizable portion of total cross-border flows in the run up to the global financial crisis and it remains closely associated with debt flows and international financial conditions more generally.

The estimation results show that an exogenous surge in global liquidity (ie, a global liquidity shock) affects house prices, consumption, and the current account in emerging economies

much more than in advanced economies. These effects are also associated with a weaker interest rate and exchange rate response in emerging markets.

In an attempt to interpret our empirical findings, we then explore two channels of transmission of the global liquidity shock that may be associated with financial frictions, namely the housing and the exchange rate channels.

To accomplish this, we re-estimate the effect of the same global liquidity shock holding either house prices or the exchange rate constant in the model. When we hold house prices constant, in the case of advanced economies, the main difference between the baseline and the counterfactual is the smaller response of consumption. In the case of emerging economies, by contrast, the main difference is the smaller response of the exchange rate and the current account. In addition, when we close the exchange rate channel, we find that house prices become more stable in emerging markets, while they become more volatile in advanced economies.

We interpret this evidence as suggesting that house prices amplify the response to global liquidity shocks in both advanced and emerging economies, but through different mechanisms. In advanced economies, arguably by boosting the value of housing collateral and hence supporting more household borrowing as predicted by housing models with domestic borrowing constraints; in emerging markets, by generating a lower default risk and a more appreciated exchange rate that support the international borrowing capacity of the economy.

Interactions among high-frequency traders

Summary of Working Paper No. 523 Evangelos Benos, James Brugler, Erik Hjalmarsson and Filip Zikes

High-frequency trading (HFT), where automated computer traders interact at lightning-fast speed with electronic trading platforms, has become an important feature of many modern financial markets. The rapid growth, and increased prominence, of these ultrafast traders have given rise to concerns regarding their impact on market quality and market stability. These concerns have been fuelled by instances of severe and short-lived market crashes such as the 6 May 2010 'Flash Crash' in the US markets. One concern about HFT is that owing to the high rate at which HFT firms submit orders and execute trades, the algorithms they use could interact with each other in unpredictable ways and, in particular, in ways that could momentarily cause price pressure and price dislocations in financial markets.

Using unique transactional data that allows us to identify the activity of HFT firms present in the UK equity market, we examine if their activity is indeed correlated and what this means for market quality. We focus our analysis on the ten largest HFT firms, which account for the bulk of the stand-alone HFT firm activity in our sample. In doing so we compare their activity with that of the ten largest investment banks present in our sample.

We estimate a dynamic regression model of order flow, by HFT firms and investment banks, in individual stocks as well as across different stocks. Order flow is defined as the net aggressive buying volume over a given time interval. In other words, it is the difference between the number of shares bought and sold via orders that are executed immediately at the best available price. The estimation is done using data sampled at a ten-second frequency in order to capture any short-lived interactions across HFT firms.

We find that HFT order flow is more correlated over time than that of the investment banks, both within and across stocks. This means that HFT firms tend more than their peer investment banks to buy or sell aggressively the same stock at the same time. Also, a typical HFT firm tends to simultaneously aggressively buy and sell multiple stocks at

the same time to a larger extent than a typical investment bank.

What does that mean for market quality? A key element of a well-functioning market is price efficiency; this characterises the extent to which asset prices reflect fundamental values. Dislocations of market prices are clear violations of price efficiency as they happen in the absence of any news about fundamental values.

To assess the impact of correlated trading by HFT firms on price efficiency, we first construct a metric that captures the extent of correlated trading within a day by HFT firms and investment banks. We then run regressions of stock returns on contemporaneous and lagged order flow by HFT firms and investment banks. If order flow has a longer-lasting (ie 'permanent') price impact, then this is indicative of informed trading; for if the trade had no information content, its price impact would be temporary as the induced price change would not be justified by any changes in fundamentals and market participants would force the price back to its original value. The key question is then if our metric of correlated trading is associated with a permanent or temporary price impact.

