Quarterly Bulletin

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BANK OF ENGLAND

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Topical articles

Macroprudential policy at the Bank of England

By Paul Tucker, Deputy Governor for Financial Stability, and Simon Hall and Aashish Pattani of the Bank's Macroprudential Strategy Division.[1]

- A vital element of recent reforms to the UK architecture of financial regulation is the creation of a macroprudential authority at the Bank of England — the Financial Policy Committee (FPC).
- This article explains the role and powers of the FPC. It also describes some of the processes supporting the Committee.

Overview

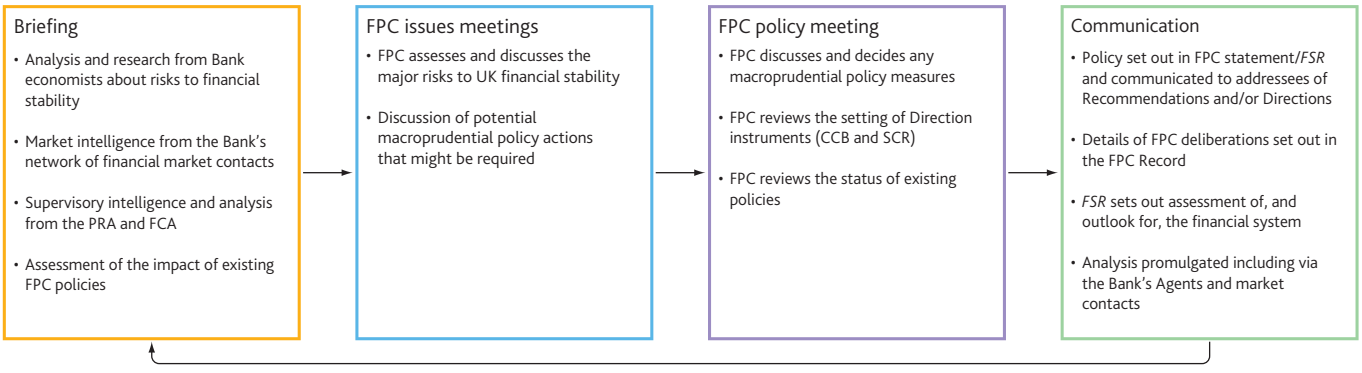
The FPC's primary role is to identify, monitor, and take action to remove or reduce risks that threaten the resilience of the UK financial system as a whole. It comprises five Executives of the Bank of England, the Chief Executive of the Financial Conduct Authority, four external members and a non-voting HM Treasury member.

The FPC can issue Directions and Recommendations to the Prudential Regulation Authority (PRA) and Financial Conduct Authority (FCA), and can make Recommendations to other bodies. For banks, the FPC has been given a power of Direction over sectoral capital requirements (SCRs) and will also be given a power to set the countercyclical capital buffer (CCB) under new EU legislation.

The FPC meets quarterly to a published schedule. Each quarterly round comprises a briefing on financial system developments; focused discussions of key threats to stability and potential macroprudential policy interventions; and a formal meeting to agree on policy decisions, for example to make Directions and/or Recommendations.

Accountability is a key element of the new arrangements. The FPC must explain the decisions it has taken, publish a Record of its formal meetings and, twice a year, publish a *Financial Stability Report* (*FSR*). FPC members also appear regularly at Treasury Committee hearings.

A typical FPC quarterly cycle



(1) The authors would like to thank Victoria Kinahan and Michael Snapes for their help in producing this article. Aashish Pattani left the Bank in June 2013.

The crisis has underlined the importance of financial stability as a precondition for monetary stability and broader economic health and prosperity. Policymakers around the world recognised that focusing separately on price stability and on microprudential regulation of individual firms and markets was not enough. A broader approach — macroprudential policy — was needed to ensure the resilience and stability of the financial system.

In the United Kingdom, the Financial Policy Committee (FPC) was created to fill that gap. Its work is important globally, as well as domestically, given London's role as an international financial centre. That was recognised by the International Monetary Fund (IMF) in deciding to include the United Kingdom as one of five globally systemic economies covered in the IMF's 'spillover reports' on cross-country economic and financial linkages.(1)

Other countries are also introducing macroprudential regimes in the wake of the crisis. For example, in the United States the Financial Stability Oversight Council is responsible for identifying risks and responding to emerging threats to financial stability, with the Federal Reserve Board responsible for establishing enhanced prudential standards for systemically important firms. The European Systemic Risk Board (ESRB) contributes to the prevention or mitigation of systemic risks to financial stability in the European Union (EU). Within the EU, countries, including France and Germany, are also creating macroprudential authorities, partly in response to recommendations from the ESRB.(2)

An article in the 2013 Q1 *Quarterly Bulletin* summarised the main changes to the Bank of England as a result of recent reforms to the United Kingdom's system of financial regulation, including the creation of the new Prudential Regulation Authority (PRA) and the FPC. This article provides more detail on the specific role and powers of the FPC. It also describes some of the processes supporting the Committee.

Objectives of the FPC

Under the Bank of England Act 1998 ('the Act'), as amended by the Financial Services Act 2012, the Bank has a statutory objective to protect and enhance the stability of the financial system of the United Kingdom. The FPC is tasked with helping the Bank meet that objective and, subject to that, also supporting the Government's economic policy, including its objectives for growth and employment. Before determining or revising the Bank's financial stability strategy, the Bank's Court of Directors must consult the FPC.

HM Treasury is required to give the FPC written notice each year of the Government's economic policy and must make recommendations about the Committee's responsibility in relation to the financial stability objective. The Treasury may also make recommendations to the Committee, including regarding the Committee's responsibility in relation to support for the Government's economic policy and matters that the Committee should have regard to in exercising its functions. The Treasury sent the FPC a first remit and recommendations letter on 30 April 2013, to which the FPC responded in June 2013.(3)

The FPC has a statutory responsibility to identify, monitor, and take action to remove or reduce risks that threaten the resilience of the UK financial system as a whole. This is supported by the objectives of the microprudential regulators. The PRA is part of the Bank. It is responsible for the microprudential regulation of individual deposit-takers, insurers and major investment firms.(4) The Financial Conduct Authority (FCA) is a separate institution responsible for ensuring that relevant markets function well, for conduct regulation and for microprudential regulation of financial services firms not supervised by the PRA, such as asset managers, hedge funds, many smaller broker-dealers and independent financial advisers.(5)

Examples of systemic risks highlighted by the legislation include:

- risks relating to structural features of financial markets, such as connections between financial institutions;
- risks relating to the distribution of risk within the financial sector; and
- unsustainable levels of leverage, debt or credit growth.

Risks from linkages within the financial system

Linkages among financial institutions — including via common membership of payment, settlement and clearing systems — can, if infrastructure is strong, bolster system resilience, by allowing risks to be shared and managed. But if key firms or funds within the system are fragile, heightened interconnectedness can also make the system more vulnerable to shocks spreading from one institution to another.

Connections between markets and financial institutions increased and became more complex internationally ahead of the crisis, partly as a result of growth in cross-border investment in asset-backed securities and related products and greater sourcing by banks of funding from overseas.(6) When

(1) 'The size and interconnectedness of the UK financial sector make it a powerful originator, transmitter, and potential dampener of global shocks. The United Kingdom agglomerates core international financial functions making it a key node in 'funding' liquidity and balance sheet hedging, providing buoyancy to global markets and acting as a key channel transmitting shocks or stabilizing measures', see International Monetary Fund (2011).
(2) See European Systemic Risk Board (2011).
(3) See 'Remit and recommendations for the Financial Policy Committee — April 2013', available at www.bankofengland.co.uk/financialstability/Pages/fpc/remit.aspx.
(4) See Bailey, Breeden and Stevens (2012).
(5) See Murphy and Senior (2013).
(6) Parkinson and Speight (2003) describe the increased reliance of UK banks on overseas wholesale funding. Recent developments in cross-border credit are discussed by Hills and Hoggarth (2013).

the crisis broke inadequate disclosure meant there was widespread uncertainty about those institutions across the globe that were exposed — directly or indirectly — to sub-prime assets, such as loans extended to borrowers that are more likely to have difficulties meeting repayments. Given the poor capitalisation of many banks and shadow banks this, in turn, led to a breakdown in the functioning of interbank markets as financial institutions began to lose confidence in the resilience of their counterparties.

Risks relating to the distribution of risk

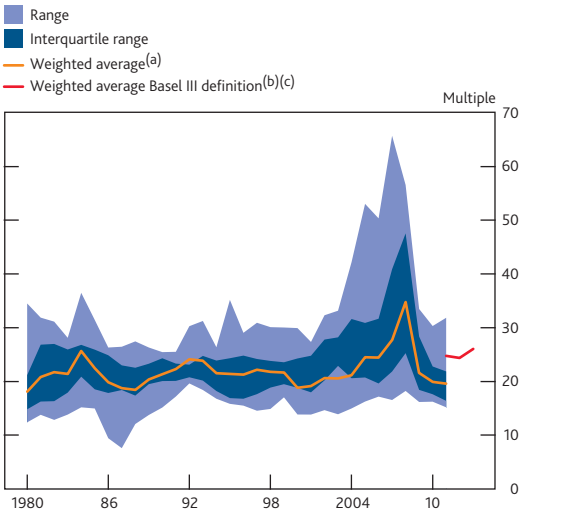
A second dimension of risk to systemic resilience is the distribution of risk within the financial system. Risk may be concentrated in specific parts of the system, for example in large financial institutions with a significant footprint in financial markets, or at critical infrastructure providers, such as central counterparties.(1) As a result, the resilience of the system as a whole depends on the strength of these entities.

Cyclical systemic risks

A third dimension to systemic risk relates to the cyclical build-up of debt or leverage. After an extended period of stability, financial firms, households and companies may take decisions to lend or borrow that make sense while economic conditions remain benign but, collectively, entail fragility across the system as a whole. A sudden economic slowdown can then lead to unexpected and widespread losses. The scale of losses across the system, and wider economic impact, may be amplified if lenders have insufficient capacity to absorb losses and as a result rein back on new activity.

The crystallisation of systemic risks following a large build-up of debt has been evident in previous financial booms and busts such as those in the United States, Scandinavia and Japan in the 1980s and 1990s. In the United Kingdom in the run-up to the recent crisis, balance sheets of financial institutions expanded rapidly relative to their capital base.(2) This can be seen in the increase in reported leverage of UK banks shown in **Chart 1**, defined as total assets — including, for example, the stock of outstanding loans — to capital, which can absorb losses on those loans.(3) Similar developments were seen in other financial systems. Rising asset prices and a progressive easing in access to finance went hand in hand. But as the crisis unfolded conditions reversed rapidly. For example, in the run-up to the crisis, as house prices rose, UK households were able to obtain mortgages at higher loan to value and loan to income ratios, but then terms tightened sharply as conditions deteriorated. In financial markets, the cost of accessing finance, as indicated by initial margin or haircut requirements — the collateral required to back borrowing — fell ahead of the crisis, but then rose sharply when the crisis hit. This had the effect of amplifying the falls in asset prices and activity in some markets and spreading problems across the financial system.

Chart 1 UK banks' reported leverage multiples



Sources: PRA supervisory data, published accounts and Bank calculations.

(a) The weighted average and ranges shown are based on a simple leverage multiple defined as total assets based on banks' published accounts to shareholders' claims (note a discontinuity due to introduction of IFRS accounting standards in 2005, which tends to increase leverage multiples thereafter). Data exclude Northern Rock/Virgin Money from 2008. The last data point in this series is at end-2011.
(b) The 'Basel III leverage multiple', from end-2011 onwards, is calculated as aggregate leverage ratio exposure, according to the proposed Basel III definition, over aggregate peer group Tier 1 capital. However, Tier 1 capital includes some 'grandfathered' instruments which will no longer be eligible after the full transition to Basel III in 2019. The Basel III sample includes Barclays, Co-operative Bank, HSBC, Lloyds Banking Group, Nationwide, Royal Bank of Scotland, and Santander UK. Last data point is June 2013.
(c) The Basel III leverage multiple series does not include adjustments to capital as discussed by the FPC and PRA earlier this year.

Banks also took on more liquidity risk by financing an ever higher share of their loans — which are typically extended over a long term — with short-term wholesale funding, including via shadow banks. Maturity transformation based on the provision of monetary services is a valuable service to the economy, allowing savers to have ready access to their deposits and borrowers to take out loans for extended periods. But excessive maturity transformation also makes banks and shadow banks prone to the risk of 'runs'. That can mean that they need to sell assets at depressed market prices in order to meet redemptions as they fall due, which can further undermine resilience. In the run-up to the crisis, UK banks, in common with their international counterparts, had reduced their holdings of liquid assets and, at the same time, had become more reliant on unstable sources of short-term funding, in particular from wholesale markets.

The combination of highly indebted borrowers, opaque capital markets and dangerously thin capital and liquidity positions across banks and shadow banks left the global financial system highly vulnerable to shocks. By the summer of 2007, an unusual pick up in defaults on mortgages to borrowers with poor credit records in the United States had led to the widespread closing of wholesale markets used by banks and others across the globe to finance residential and commercial

(1) See Nixon and Rehlon (2013).
(2) For a primer on bank capital as a buffer to absorb losses, see Farag, Harland and Nixon (2013) on pages 201–15 of this edition of the *Bulletin*.
(3) The weighted average 'simple leverage multiple' (shown in orange) differs from the 'Basel III multiple' (shown in red) due to the latter using a narrower definition of capital, a Basel III definition of exposures and a different sample of banks.

mortgage lending. As these sources of funding dried up, banks' liquidity came under pressure, with some forced to make 'fire sales' of assets to meet redemptions. Investors were uncertain whose difficulties were fundamental. As credit conditions tightened and economic activity slowed, asset prices fell and defaults rose. Eventually the spotlight turned to whether banks were adequately capitalised. As confidence withered, liquidity seized up. Lacking adequate resolution regimes, the authorities ended up matching liquidity support with taxpayer solvency support.

Powers of the FPC

One way that the FPC can mitigate threats to the resilience of the financial system is by raising awareness of systemic risks among financial market participants. The FPC is required to publish a *Financial Stability Report* twice a year which must identify key threats to the stability of the UK financial system. At times, simply warning about risks may be sufficient to catalyse action within the private sector to reduce vulnerabilities. But experience from before the crisis showed that warnings alone are not always enough.(1)

The new legislation gives the FPC two main types of power: *Recommendations* and *Directions*. EU law provides the overarching framework within which the FPC can use these powers. For banks, two key elements of EU legislation are the Capital Requirements Regulation and the Capital Requirements Directive IV, which are due to come into force in January 2014. While the EU regulation is directly applicable or 'maximum harmonised' — meaning that it restricts the scope for national variation in regulatory rules — some national flexibility is permitted. For example, in addition to the countercyclical buffer, a range of other tools are identified within a so-called 'macroprudential carve out' and can be set at a national level. For tools within that carve out, if the relevant national authority considers it needs to take action, it must notify various EU bodies of that fact and submit evidence and reasoning for taking the proposed measure. Once that process is complete, and provided the proposed action is not rejected by the European Council based on opinions of the other EU bodies, the measure can be introduced.

In seeking to meet its objectives, the FPC is not allowed to take actions that would in its view be likely to have a significant adverse effect on the capacity of the financial sector to contribute to the growth of the economy in the medium or long term. It must also consider whether any adverse effects of its actions on financial institutions or activities are proportionate to the benefits. Generally, the FPC must also explain its reasons for taking action and provide, where practicable, an estimate of the costs and benefits that would arise from compliance. It must also, so far as is possible while complying with its objectives, seek to avoid prejudicing the PRA and FCA's respective objectives.

Powers of Recommendation

Under its power of *Recommendation* the FPC can ask the PRA and FCA to take measures to mitigate risks. Such Recommendations can cover any aspect of the activities of the regulators but cannot relate to a specified individual regulated entity. The FPC can also make Recommendations to the PRA and FCA on a 'comply or explain' basis — in which case, the regulators are required to act as soon as reasonably practical. If one of these regulators were to decide not to implement a Recommendation, it must explain the reasons for not doing so.

The FPC can also make Recommendations to other bodies, though not on a 'comply or explain' basis, so there is not a statutory obligation on the recipient to respond. For example, it could issue a Recommendation to the Bank of England in relation to the provision of liquidity to financial institutions (but not to a particular financial institution) or with regard to its oversight of payments systems, settlement systems and clearing houses. The FPC can also make Recommendations to other bodies, for example to the Financial Reporting Council or industry representative bodies, such as the British Bankers' Association.

The FPC can give Recommendations to HM Treasury, including over the scope of activities regulated under the Financial Markets and Services Act 2000. Developments in the structure of the financial system can leave regulatory rules out of date. For example, financial market participants can find ways to avoid regulatory rules, which may lead to risks shifting into new, hitherto unregulated areas. The job of microprudential bodies is to focus on risks to specific regulated institutions. The FPC can look more broadly at the emergence of risks across the system as it evolves and recommend changes to regulation that are needed to maintain stability. That could include a change to the regulatory perimeter — including the division between regulated and unregulated activities as well as the split of responsibilities between the FCA and PRA.

Powers of Direction

The FPC has a distinct set of powers to give *Directions* to the PRA and FCA to deploy specific macroprudential tools that are prescribed by HM Treasury, and approved by Parliament, for these purposes. To date, HM Treasury has given the FPC a power of Direction over sectoral capital requirements (SCRs). The FPC will also be given a power to set the countercyclical capital buffer (CCB) under new EU legislation.(2)

For each of its powers of Direction, the FPC must prepare, publish and maintain a written statement of the general policy that it proposes to follow in relation to the exercise of its

(1) The limits of warnings alone are discussed in a speech by Mervyn King, see King (2009).
(2) The countercyclical buffer is part of the Basel III reforms implemented in EU law via the Capital Requirements Directive IV and Regulation (CRD IV/CRR), which also include capital conservation and systemic risk buffers.

powers. The interim FPC published a draft policy statement relating to these two prospective Direction powers over capital requirements in January 2013.(1) This will be updated and reissued by the statutory FPC.

The Government has also stated its intention to provide the FPC with a Direction power over a time-varying leverage ratio tool, although this will come into effect no earlier than 2018 and subject to a review in 2017 to assess progress on international standards. The FPC can at any time make a Recommendation to HM Treasury for its consideration if the Committee believes it needs an additional power of Direction.

Countercyclical capital buffers and sectoral capital requirements

The CCB and SCR tools both focus on banks' capital buffers. The more a bank uses capital — such as equity — to finance itself, the more it is able to absorb unexpected losses on its assets, without failing or needing to scale back on new lending.(2) As risks evolve over the cycle, varying the settings of these tools — and, therefore, banks' overall capital requirements — can reduce the chances of financial crises emerging by making banks better able to cope with unexpected losses.(3)

The CCB tool will allow the FPC to change capital requirements above normal microprudential standards in relation to all loans and exposures of banks to borrowers in the United Kingdom. Authorities abroad will also determine whether banks are required to have a CCB against foreign exposures.

The SCR tool is more targeted and allows the FPC to change capital requirements on exposures to specific sectors judged to pose a risk to the system as a whole. The FPC is able to adjust SCRs for banks' exposures to three broad sectors, namely residential property (including mortgages), commercial property and other parts of the financial sector. In addition, SCRs can be adjusted at a more granular level, for example on mortgages with high loan to value or loan to income ratios at origination. The CCB and SCR tools can be applied to all UK-incorporated banks, building societies and large investment firms (for example, broker-dealers).

The use of these tools can improve the ability of the financial system to withstand shocks. When the FPC judges that current and future threats to financial stability are low, the CCB applied to UK exposures and SCRs will be set to zero. In this case, banks will need to meet simply their normal, microprudential capital requirements. When threats to stability emerge, the FPC can raise the CCB or SCRs, requiring banks to have a larger capital buffer which can then be used to absorb unexpected losses when the 'cycle' turns.

The tools may also affect the resilience of the financial system indirectly through effects on the price and availability of credit. These effects are likely to vary over time and according to the state of the economy.(4) For example, in periods where there are concerns about the strength of financial institutions, both resilience and lending can be supported by recommending that banks raise capital. For those banks that are perceived by the market to be inadequately capitalised, official action to increase their equity capital will boost resilience and that is likely to reduce the cost of their funding, which will tend to improve credit availability.

In an environment where market participants perceive risks to the financial system to be small, banks may be able to borrow at a rate that is relatively insensitive to how much capital they have. In that case, if the FPC were to judge that the risks to overall financial stability were greater than believed by the market and hence instigated an increase in capital requirements, banks' cost of funding may rise. This might lead to a tightening in credit conditions facing households, companies and financial intermediaries, helping to arrest the build-up of vulnerabilities created by an overextension of credit and thereby boost banks' resilience.

When threats to resilience are judged to have receded and banks' capital buffers are judged to be more than sufficient to absorb future unexpected losses in the event of stressed economic or financial conditions, previously accumulated macroprudential capital buffers (the CCB or SCRs) might be reduced.

Other FPC responsibilities

In addition to using its powers of Recommendation and Direction, the FPC can influence financial system resilience by giving advice. It is consulted on a range of issues by other bodies. For example, the Bank's Court of Directors is required to consult the FPC on the Bank's overall financial stability strategy. The Bank also seeks the views of the FPC on developments in its Sterling Monetary Framework under a protocol agreed in May 2013.(5) In April 2013, the Chancellor announced a 'Help to Buy' scheme that will run for three years. Should the Government be considering an extension of the scheme at that time, the FPC would be asked for advice on the impact on systemic risks.

The Monetary Policy Committee (MPC) is also seeking the advice of the FPC as part of its new framework for forward guidance. The FPC is asked to alert the MPC if the stance of monetary policy poses a significant threat to financial stability

(1) See Bank of England (2013a).
(2) Note that in addition to unexpected losses, banks also expect some degree of losses to crystallise on loans (which will vary depending on the type of loan, credit rating of the borrower, and so on). Banks' lending practices should account for these expected losses, for example via the price of new lending and provisions. See, for example, Button, Pezzini and Rossiter (2010).
(3) This section draws on 'The Financial Policy Committee's powers to supplement capital requirements', see Bank of England (2013a).
(4) See Tucker (2013).
(5) See Bank of England (2013b).

that cannot be contained by the substantial range of mitigating policy actions available to the FPC, the FCA and the PRA in a way consistent with their objectives. More broadly, in its remits to the MPC and FPC, HM Treasury asked the Committees to explain how they consider the policies of each other in discharging their responsibilities.(1)

Policy co-ordination is a central feature of the new arrangements, and one of the reasons for overlapping memberships of the FPC with other policy bodies (**Figure 1**). The FPC is also required to have regard to the United Kingdom's international obligations. To that end, it expects to co-operate closely with overseas macroprudential bodies, including the ESRB. Proposed new EU legislation sets out formal co-ordination arrangements on the CCB within the European Economic Area: overseas regulators will apply the CCB chosen by the FPC to their banks' UK exposures, while the relevant overseas regulators will normally set the CCB in relation to UK banks' overseas exposures. SCRs will be subject to different co-ordination arrangements under the EU legislation.

How do FPC rounds work?

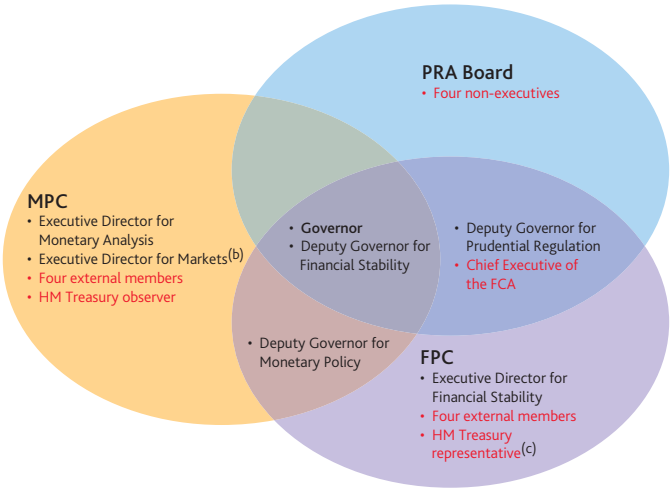
The composition of the FPC and its location in the central bank means it is able to draw on a diverse experience and a wide range of information in detecting and assessing threats to financial stability.

The FPC has ten voting members: the Governor (who chairs the FPC); the Deputy Governors for Financial Stability, Monetary Policy and Prudential Regulation; the Executive Director of the Bank of England for Financial Stability; the Chief Executive Officer of the FCA; and four external members (**Figure 1**). In addition, a representative of HM Treasury is a non-voting member of the FPC. The FPC therefore has direct insights from MPC members into developments in the macroeconomy and in its interaction with the financial system. Membership from the microprudential regulators — the PRA and FCA — ensures that supervisory intelligence relevant to financial stability is brought into the FPC's discussions. External members add to the diversity of experience and information available to the FPC. The Bank's Executive Director for Markets routinely attends FPC meetings so as to offer insights on financial markets.

The processes supporting the FPC, including the format of meetings in which members discuss risks to stability and possible policy responses, are likely to evolve over time. But experience over the past two years of the interim FPC can provide some insights on the broad shape of regular rounds.

The FPC has a pre-announced quarterly schedule, with the dates of formal policy meetings, published on the Bank's website.(2) A typical quarterly cycle contains four elements:

Figure 1 Membership of Bank of England policy committees(a)



(a) Members shown in red are not part of the Bank's Executive Team.
(b) The Executive Director for Markets will also routinely attend FPC meetings.
(c) Non-voting member of the FPC.

- briefing on financial system developments;
- focused discussions of key issues germane to UK financial stability and potential areas for macroprudential policy interventions;
- a policy meeting, culminating in decisions about macroprudential policy, for example to make Directions and/or Recommendations; and
- communication of the policy decision, including via the FPC Record and, twice a year, the *Financial Stability Report* (*FSR*).

The Committee is supported in these areas by a broad range of staff. A dedicated FPC Secretariat, housed within the Bank, is responsible for co-ordinating the wide-ranging inputs to the FPC, as well as supporting the Committee's outputs, including some of its public communications. **Figure 2** sets out the cycle for a typical quarterly FPC round. The various components of the process are described in more detail below.