We find that instances of correlated trading by HFT firms are associated with a permanent price impact whereas correlated trading by investment banks is associated with only a temporary price impact. We interpret this as evidence that HFT correlated trading is information-based; in other words, HFT firms appear to be reacting simultaneously and quickly to new information as it arrives at the market place, which makes prices more efficient. This suggests that correlated trading by HFT firms does not appear to contribute to undue price pressure and price dislocations on a systematic basis in the UK equity market. Of course, this does not mean that HFT activity may never cause or exacerbate any price dislocations either in the equity or other markets. To assess that, additional research with more data, covering periods of market stress, would be necessary.

On a tight leash: does bank organisational structure matter for macroprudential spillovers?

Summary of Working Paper No. 524 Piotr Danisewicz, Dennis Reinhardt and Rhiannon Sowerbutts

Do multinational banks' branches reduce their lending in foreign markets more than subsidiaries in response to changes in the regulatory environment in their domestic markets? And if so, how strong is this effect and how long does it last? To answer these questions, we use a novel data set on changes in the intensity of macroprudential regulation in approximately 70 countries. Our analysis focuses on the effect of tightening of capital requirements, lending standards and reserve requirements on foreign banks' lending to bank and non-bank borrowers in the United Kingdom.

This work relates to a number of strands in existing research: how multinational banks transmit financial shocks to their balance sheets across country borders; how differences between banks — such as being geographically distant, poorly capitalised, or a branch versus a subsidiary — affects how these spillovers occur; and also the cross-border spillovers of regulatory changes via multinational banks' operations.

This paper's main contribution is that we explore how the change in lending by foreign banks in the United Kingdom in response to regulatory changes in their home countries depends on whether the lending is done via a branch or a subsidiary. Why would the change in lending differ depending on the organisational form of foreign banks? We argue that it does so because of the legal distinction between branches and subsidiaries. Under the branch structure foreign affiliates constitute an inseparable part of the parent organisation. This structure allows for cheaper and more flexible transfer of funds between the parent and its foreign entity. Subsidiaries on the contrary are considered as stand-alone institutions, with their own board of directors that are separately capitalised and are subject to the host country regulations.

More importantly, the organisational form of foreign affiliate also determines the degree of control which the parent organisation has over its foreign affiliate. Branches form an integral part of the parent bank, but in contrast subsidiaries'

business decisions need to be verified and approved by their own board of directors. As a result it should be easier for the parent to control a branch than a subsidiary. It therefore seems reasonable to expect that in the case of a capital requirement tightening, the parent bank might find it easier and swifter to reduce lending provided by its foreign branches than lending provided by subsidiaries.

Providing compelling evidence that the magnitude of the cross-border regulatory spillovers varies with the organisational structure of foreign banks' affiliates requires addressing several challenges. One needs to control for all factors that might affect parent banks' lending decisions. But this is made difficult by the fact that many of these aspects, such as the strength of home bias, are difficult to observe and quantify. We overcome this problem by using an identification strategy that focuses on UK lending provided by branches and subsidiaries which belong to the same banking group. In other words, we limit our sample to foreign affiliates of multinational banks that operate at least one branch and one subsidiary in the United Kingdom.

The United Kingdom is an ideal country to examine our hypothesis as there are more than 150 branches and approximately 100 subsidiaries of multinational banks operating in the country and, in addition, there a number of banking groups operating under both organisational structures.

Using this strategy we find that an increase in capital requirements at home causes foreign branches to reduce their lending growth to other banks operating in the United Kingdom by 6.3 percentage points more than foreign subsidiaries. However, a tightening in lending standards and reserve requirements does *not* affect lending of branches and subsidiaries differently. Additionally, we find that none of the macroprudential regulations in our sample causes differences in the provision of lending to non-bank borrowers.

Filtered historical simulation Value-at-Risk models and their competitors

Summary of Working Paper No. 525 Pedro Gurrola-Perez and David Murphy

One of the standard approaches for measuring the risk of portfolios of financial instruments is a family of models collectively known as Value-at-Risk or 'VaR'. The most commonly used of the first generation of VaR models provide an unconditional risk measure, while later refinements estimated risk conditional on more recent market conditions. These second-generation *filtered historical simulation* or 'FHS' models are the subject of this paper.

We begin by briefly setting out the historical development of VaR models and their use in financial risk measurement. We discuss the FHS approach in detail, showing how a new returns series is constructed in two steps: the first 'devolatilising' returns by dividing by an estimate of volatility on the day of the return; the second 'revolatilising' them by multiplying by an estimate of volatility on the day of the VaR measure. The performance of two models in the FHS family with different devolatilising methods is illustrated. This shows in particular how filtering modifies various properties of the return distribution such as its unconditional volatility, skewness, kurtosis and autocorrelation. Filtering two return series separately also changes their correlation, as we illustrate. This in turn has consequences for portfolio risk measures, and hence its effects need to be understood by model users and model designers.

We present two ideas of risk measurement: one as a search for a particular risk measure, such as the 99th percentile of the return distribution; the other as a search for a convincing account of the returns-generating process which happens, as a side-product, to provide a variety of risk measures. This leads us to discuss the process for testing (and perhaps rejecting) a risk measure based on its performance both in backtesting and in capturing other features of the time series of returns.

A related issue is the calibration of risk models in general and FHS models in particular. We discuss some criteria for finding an optimal calibration, and the necessity of ensuring that models do not drift away from an acceptable calibration over time.

FHS models typically aim to react faster to changes in market conditions than first-generation VaR models. A natural consequence of this reactivity is that if these models are used to calculate initial margin requirements (for instance at a central counterparty or by a party in the bilateral over the counter derivatives market), they place an increased liquidity burden on market participants. We analyse this *procyclicality* and illustrate the importance of calibration in this context.

The paper concludes with a discussion of various extensions to the FHS paradigm and some of the implications of this work for the application of FHS models in risk management.

A joint affine model of commodity futures and US Treasury yields

Summary of Working Paper No. 526 Michael Chin and Zhuoshi Liu

Commodity price fluctuations can have a significant effect on inflation, and as a result central banks are interested in where commodity prices currently are, and in where they might go in the future. It is possible to obtain commodity price forecasts from financial markets, where prices of commodity 'futures' contracts — agreements to buy or sell a commodity at a future date — reflect market participants' forecasts of commodity prices at various points in the future. Central banks often use these futures prices directly in forecasting commodity prices. Unfortunately, however, previous work has found that futures prices do not accurately predict future commodity prices. In a sense, this result is not too surprising, as in theory there are factors other than expectations of future commodity prices that can determine the prices of futures contracts. In particular, investors may require additional compensation or a 'risk premium' for the uncertainty around future prices, and prices of futures contracts will reflect this. We can think of a futures price as being made up of two components, the expected future price and the risk premium. These components cannot be observed separately.

In this paper, we develop an econometric model to estimate the expected future price and risk premium components embedded in futures prices. Specifically, we jointly model the US yield curve (ie the interest rates on US government bonds of different maturities), and the futures prices of two commodities: oil and gold, respectively. Until recently, models of interest rate and commodity markets have mostly been developed in isolation, and this separation may have been increasingly unjustified over time, as over the past decade or so, financial institutions have become more involved in commodity markets while maintaining a significant presence in interest rate markets. An attractive feature of our framework is that it allows for the potential interactions between these markets, that may result from this 'financialisation' of commodity markets. We statistically test whether it is better to model these markets in isolation, or whether one should indeed allow for the markets to interact, and find evidence strongly in favour of a joint model of interest rates and commodities.

Within our model, 'no-arbitrage' relationships are enforced, meaning there are no risk-free profits that can be made in the bond and futures markets. The advantage of using this assumption is that it allows us to identify the risk premium and forecast components of futures prices in a robust theoretical framework. We find that there is a significant difference between the risk premium in oil futures and the premium in gold futures. On average, the risk premium is negative for oil contracts, while it