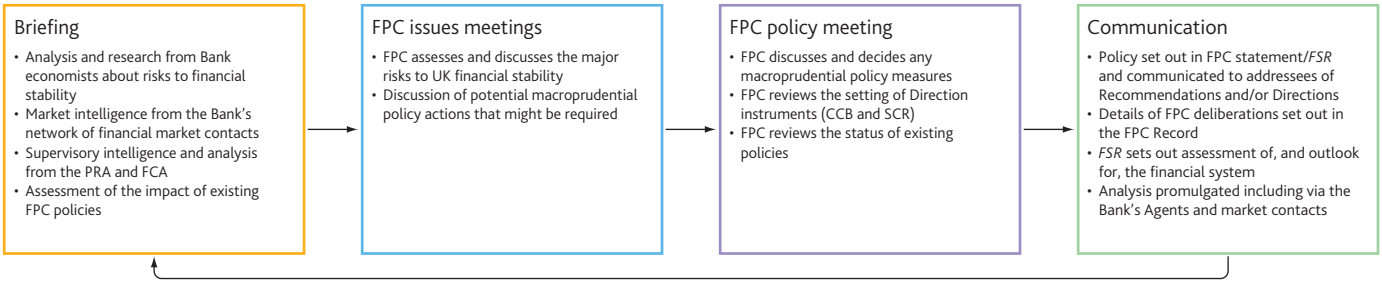
Briefing

Briefing papers produced by staff, including analytical work and market and supervisory intelligence, are circulated to the FPC throughout each quarter. Some papers are requested directly by the FPC, while others are provided on the initiative of staff. The information covers a very broad spectrum of issues and varies in detail depending on the topic.

At one extreme, the Committee receives short, factual updates on breaking news: for example, latest developments in vulnerable euro-area economies. At the other extreme the FPC

(1) See 'Remit for the Monetary Policy Committee', March 2013, available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/221566/chx_letter_to_boe_monetary_policy_framework_200313.pdf and 'Remit and recommendations for the Financial Policy Committee – April 2013', available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/207473/remit_fpc_290413.pdf.
(2) See www.bankofengland.co.uk/financialstability/Pages/fpc/meetings/default.aspx.

Figure 2 A typical FPC quarterly cycle



may receive in-depth reports, for example on loan forbearance by banks. The most common form of briefing tends to be short notes that examine recent economic or financial developments and use analytical techniques or intelligence to answer specific questions. For example, what are the key risks to UK financial stability arising from emerging market economies? Or to what extent is there evidence of exuberance and excessive 'search for yield' in financial markets?

A substantial proportion of the analytical support for the FPC's activities comes from staff in the Bank's Financial Stability Directorate. Market intelligence, supervisory insights and analysis from staff in other parts of the Bank and FCA, and on occasion HM Treasury, are also critical inputs into the FPC's activities. The Bank's market intelligence (MI) is drawn from an extensive, growing, and internationally diverse contact base including banks, dealers, brokers, asset managers, pension funds, insurance companies, hedge funds, private equity funds and infrastructure providers. It covers a wide range of markets, from 'vanilla' instruments such as gilts, equities, commodities, bonds and repo through to complex derivative products. It helps the FPC to understand better the qualitative behavioural patterns that underlie quantitative movements in financial variables and to spot new developments or risks that might introduce potential vulnerabilities into parts of the financial system.

Supervisory intelligence and other briefing are provided by staff from the PRA and the FCA. This allows the Committee to draw together granular supervisory insights to form a better understanding of developments across the system as a whole.

A focal point for the quarterly FPC briefings is a set of presentations by senior Bank (including PRA) and FCA staff on key developments. Agendas vary from briefing to briefing, but typically include:

- a summary of MI from the Bank's Markets Directorate (for example, risks arising from the search for yield);

- presentations by the Bank's Financial Stability Directorate on domestic and international macroeconomic and capital market risks (for example, risks of spillovers from stress in parts of the euro area, or signs of emerging threats to stability from beyond the regulatory boundary), resilience of the financial system (for example, risks from weak UK bank profitability) and non-cyclical issues affecting system resilience (such as banks' risk-weight methodologies or risk management practices at central counterparties); and

- a summary of supervisory intelligence from the PRA (for example, themes from banks' capital and liquidity planning); and

- a summary of key issues from the FCA (for example, on developments in relevant products, markets or among firms regulated by the FCA).

As part of this briefing, the FPC will consider a wide range of information, alongside economic and financial indicators. No single set of indicators can ever provide a perfect guide to systemic risks, or to appropriate policy responses, due to the complexity of financial interlinkages, the tendency for the financial system to evolve over time and time lags before risks become apparent. The FPC also monitors a specific set of indicators as a core input to the use of the CCB and SCR. These include measures relating to the size and composition of balance sheets within the financial system and among borrowers, and information on terms and conditions in financial markets. They are published in each *FSR* and on the Bank's website.(1)

The FPC sees attractions in synthesising information from a broad range of indicators via a stress-testing framework that can explore the resilience of the financial system in various adverse scenarios. To that end, it has asked the Bank, including the PRA, to develop a framework for regular stress testing of the UK banking system. Results from proposed future stress-test exercises will be discussed by the FPC.

There is some overlap between the briefing received by the FPC and the MPC. As noted above, FPC members who sit on the MPC are able to incorporate the insights that have been

(1) See, for example, the June 2013 *Financial Stability Report*, available at www.bankofengland.co.uk/publications/Documents/fsr/2013/fsrfull1306.pdf.

provided to them as monetary policy makers into macroprudential policy discussions. In addition, analysis on issues such as credit conditions, the banking system and financial market developments is produced jointly by staff across the Bank, and circulated to both Committees. Furthermore, FPC members have the opportunity to observe the monthly briefing session held for the MPC, and *vice versa*. PRA Board independent members can also attend these two briefing meetings.

Issues discussions

'Issues' discussions are an opportunity for the Committee to assess the major risks to UK financial stability and discuss in more detail key areas of concern. Staff prepare briefing and analysis to support FPC discussion of potential macroprudential policy responses. The Committee also considers a range of issues relevant to its statutory responsibilities, including the effect of potential policy interventions on resilience and the economy. These deliberations guide staff in preparing any further material to support the Committee's subsequent policy decisions.

The FPC is updated by staff, or members of the Committee, on progress in implementing previously issued policy decisions.

Policy meeting

New macroprudential policy measures that may be required to mitigate risks to financial stability are discussed and, where appropriate, agreed by the FPC at the policy meeting. Aside from FPC members, only a few Bank staff are present, including a Secretariat with responsibility for producing the Record of the discussion.

The legislation sets out that the Chair of the FPC — the Governor or, if the Governor is not present, the Bank's Deputy Governor for Financial Stability — should seek to ensure that macroprudential policy decisions of the FPC on new Recommendations or Directions are reached by consensus wherever possible. Where that is not possible a vote is taken by the Committee.

At the policy meeting, the FPC also reviews formally the status of previous policy Recommendations or Directions. The Committee assesses actions taken in response, and decides whether to withdraw the policy measure — if it has been successfully implemented or is no longer required to mitigate risks to UK financial stability — or to retain it as being in progress.

Where it judges that disclosure is against the public interest, the FPC is able under section 9V of the Act, to delay disclosure and make private Recommendations. But the Committee is required to review any private Recommendations that it may have made previously, and to consider whether publication is still against the public interest.

Accountability

The FPC policy decision, including any new Directions and/or Recommendations that have been agreed, are communicated to those to whom the action falls — for example, the PRA or FCA. The policy decision is communicated to the public in either a short statement typically released a week after the policy meeting — in the first and third quarters of the year — or in the *FSR* in Q2 and Q4.

Under the Act, the *FSR* must include: the FPC's view of the stability of the UK financial system at the time of the *Report's* preparation; an assessment of the developments that have influenced the current position of the UK financial system; the strengths and weaknesses of the UK financial system; risks to the stability of the UK financial system; and the Committee's view of the outlook for the stability of the UK financial system. It also reports the Committee's view of progress against previous Recommendations and Directions, as well as reporting any new policy actions taken to reduce and mitigate risks to stability. The *FSR* is prepared by the FPC, with a draft produced by Bank staff. The FPC provides comments and formally agrees the text at a special meeting prior to publication.

The key messages and policy actions in the *FSR* are conveyed to a wide audience. A press conference is held when the *FSR* is published. Participants in financial markets — including the Bank's network of market intelligence contacts — are also informed of policy decisions when the *FSR* is published. FPC members and other Bank staff hold regular meetings with financial market participants where FPC decisions are discussed. The Bank's network of Agents across the United Kingdom is able to promulgate and discuss messages with business contacts, often supported by FPC members or other Bank staff.

A formal Record of the policy meeting is published at present around a fortnight after the corresponding meeting. It must specify any decisions taken at the meeting and must set out, in relation to each decision, a summary of the Committee's deliberations.(1)

FPC members also appear regularly before Members of Parliament at Treasury Committee hearings, where they are required to explain their assessment of risks and policy actions. The Treasury Committee has also held appointment hearings for members.

The procedures followed by the FPC are kept under review by a committee of the Court of Directors of the Bank, the Oversight Committee established under the Act. It may appoint persons

(1) Although, as previously discussed, the Act gives the FPC the right to delay disclosure of private Recommendations where it judges immediate publication to be against the public interest.

to conduct specific performance reviews, which would be published unless the Bank's Court judges that publication at a particular time is against the public interest.

Conclusion

In the period leading up to the crisis insufficient attention was paid to tackling risks and vulnerabilities across the financial system as a whole. The FPC fills that gap by identifying, monitoring and, crucially, taking action to remove or reduce systemic risks to the resilience of the financial system. This article has described the objectives and powers of the FPC. It has also provided an overview of some of the processes currently supporting the Committee.

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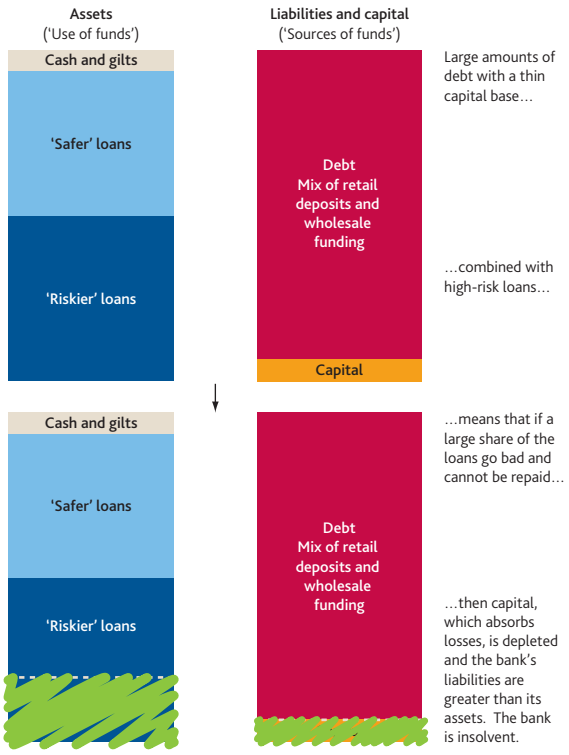
Bank capital and liquidity

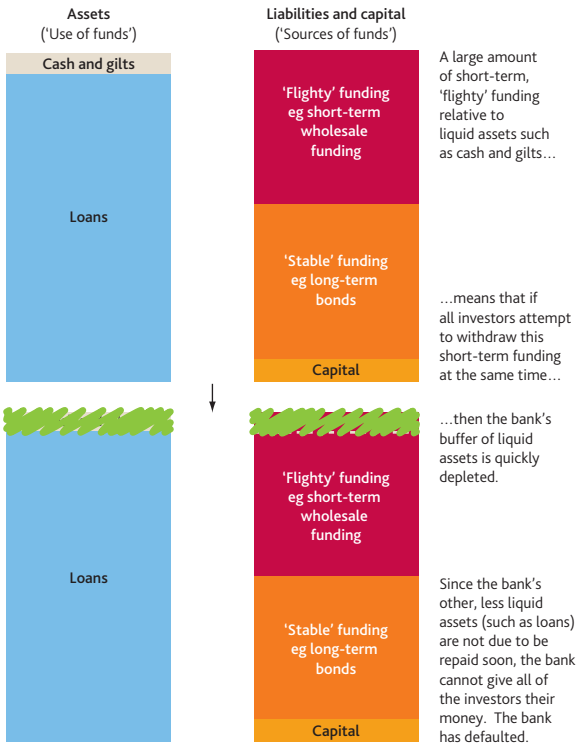
By Marc Farag of the Bank's Financial Stability Directorate, Damian Harland formerly of the PRA's Banking Policy Department and Dan Nixon of the Bank's Media and Publications Division.[1]

- Bank capital, and a bank's liquidity position, are concepts that are central to understanding what banks do, the risks they take and how best those risks should be mitigated. This article provides a primer on these concepts.
- It can be misleading to think of capital as 'held' or 'set aside' by banks; capital is not an asset. Rather, it is a form of funding — one that can absorb losses that could otherwise threaten a bank's solvency. Meanwhile, liquidity problems arise due to interactions between funding and the asset side of the balance sheet — when a bank does not hold sufficient cash (or assets that can easily be converted into cash) to repay depositors and other creditors.
- It is the role of bank prudential regulation to ensure the safety and soundness of banks, for example by ensuring that they have sufficient capital and liquidity resources to avoid a disruption to the critical services that banks provide to the economy.

Example of solvency problems



Example of liquidity problems



Implications

Unlike other types of funding, capital, such as shareholder equity, can absorb losses:

- So to be resilient against failure, banks need a large enough buffer of capital.
- And the riskier a bank's assets, the more capital it needs.

Implications

To avoid liquidity problems banks need to have a combination of:

- Stable sources of funding that will not dry up during stressed market conditions.
- A buffer of liquid assets.

(1) The authors would like to thank Guy Benn, Stephen Bland and John Cunningham for their help in producing this article.

Bank capital, and a bank's liquidity position, are concepts that are central to understanding what banks do, the risks they take and how best those risks should be mitigated — by banks themselves, and by prudential regulators. As the recent financial crisis powerfully demonstrated, the instability that can result from banks having insufficient financial resources — capital or liquidity — can acutely undermine the vital economic functions they perform.

This article is split into three sections. The first section introduces the traditional business model for banks of taking deposits and making loans. The second section explains the key concepts necessary to understand bank capital and liquidity. This is intended as a primer on these topics: while some references are made to the recent financial crisis, the aim is to provide a general framework for thinking about bank capital and liquidity. The box on page 206 explains some of the accounting principles germane to understanding bank capital.

The final section gives an overview of capital and liquidity regulation. In April 2013, the Bank, through the Prudential Regulation Authority (PRA), assumed responsibility for the safety and soundness of individual firms, which involves the microprudential regulation of banks' capital and liquidity positions.(1) At the same time, the Financial Policy Committee (FPC) within the Bank was given legal powers and responsibilities(2) to identify and take actions to reduce risks to the financial system as a whole — macroprudential regulation — including by recommending changes in bank capital or liquidity requirements, or directing such changes in respect of certain capital requirements. The FPC has already made recommendations in 2013 on capital that the PRA have taken steps to implement.(3)

The box on pages 210–11 sets out the latest 'Basel III' international standards for capital requirements, including minimum requirements as well as a number of additional capital buffers. The box on page 213 explores some of the links between a bank's capital and liquidity positions.(4)

The traditional banking business model

Understanding why capital and liquidity are important requires an overview of what banks do. This section sets out the traditional banking business model, using a simplified bank balance sheet as an organising framework and highlighting some of the risks inherent to a bank's business.

Banks play a number of crucial roles in the functioning of the economy. First, they provide payments services to households and companies, allowing them to settle transactions. Second, they provide credit to the real economy, for example by providing mortgages to households and loans to companies. And third, banks help households and businesses to manage the various risks they face in different states of the world. This includes offering depositors access to their current accounts 'on demand', as well as providing derivatives transactions or other financial insurance services for their broader customer base.(5)

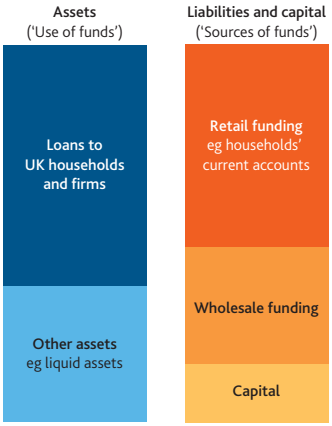
The focus for this article is the second function: providing credit to the real economy. Borrowers frequently need sizable longer-term loans to fund investments, but those with surplus funds may individually have smaller amounts and many want swifter access to some or all of their money. By accepting deposits from many customers, banks are able to funnel savers' funds to customers that wish to borrow. So, in effect, banks turn many small deposits of a short-term maturity into fewer longer-term loans. This 'maturity transformation' is therefore an inherent part of a bank's business model.

Banks profit from this activity by charging a higher interest rate on their loans than the rate they pay out on the deposits and other sources of funding used to fund those loans. In addition they may charge fees for arranging the loan.(6)

Introducing a bank's balance sheet

A useful way to understand what banks do, how they make profits and the risks they take is to consider a stylised balance sheet, as shown in **Figure 1**. A bank's balance sheet provides a snapshot at a given point in time of the bank's financial position. It shows a bank's 'sources of funds' on one side (liabilities and capital) and its 'use of funds' (that is, its assets) on the other side. As an accounting rule, total liabilities plus capital must equal total assets.(7)

Figure 1 A stylised bank balance sheet



(1) The PRA also supervises insurance companies. For more information see the article by Debbage and Dickinson on pages 216–22 of this edition of the *Bulletin*.
(2) The FPC had existed in interim form since February 2011. See, for example, Murphy and Senior (2013).
(3) The speech by Governor Carney on 28 August 2013 gives more details and also explores the links between capital and liquidity (Carney (2013)).
(4) A short **video** accompanying this article talks through the examples of bank solvency and liquidity problems illustrated on the front page of this article (these are also discussed in the following section). See www.youtube.com/watch?v=kAgNJNvDcu8.
(5) For more details on the economic role of banks, see, for example, Freixas and Rochet (2008).
(6) Of course, other banking activities will also generate income streams and profits. See DeYoung and Rice (2004) and Radecki (1999) for a discussion of some of these other sources of revenues.
(7) See also, for example, Mishkin (2007).

Like non-financial companies, banks need to fund their activities and do so by a mixture of borrowed funds ('liabilities') and their own funds ('capital'). **Liabilities** — what banks owe to others — include retail deposits from households and firms, such as current or savings accounts. Banks may also rely on wholesale funding: borrowing funds from institutional investors such as pension funds, typically by issuing bonds. In addition, they borrow from other banks in the wholesale markets, increasing their interconnectedness in the process. A bank's **capital** represents its own funds. It includes common shares (also known as common equity) and retained earnings. Capital is discussed in more detail in the following section.

Banks' **assets** include all financial, physical and intangible assets that banks currently hold — or are due to be paid at some agreed point in the future. They include loans to the real economy such as mortgages and personal loans to households, and business loans. They also include lending in the wholesale markets, including to other banks. Lending can be secured (where a bank takes collateral that can be sold in the event that the borrower is unable to repay) or unsecured (where no such collateral is taken). As well as loans, banks hold a number of other types of assets, including liquid assets such as cash, central bank reserves or government bonds;[1] the bank's buildings and other physical infrastructure; and 'intangible' assets such as the value of a brand. Finally, a bank may also have exposures which are considered to be 'off balance sheet', such as commitments to lend or notional amounts of derivative contracts.

Credit risk, liquidity risk and banking crises

In transforming savers' deposits into loans for those that wish to borrow, the traditional banking business model entails the bank taking on credit risk and liquidity risk.[2] **Credit risk** is the risk of a borrower being unable to repay what he or she owes to a bank. This causes the bank to make a loss. This is reflected in a reduction in the size of the bank's assets shown on its balance sheet: the loan is wiped out, and an equivalent reduction must also be made to the other side of the balance sheet, by a reduction in the bank's capital. If a bank's capital is entirely depleted by such losses, then the bank becomes 'balance sheet insolvent' — illustrated on the left-hand column of the figure on the first page of this article — that is, its liabilities exceed its assets.

Liquidity risk takes on a number of forms. Primarily for a bank, it is the risk that a large number of depositors and investors may withdraw their savings — that is, the bank's funding — at once, leaving the bank short of funds. Such situations can force banks to sell off assets — most likely at an unfavourably low price — when they would not otherwise choose to. If a bank defaults, being unable to repay to depositors and other creditors what they are owed as these debts fall due, it is 'cash-flow insolvent'. This is illustrated on the right-hand column of the figure on the first page of this article. A bank 'run' — where many depositors seek to withdraw funds from the bank — is an extreme example of liquidity risk.

The failure of a bank can be a source of financial instability because of the disruption to critical economic services. Moreover, the failure of one bank can have spillover effects if it causes depositors and investors to assume that other banks will fail as well. This could be because other banks are considered to hold similar portfolios of loans — that might also fail to be repaid — or because they might have lent to the bank that has failed.

These risks and others need to be managed appropriately throughout the business cycle. The following section considers in more detail how bank capital can mitigate the risk of an insolvency crisis materialising and how a bank's mix of funding and buffer of liquid assets can help it to prevent or withstand liquidity stresses.

Capital and liquidity

The difference between capital and liquidity: an overview

As outlined in the previous section, a bank's capital base and its holdings of liquid assets are both important in helping a bank to withstand certain types of shocks. But, just as their natures as 'financial resources' differ, so does the nature of the shocks they mitigate against. Capital appears alongside liabilities as a ***source of funding***; but, while capital can absorb losses, this does not mean that those funds are locked away for a rainy day. Liquid assets (such as cash, central bank reserves or government bonds) appear on the other side of the balance sheet as a ***use of funding*** and a bank holds a buffer of liquid assets to mitigate against the risk of liquidity crises caused where other sources of funding dry up.

Importantly, both capital and liquidity provisioning and risk mitigation require a consideration of the details of both the 'source of funds' and the 'use of funds' sides of the balance sheet. It is useful to consider how the characteristics of various types of typical bank assets and liabilities differ. Some of these characteristics are summarised in **Table A**.

For instance, if a bank holds more risky assets (such as unsecured loans to households and firms) it is likely to need to hold more capital, to mitigate against the risk of losses in the event that such loans default. And if a bank relies on a high proportion of unstable or 'flighty' sources of funding for its

(1) Central bank reserves are effectively current accounts for banks. Whereas an individual places his or her deposits in a commercial bank, a commercial bank keeps its deposits (called reserves) with the central bank. See, for example, Bank of England (2013a).
(2) While the focus of this article is on credit risk and liquidity risk, other risks faced by banks include market risk and operational risk. These are discussed briefly in the box on pages 210–11.

Table A Key properties of different types of bank funding and assets

Sources of funding (liabilities and capital)	
Seniority:	If a bank becomes insolvent, 'senior' liabilities are repaid before 'junior' ones. Common equity is the most junior and is the first to absorb any losses.
Maturity:	This refers to the date at which funding can be contractually withdrawn. Some funds can be withdrawn at any time by the borrower (such as current accounts). Others have a fixed term (a two-year bond, say) or are permanent (common shares).
Cost:	The cost is the expected rate of interest that a bank pays on its liabilities or capital. Typically, a bank would have to offer a higher yield to attract investors, the more credit risk or liquidity risk it takes.
Use of funding (assets)	
Liquidity:	This is a measure of the ease with which an asset can be converted into cash. Central bank reserves and 'safe' securities like government bonds are considered liquid, while loans to households and firms, or a bank's buildings, are relatively illiquid assets.
Credit risk:	This is the risk that a borrower will fail to pay what they owe on the due dates. Government bonds (with high credit ratings) are usually considered 'low-risk' assets. Loans carry credit risk, the amount varying for different types of borrower and loan product.
Yield:	This is the return (interest and fees) banks earn on their assets. For loans, it is reflected in the interest rate they charge, plus any fees. Typically, lending offers banks a higher yield (but also more risk) than they can get by holding a safer asset.

activities, such as short-term wholesale funding, to avoid the risk of a liquidity crisis, then it will need to hold more liquid assets.

The following subsections explain the concepts of capital and liquidity in more detail. While they are considered separately, in practice, there is often likely to be considerable interplay between risks to a bank's capital and liquidity positions. Doubts surrounding a bank's capital adequacy, for example, can cause creditors to withdraw their deposits. Meanwhile, actions that a bank takes to remain liquid — such as 'fire sales' or paying more than it would normally expect for additional funds — can, in turn, reduce profits or cause losses which undermine its capital position. Some of the ways in which changes in a bank's capital position could affect its liquidity position, and *vice versa*, are discussed at the end of the article.

Capital

As noted above, banks can make use of a number of different funding sources when financing their business activities. **Capital can be considered as a bank's 'own funds', rather than borrowed money such as deposits.** A bank's own funds are items such as its ordinary share capital and retained earnings — in other words, *not* money lent to the bank that has to be repaid. Taken together, these own funds are equivalent to the difference between the value of total assets and liabilities.

While it is common usage to refer to banks 'holding' capital, this can be misleading: unlike items such as loans or government bonds that banks may actually hold on the asset side of their balance sheet, capital is simply an alternative source of funding — albeit one with particular characteristics.

The key characteristic of capital is that it represents a bank's ability to absorb losses while it remains a 'going concern'. Much of a bank's activities are funded from customer deposits and other forms of borrowing by the bank that it must repay in full. If a bank funds itself purely from such borrowing, that is, with no capital, then if it incurred a loss in any period, it would not be able to repay those from whom it had borrowed — it would be balance sheet insolvent: its liabilities would be greater than its assets. But if a bank with capital makes a loss, it simply suffers a reduction in its capital base. It can remain balance sheet solvent.

There are two other important characteristics of capital. First, unlike a bank's liabilities, it is perpetual: as long as it continues in business, the bank is not obligated to repay the original investment to capital investors. They would only be paid any residue in the event that the bank is wound up, and all creditors had been repaid. And second, typically, distributions to capital investors (dividends to shareholders, for instance) are not obligatory and usually vary over time, depending on the bank's profitability. The flipside of these characteristics is that shareholders can generally expect to receive a higher return in the long run relative to debt investors.