is positive for gold. This suggests, as one might expect, that over time oil and gold have been perceived rather differently in financial markets. While the oil risk premium is negative over large parts of the period covered by our data, it follows an upward trend during the 2000s and recently turns positive. This behaviour could reflect the changing nature of the oil market over time, where the relative importance of demand and supply factors may have changed. In general, positive demand shocks are more likely to be associated with oil price increases, whereas negative supply shocks can imply oil price increases that put downward pressure on economic growth. To the extent that there have been large supply shocks in the oil market, an investor might actually have benefited from holding oil, since the value of their holding would have increased in difficult times. Since investors prefer to hold assets that pay off in situations when their income is low (for example, a recession), they are willing to pay a premium for this type of asset, and this would imply a negative risk premium. Previous evidence suggests that supply influences on the price of oil were more important in the past, though have diminished over time, where demand shocks have been more prominent recently. This is consistent with the value of holdings co-varying positively with the economic cycle in more recent times, and with market participants requiring a positive risk premium as a result. We estimate that the gold premium is mostly positive, indicating that in general investors require additional compensation for holding gold relative to US government bonds. This suggests that gold holdings are not perceived as providing better protection against economic downturns relative to US government bonds, where the value of gold generally falls in bad states of the world. This contrasts with the common portrayal of gold as an asset that offers a high level of protection against bad states of the world.

According to our estimates, the risk premium components of oil and gold futures prices can be relatively large. The importance of this component does appear to change over time, however, and this suggests that there are periods when futures prices may be a better forecast measure, and other times when they are not so reliable. Within our paper, we explore the behaviour of the premia further; by examining how risk premia change depending on different states of the economy, and under different financial market conditions. We find that risk premia vary depending on the level of economic activity and inflation. We also find that both oil and gold risk premia depend on the types of market participants holding futures contracts, where the balance of participants hedging risks, and speculating on commodity price movements, explains movements in premia over time.

Appendices



Contents of recent Quarterly Bulletins

The articles that have been published recently in the *Quarterly Bulletin* are listed below. Articles from December 1960 to Winter 2004 are available on the Bank's website at:

www.bankofengland.co.uk/archive/Pages/digitalcontent/historicpubs/quarterlybulletins.aspx.

Articles from Spring 2005 onwards are available at:

www.bankofengland.co.uk/publications/Pages/quarterlybulletin/default.aspx.

Articles

2011 Q1

- Understanding the recent weakness in broad money growth
- Understanding labour force participation in the United Kingdom
- Global imbalances: the perspective of the Bank of England
- China's changing growth pattern
- Monetary Policy Roundtable

2011 Q2

- Assessing the risk to inflation from inflation expectations
- International evidence on inflation expectations during Sustained Off-Target Inflation episodes
- Public attitudes to monetary policy and satisfaction with the Bank
- The use of foreign exchange markets by non-banks
- Housing equity withdrawal since the financial crisis
- Using internet search data as economic indicators
- A review of the work of the London Foreign Exchange Joint Standing Committee in 2010

2011 Q3

- The United Kingdom's quantitative easing policy: design, operation and impact
- Bank resolution and safeguarding the creditors left behind
- Developments in the global securities lending market
- Measuring financial sector output and its contribution to UK GDP
- The Money Market Liaison Group Sterling Money Market Survey
- Monetary Policy Roundtable

2011 Q4

- Understanding recent developments in UK external trade
- The financial position of British households: evidence from the 2011 NMG Consulting survey
- Going public: UK companies' use of capital markets
- Trading models and liquidity provision in OTC derivatives markets

2012 Q1

- What might be driving the need to rebalance in the United Kingdom?
- Agents' Special Surveys since the start of the financial crisis
- What can the oil futures curve tell us about the outlook for oil prices?
- Quantitative easing and other unconventional monetary policies: Bank of England conference summary
- The Bank of England's Special Liquidity Scheme
- Monetary Policy Roundtable

2012 Q2

- How has the risk to inflation from inflation expectations evolved?
- Public attitudes to monetary policy and satisfaction with the Bank
- Using changes in auction maturity sectors to help identify the impact of QE on gilt yields
- UK labour productivity since the onset of the crisis — an international and historical perspective
- Considering the continuity of payments for customers in a bank's recovery or resolution
- A review of the work of the London Foreign Exchange Joint Standing Committee in 2011