Expected and unexpected losses

Banks' lending activities always involve some risk of incurring losses. Losses vary from one period to another; and they vary depending on the type of borrower and type of loan product. For example, an unsecured business loan to a company in an industry with highly uncertain future earnings is riskier than a secured loan to a company whose future revenue streams are more predictable.

While it is not possible to forecast accurately the losses a bank will incur in any given period, banks can estimate the average level of credit losses that they expect to materialise over a longer time horizon. These are known as **expected losses**.

Banks can take account of their expected losses when they manage their loan books. Expected losses are effectively part of the cost of doing business — as such, they should be taken into account in the interest rate that the bank sets for a particular loan. Suppose, for example, a bank lends £1 to 100 individuals and it expects that 5% of its loans will default, and it will receive no money back. For simplicity, it is assumed that the bank has no operating costs and is not paying any interest itself on the £100 of funds that it is lending out. In this scenario, if the bank charges no interest on the loans then it would expect to receive £95 back from the borrowers. In order to (expect to) receive the full £100 back it would need to charge interest on each individual's loan. The required interest rate works out to be just fractionally more than the proportion of borrowers expected to default. In this example,

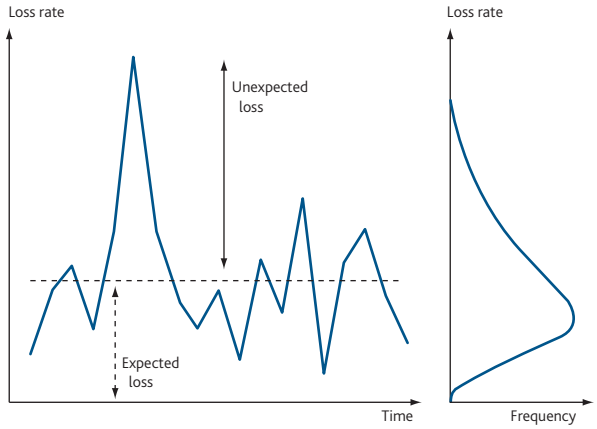
then, the bank would need to charge just above 5% on each of the £1 loans in order to (expect to) break even, taking account of expected losses.(1)

Of course, banks are not able to predict future events perfectly. Actual, realised losses will typically turn out higher or lower than losses that had been expected. Historical losses may prove poor predictors of future losses for a number of reasons. The magnitude and frequency of adverse shocks to the economy and financial system, and the riskiness of certain types of borrowers and loans, may change over time. For loans where borrowers have pledged collateral, banks may recover less than they had expected to in the event of default. In the case of mortgages, for example, this would occur if the value of the property falls between the time the loan was made and when the borrower defaults. Or banks may underestimate the likelihood that many borrowers default at the same time. When the economy is unexpectedly hit by a large, adverse shock, such as that experienced during the 2007–08 financial crisis, all of these factors may be at play.

Banks therefore need to take account of the risk that they incur **unexpected losses** over and above expected losses. It is these unexpected credit losses (the amount by which the realised loss exceeds the expected loss) that banks require a buffer of capital to absorb.

While expected losses can, arguably, be estimated when sufficient past data is available, unexpected losses, in contrast, are by their nature inherently hard to predict. They would include losses on banks' loan books associated with large, adverse shocks to the economy or financial system. **Figure 2** gives a stylised example of how actual, realised losses can be split into expected and unexpected components. The right-hand panel shows that for a given period, while the expected loss rate is the expected outcome, in reality losses may be higher or lower than that.

Figure 2 Expected and unexpected losses



Source: Basel Committee on Banking Supervision (2005).

Accounting for losses on the balance sheet

Usually, there is a period between when a borrower has defaulted and when the bank 'writes off' the bad debt. When losses on loans are incurred, banks set aside impairment provisions. Provisions appear on the *balance sheet* as a reduction in assets (in this case, loans) and a corresponding reduction in capital. Impairment provisions are based on losses identified as having been incurred by the end of the relevant period, but not yet written off. The box on page 206 discusses recent developments in the accounting treatment of provisions in more detail. It also explains other accounting principles relevant to understanding bank capital, such as how retained earnings feed into the capital base and the different ways of valuing financial assets.

The leverage ratio

A useful indicator of the size of a bank's balance sheet — and hence potential future losses that a bank is exposed to — relative to its 'own funds' (capital) is the **leverage ratio**. In the context of regulatory requirements, it is usually expressed inversely, as the ratio of capital to total assets.(2) It reflects an aspect of the riskiness of a bank since capital absorbs any losses on the bank's assets: so high leverage (that is, a low ratio of capital to total assets) is riskier, all else equal, as a bank has less capital to absorb losses per unit of asset. This could increase the risk of the bank not being able to repay its liabilities. Different definitions of leverage can also include a bank's off balance sheet exposures. These include items such as derivatives, security lending and commitments. By capturing these items, the leverage ratio provides a relatively comprehensive overview of a bank's capital relative to its total exposures. Other metrics for gauging the capital adequacy of a bank, such as the **risk-based capital ratio**, are discussed in the section on capital regulation.

Liquidity

The concept of liquidity is also intrinsically linked to both sides of a bank's balance sheet. It relates to the mix of assets a bank holds and the various sources of funding for the bank, in particular, the liabilities which must in due course be repaid. It is useful to distinguish between two types of liquidity risk faced by banks.(3) These are:

- **Funding liquidity risk**: this is the risk that a bank does not have sufficient cash or collateral to make payments to its counterparties and customers as they fall due (or can only do so by liquidating assets at excessive cost). In this case the bank has defaulted. This is sometimes referred to as the bank having become 'cash-flow insolvent'.

(1) There would of course also be a charge to generate the expected profit on the transaction. For more detail on how banks price loans, see Button, Pezzini and Rossiter (2010).
(2) For example, in June 2013 the PRA Board asked two firms to submit plans to reach a 3% common equity Tier 1 leverage ratio. See the June 2013 *Financial Stability Report*.
(3) See, for example, Brunnermeier and Pedersen (2008).

'Accounting principles 101' for understanding bank capital

The accounts of a bank are the building block of capital regulation as they present an audited view of its financial condition. This box describes some accounting concepts relevant to understanding bank capital, including how provisions and retained earnings feed into the balance sheet and the capital position.

Balance sheets and income statements

A **balance sheet** shows a snapshot of the financial condition of a company at a given point in time. A simple example for a bank is shown in **Figure 1** in the main text. Assets are recorded in various categories (such as cash and central bank reserves; loans and advances to customers; and derivative financial instruments) as are liabilities (for instance, retail deposit accounts and debt securities in issue) and capital (such as ordinary share capital and retained earnings). A balance sheet must balance; resources (assets) must equal the funding provided for the resources (liabilities plus capital). A company's **income statement**, meanwhile, shows its revenues and expenses (and certain gains and losses) during a given period of time.

Losses, provisions, retained earnings and capital

Accounting rules require that losses on assets such as loans are recognised in the form of **impairment provisions** as soon as they are incurred, but no earlier.(1) Provisions appear in two places in the accounts: on the income statement they appear as an expense, reducing net income; on the balance sheet they appear as a reduction in assets (in this case loans to customers) and a corresponding reduction in capital (specifically, shareholders' equity). The focus on losses arising from past loss events has led to concerns that banks' reported profitability and balance sheets may not reflect adequately the economics of lending. Specifically, a bank recognises the interest income that it receives from a loan as it is earned; but while some of this income will reflect expected future losses that have been 'priced in' to the loan (see main text for an example), these expected losses are not deducted elsewhere on the income statement; only incurred losses are deducted. This risks overstating the bank's profitability in the period before the losses are incurred.

A recent proposal from the International Accounting Standards Board (IASB) aims to respond to credit deterioration in a more timely fashion by requiring banks to build up provisions earlier in the cycle and in advance of the losses being incurred.(2) The proposal recommends a staged approach to establishing loan provisions: from the inception of a loan, provisions would be raised to cover expected losses arising from defaults expected in the next twelve months. This twelve-month loss estimate would be updated as the probability of default changes and, where there has been a significant credit deterioration since origination, the provision on the loan would be increased to cover the full lifetime expected loss.(3) This approach should result in a more prudent assessment of banks' profitability and capital. As with any forward-looking model, the new approach would rely on some combination of internal models and management's judgements about expected losses.

Along with shareholder equity, **retained earnings** form a part of a bank's capital base. They also show up on both the income statement and the balance sheet. A simple example helps to illustrate this. Suppose a bank makes a profit of £100 million in a given period, which would be recorded on the bank's income statement. As with other firms, the bank can then choose whether to distribute this money to shareholders (typically in the form of dividend payments) or retain it. If all of the £100 million is retained then this shows up as an increase in capital resources and — at least in the first instance — as an increase in cash (or central bank reserves) on the asset side of a bank's balance sheet.(4)

Valuation of financial assets

Financial assets are those assets such as cash and deposits, loans and receivables, debt and equity securities and derivatives. The classification of a financial asset held by a bank determines how it is valued on the balance sheet and how it affects the income statement. The loans and receivables discussed above will generally be measured on an 'amortised cost' basis with income accrued over time, having deducted any provisions for credit impairment. This is the typical 'banking book' treatment. The 'trading book' treatment involves measuring assets on a current market price (that is, 'fair value') basis.

These classifications mean that the market value of a bank's assets may be lower (or, in some instances, higher) than the amount at which the asset is recorded in the accounts. This can be because there is no requirement to mark the assets to market although, where the market value is lower, it will also mean the bank has concluded that the fact that fair value is below amortised cost is not evidence that the asset is impaired. In such cases, the accounting equity would overstate the bank's true capital position and ability to absorb losses.

(1) Note that accountants also use the term 'provisions' to describe liabilities for *known* future expenditures where the exact amount and timing is uncertain, such as mis-selling compensation.
(2) In March the IASB — the body responsible for setting accounting standards in the United Kingdom — published its third set of proposals to reform the recognition, measurement and reporting of credit impairment losses ('provisions') on loans and other financial assets.
(3) This approach could also reduce procyclicality in the system that stems from the current, backward-looking approach, which tends to inflate banks' balance sheets in upswings and deflate them in downswings. For more details, see Box 4 on pages 56–57 of the June 2013 *Financial Stability Report*.
(4) In general, retained earnings will only count as capital for regulatory purposes once they have been audited.

- **Market liquidity risk**: this is the risk that an asset cannot be sold in the market quickly, or, if its sale is executed very rapidly, that this can only be achieved at a heavily discounted price. It is primarily a function of the market for an asset, and not the circumstances of an individual bank. Market liquidity risk can soon result in the bank facing a funding liquidity crisis. Alternatively, with a fire sale, it may result in the bank suffering losses which deplete its capital.

Banks can mitigate these liquidity risks in two ways. First, they can seek to attract stable sources of funding that are less likely to 'run' in the event of stressed market conditions. And second, banks can hold a buffer of highly liquid assets or cash that can be drawn down when their liabilities fall due. This buffer is particularly important if a bank is unable to roll over (renew) its existing sources of funding or if other assets are not easy to liquidate. This buffer mitigates both types of liquidity risk.

Liquidity crises: 'runs' on banks

A bank 'run' is an acute crystallisation of funding liquidity risk and occurs when a significant number of depositors seek to withdraw funding at the same time. The reason this can happen relates to the 'maturity transformation' aspect inherent to traditional banking: short-term liabilities, including deposits, are used to fund long-term loans.

One trigger for a run on a bank is whether creditors have confidence that the bank is 'balance sheet insolvent' — that is, whether it has sufficient capital to absorb losses and to repay its deposits. In this case a depositor who withdraws their funds early will receive all of their money back immediately, while one who waits may only receive compensation up to the £85,000 limit from the Financial Services Compensation Scheme (FSCS) within a target of seven days.(1)

Liquidity risk can also arise for other reasons. For instance, 'contingent risk' arises from scenarios such as an increase in the number of customers drawing down pre-agreed credit lines. In this scenario the bank's liquid assets are used to meet the contingent commitments to such customers, so that the assets are transformed into loans.

Mitigant (i): stable funding profiles

A bank can adopt a stable funding profile to mitigate against funding liquidity risk and minimise the chances of a bank run happening. Runs are caused by depositors reacting to a fear of losing their money and enforcing their contractual right to withdraw their funding. Stable funding is therefore typically:

- diversified across a range of sources;
- sourced from investors or depositors who are less likely to withdraw funds in the event that a bank makes losses;(2) and
- sourced via instruments that contractually lock in investors' savings for a long period of time.

Banks typically assess the stability of their depositors in three stages: they start with the borrower's contractual rights, then they assess their behaviour in normal times, and finally they predict behaviour in a stressed market scenario.

In the case of retail deposits (such as households' current accounts), while account holders may have the contractual right to withdraw on demand, these deposits in normal times may be very stable, not least because retail depositors have the protection of a deposit guarantee up to £85,000(3) and are thus less incentivised to monitor the credit quality of the bank. Retail depositors generally withdraw deposits as and when needed, to pay for the goods and services they want to buy. In a stressed environment, such depositors may seek to withdraw their funds to a greater extent due to wider uncertainties. For wholesale unsecured investors, short-term deposits typically have a fixed maturity date. In normal times they would be likely to roll over funding as it matures, but in a stressed market, these informed investors are very sensitive to the creditworthiness of the deposit-taking bank and may withdraw substantial volumes of funding.

One measure of a bank's funding profile is its loan to deposit ratio. A bank with a high ratio of loans (which tend to be long term and relatively illiquid) to retail deposits could imply a vulnerable funding profile. Although widely used, this is an imperfect assessment of a bank's structural funding profile since certain forms of stable funding — such as long-term debt funding — are excluded.

The recent financial crisis exposed a number of cases of liquidity and funding problems that resulted from a false assessment of funding stability — especially short-term wholesale funding. And while a maturity mismatch is inherent in the 'borrow short term, lend long term' banking business model which plays a vital role in providing credit to the economy, the resulting funding liquidity risk can lead to the failure of a bank. Liquidity regulation, as described later in this article, seeks to incentivise the use of stable funding structures and discourage maturity transformation using unstable funding sources.

Mitigant (ii): buffer of liquid assets

The second line of defence against funding liquidity shocks is for banks to hold a buffer of liquid assets. **A bank's liquidity resources are cash or assets that the bank can convert into cash in a timely manner and at little cost.** They help a bank manage its liquidity risk in two ways. First, they provide a

(1) For more information see www.fscs.org.uk.
(2) Deposit protection for retail customers and secured wholesale borrowing are examples of depositors who may face limited losses if a bank fails.
(3) Per depositor per authorised deposit-taker.

source of liquidity to ensure the bank can meet payments that come due in a stress. But second, their very existence can provide reassurance that a bank will be able to continue to meet its obligations. This reduces incentives for its depositors to 'run'.

A bank can convert its buffer into cash either by selling the assets or pledging them to secure borrowing. In normal times this may be simple to execute, but banks face market liquidity risk so that, in order to be a reliable source of funds across a range of possible market conditions, the buffer should comprise assets that have the best chance of remaining liquid in stressed times. The Basel Committee on Banking Supervision (BCBS) outlines certain characteristics of assets and markets that maximise this chance.(1)

The most liquid assets in the financial system are on-demand deposits at the central bank, also called reserves. They are essentially credit risk-free and can be used to make payments to counterparties directly. However, they are also low yielding and as such have a significant opportunity cost (that is, representing the 'lost' opportunity for income from other, more profitable uses of funds).

Other securities that trade in active and sizable markets and exhibit low price volatility can also be liquid during a stress, for instance government bonds and corporate bonds issued by non-financial companies. While they may remain liquid, selling such assets during stressed market conditions could entail significant discounts and losses.(2)

A key role of the central bank is to provide liquidity insurance to the banking system to help banks cover unexpected or contingent liquidity shocks. Since the crisis, the Bank of England has significantly expanded its Sterling Monetary Framework facilities to ensure that it offers effective liquidity insurance to the banks. The Bank is currently considering further suggestions to improve the efficacy of its liquidity insurance facilities: see the report by Winters (2012).(3)

Capital and liquidity regulation

The previous section explained capital and liquidity and why they are needed to help mitigate the risks that banks take. Building on that, this section provides an overview of the key concepts related to capital and liquidity regulation. It includes a summary of the latest international capital standards, which are set out in the box on pages 210–11.

The PRA requires banks to have adequate financial resources as a condition of authorisation. Regulation is designed to help correct market failures and the costs to society that these impose.(4) Specifically, the critical services that banks provide mean that public authorities will provide support in a crisis, for example by insuring deposits, acting as a lender of last resort, or bailing out banks directly. **Expectations of public support in stressed conditions lead to the problem of 'moral hazard' whereby banks take on excessive risk, funding their activities with lower levels of capital or liquidity than they would otherwise.** Moreover, these expectations mean that depositors and investors do not discipline banks sufficiently, which pushes down on banks' cost of funding and exacerbates the incentives for banks to take on more risk.

This is a problem because it gives rise to a 'negative externality': excessive risk-taking by banks leads to costs to other parties (the taxpayers that provide for public support). **Microprudential regulation** seeks to address this negative externality by ensuring that banks manage their activities with sufficient levels of capital and liquidity to reflect the risks that they take.(5)(6) The intention is not to stop banks taking risk — this is an essential part of the economic function that they play — but rather, to ensure that these risks are appropriately accounted for. Consistent with this, the PRA does not operate a 'zero-failure' regime: inevitably there will be cases where banks, like other types of firm, fail. In these cases, it is the regulator's responsibility to seek to ensure that a bank that fails does so in a way that avoids significant disruption to the supply of critical financial services.(7)

In addition to microprudential regulation, which is focused on the specific risks to individual banks, there is also a need to consider the risks stemming from the system as a whole. For example, a build-up in leverage across the system, or an increase in the magnitude of maturity transformation, may increase negative externalities and the riskiness of banks.(8) Examples of such externalities are contagion risks arising through the interconnectedness and common exposures of banks. Building on the microprudential regulatory framework, **macroprudential regulation** seeks to address such risks.(9)

The following sections provide a high-level overview of the frameworks for capital and liquidity regulation and illustrate how they relate to the risks banks take. Relatively more detail is given on capital regulation since more agreements have been reached regarding the international framework than is

(1) See BCBS (2013).
(2) See Holmström and Tirole (1998) for an exposition on the theory of private and public supply of liquidity.
(3) The Bank's response to the Court Reviews can be viewed at www.bankofengland.co.uk/publications/Documents/news/2013/nr051_courtreviews.pdf.
(4) Bailey, Breeden and Stevens (2012) describe the PRA's role and its supervisory approach.
(5) For further information on the rationale of prudential regulation, see, for example, Dewatripont and Tirole (1993, 1994) and Diamond and Rajan (2000).
(6) Tools for prudential regulation may affect directly the resilience of the financial system to withstand shocks. They may also affect resilience indirectly, through effects on the price and availability of credit; these effects are likely to vary over time and according to the state of the economy. See, for example, Tucker, Hall and Pattani (2013) on pages 192–200 of this edition of the *Bulletin*.
(7) See Bailey, Breeden and Stevens (2012).
(8) As discussed in Brunnermeier and Pedersen (2008) and Adrian and Shin (2010), for example.
(9) See Tucker, Hall and Pattani (2013) and Murphy and Senior (2013).

the case for liquidity regulation. Typically, regulation takes the form of a requirement specified as a ratio comparing the bank's financial resources with certain aspects of the bank's activities, so as to ensure the bank holds what it might conceivably need to stay liquid and solvent. For example, the ratio could be how much capital banks have relative to their total assets (the leverage ratio outlined above), or the amount of liquid assets that they hold relative to expected outflows as funding expires (a liquidity ratio).

Capital regulation

This section sets out, at a high level, the regulatory framework for capital that is applied to banks in the United Kingdom. The framework is embodied in EU law based on internationally agreed 'Basel' standards. The EU law has recently been updated, reflecting the Basel III standards.

As mentioned above, certain key ratios are useful in thinking about how much capital a bank needs. The previous section defined the **leverage ratio** as a bank's capital divided by its total assets. But of course, some assets are riskier than others, and each asset class can be assigned a risk weight according to how risky it is judged to be. These weights are then applied to the bank's assets, resulting in risk-weighted assets (RWAs). This allows banks, investors and regulators to consider the risk-weighted **capital ratio**, which is a bank's capital as a share of its RWAs. Another way of thinking about this approach is to consider a different capital requirement for each asset, depending on its risk category.

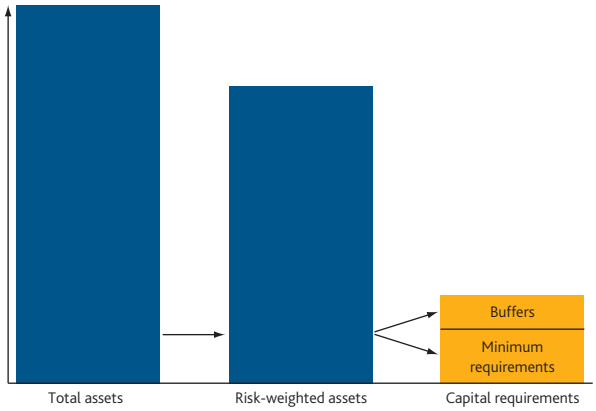
Banks can alter their ratios by either adjusting the numerator — their capital resources — or the denominator — the measure of risk. For example, they can improve their capital ratio either by increasing the amount of capital they are funded with, or reducing the riskiness or amount of their assets.(1) It is common to refer to shortfalls in required ratios in terms of the absolute amount of capital. But altering either the numerator or denominator will change the ratio and reduce this shortfall.

How much of banks' funding must be sourced from capital?

According to internationally agreed standards (Basel III), banks must fund risk-weighted assets with at least a certain amount of capital, known as the '**minimum requirements**' of capital (**Figure 3**). In addition to the minimum requirements, banks will be required to have a number of **capital buffers**.(2) These are meant to ensure that banks can absorb losses in times of stress without necessarily being deemed to be in breach of their minimum capital requirements.

Regulatory capital standards comprise three parts or 'Pillars'. Pillar 1 sets out the capital requirements for specific risks that are quantifiable. Pillar 2 consists of the supervisory review process. It is intended to ensure that firms have adequate capital to support all relevant risks in their business. Pillar 3 complements the other two pillars and includes a set of disclosure requirements to promote market discipline. These standards are discussed in more detail in the box on pages 210–11.

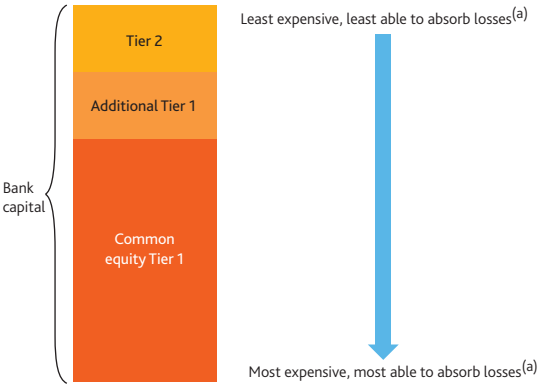
Figure 3 Total assets, risk-weighted assets and capital requirements



What counts as 'capital'?

Banks obtain funding by way of a variety of financial instruments. **Figure 4** sets out the components of eligible capital resources that correspond to Pillar 1 and Pillar 2 requirements. The main component of a bank's capital resources is equity — referred to as **common equity Tier 1 (CET1)**. The key aspects of CET1 are: it absorbs losses before any other tier of capital; its capital instruments are perpetual; and dividend payments are fully discretionary. Its main constituents are **ordinary shares** and **retained earnings**.(3) The box on page 206 explains how retained earnings feed into

Figure 4 Forms of regulatory capital



(a) Refers to ability to absorb losses while the bank remains a going concern.

(1) See Tucker (2013).
(2) While in a general sense capital is said to act as a buffer to absorb unexpected losses, a 'capital buffer' may refer to a specific regulatory requirement for a bank to fund its activities with a buffer of capital over and above the minimum regulatory requirements.
(3) Capital is made up of ordinary shares and reserves. The latter mainly constitutes retained earnings but also includes the share premium account and sometimes other non-distributable reserves. Note that this use of 'reserves' as a component of bank capital is distinct from banks' holdings of central bank reserves (which feature on the asset side of a bank's balance sheet).

Basel III: the latest international standards for capital requirements

International banking standards are set by the Basel Committee on Banking Supervision (BCBS), of which the Bank of England is a member. In the United Kingdom, these standards enter into force through European legislation. The Basel Accord is a set of international standards which sets out a framework for capital regulation for banks. The latest revisions to this Accord, Basel III, were recently finalised and are being introduced in the EU in 2014.(1) Basel standards specify how much capital and, in the future, liquidity(2) banks should be required to have. The Basel standards comprise three parts or 'Pillars':

- Pillar 1 standards specify **quantitative requirements for given risks**. These standards can be fixed, for example a given exposure may attract a certain capital charge. Alternatively, they may be derived using models of expected and unexpected losses.(3)

- In the Pillar 2 supervisory review, banks assess their **overall capital adequacy** in relation to their risk profile. Supervisors review this assessment and may impose capital requirements where additional risks are identified. These can be risks not captured in Pillar 1, or risks that are captured, but not sufficiently.

- Pillar 3 sets out standards of **information disclosure**. While there are a number of additional conditions for disclosure to be effective, the publication of key risk information allows market participants to monitor the capital adequacy of a bank.

Basel 'Pillar 1' capital requirements

For traditional banks, credit risk — the risk that a borrower defaults — will usually lead to their largest capital requirements. They are calculated to reflect unexpected losses for a particular stress level. In addition, when banks' expected losses exceed their provisions — for example, because they are not fully captured by the accounting treatment applied — the difference is also included when determining capital ratios.

There are two approaches to calculating capital requirements for credit risk. Standardised approaches are designed to be broad-brush and relatively simple, while internal ratings-based (IRB) approaches are intended to be more complex, but also allow a greater degree of refinement and risk-sensitivity. Both approaches assign capital requirements that are intended to reflect a bank's credit risk based on its exposures to a wide range of counterparties, including sovereigns, other banks, corporates and retail customers. Capital requirements under the standardised approach are generally based on fixed risk weights or are a function of the counterparty's external credit rating. Under the IRB approach, capital charges are a function of a number of parameters that would affect how much the bank stands to lose should its counterparty default. These parameters include the size of the bank's exposure, the probability of default and the loss given default (which would be lower, all else equal, if the bank held collateral against its exposure). Some of these parameters are estimated by banks' internal models, subject to regulatory approval.

The Basel framework also includes a capital treatment for market risk, which aims to capture the risk of losses resulting from changes in market prices. Separately, banks are required to account for the risk of losses resulting from inadequate or failed internal processes — known as operational risk. As with the credit risk framework, the market and operational risk standards include a relatively simple standardised approach as well as an internal-model approach.

Additional capital requirements

In addition to capital requirements that derive from Pillar 1, under Pillar 2, the supervisory review is used to address risks not captured (or fully captured) in Pillar 1. These could include, for example, the risk that changes in interest rates reduce a bank's net interest income and underlying economic value; and risks stemming from deficient systems and controls.

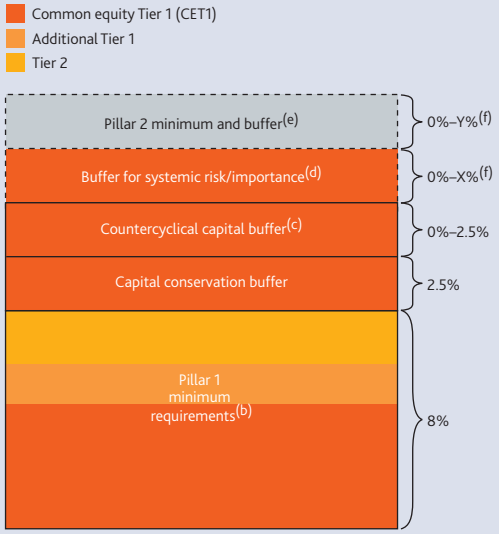
On top of these **minimum capital requirements** to cover the risks that banks are currently running, regulators also require banks to have **capital buffers**. The purpose of these buffers is to ensure that if the bank does experience significant losses, it will still have sufficient capital to retain the confidence of its counterparties and remain a going concern. So it is important that they are drawn down when they are most needed: without them, capital requirements calibrated to cover only expected and unexpected losses could lead to banks having no further capital if those losses crystallised.

The various minimum requirements and additional buffers that form part of the regulatory framework for bank capital are summarised in **Figure A**.

- In the United Kingdom, there are **Pillar 2 minimum capital requirements** for risks that are not (fully) captured under Pillar 1. There is also a **Pillar 2 buffer** to mitigate against external factors such as the business cycle, determined as part of the supervisory review process.

- The **capital conservation buffer** is set at a fixed rate and is intended to allow banks to absorb losses in stressed periods. Under the Basel III framework, banks would be allowed to

Figure A Summary of capital requirements under UK and European legislation[a]



Source: CRD IV/CRR.

(a) Expressed as a percentage of risk-weighted assets (RWAs).
(b) Within the 8% Pillar 1 minimum requirement for total capital, banks are subject to fund at least 6% of RWAs with Tier 1 capital, and at least 4.5% must be with CET1 capital.
(c) For a countercyclical capital buffer (CCB), up to 2.5%, mandatory international reciprocity provisions apply. This means that if the FPC, say, sets a rate between 0%–2.5% for the UK banking sector, overseas regulators would be bound to apply a CCB to banks in their jurisdiction for their UK exposures that is no less than the rate chosen by the FPC. Macroprudential regulators may apply a higher CCB, but the portion above 2.5% is not subject to mandatory international reciprocity provisions.
(d) For a given bank, this will be set equal to the highest of (i) the systemic risk buffer; (ii) the buffer for 'global systemically important institutions'; and (iii) the buffer for 'other systemically important institutions' that apply for that bank.
(e) The chart assumes that the Pillar 2 buffer requirement is net of the other buffers shown. The quality of capital eligible for Pillar 2 requirements is in the process of being finalised. See Bank of England (2013b) for the proposed eligibility.
(f) Specific level based on a policy decision.

draw down this buffer in times of stress. However, banks that do so will be subject to distribution restrictions — for example, how much they pay out in the form of dividends or bonuses — to ensure that the buffers are rebuilt in due course. As such, the capital conservation buffer assists in allowing banks to continue lending and providing other critical financial services during times of stress, while also promoting capital conservation in the banking sector.

- A time-varying **countercyclical capital buffer** can be built up when aggregate growth in credit and other asset classes is judged to be associated with a build-up of system-wide risk. When threats to resilience are judged to have receded or banks' capital buffers are judged to be more than sufficient to absorb future unexpected losses in the event of stressed conditions, this capital buffer might be reduced.

- Additional buffers exist for institutions that are deemed to be **systemically important** — that is, those whose failure is likely to be associated with negative externalities and wider spillover risks. In Europe, a so-called systemic risk buffer is available to prevent and mitigate long-term non-cyclical systemic or macroprudential risks not covered elsewhere in the regulatory framework.

The capital conservation buffer, countercyclical capital buffer and the buffers for systemically important institutions are being phased in over time and will be fully in place by 2019. It is worth noting that the requirements shown in **Figure A** are expressed in terms of ***total*** capital. Within these, in some cases there are minimum requirements for how much **equity** capital — specifically, so-called 'common equity Tier 1' (CET1) capital — banks must have compared to the other eligible forms of capital.[4] These are shown in dark orange. For example, 4.5 percentage points of the 8% Pillar 1 total minimum requirements are required to be in the form of CET1 capital. The 2.5% capital conservation buffer is required to be fully in CET1 capital so that, under the Basel III framework, banks will be required to fund 7% of their risk-weighted assets with CET1 capital (4.5% minimum + 2.5% capital conservation buffer). Reference is sometimes made to CET1 capital ratios — such as this 7% CET1 figure — instead of total capital ratios.[5] When other buffers are activated or applied, the total CET1 ratio may be higher.

(1) The reforms are being implemented in the EU by means of two pieces of legislation, the Capital Requirements Regulation and the Capital Requirements Directive IV, which are due to come into force in January 2014. In August, the PRA launched a consultation on its approach to implementing the CRD IV — see www.bankofengland.co.uk/pra/Documents/publications/policy/2013/implementingcrdivcp513.pdf.
(2) International liquidity standards are not yet in force; they will be imposed from 1 January 2015.
(3) Such models are subject to minimum standards and in general banks must obtain their supervisor's permission to use them.
(4) These different forms of capital are described in the main text in more detail.
(5) For example, the FPC recommended the PRA in March 2013 to take steps to ensure that, by the end of 2013, major UK banks and building societies hold capital resources equivalent to at least 7% of their risk-weighted assets (referring to the sum of the 4.5% CET1 minimum requirements and the 2.5% conservation buffer). See www.bankofengland.co.uk/publications/Documents/records/fpc/pdf/2013/record1304.pdf.

capital from an accounting perspective. For the purposes of capital requirements, to calculate the amount of CET1, adjustments are made to the accounting balance sheet. For example, items which would give rise to double counting of capital within the financial system, or which cannot absorb losses during stressed periods, are deducted.(1)

Banks can also count, to a limited extent, further instruments in their regulatory capital calculations. So-called additional Tier 1 (AT1) capital includes perpetual subordinated debt instruments. Basel III standards require that AT1 instruments must have a mechanism to absorb losses in a going concern, for example convertibility into ordinary shares or write-down of principal when capital ratios fall below a pre-specified trigger level.

A bank's regulatory capital resource also comprises 'gone concern' capital. Gone concern capital supports the resolution of banks and the position of other creditors such as the bank's deposit customers in bankruptcy proceedings. This includes Tier 2 capital, which is dated subordinated debt with a minimum maturity of five years. In addition, under Basel III, all additional Tier 1 and Tier 2 capital instruments must have a trigger so that they convert into ordinary shares or are written down when the authorities determine that a bank is no longer viable.(2)

Liquidity regulation

Microprudential regulation seeks to mitigate a bank's funding liquidity risk — the risk that, under stressed market conditions, the bank would be unable to meet its obligations as they fall due. It aims to achieve this by incentivising — or requiring — banks to have sufficiently stable sources of funding and an adequate buffer of liquid assets. A useful analogy is the risk of a commercial building burning down: regulations require both that the building is built to minimise the risk of fire breaking out (stable funding) and that it has a sprinkler system to extinguish a fire should one occur (liquid asset buffer).(3) In other words: both to reduce the risk of the adverse event occurring and ensure that, if it does, the harm done is limited.

International liquidity standards have not yet been finalised and implemented. The Basel Committee has agreed the first of two liquidity standards, the Liquidity Coverage Ratio (LCR).(4) It is designed to ensure that banks hold a buffer of liquid assets to survive a short-term liquidity stress. A second standard, the Net Stable Funding Ratio, is designed to promote stable funding structures and is currently under review by the Basel Committee. The rest of this section characterises the approach of the regulator, although fundamentally this should be closely linked to a firm's own approach in managing its liquidity risk.

Prudential regulators need to consider how adequate a bank's liquidity position would be during a hypothetical stressed scenario. Such a scenario needs to consider the various identifiable sources of liquidity risk in the banking business model, for example: maturing deposits from retail and wholesale customers; triggers for a withdrawal of funds relating to the bank's credit rating; the amount of new lending to customers; and the impact of increased market volatility leading to margin calls and non-contractual obligations that mitigate reputational risk. The hypothetical stressed scenario is typically of short duration — one to three months — and is a period of time during which the regulator expects each bank to be able to survive with funding from the private markets, without needing central bank support.

Typically, for the stressed scenario, regulators first of all determine the **liquidity outflows** during the stress period. These depend on the mix of types and maturities of funding that make up the bank's liabilities. Depositors and counterparties are assumed to have varying degrees of sensitivity to the creditworthiness of the bank and behave accordingly. The assumption is that the most credit-sensitive depositors, such as other banks, withdraw funding at a quicker rate than less credit-sensitive ones, such as insured retail depositors. Other liquidity outflows may occur if adverse market movements in respect of derivative positions mean that a bank is obliged to post liquid assets as collateral.

The regulator then defines acceptable **liquidity resources**, which lie on the asset side of the bank's balance sheet. The regulatory definition of liquid assets stipulates the quality of the liquid assets that banks must hold. The definition in force in the UK regime comprises central bank reserves and high-quality supranational and government bonds. As one bank may lend to another, or hold securities it has issued (unsecured and secured bank debt), the liquid assets of one bank may be liabilities elsewhere in the banking system. These are known as 'inside liquidity'. In a financial market stress, selling the debt of another bank is likely to prove difficult. Therefore many regulatory regimes exclude 'inside liquidity' from the definition of liquid assets.

The interaction of capital and liquidity regulation

There are a number of ways in which banks can alter their liquidity and capital positions. While there is no mechanical link between the two, there are a number of channels through which changes in liquidity metrics such as the LCR may impact a bank's capital position, and *vice versa*. The box on page 213 illustrates some simple balance sheet examples of how changes in one metric might affect the other.

(1) These include significant investments in the ordinary shares of other financial entities and goodwill.
(2) For more information on the definition of regulatory capital, see BCBS (2011).
(3) See Goodhart and Perotti (2012).
(4) See BCBS (2013) for more information on the LCR. The PRA confirmed in August 2013 that it will implement the Financial Policy Committee's recommendation that banks and building societies should adhere to a minimum requirement of an LCR of 80% until 1 January 2015. This requirement will then rise, reaching 100% on 1 January 2018. See www.bankofengland.co.uk/publications/Pages/news/2013/099.aspx.

The relationship between a bank's capital and liquidity positions

There are a number of ways in which banks can alter their liquidity and capital positions and there is no mechanical link between them. Even so, under certain assumptions, changes in one might affect the other. The purpose of this box is to illustrate some of the ways in which this could happen: in reality, the ultimate impact of a change to one of these ratios will depend on a range of factors.

Two scenarios are considered in **Figure A**. Relative to the baseline case, in Scenario 1 the bank increases its **risk-based capital ratio** (capital as a share of risk-weighted assets). In Scenario 2, the bank increases its **liquidity coverage ratio** (liquid assets held to cover a period of stressed net cash outflows). For both the scenarios considered, changes in the relevant ratios come about via the mix of different types of assets and liabilities, leaving the total size of the bank's balance sheet unchanged:

- **Scenario 1**: the bank increases its risk-based capital ratio by retiring short-term, 'flighty' funding from wholesale investors and issuing new equity of the same amount. Its assets are unchanged.

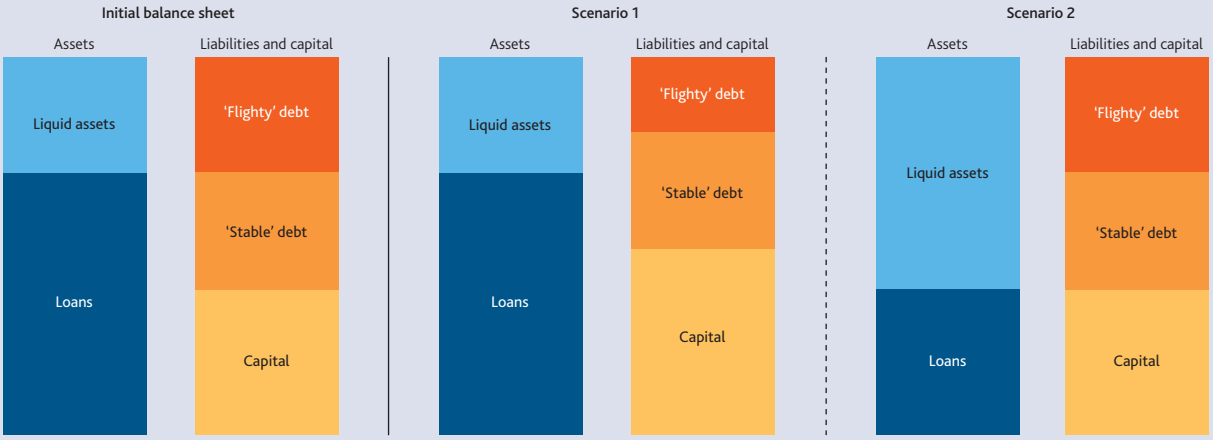
  Impact on liquidity: in this scenario, the bank's liquidity position is also improved, since it holds the same amount of liquid assets for a smaller amount of 'flighty' wholesale debt. Moreover, as Governor Carney has pointed out, higher levels of capital gives confidence to depositors and investors who provide funding to banks. With more long-term, stable funding assured, banks can safely hold fewer liquid assets.(1)

- **Scenario 2**: the bank increases its liquidity coverage ratio by keeping its liabilities unchanged and replacing illiquid loans (once these have been repaid) with liquid assets such as gilts.

  Impact on capital: the amount of capital is unchanged but, since the additional liquid assets it now holds are assumed to have a lower risk weight than the loans they are replacing, the capital ratio increases.

These examples are intended to be purely illustrative. As mentioned above, the actual impact of a change to one of these ratios will, in practice, depend on a number of factors. If a bank seeks to improve its capital or liquidity position then the total size of the balance sheet may not remain constant, as assumed here. In Scenario 1, for instance, if increased capital issuance is associated with a higher aggregate funding cost then the bank may choose to hold a different amount of loans, either in absolute terms or relative to safer assets. Similarly, Scenario 2 assumes that an increase in the liquidity coverage ratio gives rise to an improvement in the capital ratio but one possibility is that, by holding a greater share of low-yield liquid assets, the bank's future profits may be lower (all else equal) and so the potential for future increases in capital via retained earnings would be lower. In addition, the examples do not take account of other important factors such as changes in the perceived riskiness of a bank — hence its funding costs and profitability — in response to changes in its resilience as proxied by the capital and liquidity coverage ratios.

Figure A Stylised scenarios that represent changes in capital and liquidity ratios



(1) See Carney (2013).

Conclusion

A key function of banks is to channel savers' deposits to people that wish to borrow. But lending is an inherently risky business. Understanding the concepts of a bank's capital and liquidity position helps shed light on the risks the bank takes and how these can be mitigated.

Capital can be thought of as a bank's own funds, in contrast to borrowed money such as customer deposits. Since capital can absorb losses, it can mitigate against credit risk. In order to prevent balance sheet insolvency, the more risky assets a bank is exposed to, the more capital it is likely to need. Meanwhile, in stressed market conditions, it is possible that banks find that they do not hold sufficient cash (or assets that can easily be converted into cash) to repay depositors and other creditors. This is known as liquidity risk. A stable funding profile and a buffer of highly liquid assets can help to mitigate this risk.

Banks may prefer to operate with lower levels of financial resources than is socially optimal. Prudential regulation seeks to address this problem by ensuring that credit and liquidity risks are properly accounted for, with the costs borne by the bank (and its customers) in the good times, rather than the public authorities in bad times.

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The rationale for the prudential regulation and supervision of insurers

By Simon Debbage of the Bank's Financial Stability Directorate and Stephen Dickinson of the Prudential Regulation Authority's Regulatory Policy Department.[1]

- The financial crisis has necessitated a re-examination of the level, nature and distribution of risk across the financial system, including insurance companies. But the degree to which a common understanding has been reached on how insurers might affect financial stability is lower than, for example, the analogous discussion for banks.
- In a Workshop hosted by the Bank in July 2013, the risks posed by insurers for both insurance policyholders and financial stability were discussed, together with what this might mean for how insurers should be regulated and supervised.

Overview

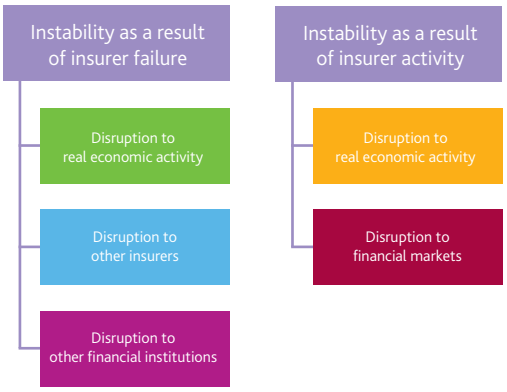
The financial crisis led to wide-ranging reforms across the financial system, including the insurance sector. In April 2013, the Prudential Regulation Authority, as part of the Bank of England, became responsible for the prudential regulation and supervision of insurers. In part as a result of these changes, the Bank has undertaken work to re-examine the economics of insurance and its regulation and supervision.

Insurers play a critical role within the financial system and support economic activity. However, there can be examples where insurance markets — if left unchecked — can result in poor outcomes for policyholders, for example if insurer failure resulted in disruption to insurance payments.

Insurance might also affect financial stability (see **summary figure**). Insurer failure can directly disrupt the provision of critical financial services. There might also be indirect effects if the failure of an insurer propagates stress to other financial firms, for example through financial market interconnections. Insurers might also affect financial stability through their ongoing activities, including relating to their large asset holdings.

These issues were discussed with representatives from the industry, academia and the wider policymaking community at a Workshop hosted by the Bank in July 2013. Most agreed that it was not obvious that insurers cannot generate risks to financial stability. Nevertheless it is clear that insurers are not systemic in the same way as banks. There was also general agreement that the relevance of different types of insurance markets and firms to protecting policyholders and maintaining financial stability will vary across insurance products and with the activities of the insurer. This might suggest that the intensity of prudential regulation and supervision should vary according to the nature of the risk. More work is needed to examine the channels by which insurance affects financial stability, and whether a greater degree of differentiation in regulatory and supervisory intensity is warranted.

Summary figure How insurers could affect financial stability



(1) The authors would like to thank John Breckenridge, William Hewitson, David Humphry, Tamara Li, Pippa Lowe and Tahir Mahmood for their help in producing this article.

In April 2013, the Bank of England became responsible for regulating and supervising insurance companies for the first time. This is carried out through the operations of the Prudential Regulation Authority (PRA), which was created as a part of the Bank in response to the recent financial crisis.(1) The PRA has two complementary statutory objectives relating to insurers.(2) The first follows from the PRA's general objective to promote the safety and soundness of the firms it regulates, focusing on the adverse effects that they can have on the stability of the UK financial system. The second is a specific insurance objective to help ensure that policyholders are appropriately protected. These objectives support the Bank's objective of protecting and enhancing the stability of the financial system.

On 18 July, the Bank hosted a Workshop on the rationale for the prudential regulation and supervision of insurance companies. The aim of the Workshop was to examine the risks posed by insurers for policyholder protection and financial stability and discuss what this might mean for how insurers should be regulated and supervised. Participants at the Workshop included senior representatives from leading insurers, academics operating in the insurance field and policymakers from the United Kingdom and overseas.

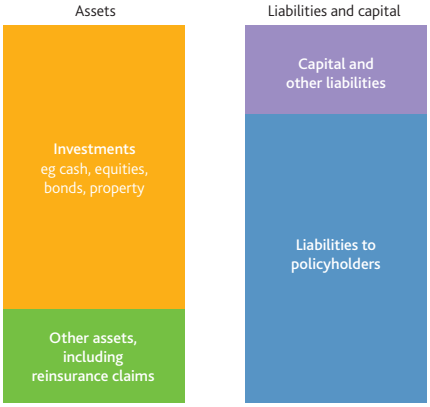
The first two sections of this article set out some of the channels through which the actions of insurers may generate poor outcomes for their policyholders or pose risks to financial stability. The final section then summarises the main themes that emerged during the Workshop on how the potential impact on policyholders and financial stability should influence the regulation and supervision of insurance firms. The Workshop was conducted under 'Chatham House Rule', so opinions are not attributed to individuals. This article does not represent the views of the Bank, the PRA Board or the Financial Policy Committee.

The impact on policyholders of insurer failure

Insurance is a critical financial service. It enables firms and households to transfer some of the risks they face to others better placed to bear them. General insurance — for example, property, motor or liability insurance — reduces policyholders' uncertainty over future outcomes. This can support economic activity since, for example, firms may find it easier or cheaper to obtain financing if they are insured against events which may otherwise disrupt their business activities, such as fire or theft. Life insurance provides benefits in the event of death, retirement or changes in health, and also represents an important savings mechanism for households.

The importance of the insurance sector is underlined by the scale of payments made to households and firms by insurers. In 2011, for instance, UK insurers paid out £9.3 billion in motor claims and £4.7 billion in property claims to firms and households.(3) These payments arise from the obligations of insurers to their policyholders according to the terms of their insurance policies, and will typically be funded by the assets held to back the insurer's liabilities, as shown in **Figure 1**.

Figure 1 A stylised balance sheet for an insurance firm



The scale and nature of insurance provision suggests that the disorderly failure of insurers could result in considerable costs for firms and households if, for example, this resulted in insurance payments not being made as expected. Such costs will vary considerably with the type of insurance. For instance, the impact for an individual of an insurer not meeting medical bills is likely to be much greater than if, say, mobile phone insurance claims were not honoured.

There could also be other costs besides non-receipt of expected payments. If an insurer fails and its policyholders need to find another insurance provider, then they will lose out if they are unable to secure cover on similar terms elsewhere. This may be particularly important for life insurance where the policyholder's life expectancy may have reduced considerably since the original policy was taken out, meaning that life insurance premiums on a new contract would be much higher. There may be examples, however, when policyholders should not necessarily expect to secure cover on similar terms, for instance if underpricing had led to the insurer's failure. In addition, policyholders may be prevented from undertaking certain activities — such as driving a car — until cover is replaced, with potentially large economic impacts. Alternatively, policyholders could, in effect, be forced to self-insure and accept additional risk until they obtain a new policy.

But the existence of potential costs for policyholders following insurer failure does not itself establish a case for prudential regulation and supervision. Public intervention will only be

(1) For an overview of the new regulatory framework for the financial system in the United Kingdom, see Murphy and Senior (2013).
(2) See Bailey, Breeden and Stevens (2012) for a description of the PRA's role and its approach to supervision for deposit-takers, insurers and major investment firms.
(3) Association of British Insurers (2012).

justified if it can successfully address the underlying market failures which give rise to insurance firm failure in the first place. And even if that is the case, it would need to be determined whether intervention takes the form of *prudential* regulation and supervision — that is, promoting the safety and soundness of individual firms. For some types of market failure, compensation schemes (such as the Financial Services Compensation Scheme[1] in the United Kingdom), resolution arrangements or conduct regulation may be sufficient. There are examples from other sectors — for example, certain parts of the tourism industry — where there are arrangements to protect consumers in the event of firm failure, but where a framework of prudential regulation and supervision has not been judged necessary.

An example of a market failure relevant in insurance markets is the potential for 'moral hazard'. This arises because insurers receive premium income from policyholders upfront but do not have to make payments to the policyholder for some time, if at all. This can incentivise or allow behaviour which — if left unchecked by regulation and supervision — can lead to a firm making poor underwriting or reserving decisions, or holding excessively risky assets, not consistent with safeguarding the interests of policyholders or society as a whole. **Table A** lists some of the main market failures relevant for insurance regulation and supervision.

Table A Market failures in insurance

Market failure	Example
Moral hazard: insurers receive premiums upfront, but it can be a long time (if ever) before any payments are due. This gives scope for insurers to take action in the meantime at odds with policyholders' interests and financial stability.	Firms may be able to take risks greater than their policyholders would prefer, for example by underpricing policies or holding very risky assets. But policyholders may be constrained from switching insurers if, for example, contracts are very long (such as for many life insurance contracts).
Adverse selection: some policyholders are less able or less incentivised to assess their insurers. Intermediaries may also lack information or face conflicts of interest in their assessment of insurers.	Retail policyholders may be less able to assess the riskiness of insurers (because of asymmetric information) than corporate policyholders. In many cases, retail policyholders may simply select the cheapest cover available.
Degree of competition: if the level of competition is weak, firms which make poor risk decisions may nevertheless not exit the industry.	Barriers to entry and exit tend to be highest in life insurance markets, as are impediments to switching between firms and market concentrations.
Externalities: there may be costs related to insurance provision not taken into account by the insurer.	There may be important costs for other financial firms and the wider economy from insurer failure or the firm's asset allocation choices.