2012 Q3

- RAMSI: a top-down stress-testing model developed at the Bank of England
- What accounts for the fall in UK ten-year government bond yields?
- Option-implied probability distributions for future inflation
- The Bank of England's Real-Time Gross Settlement infrastructure
- The distributional effects of asset purchases
- Monetary Policy Roundtable

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- The Funding for Lending Scheme
- What can the money data tell us about the impact of QE?
- Influences on household spending: evidence from the 2012 NMG Consulting survey
- The role of designated market makers in the new trading landscape
- The Prudential Regulation Authority

2013 Q1

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- The profile of cash transfers between the Asset Purchase Facility and Her Majesty's Treasury
- Private equity and financial stability
- Commercial property and financial stability

- The Agents' company visit scores
- The Bank of England *Bank Liabilities Survey*
- Monetary Policy Roundtable

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- Public attitudes to monetary policy
- Cross-border bank credit and global financial stability
- The Old Lady of Threadneedle Street
- Central counterparties: what are they, why do they matter and how does the Bank supervise them?
- A review of the work of the London Foreign Exchange Joint Standing Committee in 2012

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- Macroprudential policy at the Bank of England
- Bank capital and liquidity
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- Recent developments in the sterling overnight money market
- Nowcasting world GDP and trade using global indicators
- The Natural Rate Hypothesis: an idea past its sell-by date
- Monetary Policy Roundtable

2013 Q4

- SME forbearance and its implications for monetary and financial stability
- Bringing down the Great Wall? Global implications of capital account liberalisation in China
- Banknotes, local currencies and central bank objectives
- Banks' disclosure and financial stability
- Understanding the MPC's forecast performance since mid-2010
- The financial position of British households: evidence from the 2013 NMG Consulting survey
- What can company data tell us about financing and investment decisions?
- Tiering in CHAPS
- The foreign exchange and over-the-counter interest rate derivatives market in the United Kingdom
- Qualitative easing: a new tool for the stabilisation of financial markets

2014 Q1

- Money in the modern economy: an introduction
- Money creation in the modern economy
- The Court of the Bank of England
- Dealing with a banking crisis: what lessons can be learned from Japan's experience?
- The role of business model analysis in the supervision of insurers
- Nowcasting UK GDP growth

- Curiosities from the vaults: a Bank miscellany
- Monetary Policy Roundtable

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- Credit spreads: capturing credit conditions facing households and firms
- Assessing the risk to inflation from inflation expectations
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- How have world shocks affected the UK economy?
- How has the Liquidity Saving Mechanism reduced banks' intraday liquidity costs in CHAPS?
- Risk managing loan collateral at the Bank of England
- Sterling Monetary Framework Annual Report 2013–14
- A review of the work of the London Foreign Exchange Joint Standing Committee in 2013

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- The economics of digital currencies
- How might macroprudential capital policy affect credit conditions?
- Household debt and spending
- Enhancing the resilience of the Bank of England's Real-Time Gross Settlement infrastructure
- Conference on Monetary and Financial Law
- Monetary Policy Roundtable
- Changes to the Bank's weekly reporting regime

2014 Q4

- Bank funding costs: what are they, what determines them and why do they matter?
- Why is the UK banking system so big and is that a problem?
- The interaction of the FPC and the MPC
- The Bank of England's approach to resolving failed institutions
- The potential impact of higher interest rates on the household sector: evidence from the 2014 NMG Consulting survey

2015 Q1

- Investment banking: linkages to the real economy and the financial system
- Desperate adventurers and men of straw: the failure of City of Glasgow Bank and its enduring impact on the UK banking system
- Capital in the 21st century
- The Agencies and 'One Bank'
- Self-employment: what can we learn from recent developments?
- Flora and fauna at the Bank of England
- Big data and central banks

Bank of England publications

The Bank of England publishes information on all aspects of its work in many formats. Listed below are some of the main Bank of England publications. For a full list, please refer to our website:

www.bankofengland.co.uk/publications/Pages/default.aspx.

Working papers

An up-to-date list of working papers is maintained on the Bank of England's website at:

www.bankofengland.co.uk/research/Pages/workingpapers/default.aspx

where abstracts of all papers may be found. Papers published since January 1997 are available in full, in portable document format (PDF).