The relevance of these market failures will vary with the type of insurance. Economic theory would suggest that in well-functioning markets consumers are able to exert sufficient influence over firms such that the way they operate is broadly consistent with consumer preferences. This influence will often be exerted through the threat of switching to alternative providers. However, the extent to which this holds in insurance markets varies across products. For example, retail policyholders are less likely to be able to influence their insurance provider than a large corporate policyholder. And within retail insurance, the fact that much life insurance involves very long contract periods and early redemption penalties reduces the ability to switch providers. By contrast, within general insurance, personal property insurance is typically renewed more frequently.

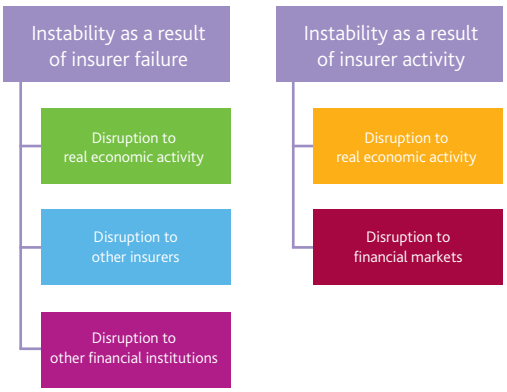
Insurance and financial stability

As noted in **Table A**, insurance markets can be subject to externalities. An important example of insurance externalities stems from the impact of insurers on other financial institutions, and the firms and households which use their services. If these potential financial stability effects are material, this could justify the regulation and supervision of insurers.

A stable financial system can be defined as one which is able to provide a smooth supply of critical financial services to firms and households. Such services will include efficient risk transfer and channelling savings into investment. While the insurance sector is critical to both these services, this does not necessarily mean that an insurer will generate financial instability.

To evaluate whether and how insurers are most likely to generate risks to financial stability, one can set out the potential channels and then examine case-study evidence to assess their relative likely importance. These are summarised in **Figure 2** which groups the possible channels by which insurers could generate financial instability into two categories: those stemming from insurer failure (or extreme distress) and those related to insurers' activity during the normal course of their operations.

Figure 2 How insurers could affect financial stability



Financial stability risks resulting from insurer failure

Insurer failure can directly disrupt the provision of critical financial services, in particular where the firm is dominant in a market and cannot easily be substituted by other insurers in

(1) For more information see www.fscs.org.uk.

the short term. For example, the failure of the Australian general insurer HIH Insurance in 2001 resulted in significant short-term disruption to Australia's construction industry. This was because HIH dominated the market for mandatory builders' warranty insurance — largely because it underpriced its policies. But this underpricing, and subsequent underreserving, resulted in HIH's failure. Given the lack of competing providers to step in when HIH failed, this led to a disruption in the supply of a critical type of insurance.(1)

Financial instability might also be the result of insurer failure propagating stress to other financial firms. For example, interconnections within the insurance sector can be generated through reinsurance, whereby insurers pass on some of the risks they have taken on to other insurers. While reinsurance helps individual insurers manage their insurance risk, it also results in additional counterparty exposures. Hence if a major reinsurer failed and was not able to meet its reinsurance obligations, this could affect the solvency of the insurers from which it faced claims, and so threaten the supply of services they provide. While we have seen no failures of very large reinsurers, huge losses were generated in the London reinsurance market in the 1990s as a result of complex and opaque interconnections between reinsurers, subsequently addressed through a number of reforms in the market, including tougher prudential requirements and improved disclosure.

Insurers are also interconnected with other parts of the financial system. These interconnections can result from insurance firms forming part of wider financial groups, including banks. They can also follow from insurers' participation in financial markets (for example related to the investments that insurers hold as assets, as shown in **Figure 1**). The collapse of AIG — a major global insurance group — was triggered by its activities in derivative and securities lending markets, and it was rescued by the US government partly because of the likely impact that a disorderly failure would have had on other participants in these markets. An important point here is that it was not AIG's insurance underwriting activity which caused its failure and threatened financial stability, but the auxiliary financial market activities it undertook on the back of its core insurance business.(2)

Financial stability risk arising from insurer activity

Aside from failure, insurers might also affect financial stability through the activities they undertake as part of their normal operations. In particular, the insurance sector is a natural provider of long-term financing to the real economy given that many insurance liabilities — such as annuity payments — are similarly long-lived. Indeed insurers are large, long-term providers of corporate finance, with UK insurers holding over £370 billion of UK companies' debt and equity. Changes in the size or type of this investment could therefore affect the provision of funding to the real economy.

These large asset holdings also mean that insurers' investment decisions could have broader impacts within the system. For example, insurers may be incentivised to act in ways that generate or amplify price movements in asset markets, potentially contributing to 'fire sales' or asset price bubbles. Insurers in the United Kingdom have been granted 'regulatory forbearance' — that is, the waiving or relaxing of prudential requirements where permitted by the legal framework — during past periods of financial market disruption so as to ensure that regulatory requirements did not encourage fire-selling behaviour. Insurers may also affect financial markets through providing insurance products that can amplify credit booms. For example, the underpricing of financial guarantee insurance — providing insurance to holders of particular securities to protect against the non-payment of interest and principal — in the run-up to the recent financial crisis may have helped amplify aggregate credit expansion.

Key topics from the Workshop discussion

This section sets out three key themes which emerged during discussion at the Workshop held at the Bank on 18 July 2013. The themes relate to the channels through which insurers may affect policyholder protection and financial stability, and what this might imply for the approach to regulation and supervision of insurers in practice. The Workshop was conducted under 'Chatham House Rule' so individual comments are not attributed to particular speakers.

Policyholder protection and insurance regulation and supervision

Most Workshop participants agreed that market failures, and the potential impacts on policyholder protection, can differ considerably across insurance types. While there was a mix of views as to what this means in terms of a supervisor's priorities, there was relatively broad agreement that — given supervisory resource is inevitably limited — attention should be focused on firms providing insurance products that are subject to the most significant market failures and which could pose the greatest economic costs following insurer failure.

It was noted that it was often unreasonable to expect policyholders to be able to exert any disciplining effect on insurers, or take any action to diversify insurance exposures across firms. Many policyholders selected insurance based on price alone. This suggested a strong case for public intervention, at least for some insurance products.

One participant queried whether there may be risks to reducing supervisory attention on particular types of insurance. Even where insurance covers relatively 'low-value' risks for policyholders, the failure of a large provider of such

(1) See HIH Royal Commission (2003).
(2) See US Government Accountability Office (2011).

cover would still affect a large number of consumers and could erode trust in the industry and in the regulatory and supervisory framework. This could lead, for example, to firms and households underinsuring or life insurance policyholders seeking to liquidate their policies where they are able to.

Another participant noted, however, that regulatory and supervisory interventions impose costs on the industry, and that these can be passed on to policyholders. If these costs become excessive, they could affect the amount and type of insurance that can be provided by the industry at a reasonable cost to consumers.

What is the case for insurance supervision and regulation based on financial stability considerations?

Turning to the possible financial stability relevance of insurers, one participant suggested that many large firms, including non-financial firms, could be considered systemic because of the complexity of their supply chains and the importance of the continuity of supply of their products. It was not clear to this speaker that insurers would feature at the top of a list of non-bank systemic firms. As such, there was a risk that additional regulation and supervision for insurers relative to other financial sector firms on financial stability grounds was unwarranted and risked stifling innovation.

For others, however, it was not clear that the failure of an insurance firm would not generate financial instability. A number of participants stressed the potential effect of the failure of a large insurer that provides critical cover on the economic activity of firms and households. One participant suggested that the number of government interventions in a sector could be a key indicator of potential relevance for financial stability, and that there had been a number of significant interventions in the insurance sector, both in the United Kingdom and elsewhere. This argument rests on the assumption that the interventions in question were undertaken, at least in part, with financial stability objectives in mind.

The relevance of different types of insurance for financial stability was highlighted by a number of participants. Some types of life insurance, for example, can be considered to be savings vehicles allowing policyholders ready access to funds as well as providing guarantees on the level of returns. To the extent that such products are backed by long-term and illiquid investments, this generates a risk for the insurer that policyholders seek to liquidate their holdings faster than the insurer can convert its assets into cash. As such, policyholders could be incentivised to liquidate at the first sign of any apparent distress, although the use of policy surrender penalties can limit such behaviour. This type of 'run risk' is usually associated with banks, and is one of the key reasons why banks are subject to prudential regulation and supervision.

Aside from 'runs', participants also discussed other scenarios where insurers might be incentivised or forced to sell assets in a disorderly way, which could propagate stress to other market participants. For example, insurers might participate in fire sales in falling markets because they find it difficult to deviate from the behaviour of other market participants. In addition, regulatory requirements or shareholder pressure might encourage insurers to sell assets even when values are decreasing because to do otherwise could further weaken their balance sheet. The role of accounting rules, including valuation approaches, in driving such behaviour was also highlighted.

Insurers are generally acknowledged to be long-term investors. But they can respond during periods of economic stress by rapidly changing their asset allocations. There was broad agreement that if insurers are incentivised to act in a short-termist way this would undermine insurers' ability to hold assets to maturity. There was discussion over whether insurers' regulatory requirements contributed to this, and whether requirements should be altered in order to reduce or remove the incentive to sell assets in response to short-term market falls and thereby support insurers' role in providing long-term finance to the real economy. There was agreement that more work was needed in this area.

One participant suggested that in the run-up to the recent financial crisis, the extent to which banks lent to each other became excessive relative to the credit banks provided to firms and households, and that the scale of such intra-sector activity was a key vulnerability revealed during the crisis. This might suggest that the relative size of insurers' intra-financial sector claims — including reinsurance — could similarly be an early indicator of financial stability risks arising in the insurance sector. While work has been undertaken to improve transparency in reinsurance markets,[1] the relative lack of data to understand reinsurance interconnectedness was also highlighted. Another participant argued, however, that there were no instances where reinsurer failure had significantly affected other insurers, and that the market was characterised by a high degree of substitutability between firms.

Which factors should shape how insurers should be regulated and supervised in practice?

Most participants highlighted weak governance and poor risk management decisions as the key underlying causes of insurer failure.[2] As a result, most were keen that a greater focus should be given in insurance regulation and supervision to governance issues. It was noted, however, that it was easy to identify examples of bad decisions after the event; it was

(1) See, for example, International Association of Insurance Supervisors (2012), which draws on work undertaken by the IAIS Reinsurance Transparency Group.
(2) A number of participants referenced the findings of the 2002 report on the 'Prudential supervision of insurance undertakings' by the Conference of Insurance Supervisory Services of the Member States of the European Union (the 'Sharma Report').

much harder for supervisors to design frameworks to identify and challenge poor or irrational choices before decisions are made.

The role of the board of directors in decision-making was highlighted, and in particular the need for the board to exhibit expert and professional judgement. Diversity of board members was also said to be important. One participant suggested that more should be done to make board members more accountable. Another noted that the board can play a key role in approving a sound business plan and setting appropriate checks and balances. One participant highlighted the complexities in managing cross-border groups, which can complicate the supervisory process.

A wide range of views was expressed on how much weight to place on model outputs versus judgement in insurer risk assessment. At one end of the spectrum, one participant believed that models were frequently a waste of time and money, in particular where they were built on an overly theoretical or simplified approach. Another participant argued that while models were useful, there was a danger of overreliance on models in supervisory frameworks. Most speakers, however, agreed that models were a useful input into decision-making, so long as they did not replace expert judgement. Several emphasised early warning indicators or alternative quantitative measures of risk as a valuable tool in the supervisors' toolkit. Finally, one participant suggested that a focus on supervisory judgement could generate additional uncertainty for firms.

The importance of effective resolution arrangements for insurers was stressed by a number of participants. One participant said that they doubted whether the tools and powers to facilitate a reasonably orderly resolution of a large insurer were in place. Another participant stressed the need for effective resolution arrangements given the interconnectedness of some insurer activities — including both those supporting mainstream insurance business such as the use of derivatives and securities lending markets, as well as non-insurance activities.

The possible trade-offs between the policyholder protection and financial stability objectives were also highlighted. For example, the two objectives may suggest different priorities for supervisory intensity across insurance markets.

Conclusion

The Workshop yielded much useful discussion and highlighted a number of important avenues to explore. Most participants agreed that market failures, and the potential impacts on policyholder protection and financial stability, will vary considerably depending on the type of insurance. This might suggest that the intensity of prudential regulation and supervision should also vary across insurance markets. This is already a feature of many supervisory frameworks — for instance, life and general insurance are typically separated. But there may be value in considering whether there is a case for extending this approach further, and if so, how this could be effected in practice. The role that other interventions, for example resolution arrangements, compensation schemes and disclosure requirements, can play in addressing insurance market failures as an alternative or complement to prudential regulation and supervision should also be further explored.

The balance of views expressed at the Workshop suggested that it is not clear that insurer failure could not generate financial instability. Nevertheless, it was equally unclear precisely how insurers generate risks that could threaten the rest of the financial system and the real economy. What was clear was that insurers are not systemic in the same way as, for example, banks. More work is needed to evaluate the importance of the channels through which insurance can be relevant for financial stability. In particular, it would be useful to consider the counterfactuals of episodes where regulatory forbearance or other public interventions may have reduced the financial stability impact of insurer failure or activity.

Such work would be important in considering whether there could be a case for further adapting insurers' regulatory requirements in accordance with macroprudential objectives. Exploring whether financial stability objectives would always be consistent with those of policyholder protection also warrants further analysis. For example, insurers' asset allocation choices will be relevant to supporting the provision of credit to the wider economy, but such benefits may not be taken into account with solely policyholder protection objectives in mind.

The Bank will continue to examine these issues and participate in the international debate, including through existing relevant fora such as the Financial Stability Board, the International Association of Insurance Supervisors, the European Insurance and Occupational Pensions Authority and the European Systemic Risk Board.

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Recent developments in the sterling overnight money market

By Christopher Jackson and Mathew Sim of the Bank's Sterling Markets Division.[1]

- The sterling overnight money market plays an important role in the implementation of monetary policy. This article examines developments in this market since the peak of the financial crisis.
- Developments over this period include a fall in unsecured turnover and increasing use of secured transactions in overnight money markets. These trends have been driven by a number of factors, including perceptions of bank credit and liquidity risk, developments in the Bank's operational framework, liquidity regulation and changes to banks' business models.
- Some of these developments could be expected to unwind as the Bank withdraws its unconventional monetary policy measures in due course. But other factors, such as the impact of new international liquidity regulation, are likely to persist in the longer term.

Overview

The sterling overnight money market plays a key role in the implementation of monetary policy. It is the market through which the Monetary Policy Committee seeks to influence short-term market interest rates by setting its policy rate, Bank Rate. Changes in overnight interest rates and market participants' expectations of future rates influence longer-term interest rates and other asset prices in the wider economy. The functioning of this market is therefore important for the effective transmission of monetary policy.

Operational developments since the financial crisis

Since the start of the financial crisis in 2007, the Bank has significantly increased the supply of liquidity to the banking system. The Bank initially accommodated this within its 'reserves averaging' framework. But in March 2009, when the Bank began its 'quantitative easing' programme — the purchasing of assets financed by the issuance of central bank reserves — it introduced a 'floor' system whereby it remunerated all central bank reserves at Bank Rate. This provided a floor to overnight interbank interest rates as no bank with a reserves account should have the incentive to lend reserves at a rate below Bank Rate.

Structural developments in the market

Activity in the sterling overnight money market has changed since the start of the financial crisis, as a result of both the crisis itself and policymakers' responses to it.

The financial crisis increased market participants' awareness of bank credit risk and of their own liquidity risk. During the height of the crisis, banks increasingly transacted with the Bank rather than the money market to manage their liquidity. The introduction of the floor system and the significant increase in reserves further reduced banks' need to use the money market for liquidity management. As a result, money market activity, particularly in the unsecured interbank market, fell. At the same time, heightened sensitivity to credit risk, and international liquidity regulations, have encouraged banks to trade on a secured rather than an unsecured basis. Changes in banks' business models have also altered incentives to arbitrage differences between market rates and Bank Rate.

Some of these changes may be temporary and unwind with the eventual withdrawal of unconventional monetary policy measures. But other changes, such as international liquidity regulations, are likely to have a longer-term effect on the structure of the market.

Summary table Key developments in sterling overnight markets

- An increased awareness of bank credit risk and liquidity risk.
- Introduction of the 'floor' system and an increase in the supply of reserves.
- Reduced volatility in overnight interest rates since the introduction of the 'floor' system.
- A decline in unsecured money market activity and growth of the secured market.
- Introduction of international prudential liquidity regulations.
- Changing incentives to arbitrage overnight interest rates.

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The sterling money market is the market for short-term borrowing and lending of cash among banks and other institutions. While the maturities of these transactions can extend to one year, this article focuses on the shortest maturity of transactions, those in the overnight money market.

This article describes how the sterling money market has developed since the height of the financial crisis.(1) The first section outlines developments in the Bank's operations and the overnight money market in response to the financial crisis. The article then goes on to discuss how the financial crisis — and policymakers' responses to it — have affected the structure and functioning of the overnight market in the longer term. The box on page 231 provides a comparison with developments in international money markets.

Overview of the market

The sterling overnight money market plays an important role in the transmission of monetary policy. The Bank operates in the sterling money market to implement the interest rate decisions of the Monetary Policy Committee (MPC). It does so by seeking to maintain overnight market interest rates in line with the MPC's policy rate (Bank Rate) between MPC meetings, with little day-to-day or intraday volatility. In doing so, it seeks to establish the benchmark short-term risk-free rate on which other interest rates pertinent to the real economy are based. Changes in overnight interest rates and changes in market participants' expectations of their future values affect longer-term interest rates. These in turn influence the cost of credit and prices of assets in the wider economy. The Bank's operations in the sterling money markets are set out in its Sterling Monetary Framework (SMF).(2) The box on page 225 provides an overview of data sources that the Bank uses to monitor the overnight money market.

The overnight money market can be divided into two parts: the market for unsecured deposits or loans, and the market for repurchase, or 'repo', transactions. Unsecured lending consists of transactions that are not collateralised.(3) A repo, by contrast, is the lending of cash secured against collateral, typically UK government debt. In a repo transaction, a borrower agrees to sell a security and repurchase it at a specified date in the future. The lender holds the security as collateral, or insurance, in the event of default.

A range of institutions participate in the overnight money market. Banks typically use it to manage their daily liquidity needs and source their short-term funding. Non-bank financial institutions (such as money market funds, pension funds and insurers) and non-financials (such as non-financial corporates and local authorities) also operate in the overnight money market. These institutions primarily seek to lend their cash holdings to banks, and do so in the short-term money market to limit their exposure to credit and liquidity risk. The UK Government's Debt Management Office (DMO) also lends and borrows at a range of maturities.

Operational developments in response to the financial crisis

The Bank currently influences overnight market interest rates through the rate it pays on central bank reserves, Bank Rate. These reserves are deposits that commercial banks hold at the Bank. In 2006, the Bank introduced a system of 'reserves averaging'. Under this system, banks' reserves balances were remunerated at Bank Rate provided their reserves were, on average, within a certain range of their voluntary targets. The box on page 227 provides a fuller overview of the reserves averaging framework.

Between 2006 and 2007, this system maintained overnight interest rates within a relatively small range around Bank Rate. During 2007–08, however, the sterling interbank money market experienced stress due to market participants' concerns about other banks' solvency and their own liquidity positions. The volatility of overnight rates increased as banks became unwilling to lend reserves to other banks. Market participants no longer perceived unsecured overnight lending to a bank as being near risk-free. In addition, banks became uncertain about the possibility of future shocks to their own reserves balances. These factors became particularly acute after the bankruptcy of Lehman Brothers in September 2008.

The Bank responded to the stress in the money market by increasing the supply of reserves to the banking system (**Chart 1**). The increase in the supply of reserves in 2007–08 largely reflected changes to the banks' own voluntary reserves targets, which nearly tripled from £16 billion in July 2007 to £45 billion in December 2008, as their precautionary demand for reserves grew. The Bank injected considerably more reserves than this into the banking system in gross terms, but it typically offset much of these increases with its open market operations to 'drain' reserves in excess of banks' targets.(4) The Bank also significantly widened the range around reserves targets within which reserves were remunerated so that banks could, in aggregate, hold these additional reserves without being penalised for exceeding their targets. Overnight interest rates during this period, however, remained volatile compared with the pre-crisis period (**Chart 2**).

(1) For an overview of the history of the wider sterling money market and some of the other themes discussed in this article, see Hauser (2013).
(2) See Bank of England (2013a).
(3) The unsecured money market also contains certificates of deposit and commercial paper. These instruments tend to be of a maturity greater than overnight. Therefore this article focuses on deposits in the unsecured market.
(4) See Cross, Fisher and Weeken (2010).

Monitoring the overnight money market

There is no single comprehensive measure of interest rates and activity in the overnight money market. As a result, the Bank monitors a range of information.

The timeliest measures of overnight interest rates come from brokered transactions, in which a broker acts as an intermediary between borrower and lender. Interest rates in the brokered unsecured market are represented by the sterling overnight index average (SONIA), which is the daily weighted average interest rate of unsecured overnight transactions brokered by members of the Wholesale Markets Brokers' Association (WMBA). In the brokered secured market, interest rates are represented by the repurchase overnight index average (RONIA), the daily weighted average interest rate of transactions secured against UK government debt, also brokered by WMBA members.(1)

SONIA and RONIA provide a daily source of data on overnight money market interest rates and volumes. They also provide the reference rates for overnight index swaps, which are used by market participants to hedge or speculate on changes in future short-term interest rates. Rates on these swaps can be used to infer market expectations of future overnight interest rates. But both measures currently capture a relatively small proportion of total transactions in the overnight money market, around 25% of the unsecured market and 10% of the secured market. Contacts note that this is largely because of an increased preference for market participants to transact directly with one another rather than through a broker.

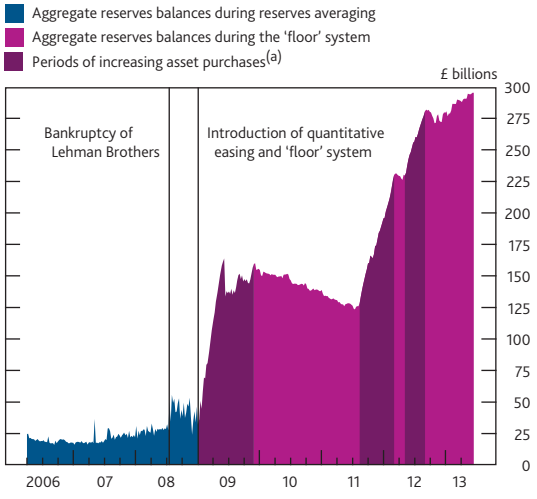
A more comprehensive, but less timely, source of data is the Sterling Money Market Survey, carried out by the Bank on behalf of the Money Market Liaison Group.(2) The survey, run since May 2011, is conducted twice a year and is designed to capture broad trends in money market activity. This has the broadest coverage of money market activity. Respondents, which include the most active bank participants in the sterling money market, are asked to provide quantitative and qualitative information about a range of wholesale sterling money market transactions. The Bank also administers a quarterly survey of the secured sterling money market, which began in 1996.(3)

Another indicator of activity is the estimated volume and the weighted average interest rate of unsecured overnight trades derived from the UK CHAPS payments system. This is the system through which sterling unsecured transactions between settlement banks are settled. This measure includes all overnight transactions, except for those that are settled using the same settlement bank.(4) The estimated volumes are therefore likely to be higher than those recorded by SONIA, but lower than those reported to the Sterling Money Market Survey.

The Bank also obtains information about conditions in, and the functioning of, the overnight sterling money market through its own operations. The Bank complements this information with regular conversations with its counterparties through its market intelligence programme.(5)

(1) For further details on SONIA and RONIA, see www.wmba.org.uk.
(2) See The Bank of England (2013b).
(3) See Bank of England (1996).
(4) For further details of this measure, see Millard and Polenghi (2004).
(5) For further details of this programme, see Fisher (2011).

Chart 1 Aggregate reserves balances



(a) Excluding purchases that represent the reinvestment of proceeds from matured gilts.

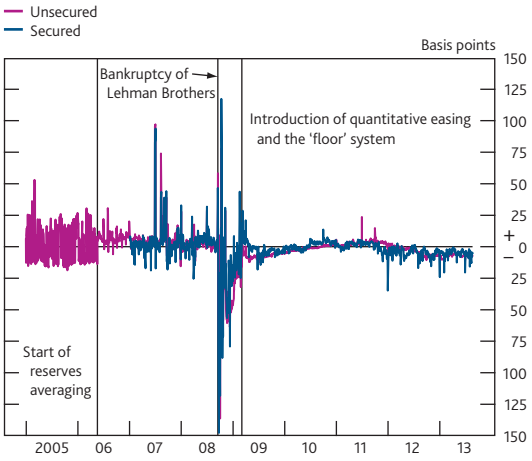
The introduction of the floor system

At its meeting on 5 March 2009, the MPC announced that the Bank would begin a programme of asset purchases financed by the creation of central bank reserves (known as 'quantitative easing').(1) This resulted in a large and sustained increase in reserves supplied to the banking system.(2) Aggregate reserves balances increased by around £260 billion between March 2009 and August 2013, compared with the increase of around £30 billion between July 2007 and December 2008 (**Chart 1**).

At the same time as introducing quantitative easing, the Bank suspended reserves averaging and implemented a 'floor'

(1) For a description of the design and aims of quantitative easing, see Joyce, Tong and Woods (2011).
(2) The Bank purchased gilts and, to a lesser extent, corporate assets, from a range of investors. If the Bank purchases an asset, financed by the issuance of central bank reserves, from a non-bank company, it pays for the asset via the seller's bank while the bank then creates a deposit for the non-bank company. The corresponding reserves are accrued to the reserves account of the seller's bank. See Benford *et al* (2009).

Chart 2 Spread of overnight interest rates to Bank Rate



Sources: Wholesale Markets Brokers' Association and Bank calculations.

system, in which all reserves account balances were remunerated at Bank Rate. This allowed the Bank to increase the aggregate supply of reserves through its asset purchases without interfering with the implementation of the MPC's policy rate in the money markets.

Remunerating all reserves at Bank Rate provides a 'floor' to market interbank overnight interest rates because it means that individual banks with reserves accounts have no incentive to lend reserves in the market at a rate below that at which reserves are remunerated by the Bank. If money market rates are below Bank Rate, reserves account holders can — at least in theory — arbitrage a riskless profit by borrowing at the market rate and placing the money in their reserves account. **Table A** shows that, on average, overnight interest rates have been within 2 or 3 basis points of Bank Rate since the introduction of the floor system, and have been slightly closer to the policy rate than during the reserves averaging period.

The floor system and the large quantity of reserves also led to a further reduction in the volatility of overnight interest rates compared to both that at the peak of the crisis and during the earlier period of reserves averaging (**Chart 2**). The standard deviation of the spread of unsecured interest rates to Bank Rate rose from 9 basis points during the reserves averaging period to 35 basis points in the 'peak crisis period', but has since fallen to around 4 basis points (**Table A**).

Table A Developments in overnight interest rates

Basis points

		Reserves averaging[a]	Peak crisis period[b]	Floor system[c]
Mean spread to Bank Rate	Unsecured	6	-30	-3
	Secured	3	-26	-2
Standard deviation of spread to Bank Rate	Unsecured	9	35	4
	Secured	11	39	5

Sources: Wholesale Markets Brokers' Association and Bank calculations.

(a) 18 May 2006-31 August 2008.
(b) 1 September-31 December 2008.
(c) 5 March 2009-16 August 2013.

Structural developments

There have also been a number of structural factors since the start of the financial crisis with implications for the current and future functioning of overnight money markets. These include:

- an increased awareness of credit and liquidity risk;
- a decline in unsecured money market activity and growth of the secured market;
- the introduction of prudential liquidity regulation; and
- changing incentives for SMF participants to arbitrage money market rates.

These trends are discussed in turn below. Many of these developments are part of wider trends in global money markets, as discussed in the box on page 231.

An increase in perceptions of credit and liquidity risk

The failure of Lehman Brothers in September 2008 caused major disruption to the financial system, and the money markets in particular. It led market participants to reconsider both the likelihood that their counterparties might fail as well as their own liquidity risk. This had implications both for interest rates and for activity in the overnight market.

One immediate effect was an increase in the differentiation of unsecured overnight interest rates that market participants demanded for lending to different banks. Prior to the crisis, the credit risk of lending to banks was generally perceived to be low and reasonably uniform across all institutions, particularly for lending overnight. As a result, unsecured overnight rates traded at only a small premium above secured rates. But the crisis led market participants to increasingly differentiate between counterparties based on perceptions of their credit risk. Banks that other market participants perceived to be riskier paid higher interest rates to borrow, even at an overnight maturity. **Chart 3** shows the widening range of unsecured overnight interest rates paid by market participants after September 2008. The increase in the range of interest rates paid for secured overnight borrowing was typically less severe, reflecting the fact that lending was secured against collateral (**Chart 4**).

Since 2009, the range of brokered unsecured overnight interest rates has narrowed, largely because of the increase in reserves and an improvement in perceptions of banks' credit risk since the height of the crisis.

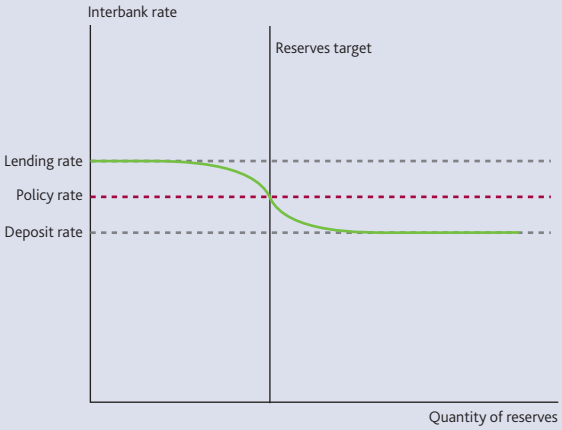
A further consequence of the heightened sensitivity to credit and liquidity risk was a reduction in banks' appetite to use the

The reserves averaging framework

Between May 2006 and March 2009, the Bank influenced overnight interest rates through a system of reserves averaging.(1) This system aims to create a close and stable relationship between overnight market rates and Bank Rate, and encourage banks to manage their own liquidity actively through the sterling interbank money market. Commercial banks set voluntary reserves targets each month, and the Bank supplied sufficient reserves, in aggregate, for banks to meet their targets. Banks' reserves balances were remunerated at Bank Rate, provided their average reserves balances between one MPC decision and the next was within a small range around the targets they had set themselves. Institutions were charged a penal rate if their reserves balances were on average above or below the target range.

The introduction of reserves averaging significantly increased the Bank's influence over overnight interest rates. The Bank used a 'corridor system' in which banks could borrow or deposit reserves using the Bank's standing facilities at interest rates fixed above and below Bank Rate, respectively.(2) As commercial banks were typically unwilling to trade in the market at rates worse than those available from the Bank, these standing facilities provided a corridor within which overnight rates traded. A stylised illustration of the demand for reserves is depicted in **Figure A**. If, for example, reserves were in short supply, banks may be willing to bid rates higher in the money market to gain additional reserves, but not higher than the level at which a bank could borrow from the Bank's lending facility. Similarly, if a bank had an excess of reserves, it would not lend these at a rate below that which it could receive for placing reserves on the Bank's deposit facility. As such, provided market overnight rates traded within the corridor created by the standing facilities, banks were incentivised to trade with each other, rather than with the Bank, to meet their reserves targets.

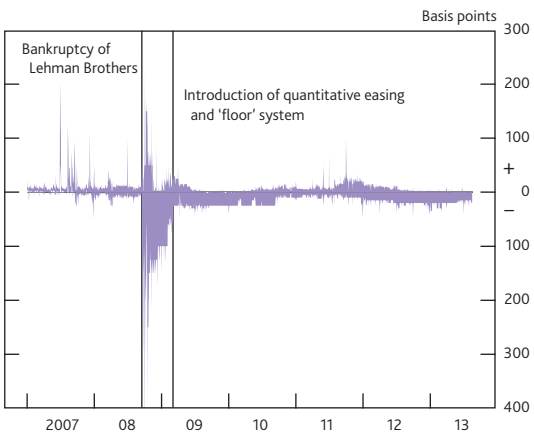
Figure A Stylised demand for reserves in a 'corridor system'



In addition, the ability of banks to vary their day-to-day reserves balances with the Bank, while still meeting their reserves targets on average over a maintenance period ensured that overnight interest rates remained close to Bank Rate throughout the period, as well as within the corridor. If banks expected the Bank to supply the correct amount of liquidity on the final day of the maintenance period — so that the overnight rate would be close to Bank Rate — then the overnight rate would also remain close to Bank Rate throughout the rest of the maintenance period.(3) This is because banks only had to meet their reserves target on average over the period. This allowed them to increase or decrease their reserves balance to take advantage of divergences between the market rate and the rate expected on the final day of the maintenance period.

(1) For a detailed account of the reserves averaging framework, see Clews (2005).
(2) In 2006, the lending and deposit rates were 1 percentage point above or below Bank Rate, except for the last day of each maintenance period when they were 0.25 percentage points above or below Bank Rate.
(3) This result is known as the 'martingale property'. See Mac Gorain (2005).

Chart 3 Range of the spread of brokered unsecured overnight rates to Bank Rate



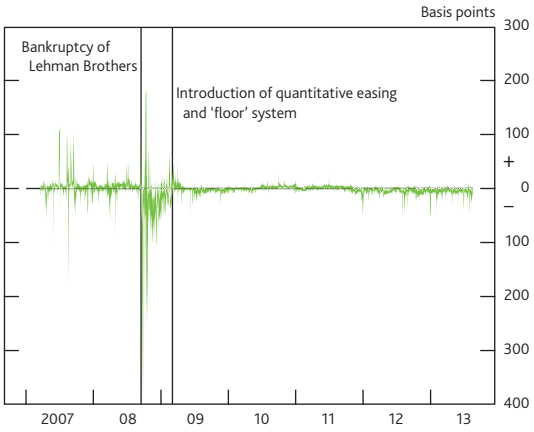
Sources: Wholesale Markets Brokers' Association and Bank calculations.

money market to manage their liquidity. Instead, during the peak of the financial crisis, banks increasingly preferred to transact directly with the Bank. The Bank supplied additional reserves to banks as they increased their reserves targets, and borrowed reserves back through draining operations. As a result, activity in the private money market fell — particularly in segments most exposed to bank credit risk, such as unsecured interbank transactions of longer maturities.

A decline in unsecured money market activity and growth of the secured market

The significant increase in reserves and the introduction of the floor system in March 2009 further reduced banks' need to use the private money market to manage their liquidity. The higher supply of reserves provided banks with larger buffers with which to absorb payment shocks. And the introduction

Chart 4 Range of the spread of brokered secured overnight rates to Bank Rate

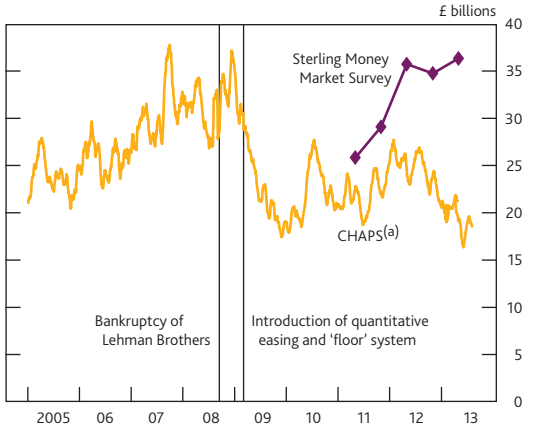


Sources: Wholesale Markets Brokers' Association and Bank calculations.

of the floor system meant that banks no longer needed to actively manage their reserves balances to meet a target in order for their reserves to be remunerated at Bank Rate. This reduced banks' need to use the money market, even as fears of further shocks to the banking system began to abate.

The effect of high levels of reserves on money market activity has been particularly pronounced in unsecured markets. **Chart 5** shows that estimates of the daily volume of unsecured overnight trades derived from the CHAPS payment system fell by around a third shortly after the introduction of the floor system.

Chart 5 Turnover in the overnight unsecured money market



Sources: Bank of England and Money Market Liaison Group Sterling Money Market Survey.

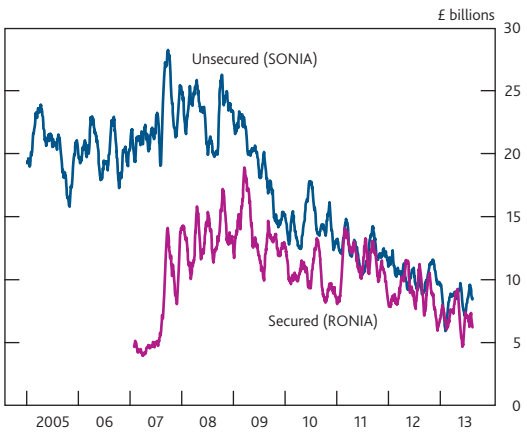
(a) Twenty working day moving average. Estimated from daily payments made through the CHAPS payment system. CHAPS data do not include payments where both legs are conducted through the same settlement bank, which is likely to be the main difference between the Sterling Money Market Survey and CHAPS.

Contacts report that the decline in unsecured activity was most severe for interbank transactions. In contrast, non-bank market participants, such as money market funds and non-financial corporates, have remained relatively active in lending to banks. As a result, non-banks' share of the unsecured overnight market has grown. Banks reported in the most recent Sterling Money Market Survey that they sourced around 70% of their overnight unsecured borrowing from non-banks. While banks currently have little need or desire for unsecured interbank trading, many continue to maintain some presence in the wider overnight market in order to foster existing client relationships with non-bank institutions. This is both to maintain these client relationships for other parts of their business, as well as to protect a potential source of short-term borrowing should banks need it.

The involvement of non-bank institutions in the secured market has also grown in recent years, incentivised by the similar returns on offer between secured and unsecured lending despite the lower credit risk of the former. Non-banks, however, remain a less significant feature of the secured market compared to the unsecured market. Contacts report that a number of factors have prevented a faster transition to secured trading, including the relative complexity of establishing the operational capability to trade in the secured money market.

After the sharp initial fall in activity, turnover in the unsecured overnight market since 2010 has been relatively stable. The Sterling Money Market Survey, which began in May 2011, even reports something of an increase in overnight money market activity since the survey's inception (**Chart 5**). Indicators of market activity derived from brokered transactions suggest a more sustained decline in turnover since 2008 (**Chart 6**). But the recent divergence between SONIA volumes and other measures reflects the declining importance of brokered transactions relative to bilateral transactions. Market intelligence suggests that this is driven by the greater importance that market participants attach to client relationships and greater discrimination in their choice of

Chart 6 Turnover in brokered unsecured and secured overnight money markets(a)



Sources: Wholesale Markets Brokers' Association and Bank calculations.

(a) Twenty working day moving average.

counterparties. This has reduced market participants' use of brokers as, with fewer potential counterparties to which they are willing or permitted to lend, there is less need to use an intermediary to find potential borrowers.

Some of the decline in unsecured overnight money market activity may only be temporary. Interbank activity may increase with a fall in the level of reserves as and when unconventional monetary policy unwinds, requiring banks to manage their reserves balances by borrowing and lending more actively in the interbank money market. But banks are unlikely to return to their pre-crisis reliance on short-term interbank funding, reflecting sustained aversion to bank credit risk and prudential liquidity regulations.

A sustained period of low unsecured interbank activity could have implications for market infrastructure. In general, contacts believe that, despite the fall in activity, they have retained the skills, staff and operational capabilities needed to manage their reserves balances and liquidity as and when activity picks up. Many money market trading desks, however, have reportedly consolidated and reduced staff numbers. Some smaller desks have diversified their activities to utilise spare capacity.

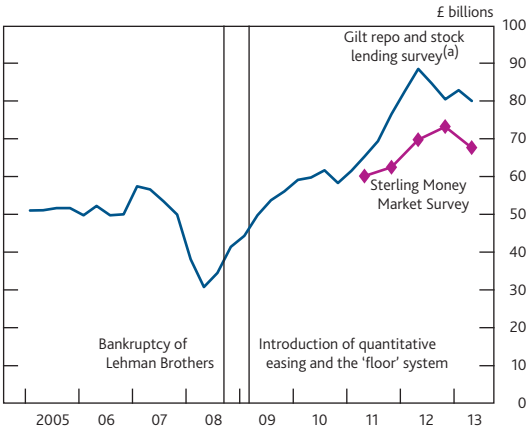
In contrast to the unsecured market, activity in the secured market appears to have increased since the start of the financial crisis. **Chart 7** shows that the value of overnight repo transactions recorded by the gilt repo and stock lending survey has steadily grown since the peak of the financial crisis. And secured transactions currently constitute around two thirds of total overnight activity recorded by the Sterling Money Market Survey. In part, the growth of the secured relative to the unsecured market reflects market participants' attempts to reduce their exposure to bank credit risk. Contacts also note, however, the important role played by prudential liquidity regulation, which incentivises banks to borrow on a secured rather than unsecured basis. These rules are discussed below.

One result of an increased preference for secured, rather than unsecured, lending is a rise in demand for collateral. Higher demand for collateral may, all else equal, push down on secured overnight interest rates. This is because secured interest rates reflect both demand for cash and demand for the collateral. The more scarce collateral is, relative to supply, the lower the interest rate that market participants generally demand to lend their cash for collateral.

Prudential liquidity regulation

The strengthening of prudential liquidity regulation, both at a national and global level, has important implications for how banks manage their liquidity risk and has altered banks' incentives to use overnight money markets.(1)

Chart 7 Turnover in the overnight secured money market



Sources: Gilt repo and stock lending survey, Money Market Liaison Group Sterling Money Market Survey and Bank calculations.

(a) Four-quarter moving average of outstanding repo and reverse repo transactions. Amounts outstanding and turnover are equivalent when the maturity of trades is overnight. Includes intragroup activity and activity involving the official sector.

The Prudential Regulation Authority's (PRA's) Individual Liquidity Guidance (ILG), introduced in 2010, requires UK banks to hold a stock of liquid assets against estimated wholesale net cash flows during a liquidity stress scenario. The Basel III reforms will require banks from 2015 onward to transition to the Liquidity Coverage Ratio (LCR), a metric conceptually similar to ILG.(2) The PRA confirmed in August 2013 that it would amend its current liquidity framework such that firms should, until 1 January 2015, aim to hold highly liquid assets broadly equivalent to 80% of the LCR agreed in January 2013 by the Basel Committee on Banking Supervision, rising thereafter to 100% by January 2018.(3)

These liquidity metrics assume that, in a liquidity stress scenario, banks lose different sources of funding at different rates. Banks are incentivised to use types of borrowing with lower 'run-off rates' — the rates at which banks are assumed to lose funding — because they do not have to hold so many liquid assets against them. In essence, these run-off rates provide banks with incentives to replace short-term, unsecured funding from banks with secured borrowing, unsecured borrowing at longer maturities, or borrowing from non-bank institutions.

Banks have become more sensitive to the type, maturity and source of their liquidity and funding as a result of these regulations. In particular, contacts believe that liquidity regulations are likely to keep short-term unsecured interbank borrowing volumes at relatively subdued levels, while encouraging banks to manage their liquidity through trading in the secured market. Banks have also reportedly become less

(1) For background information on the concept of liquidity for the banking sector, see 'Bank capital and liquidity' on pages 201–15 of this edition of the *Bulletin*.
(2) For further details of the Liquidity Coverage Ratio, see www.bis.org/publ/bcbs238.pdf.
(3) See www.bankofengland.co.uk/publications/Pages/news/2013/099.aspx.

willing to lend reserves unsecured because it reduces their liquid asset buffer, as reserves are considered to be the most liquid asset. Consequently, some banks, particularly smaller institutions, have significantly reduced their use of wholesale unsecured markets, preferring to use a combination of longer-term funding and holding reserves at the central bank to manage their liquidity needs.

Changes in incentives to arbitrage money market rates and Bank Rate

Since the introduction of the floor system, overnight rates have typically traded close to Bank Rate, with volatility at historically low levels (**Table A**). Under the floor system, the remuneration of all reserves at Bank Rate and arbitrage by reserves account holders should, in theory, keep overnight interest rates in the market close to Bank Rate. Reserves account holders should have no incentive to lend reserves below the rate they receive by depositing them with the Bank. By contrast, institutions without access to reserves accounts — such as non-banks — may be willing to lend at rates below Bank Rate. But if, as a result of this, market rates fell below Bank Rate, banks could earn a risk-free — or 'arbitrage' — profit by borrowing reserves in the market and depositing them with the Bank, where they earn Bank Rate. This should drive overnight interest rates back towards Bank Rate.

Since mid-2012, however, overnight rates have traded around 5–10 basis points below Bank Rate (**Chart 2**). Contacts report that banks have been unwilling to bid up for cash offered by non-banks at rates below Bank Rate. There are two reasons for this. First, banks' demand for short-term liquidity fell. Contacts note that this reflected several factors including banks' ongoing efforts to reduce their reliance on short-term wholesale funding, a reduction in the perceived risk outlook and a relaxation of regulatory liquidity requirements.(1)

Second, banks have become less willing to borrow to arbitrage overnight rates against their reserves accounts. Such borrowing increases the size of their balance sheets and leverage ratios.(2) Since the start of the crisis, banks have been trying to deleverage their balance sheets to wind down holdings of certain 'legacy' assets accumulated in the run-up to the crisis and conform to national and international regulatory requirements. The 2013 Q1 *Bank Liabilities Survey* found that the most common reason for banks' limited appetite to increase short-term wholesale borrowing was a desire to manage the size of their balance sheet.(3) As a result, many banks have increased the returns they require to justify a given amount of borrowing. Contacts report that they will typically not arbitrage low overnight rates until they are up to 10 basis points below Bank Rate.

The expansion in the number and variety of reserves account holders since 2009 may, however, over time help to strengthen the arbitrage mechanism. In October 2009, the Bank widened the population of institutions eligible to hold reserves accounts and access the Bank's facilities.(4) As of 5 September 2013, there were 112 reserves account holders, compared with 45 in July 2008. All else being equal, this should reduce the likelihood that interest rates diverge from Bank Rate because more institutions are able to use the Bank's facilities as an alternative to the money market and arbitrage differences between Bank Rate and market rates.

Conclusion

This article has described the role played by the sterling overnight money market in the implementation of the MPC's interest rate decisions. The financial crisis and the MPC's asset purchase programme have led the Bank to adapt how it influences overnight interest rates. Nevertheless, overnight interest rates have remained close to the Bank's policy rate. The structure of the market, however, has changed. Some of these developments may, in time, reverse. The fall in unsecured interbank turnover, which is in part a consequence of the high levels of aggregate reserves, may partially unwind as and when monetary policy and the level of reserves normalise. But other changes are likely to have a more lasting effect. In particular, the growth of the secured market is likely to be sustained, as liquidity regulations and banks' own risk aversion deter unsecured activity. The Bank will continue to monitor these developments, as well as those in the wider money market.

(1) See www.fsa.gov.uk/library/communication/statements/2012/fpc.shtml.
(2) A bank's leverage ratio is calculated as its total assets divided by its capital base. See 'Bank capital and liquidity' on pages 201–15 of this edition of the *Bulletin*.
(3) This refers to the three months to the beginning of March 2013. The 2013 Q1 *Bank Liabilities Survey* is available at www.bankofengland.co.uk/publications/Documents/other/monetary/bls/bls13q1.pdf.
(4) The Bank expanded its eligibility criteria such that all institutions that are required to report eligible sterling liabilities to the Bank are eligible to apply to hold reserves accounts; previously, only those reporting eligible liabilities over £500 million could apply.

An international comparison

Overnight money markets in other countries have also experienced changes as a result of the financial crisis. This box examines such developments in the United States and euro area. It also draws on the experience of Japan, both since the 2007 crisis and during the Bank of Japan's quantitative easing and zero interest rate policies between 2001 and 2006.

An increase in the supply of reserves

A response to the financial crisis common across central banks was the significant increase in the supply of central bank reserves. This was often in excess of the level banks were required to hold or even demanded to hold as a precautionary buffer.

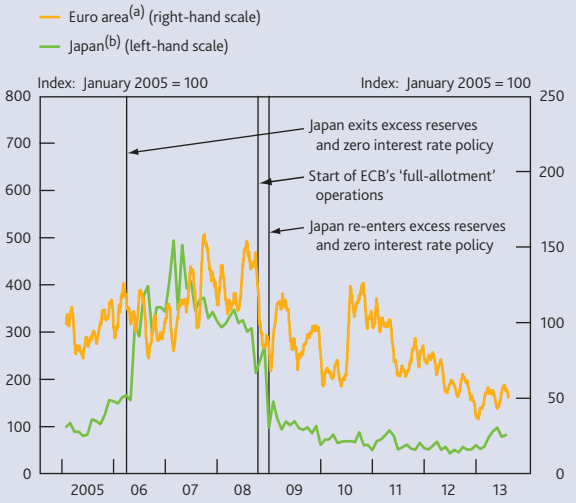
In the United States and Japan, these increases related to their asset purchase programmes, financed by central bank reserves. In the euro area, the increase in reserves was largely demand-led. Since October 2008, the European Central Bank (ECB) has run so-called 'full-allotment' operations which allow banks to borrow as much as they need at a fixed rate, subject to having suitable collateral.

Low turnover

As in the sterling market, the large increase in reserves led to initial declines in market turnover, particularly in unsecured markets (**Chart A**).(1) Central banks took the place of the money market, as banks no longer needed to access the market to the same degree to manage their liquidity and respond to payment shocks, relying instead on the central bank. The effect of high reserves can be seen most starkly in the case of Japan. When the Bank of Japan reduced reserves after its 2001–06 quantitative easing operations, unsecured overnight activity rose sharply. But in 2009, when the Bank of Japan markedly increased the amount of reserves again, activity fell back sharply.

Market participants have also cited similar incentives to transact on a secured basis to those in the sterling money market, including lenders' increased concerns over counterparty credit risk and the proposed need to meet prudential liquidity regulations. These have decreased the attractiveness of trading unsecured relative to secured.

Chart A Turnover in overnight unsecured money markets



Sources: Bank of Japan, Bloomberg and Bank calculations.

(a) Twenty working day moving average.
(b) Value outstanding at month end.

As in the United Kingdom, the decline in international money market activity has had an impact on money market infrastructure. Market participants in the euro area have reported a decline in the number of credit limits they maintain to lend to other banks.(2) And between 2001 and 2006, the Bank of Japan found that, as well as cutting credit limits to lend to other banks, many banks downsized their money market desks and systems.(3) This restricted the flow of liquidity to banks wishing to borrow in the interbank market.

(1) While data on turnover in the federal funds market are not published, Federal Reserve Bank of New York (2012) notes a significant fall in turnover after the rise in reserves balances in 2008.
(2) See European Central Bank (2012).
(3) See Bank of Japan (2006).

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Nowcasting world GDP and trade using global indicators

By Kate Stratford of the Bank's International Economic Analysis Division.[1]

- Global activity is a key driver of UK economic growth. Official estimates of world GDP and trade are only available with a lag, but more timely global indicators can give an early steer on growth.
- Global indicators have been useful in predicting large swings in world activity and have been particularly helpful since the onset of the financial crisis.
- A combination of these indicators has performed much better at tracking world GDP and trade growth since 2008 than a simple benchmark model. The global manufacturing PMI export orders index has been the single best indicator during this period.

Overview

The pace of global growth is a key determinant of economic activity in the United Kingdom. World growth affects the United Kingdom through a number of channels, including the demand for UK exports, consumer and business confidence and via the performance of financial markets.

It is therefore important for the Monetary Policy Committee to monitor changes in global demand. Official data for world GDP and trade growth are only available with a lag. But more timely indicators — such as surveys of firms or financial market indicators — can be used to track developments in global activity in real time. These indicators can be used to form a nowcast, or a best guess, of the current pace of quarterly growth of world GDP and trade before the official estimates of the data become available.