No. 515 The Bank of England *Credit Conditions Survey* (November 2014)
Venetia Bell and Alice Pugh

No. 516 Mapping the UK interbank system (November 2014)
Sam Langfield, Zijun Liu and Tomohiro Ota

No. 517 Optimal contracts, aggregate risk and the financial accelerator (November 2014)
Timothy S Fuerst, Charles T Carlstrom and Matthias Paustian

No. 518 Evaluating the robustness of UK term structure decompositions using linear regression methods (December 2014)
Sheheryar Malik and Andrew Meldrum

No. 519 Long-term unemployment and convexity in the Phillips curve (December 2014)
Bradley Speigner

No. 520 A forecast evaluation of expected equity return measures (January 2015)
Michael Chin and Christopher Polk

No. 521 Do contractionary monetary policy shocks expand shadow banking? (January 2015)
Benjamin Nelson, Gabor Pinter and Konstantinos Theodoridis

No. 522 Global liquidity, house prices and the macroeconomy: evidence from advanced and emerging economies (January 2015)
Ambrogio Cesa-Bianchi, Luis F Cespedes and Alessandro Rebucci

No. 523 Interactions among high-frequency traders (February 2015)
Evangelos Benos, James Brugler, Erik Hjalmarsson and Filip Zikes

No. 524 On a tight leash: does bank organisational structure matter for macroprudential spillovers? (February 2015)
Piotr Danisewicz, Dennis Reinhardt and Rhiannon Sowerbutts

No. 525 Filtered historical simulation Value-at-Risk models and their competitors (March 2015)
Pedro Gurrola-Perez and David Murphy

No. 526 A joint affine model of commodity futures and US Treasury yields (March 2015)
Michael Chin and Zhuoshi Liu

External MPC Unit discussion papers

The MPC Unit discussion paper series reports on research carried out by, or under supervision of, the external members of the Monetary Policy Committee. Papers are available from the Bank's website at:

www.bankofengland.co.uk/research/Pages/externalmpcpapers/default.aspx.

The following papers have been published recently:

No. 41 The relevance or otherwise of the central bank's balance sheet (January 2014)
David Miles and Jochen Schanz

No. 42 What are the macroeconomic effects of asset purchases? (April 2014)
Martin Weale and Tomasz Wieladek

Monetary and Financial Statistics

Monetary and Financial Statistics (Bankstats) contains detailed information on money and lending, monetary and financial institutions' balance sheets, banks' income and expenditure, analyses of bank deposits and lending, external business of banks, public sector debt, money markets, issues of securities, financial derivatives, interest and exchange rates, explanatory notes to tables and occasional related articles.

Bankstats is published on a monthly basis, free of charge, on the Bank's website at:

www.bankofengland.co.uk/statistics/Pages/bankstats/default.aspx.

Further details are available from the Statistics and Regulatory Data Division, Bank of England: telephone 020 7601 5432; email srdd_editor@bankofengland.co.uk.

Articles that have been published in recent issues of *Monetary and Financial Statistics* can also be found on the Bank's website at:

www.bankofengland.co.uk/statistics/Pages/ms/articles.aspx.

Financial Stability Report

The *Financial Stability Report* is published twice a year under the guidance of the Financial Policy Committee (FPC). It covers the Committee's assessment of the outlook for the stability and resilience of the financial sector at the time of preparation of the *Report*, and the policy actions it advises to reduce and mitigate risks to stability. The Bank of England intends this publication to be read by those who are responsible for, or have interest in, maintaining and promoting financial stability at a national or international level. It is of especial interest to policymakers in the United Kingdom and abroad; international financial institutions; academics; journalists; market infrastructure providers; and financial market participants. The *Financial Stability Report* is available at:

www.bankofengland.co.uk/publications/Pages/fsr/default.aspx.