The usefulness of indicators varies over time

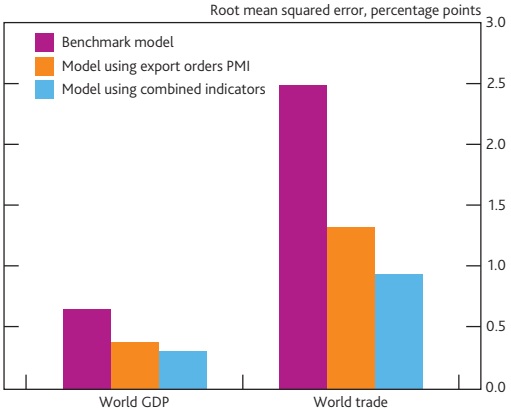
There are several global indicators available that have a high correlation with world activity and can be used to nowcast world trade and world GDP. The strength of the signal from the indicators does, however, vary a lot over time.

Between 1999 and 2007, when global growth was relatively stable, these indicators were less helpful in tracking changes in global economic growth. This is because it was difficult to predict small movements in activity. But the indicators have been more helpful during periods of large swings in world growth, as seen since the onset of the financial crisis in 2008.

The indicators were helpful during the financial crisis

This article presents analysis of the best methods for nowcasting world GDP and trade growth since 2008. Compared to a simple benchmark model, indicators have been useful in predicting the sharp falls in global activity in 2008 and the pace of the recovery since. On average, between 2008 and 2012, models that combine a number of these indicators have had the best nowcasting performance (see **summary chart** below). Since 2010, however, models based on just the export orders index from JPMorgan's global manufacturing PMI have produced the smallest errors.

Summary chart Errors from selected world GDP and world trade models since 2008



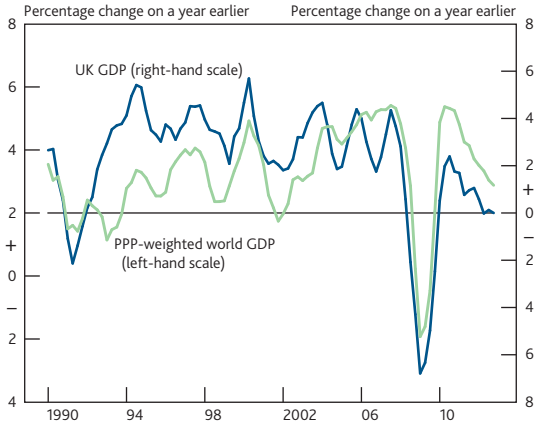
Note: Average nowcasting errors for quarterly growth rates between 2008 Q1 and 2012 Q4.

Sources: CPB Netherlands Bureau for Economic Policy Analysis, IMF, OECD, ONS, S&P indices, Thomson Reuters Datastream and Bank calculations.

(1) The author would like to thank Shiv Chowla for his help in producing this article.

The United Kingdom is a small open economy, so the pace of growth in the world economy is an important driver of UK activity. For example, as set out in the August 2013 *Inflation Report*, the assumption that growth in the rest of the world recovers is a key judgement underlying the Monetary Policy Committee's (MPC's) projections for UK growth and inflation. Most directly, changes in global growth alter the demand for UK-produced goods and services, affecting UK export growth. But other channels, such as confidence effects and financial interlinkages, are also important. Because of this, GDP growth in the United Kingdom has been highly correlated with world GDP growth (**Chart 1**), illustrating the importance of monitoring global developments closely.

Chart 1 UK and world GDP growth[a]



Sources: IMF, OECD, ONS, Thomson Reuters Datastream and Bank calculations.

(a) World GDP is constructed using data for the real GDP growth rates of 144 countries weighted according to their shares in world GDP using the IMF's purchasing power parity (PPP) weights. Data are shown up to the end of 2012.

It is useful for policymakers to form a view on the current pace of world growth, as this can contain important information about how the world economy is evolving. But official estimates of world growth are only available with a delay. For example, initial estimates of GDP growth in the first quarter of the year are not available for many countries until May. So until that point, other indicators have to be used to provide an early steer on what may be happening to world activity.

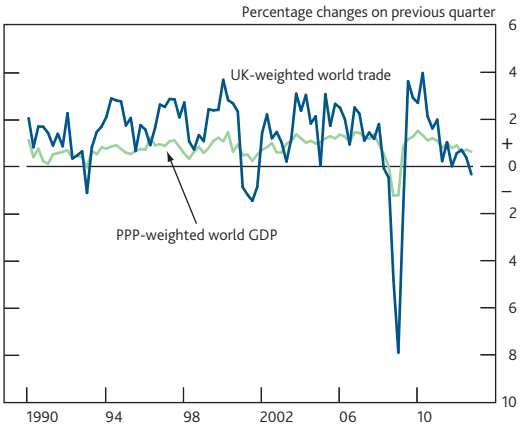
This article begins by setting out the merits of getting an early read on global activity. The article then identifies which global indicators are available and which are most useful for forming a view on world activity. The final section assesses the nowcasting performance of models that include global indicators since the start of the financial crisis.

Why nowcast world activity?

There are two aspects of global activity that are particularly important for the MPC. The first is world trade, which in this article is calculated as the growth rate of imports in the United Kingdom's main trading partners. This captures how rapidly the United Kingdom's export market is expanding, which is an important driver of UK export growth. The second key variable is world GDP. This is closely related to world trade, as stronger income will tend to boost demand for imported goods. But changes in world GDP growth also affect the UK economy through other channels. For example, changes in global confidence and economic uncertainty can spill over to affect UK spending decisions.(1) And weaker global GDP growth could reduce global asset prices and raise banks' funding costs, which may decrease domestic credit and output growth.

The growth rates of PPP-weighted world GDP(2) and UK-weighted world trade usually move closely together although, typically, world trade tends to grow more rapidly and is more volatile than world GDP (**Chart 2**).(3) The measure of world trade considered in this article weights each country according to its share in UK exports. Generally, this places more weight on advanced economies, like the euro area and the United States, than PPP weights do, as these economies are the United Kingdom's main trading partners.

Chart 2 World GDP and world trade growth[a][b]



Sources: IMF, OECD, ONS, Thomson Reuters Datastream and Bank calculations.

(a) World trade is constructed using data for import volumes of 143 countries weighted according to their shares in UK exports.
(b) World GDP is constructed using data for the real GDP growth rates of 144 countries weighted according to their shares in world GDP using the IMF's PPP weights. Data are shown up to the end of 2012.

As official world GDP and trade data are published with a delay, more timely indicators can be used to construct a best guess of the current pace of global activity growth. These so-called 'nowcasts' can inform forecasts for macroeconomic variables over the near to medium term and, therefore, the stance of monetary policy today. Nowcasting is especially

(1) For more information on the impact of macroeconomic uncertainty on economic activity in the United Kingdom, see Haddow *et al* (2013).
(2) The PPP-weighted world GDP series uses purchasing power parity exchange rates from the IMF to weight together GDP in different countries. These exchange rates show the rate at which currency from one country must be converted to another currency in order to purchase the same basket of goods in both countries. For more information, see Callen (2012).
(3) For more information on the relationship between world trade and world GDP, see Domit and Shakir (2010).

important when there are large shocks hitting the world economy, as this can give an early steer on how large the real-economy impacts of such shocks are likely to be. And understanding international developments can help when interpreting UK data.

To generate a nowcast, it is necessary to decide which indicators contain the most information. In addition, since the indicators are released at different points throughout the quarter, the information that is available is constantly changing. As a result, it may be preferable to use different models depending upon what data are available at each stage of the quarter. Subsequent sections of this article explain how this can be done.

What global indicators are available?

There are two main approaches to monitoring developments in world GDP and trade. One option is to construct different models for each individual country or region and then aggregate these to form a 'bottom-up' view of global activity. Alternatively, global indicators can be used to look at world GDP and trade directly. The focus of this article is on the latter, 'top-down' method. But in practice, both of these approaches are used when forming a view and judgement will be applied to the predictions of any mechanical models.

A wide range of global indicators can be used. Some of those indicators are directly related to global growth. For example, some surveys ask firms across the world what has happened to their output or how their assessment of the current economic outlook has changed. And monthly data on global goods trade are also available. But there are also a number of indirect measures that can track developments in global activity. For example, commodity prices will in part reflect market-specific factors, such as supply disruptions, but can also provide a steer on global demand growth. A full list of the indicators considered in this article is shown in Appendix A.

Which indicators are most useful in tracking changes in global growth?

This section begins by looking at simple correlations of the various global indicators with the growth rates of world GDP and world trade. It then discusses three factors that are important when assessing the indicators' usefulness in tracking world activity. These are:

- how timely the indicators are;
- how well they track global growth over time; and
- how best the indicators can be combined.

This sets up the framework for testing the real-time nowcasting performance of some simple models based on the global indicators, which is covered in the final section of the article.

An indicator's correlation with world activity provides a steer on how useful it is likely to be for nowcasting. **Table A** shows the correlations of the various indicators with world GDP and trade. As expected, the 'direct' measures, which are most closely related to world activity, have higher correlations. In particular, the manufacturing export orders PMI and the CPB goods trade series have a very high correlation with both world GDP and trade.(1) The latter is not surprising as the CPB series is based on official monthly data that feed into the quarterly national accounts estimates of trade for each country. In contrast, the indicators that are only indirectly related to world activity generally have lower correlations. For example, the Baltic Dry Index(2) and agricultural commodity prices do not move very closely with global growth.

Table A Correlation of global indicators with quarterly growth rates of world GDP and world trade[a]

	Correlation with:	
Indicator	PPP-weighted world GDP	UK-weighted world trade
'Direct' indicators		
JPMorgan global manufacturing PMI — export orders index	0.91	0.91
CPB world goods trade[b]	0.86	0.95
JPMorgan global composite PMI — output index	0.83	0.84
OECD composite leading indicator	0.81	0.76
IFO World Economic Climate survey	0.73	0.76
'Indirect' indicators		
IATA air freight data[b]	0.72	0.77
Suez Canal traffic (tons)[b][c]	0.68	0.73
S&P GSCI industrial metals price index[b][c]	0.67	0.58
S&P global 1200 stock price index[b][c]	0.66	0.49
Brent oil price[b][c]	0.60	0.57
S&P GSCI agricultural and livestock price index[b][c]	0.50	0.34
Baltic Dry Index[b][c]	0.28	0.11

Sources: Bloomberg, CESifo Group Munich, CPB Netherlands Bureau for Economic Policy Analysis, IMF, International Air Transport Association, OECD, ONS, S&P indices, Thomson Reuters Datastream and Bank calculations.

(a) The sample period is 2000–12.
(b) Quarterly growth rates of these indicators are used when calculating the correlations above and throughout the rest of the article.
(c) Seasonally adjusted by Bank staff.

How timely are the various indicators?

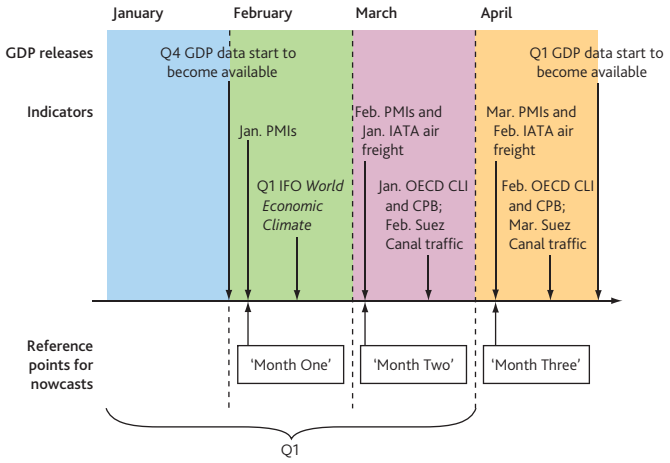
A key consideration when assessing the usefulness of an indicator is how early in the quarter it is able to provide a good steer on developments in global activity. Earlier in the quarter, only partial data are available for many of the indicators. So

(1) PMI stands for Purchasing Managers' Index. This is a survey of business activity that is conducted in a number of countries throughout the world. JPMorgan compile the monthly surveys from a number of countries to form a global aggregate. More information on these surveys and the exact questions asked can be found in Appendix A.
(2) The Baltic Dry Index is a commonly used measure of shipping costs. Shipping costs are used as an indicator of global demand in several academic papers, including Kilian (2009), as global demand is thought to be the biggest driver of shipping costs given that the supply curve is relatively inelastic in the short run. But shipping costs can be very volatile and movements do not always coincide with swings in global growth.

the correlations shown in **Table A**, which are based *ex post* on the full quarter's worth of data, are likely to flatter the strength of the signal that the indicators would give when used in real time, especially early in the quarter.

To illustrate the issue of timeliness, **Figure 1** shows when various data are released throughout the course of a typical quarter, using Q1 as an example. The timeliest indicators are daily asset prices and the monthly PMI indices. The OECD's composite leading indicator and the CPB global trade data are released with a lag of around six weeks. That means that if forming a view on Q1 growth in early February (the point labelled Month One nowcast in **Figure 1**), say, one month's PMI data will be available as well as the daily financial markets data. But there will be no data for the current quarter for any of the less timely indicators.

Figure 1 Illustrative release dates for various indicators for the first quarter(a)

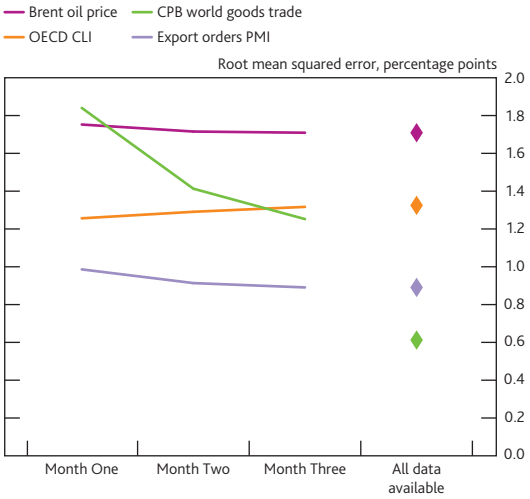


(a) See Appendix A for a full description of the indicators.

To assess their usefulness it is necessary to look at the signal each indicator gives based on data that would be available at the time. One method that can be used to do this is known as a bridge equation,(1) which involves making forecasts for missing monthly data.(2) Quarterly averages of hard data (for the months where it is assumed to be available) and forecasts for the indicator can then be mapped to the growth rates of world trade and GDP using regressions. The in-sample errors for each of the indicators at different stages in the quarter can then be compared to get a sense of how useful the data are in real time.(3) This could be done at any stage of the quarter, but throughout this article three different points in time are considered. These are around one, two and three months after the start of the quarter, specifically the point at which the preceding month's PMIs are available. These are marked as Month One, Month Two and Month Three in **Figure 1**.

For most of the indicators, there is very little change in the strength of the signal as more data become available. This can be tested by estimating simple equations that map each indicator into world trade growth. Doing this exercise, we find that the errors from the export orders PMI, for example, are only slightly smaller when all three months of data are available rather than just one month (**Chart 3** shows the errors from selected indicators). And this means that these indicators can give a useful steer on global growth even early in the quarter. However, for the CPB world goods trade data, there is a much greater improvement in accuracy throughout the course of the quarter. When the full set of monthly data is available, this indicator moves more closely with world trade than any of the others. But for the first two months of the quarter, the signal is a lot weaker as no data for the current quarter are available. This indicator is, therefore, less useful in real time than the simple *ex-post* correlations in **Table A** would suggest.(4)

Chart 3 Errors from various world trade equations at different stages of the data cycle(a)



Sources: Bloomberg, CPB Netherlands Bureau for Economic Policy Analysis, IMF, OECD, ONS, Thomson Reuters Datastream and Bank calculations.

(a) The equations used are of the form: $World\ trade_t = \alpha + \beta X\ indicator_t$, where world trade refers to the quarterly growth rate and the indicators are based on data for the months where data is assumed to be available and forecasts for missing months (see footnote 2 below). The regression coefficients are estimated using ordinary least squares estimation over the period 1998 Q1 to 2012 Q4 and are calculated using the full set of data for each indicator. The errors are calculated over the same period.

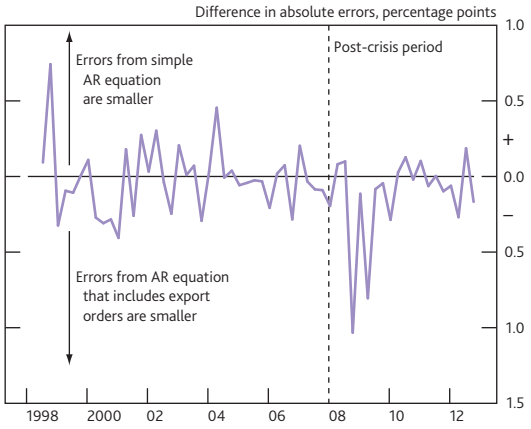
(1) For example, see Rossiter (2010).
(2) Missing monthly data are projected forward using simple assumptions that generally fit the data best. Missing data for the PMI indices and the OECD's composite leading indicator (CLI) are estimated using a simple autoregressive model. Missing data for the CPB goods trade series are assumed to grow at their historical average monthly growth rates. For all other series, data for missing months are assumed to remain at the same level as the latest data point.
(3) This exercise looks at in-sample errors from the models. To examine real-time nowcasting performance properly, only data that would have been available at the time should be used and the coefficients should also be estimated using only data available up to that point in time. Such an exercise is discussed in the final section of this article.
(4) Revisions to the indicators and world activity data are also an important consideration when thinking about real-time performance. Some of the indicators, such as the CPB and IATA data, do get revised as more information becomes available. But this does not notably affect their performance relative to other indicators. And revisions to world GDP and trade data do not materially affect the size of the errors.

How well do the indicators track world activity and how has this varied over time?

To examine how much information the indicators contain, benchmark models of world activity are needed against which models incorporating the indicators can be compared. A natural comparator is the in-sample fit from an autoregressive (AR) model.(1) This is a simple model that predicts world GDP (or trade) growth based on its past growth rates. Such models are frequently used for producing short-run forecasts and tend to perform well. In fact, it is often difficult even for fairly complex models to significantly outperform a simple AR model over short time horizons.(2) To test whether that is the case for world activity, the current period's value of an indicator can be included in an AR model as an additional explanatory variable.

Doing this exercise shows that since the onset of the financial crisis, the indicator models have performed better than the simple AR benchmark. Before 2008, however, when growth was fairly stable, the predictive power of the indicators over and above a simple AR model was fairly low. Even the export orders PMI — the indicator found to have the closest fit to world GDP growth — only improves the in-sample fit very slightly over this period (**Chart 4**). But throughout the crisis, using the export survey indicator led to a much greater improvement in the model fit, with the errors from the export orders equation 0.13 percentage points lower than the average errors from the simple AR equation over the 2008–12 period.

Chart 4 Difference in errors between the simple AR benchmark for world GDP and a model that includes the PMI indicator(a)

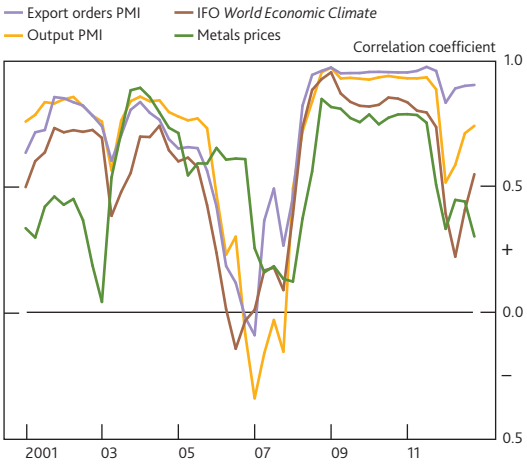


Sources: IMF, OECD, ONS, Thomson Reuters Datastream and Bank calculations.

(a) The equation for the simple AR model is:
$GDP_t = \alpha + \beta_1 GDP_{t-1} + \beta_2 GDP_{t-2} + error_t^{simple\ AR}$.
And the AR including export orders model is estimated as:
$GDP_t = \alpha + \beta_1 GDP_{t-1} + \beta_2\ export\ orders_t + error_t^{export\ orders}$.
The chart shows the difference in the errors of the two models, ie $error_t^{export\ orders} - error_t^{simple\ AR}$. The errors from the export orders equation are shown for the Month Three nowcast, when the full quarter of PMI data are available. The PMI export orders indicator is shown here as this performs better than the other indicators in the third month. Both equations are estimated over available data from 1998 Q1 to 2012 Q4 using ordinary least squares.

The information content of all of the indicators has fluctuated greatly over time. That can be seen clearly in **Chart 5**, which shows rolling three-year correlations of selected indicators with world GDP growth. The indicators all moved very closely with activity throughout the crisis, when growth fell and then recovered sharply. But prior to then, the correlation was much lower, as smaller moves in indicators did not always correspond to movements in world growth.(3) For this reason, it may be best not to place too much weight on small moves in the indicators, since the signal can be quite noisy. And it is important to recognise that there is a great deal of uncertainty when interpreting movements in the indicators.

Chart 5 Rolling three-year correlation of various global indicators with world GDP growth(a)



Sources: CESifo Group Munich, IMF, OECD, ONS, S&P indices, Thomson Reuters Datastream and Bank calculations.

(a) The correlations shown here are based on using the full quarter of data for each of the indicators.

Combining the signal from multiple indicators

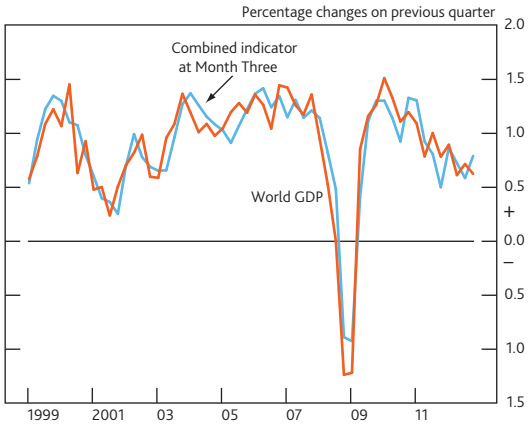
There is long-standing evidence in the literature suggesting that combinations of forecasts can outperform individual models.(4) So even though the world export orders index outperformed the other indicators in the past for both world GDP and world trade, it may be possible to improve the accuracy of the nowcasts by placing some weight on alternative indicators. A reason for this is that the errors from the different indicators may be offsetting. And given that every indicator can give a misleading signal from time to time, more confidence may be taken from a signal if it is supported by alternative indicators.

Charts 6 and **7** show the in-sample estimates from combined indicator models for world trade and world GDP. The combined indicator models are constructed by using a regression to determine how much weight should be placed on the steer from the various indicators at different points in the quarter. This method selects the combination of indicators

(1) See Hamilton (1994).
(2) See, for example, Mitchell (2009), which notes the usefulness of an AR model as a benchmark when nowcasting UK GDP.
(3) This feature is also present when looking at indicators of UK activity, where surveys of output are generally found to be a good indicator of larger movements in output, but less helpful for tracking small changes in growth. For example, see Wheeler (2010).
(4) See, for example, Bates and Granger (1969).

that has the best fit with world activity over the past. More information on these models and the indicators that are included in each model can be found in Appendix B.

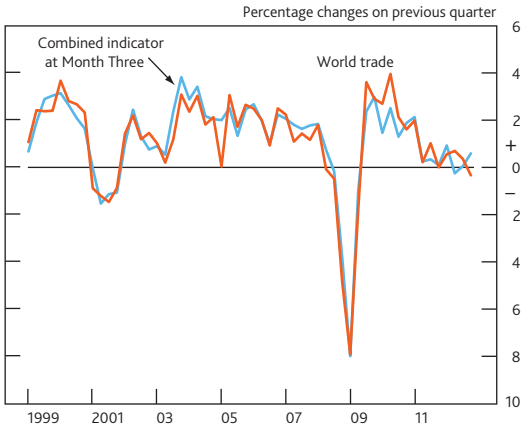
Chart 6 Combined indicator model of world GDP (in-sample fit)(a)



Sources: IMF, OECD, ONS, S&P indices, Thomson Reuters Datastream and Bank calculations.

(a) The regression model at Month Three weights together nowcasts that are generated using the manufacturing PMI export orders index, the OECD's composite leading indicator and metals prices. The equations are estimated between 1998 Q3 and 2012 Q4 using ordinary least squares. For more information see Appendix B.

Chart 7 Combined indicator model of world trade (in-sample fit)(a)



Sources: CPB Netherlands Bureau for Economic Policy Analysis, IMF, OECD, ONS, Thomson Reuters Datastream and Bank calculations.

(a) The regression model at Month Three weights together nowcasts that are generated using the manufacturing PMI export orders index, the composite PMI output index and the CPB world goods trade data. The equations are estimated between 1998 Q3 and 2012 Q4 using ordinary least squares. For more information see Appendix B.

Using the range of indicators leads to an improvement in accuracy relative to using just one indicator: on average, the in-sample errors for world GDP are around 10% smaller than those based on the model that only uses the export orders PMI. And for world trade, the combined indicator model errors are around 20% to 30% smaller than those based on the single indicator.

Testing the nowcasting performance of the indicators throughout the crisis

This section focuses on the nowcasting performance of the indicator models since 2008. In particular, it assesses which indicators gave the best early warning that growth was slowing and how well they captured the extent of the sharp fall, and subsequent recovery, in global growth. The three best individual indicators and a combined model are compared to the benchmark AR model for both trade and GDP.

To assess the indicators' nowcasting performance throughout the crisis, it is necessary to use only the information that would have been available at the time. In particular, the coefficients in the indicator models need to be re-estimated each quarter, extending the length of the sample period used by an extra quarter as additional data would have become available.(1) This is important because in the period immediately prior to the crisis, the correlation between the indicators and global activity was fairly low (**Chart 5**). And, as shown in the previous section, the indicators did not add much to a simple AR model in tracking world activity over the 1998–2008 period.

In the early part of the crisis, all of the indicator models outperformed the benchmark AR model. **Table B** shows that errors from real-time individual global indicator models at the third month of the quarter throughout the downturn (2008–09) were around 20%–40% smaller than those from the simple AR model for world GDP and around 30%–50% smaller for world trade. And the errors from the combined indicator were lower still. As expected, the improvement in nowcasting accuracy from using the indicators was smaller at early stages of the quarter.(2) Since the onset of the financial crisis, the nowcasts from the combined indicator model have given the best steer on global growth. Of the individual indicator models, the export orders model made the smallest errors over 2008 and 2009. Although the output PMI made larger errors over the period as a whole, it was quicker than other indicators to pick up the slowing in both world trade and world GDP growth in early 2008. The indicator fell sharply from the start of the year, and outperformed the other individual indicators in the early part of the crisis.