Handbooks in central banking

The series of *Handbooks in central banking* provide concise, balanced and accessible overviews of key central banking topics. The *Handbooks* have been developed from study materials, research and training carried out by the Bank's Centre for Central Banking Studies (CCBS). The *Handbooks* are therefore targeted primarily at central bankers, but are likely to be of interest to all those interested in the various technical and analytical aspects of central banking. The *Handbook* series also includes '*Technical Handbooks*' which are aimed more at specialist readers and often contain more methodological material than the *Handbooks*, incorporating the experiences and expertise of the author(s) on topics that address the problems encountered by central bankers in their day-to-day work. All the *Handbooks* are available via the Bank's website at:

www.bankofengland.co.uk/education/Pages/ccbs/handbooks/default.aspx.

The Bank of England's Sterling Monetary Framework (the 'Red Book')

The 'Red Book' describes the Bank of England's framework for its operations in the sterling money markets, which is designed to implement the interest rate decisions of the Monetary Policy Committee while meeting the liquidity needs, and so contributing to the stability of, the banking system as a whole. It also sets out the Bank's specific objectives for the framework, and how it delivers those objectives. The framework was introduced in May 2006. The 'Red Book' is available at:

www.bankofengland.co.uk/markets/Documents/money/publications/redbook.pdf.

Cost-benefit analysis of monetary and financial statistics

The handbook describes a cost-benefit analysis (CBA) framework that has been developed within the Bank to ensure a fair balance between the benefits derived from good-quality statistics and the costs that are borne by reporting banks. Although CBA is a well-established approach in other contexts, it has not often been applied to statistical provision, so techniques have had to be adapted for application to the Bank's monetary and financial statistics. The handbook also discusses how the application of CBA has enabled cuts in both the amount and the complexity of information that is required from reporting banks.

www.bankofengland.co.uk/statistics/Pages/about/cba.aspx.

Credit Conditions Survey

As part of its mission to maintain monetary stability and financial stability, the Bank needs to understand trends and developments in credit conditions. This survey for bank and non-bank lenders is an input to this work. Lenders are asked about the past three months and the coming three months. The survey covers secured and unsecured lending to households and small businesses; and lending to non-financial corporations, and to non-bank financial firms. Copies are available on the Bank's website at:

www.bankofengland.co.uk/publications/Pages/other/monetary/creditconditions.aspx.

Trends in Lending

This quarterly publication presents the Bank's assessment of the latest trends in lending to the UK economy. This report draws mainly on long-established official data sources, such as the existing monetary and financial statistics collected by the Bank that cover all monetary financial institutions, and other data collections established since the start of the financial crisis. These data are supplemented by discussions between the major UK lenders and Bank staff, giving staff a better understanding of the business developments driving the figures and this intelligence is reflected in the report. The report also draws on intelligence gathered by the Bank's network of Agents and from market contacts, as well as the results of other surveys. Copies are available on the Bank's website at:

www.bankofengland.co.uk/publications/Pages/other/monetary/trendsinlending.aspx.

Quarterly Bulletin

The *Quarterly Bulletin* explores topical issues relating to the Bank's core purposes of monetary and financial stability. Some articles present analysis on current economic and financial issues, and policy implications. Other articles enhance the Bank's public accountability by explaining the institutional structure of the Bank and the various policy instruments that are used to meet its objectives. The *Quarterly Bulletin* is available at:

www.bankofengland.co.uk/publications/Pages/quarterlybulletin/default.aspx.

Inflation Report

The Bank's quarterly *Inflation Report* sets out the detailed economic analysis and inflation projections on which the Bank's Monetary Policy Committee bases its interest rate decisions, and presents an assessment of the prospects for UK inflation. The *Inflation Report* is available at:

www.bankofengland.co.uk/publications/Pages/inflationreport/default.aspx.

The *Report* starts with an overview of economic developments; this is followed by five sections:

- analysis of money and asset prices;
- analysis of demand;
- analysis of output and supply;
- analysis of costs and prices; and
- assessment of the medium-term inflation prospects and risks.

Publication dates

Publication dates for 2015 are as follows:

<i>Quarterly Bulletin</i>		<i>Inflation Report</i>	
Q1	12 March	February	12 February
Q2	18 June	May	13 May
Q3	18 September	August	6 August
Q4	15 December	November	5 November

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