(1) World trade and world GDP data are frequently revised over time. So the early estimates for both of these series, which would have been available at the time the nowcasts were made, should also be used here. For simplicity, we have shown the results of models based on the latest vintage of data. But using the real-time estimates does not materially change the results.

(2) **Table B** reports nowcasting errors from the models based on information available at Month Three. Errors from the indicator models earlier in the quarter are generally larger and give less of an improvement relative to the AR benchmark. For example, at Month One, the average errors made by the individual indicator models for world GDP over the downturn are up to 30% larger than those made at Month Three. And the errors from the CPB model for trade are 50% larger than those made at Month Three.

Table B Real-time errors at Month Three from selected world GDP and world trade models[a]

	Root mean squared errors		
	2008–12	2008–09	2010–12
World GDP models			
Simple AR benchmark	0.64	0.98	0.21
Combined indicator	0.30	0.39	0.21
Export orders PMI	0.37	0.55	0.15
Output PMI	0.48	0.71	0.22
OECD CLI	0.51	0.76	0.20
World trade models			
Simple AR benchmark	2.47	3.69	1.05
Combined indicator	0.93	1.01	0.88
Export orders PMI	1.31	1.93	0.62
Output PMI	1.71	2.48	0.87
CPB goods trade	1.47	2.11	0.79

Sources: CPB Netherlands Bureau for Economic Policy Analysis, IMF, OECD, ONS, S&P indices, Thomson Reuters Datastream and Bank calculations.

(a) The root mean squared errors compare the nowcasts generated from each model to the actual world GDP and world trade outturns. The AR models are of the form: $activity_t = \alpha + \beta_1 activity_{t-1} + \beta_2 activity_{t-2}$. And the individual indicator models are of the form: $activity_t = \alpha + \beta_1 activity_{t-1} + \beta_2 indicator_t$. For more information on the combined indicator model see Appendix B. All equations are estimated using ordinary least squares and the coefficients are estimated recursively. For example, when nowcasting 2008 Q1, the coefficients in each model are estimated using data between 2000 Q1 and 2007 Q4. But when nowcasting 2008 Q2, the sample is expanded to use data from 2000 Q1 to 2008 Q1. The nowcasts are calculated at Month Three. For information on how missing monthly data are estimated, see footnote 2 on page 236.

None of the nowcasts from the indicator models fully predicted the extent of the sharp falls in world activity. In particular, they were slow to pick up the decline in world GDP, overpredicting growth throughout 2008 by an average of 0.5 percentage points per quarter. Part of the reason the nowcasts from some of the models were too high was because the weight placed on the indicators in the models only increased slowly. For example, the coefficient on the export orders PMI in the GDP model is almost twice the size if estimated using the full sample of data compared with the estimate that only uses data up to the end of 2007. It takes time for this coefficient to change when the sample period is just extended by one quarter at a time. That said, given that the downturn in the indicators followed the large financial shock in 2008, economic forecasters and policymakers may have had more reason to believe that the moves in indicators reflected genuine news about the pace of global growth.

Since the start of the recovery, the nowcasts from all the models have tracked global activity more closely than they did throughout the downturn: the average errors over the 2010–12 period were much smaller than those made in 2008 and 2009. The nowcasts from the export orders model have been the most accurate over this time, picking up the recovery and subsequent slowing in world activity growth better than the other models.

Conclusions

Several global indicators contain information that can be informative when tracking the pace of global growth. The signal from these indicators can help policymakers to monitor global growth developments in real time. Their usefulness has fluctuated greatly over time, though. Between 1999 and 2007, when global growth was fairly stable, the indicators did not contain much more information than a simple AR model. But when there are larger swings in the data the indicators tend to have a higher correlation with global activity. That was especially true during the sharp fall and recovery in global growth in 2008–09.

On average, since 2008, the most accurate nowcasts were produced by combining the signal from a range of indicators. The nowcasts from the combined indicator models tracked the sharp fall and recovery in global growth through 2008 and 2009 much more closely than those from the simple benchmark or any of the individual indicator models. Since 2010, however, the estimates from the export orders models for both world GDP and world trade have tracked quarterly growth particularly closely. And the nowcasts that just use this one indicator have given the smallest nowcast errors.

Appendix A
Description of the global indicators

Indicator	Frequency	Start year	Availability	Additional information
Direct indicators				
CPB world goods trade	Monthly	1991	Seven weeks after month end	A monthly estimate of the global volume of goods traded. The series is based on data from 96 individual countries and the region Sub-Saharan Africa, covering approximately 99% of world trade in goods.
JPMorgan global composite PMI — output index	Monthly	1998	Shortly after month end	A qualitative survey of manufacturing and services firms in 32 countries. Firms are asked whether their output has increased or decreased over the past month.
JPMorgan global manufacturing PMI — export orders index	Monthly	1998	Shortly after month end	A qualitative survey of manufacturing firms in 32 countries. Firms are asked whether their export orders have increased or decreased over the past month.
OECD composite leading indicator	Monthly	1970	Six weeks after month end	An indicator produced by the OECD that is designed to anticipate turning points in economic activity relative to trend. The index used here covers the OECD and six major non-OECD countries (Brazil, China, India, Indonesia, Russia and South Africa).
IFO *World Economic Climate* survey — headline index	Quarterly	1990	Half way through the quarter	A qualitative survey of economists from over 100 countries. They are asked whether their country's economic situation is good, satisfactory or poor and whether the next six months are likely to be more or less favourable. The headline index averages the response to these two questions.
Indirect indicators				
Baltic Dry Index	Daily	1985	Following day	An estimate produced daily by the Baltic Exchange that measures the price of moving raw materials by sea. The index covers 20 shipping routes.
Brent oil price	Daily	1983	Following day	Daily data of the closing spot price for Dated Brent crude.
S&P GSCI agricultural and livestock price index	Daily	1970	Following day	Daily index of agricultural and livestock spot prices. The index includes: wheat, corn, soybeans, sugar, coffee, cotton, cocoa, feeder cattle, live cattle and lean hogs.
S&P GSCI industrial metals price index	Daily	1977	Following day	Daily index of industrial metals spot prices. The index includes: aluminium, copper, lead, nickel and zinc.
S&P global 1200 stock price index	Daily	1989	Following day	An index of global equity prices that covers firms from 30 countries and approximately 70% of global stock market capitalisation.
IATA — international air freight tonne kilometres	Monthly	1997	Four weeks after month end	The volume of air freight transported internationally each month.
Suez Canal traffic — tons	Monthly	2000	Around two weeks after month end	The volume of goods passing through the Suez Canal each month, measured in tons.

Appendix B
Combined indicator models

This appendix sets out how the combined indicator models for world GDP and trade were constructed.

There are several ways to make use of the information contained in a range of indicators. One way is to use a regression to select the weights placed on each indicator to give the combination of indicators that has the best fit with activity over the past. This can be done by regressing world GDP and world trade on the fitted values from the different indicator models, removing any that do not add value in explaining activity.(1) This approach will select the combination of indicators that does the best job of explaining global growth over time. Separate equations can be estimated at different stages of the data cycle, allowing for the weights on different indicators to change as more data become available over the quarter.(2)

An alternative approach is to use a dynamic factor model. These models use statistical techniques to extract information from a very large set of data and map this into activity. The nowcasts from such models have generally been found to outperform the simple regression models described above. But there is evidence that the dynamic models have struggled to predict growth when there are large swings in the data, which is arguably when nowcasting is most important.(3) And they are not particularly appropriate here, as the number of variables considered is relatively small.(4) Given this, only the regression approach is used here to create a combined indicator model.

Estimating the model

To estimate the combined model, the first step was to map each of the individual indicators shown in **Table A** to world GDP and trade growth by estimating equations of the form:

$$GDP_t = \alpha + \beta \text{ indicator}_t + \text{error}_t \quad (1)$$

$$Trade_t = \alpha + \beta \text{ indicator}_t + \text{error}_t \quad (2)$$

Quarterly averages of the full set of data for the indicators were used to estimate the coefficients using ordinary least squares. These coefficients were then used to construct fitted values for world GDP and world trade. Three different sets of fitted values were calculated for world GDP and world trade growth based on the sets of indicators that would be available at the Month One, Month Two and Month Three stages of the quarter (**Figure 1**). These sets of indicators use only the monthly data that would actually be available at that point in time together with forecasts for any missing months.(5)

The estimates from the indicator models were then combined by regressing world GDP and world trade growth on these fitted values, dropping any indicators that were not significant. These models were estimated for the three different stages in the data cycle.

Charts 6 and **7** in the main article show the in-sample fit of the combined indicators for world GDP and trade. In the world GDP model, the fitted values based on the PMI export orders index, the OECD composite leading indicator and metals prices are significant. A similar weight is placed on each, although those weights do fluctuate from the first to third month models. For trade, the Month Three version of the model suggests weight should be placed on the fitted values based on the export orders PMI, output PMI and CPB data. But earlier in the quarter, a greater range of indicators are helpful: at Month One, the IATA air freight data and Brent crude oil price are also found to be significant.

The equations were estimated over the period 1998 Q3 to 2012 Q4. The coefficients from the Month One, Month Two and Month Three models are shown below.

World GDP

Month One model:

$$GDP_t = -0.26 + 0.37 \times fitted_t^{\text{export orders PMI}} + 0.50 \times fitted_t^{\text{OECD CLI}} + 0.46 \times fitted_t^{\text{metals prices}}$$

Month Two model:

$$GDP_t = -0.25 + 0.43 \times fitted_t^{\text{export orders PMI}} + 0.41 \times fitted_t^{\text{OECD CLI}} + 0.45 \times fitted_t^{\text{metals prices}}$$

Month Three model:

$$GDP_t = -0.22 + 0.49 \times fitted_t^{\text{export orders PMI}} + 0.38 \times fitted_t^{\text{OECD CLI}} + 0.39 \times fitted_t^{\text{metals prices}}$$

World trade

Month One model:

$$Trade_t = -1.55 + 0.35 \times fitted_t^{\text{export orders PMI}} + 0.28 \times fitted_t^{\text{output PMI}} + 0.78 \times fitted_t^{\text{IATA}} + 0.41 \times fitted_t^{\text{Brent price}} + 0.73 \times fitted_t^{\text{CPB}}$$

(1) See Barnes and Ellis (2005).
(2) This approach gives the same results that would be generated by simply regressing world activity variables on the raw data for the indicators at different stages in the quarter. But by mapping the indicators to world activity first, the coefficients can be interpreted as weights, allowing for an easy comparison of which indicators the models attach the most importance to.
(3) Lombardi and Maier (2011) estimate a dynamic factor model of growth for the euro area. They find that the nowcasts from the model were less informative than those from a simple PMI model through the recession. Their work suggests that the PMI model tends to perform better when there are very rapid changes to the outlook. The nowcasts from these change quickly when there is a downturn, whereas the dynamic factor model can be slower to adjust.
(4) Dynamic factor models typically run off many variables (potentially hundreds) whereas only twelve indicators are considered here.
(5) See footnote 2 on page 236 for more information.

Month Two model:

$$Trade_t = -0.63 + 0.30 \times fitted_t^{export\ orders\ PMI} + 0.38 \times fitted_t^{output\ PMI} + 0.47 \times fitted_t^{IATA} + 0.46 \times fitted_t^{CPB}$$

Month Three model:

$$Trade_t = -0.44 + 0.25 \times fitted_t^{export\ orders\ PMI} + 0.51 \times fitted_t^{output\ PMI} + 0.56 \times fitted_t^{CPB}$$

Where $fitted_t^{indicator} = \alpha + \beta\ \text{indicator}_t$ are the fitted values from the individual indicator models (equations **(1)** and **(2)**).

When estimating the nowcasts in **Table B**, the coefficients are updated recursively, adding an extra quarter to the sample period as more data become available. So the estimates of the coefficients gradually change over time.

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Houblon-Norman essay | Roger E A Farmer

The Natural Rate Hypothesis: an idea past its sell-by date

By Roger E A Farmer, Senior Houblon-Norman Fellow at the Bank and Distinguished Professor, UCLA.*[1]

- Central banks throughout the world predict inflation with New Keynesian models where, after a shock, the unemployment rate returns to its so-called 'natural rate'. That assumption is called the Natural Rate Hypothesis (NRH).
- This paper reviews a body of work, published over the past decade, in which I argue that the NRH does not hold in the data and provide an alternative paradigm that explains why it does not hold.
- I replace the NRH with the assumption that the animal spirits of investors are a fundamental of the economy that can be modelled by a 'belief function'. I show how to operationalise that idea by constructing an empirical model that outperforms the New Keynesian Phillips Curve.

* **The views expressed in this article are those of the author and do not represent those of the Bank or the Monetary Policy Committee.**

Overview

In 1936, John Maynard Keynes provided a radical reassessment of market economies. He argued that, contrary to received wisdom, capitalist economies are not self-correcting. They require active support from governments.

For almost 60 years, economists have relied on an interpretation of Keynesian economics that was popularised by the American economist, Paul Samuelson. Samuelson's approach is called the neoclassical synthesis. It implies that high unemployment prevails because wages and prices are sticky: they do not immediately adjust to equate the demand and supply of labour.

Samuelson's interpretation of Keynesian economics became the consensus point of view. It led to the development of the NRH, an idea that has been taught to the graduates of top economics departments for the past 30 years and is at the centre of modern policy analysis. It is used by policymakers to decide whether monetary policy is too loose, or if it needs to be tightened to help prevent future inflation.

In this article, I review the development of macroeconomic thought and I argue that macroeconomics took an important misstep when monetarists and Keynesians agreed that the right way to reconcile Keynes with the classics was with Samuelson's neoclassical synthesis. I show why the economics community — including academics and policymakers — can no longer rely on the NRH as a centrepiece of macroeconomic theory.

I argue that the General Theory never was about sticky prices. It was about a fundamental flaw in the price system that allows persistent involuntary unemployment to be one of many possible long-run equilibria of an unregulated market economy. Which equilibrium prevails depends on investors' animal spirits. I offer a constructive alternative paradigm based on a return to the central ideas of the General Theory.

I use a 'search' model of the labour market to construct a logical foundation to Keynesian economics. By modelling beliefs as a new fundamental with the same methodological status as preferences, I build a complete dynamic stochastic general equilibrium model that provides a coherent explanation of the facts.

(1) This paper was written while visiting the Bank of England for the year as a 2013 Senior Houblon-Norman Fellow. I wish to thank Spencer Dale and the Trustees of the Houblon-Norman Fund for providing me with this opportunity. I am also grateful to everyone at the Bank for making me feel so welcome and for their support during my stay. Finally, I would like to thank Mark Cornelius, Dan Nixon, Srdan Tatomir and C Roxanne Farmer for their invaluable help in producing this article.

Houblon-Norman essay | Roger E A Farmer

Six years after the onset of the Great Recession, western economies are still underperforming by historical standards. There have been calls from prominent academics, politicians and policymakers for a rethink of the foundations of macroeconomics. But what would that mean? This article explains how a radical restructuring of macroeconomic theory, based on models of multiple equilibria, can help us to understand the crisis.

To make my case, I summarise and synthesise results from my recent books and academic articles. This body of work (Farmer (2002, 2006, 2008, 2010a,b, 2012a, 2013a and 2014)) reconciles Keynesian and classical ideas in a new way. Instead of assuming prices are sticky, I develop a new paradigm to explain why high unemployment persists.

In my work, I use search theory to provide a new foundation to Keynesian economics. Unlike theories based on Samuelson's neoclassical synthesis, I explain why the data do not display a so-called natural rate of unemployment.

I replace the Natural Rate Hypothesis (NRH) with the assumption that the animal spirits of investors are a fundamental of the economy and I show how to operationalise that idea by constructing an empirical model that outperforms the New Keynesian Phillips Curve. I model animal spirits with a new fundamental that I call the belief function.

A brief history of macroeconomic thought

From Hume to Phillips

Classical economists from David Hume, through to Adam Smith, David Ricardo and John Maynard Keynes' contemporary, Arthur Pigou, viewed the economy as a self-regulating mechanism.(1) In modern parlance the classical vision was of an economy with a unique, stable, steady-state equilibrium.

Smith's idea of the 'invisible hand' was formalised in the 19th century by Léon Walras (1874) and Vilfredo Pareto (1896). They envisaged an economic system that today we would describe as 'Pareto Efficient'.(2)

Writing in 1936, following a US stock market collapse and an unemployment rate in excess of 20%, Keynes provided a different vision. He saw high persistent unemployment as a different kind of steady-state equilibrium.

Keynes' view was rejected by his followers, notably Paul Samuelson (1955). In the third edition of his undergraduate textbook, Samuelson replaced Keynes' notion, of high unemployment as an equilibrium, with a new idea: the neoclassical synthesis.(3) According to that idea, the Keynesian high unemployment equilibrium is only temporary. It applies in the short run, when prices and wages are sticky, but in the long run, when all wages and prices have had time to adjust, the economy reverts to a classical equilibrium with full employment.

Soon after Samuelson introduced the neoclassical synthesis, the theory was provided with empirical support. In an important 1958 article, A William Phillips demonstrated that there had been a structurally stable relationship between unemployment and the rate of change of money wages in a century of UK data. His article was influential because it filled a theoretical hole in Keynesian theory. The box on page 246 shows the original Phillips curve and the methodology used to construct it.

Keynesians and monetarists

Milton Friedman is a central figure in the development of macroeconomics in the latter part of the 20th century. In his 1948 article, 'A monetary and fiscal framework for economic stability', he developed the thesis that policymakers should provide a stable framework in which private agents can operate.

Active monetary and fiscal policy has no role in Friedman's analysis since he assumed that markets work well to allocate resources efficiently to competing ends.(4) Because of the central role of the money supply in Friedman's thought, his ideas are known as **monetarism**.

In 1970, Friedman explained the theoretical framework that guided his policy advice. By that time, the Phillips curve had appeared in print and Friedman was able to adopt it as the 'missing equation' that connects the Keynesian short run with the classical long run.

When Friedman explained his framework in 1970, the gap between classical and Keynesian economics was as small as it had ever been: Keynesians and monetarists had adopted a common theoretical framework and Samuelson's neoclassical synthesis had become part of the economic lexicon. For both schools of thought, Keynes' idea of unemployment as a steady-state equilibrium had been relegated to the dustbin of history and Friedman could assert without fear of contradiction from Keynesians like Paul Samuelson or Robert Solow that:

> 'Keynes's *error* consisted in neglecting the role of wealth in the consumption function…' (Friedman (1970), page 206, my emphasis.)

(1) See Hume (1742), Smith (1776), Ricardo (1817) and Pigou (1928).
(2) In the language of modern general equilibrium theory, an equilibrium is Pareto Efficient if an omniscient social planner could not rearrange the allocation of goods, including the allocation of time spent in paid employment, to make any single person better off without making some other person worse off.
(3) For a discussion of the influence of Samuelson's textbook on economic thought, see the enlightening piece by Pearce and Hoover (1995).
(4) For a competing view of why markets do not work well, see the recent piece by Farmer, Nourry and Venditti (2012), which won the inaugural 2013 Maurice Allais Prize in Economic Science.

Estimating the first Phillips curve

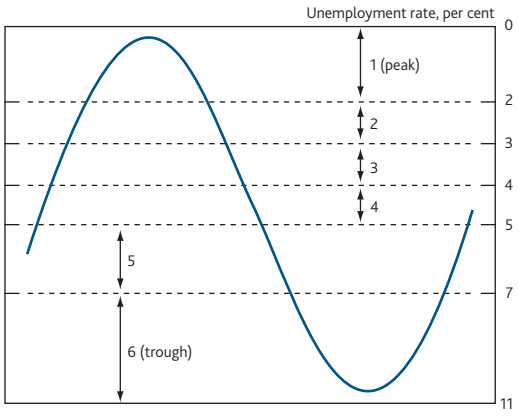
Phillips estimated the first Phillips curve using UK data on wage inflation and unemployment from 1861 through 1957.

When unemployment was high, he argued that there was an excess supply of labour that put downward pressure on money wages. When unemployment was low, he argued that there was an excess demand for labour, leading to upward pressure on money wages.

To substantiate these claims, he separated his data into three subperiods and demonstrated that the same relationship held in all three of them. Phillips' first subperiod began in 1861 and ended in 1913 with the onset of WWI. The second contained data for the inter-war period and the third began in 1948 and ended in 1957. The Phillips curve was estimated on data from the first subsample using an averaging method to remove the influence of changing unemployment on the steady-state relationship that he hoped to uncover.

Phillips divided the raw data into groups based on where an observation occurred over the business cycle. He grouped the pre-WWI data into six and a half cycles and for each cycle he assigned the unemployment data to one of six regions; the peak, the trough and four intermediate regions (**Figure A**).

Figure A How Phillips grouped the pre-WWI data

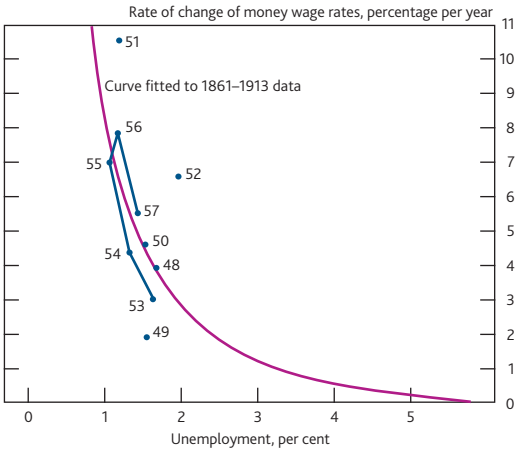


For each of the six and a half cycles, the data for unemployment and wage inflation for each region were averaged. That procedure led to six values for average wage inflation and average unemployment to which Phillips fit a non-linear equation. By grouping data in this way, he hoped to remove the effects of changing inflation and unemployment on the steady-state relationship.

The resulting curve connecting unemployment and wage inflation proved to be remarkably resilient. Phillips showed that raw data for each of the six and a half cycles in the pre-WWI period lay closely around a curve that had been fit to cycle averaged data.

Chart A, reproduced from Phillips' original article, illustrates the data for 1948 to 1957. Notice how closely the 1950s data conforms to the pre-WWI curve.

Chart A Fitting post-WWII data to the pre-WWI Phillips curve



Source: Phillips (1958). Reproduced with permission of Blackwell Publishing Ltd.

Phillips' contemporaries saw the conformity of data from the 1950s, with a curve estimated from 19th century data, as evidence that the Phillips curve was a fundamental structural relationship that characterises the wage adjustment process. The stability of the Phillips curve in a hundred years of data made them sit up and pay attention.

As a consequence of this alleged error, Friedman argued that Keynes was incorrect to model persistent unemployment as one of many possible long-run equilibria since:

> '…there is no fundamental 'flaw in the price system' that makes unemployment the natural outcome of a fully operative market mechanism.' (Friedman (1970), page 207.)

Keynesians and monetarists alike adopted the Phillips curve as the missing equation that explains the transition from the short run to the long run. By accepting that point of view, macroeconomists abandoned one of the most important insights of Keynes' General Theory: the existence of high unemployment as a persistent long-run steady-state equilibrium.

Unemployment and inflation

The inception of the Natural Rate Hypothesis

In the 1970s we entered an era of 'stagflation', characterised by simultaneously high unemployment and high inflation. These new facts were inconsistent with the Phillips curve, which predicted that high unemployment should be accompanied by low inflation.

Edmund Phelps (1967) and Friedman (1968) argued independently that stagflation was not inconsistent with the neoclassical synthesis, since we should not have expected to observe a stable trade-off between *money* wage inflation and unemployment. They asserted, instead, that the true relationship is between *real* wage inflation and unemployment. Their work explained why the Phillips curve had disappeared.

To understand the disappearance of the Phillips curve, Friedman introduced the concept of the **natural rate of unemployment**, which is:

> '…the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is imbedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the costs of mobility, and so on.'

According to Friedman,

> 'A lower level of unemployment [than the natural rate] is an indication that there is an excess demand for labor that will produce upward pressure on real wage rates. A higher level of unemployment is an indication that there is an excess supply of labor that will produce downward pressure on real wage rates.' (Friedman (1968).)

The NRH provided a tidy explanation both for the existence of the Phillips curve in 19th and early 20th century data, and for its disappearance in the 1960s and 1970s. According to this explanation, in the period before WWII, inflation expectations were anchored by the gold standard. Price inflation would never be too high or too low because the price level is determined, in the long run, by the stock of money. That, in turn, was linked to gold production.

A new concept: the expectations-augmented Phillips curve

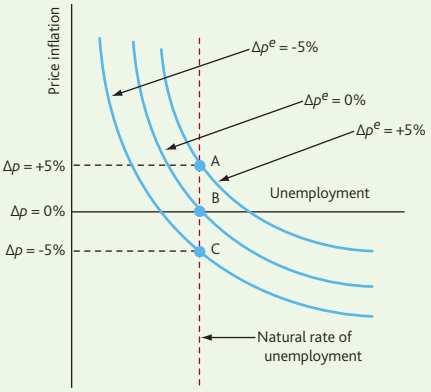
When the United States left the gold standard in 1971, the quantity of money could expand without limit and price expectations lost their natural anchor. Phelps and Friedman argued that the Phillips curve shifted because households and firms began to expect higher price inflation.

Phelps and Friedman believed that firms and workers care about real wages, not money wages, and they claimed that the expected rate of price inflation becomes written into wage contracts. If price inflation is forecast correctly, unemployment will equal its natural rate. Since forecasts of price inflation will often be wrong, unemployment, in the short run, will differ from its natural rate. The work of Phelps and Friedman led to the development of a new concept, the **expectations-augmented Phillips curve**.

According to this theory, realised price inflation replaces wage inflation on the vertical axis of the Phillips curve graph and there is a different Phillips curve for every value of expected price inflation: expected price inflation shifts the curve. Importantly, unemployment can only differ from its natural rate when expected inflation is different from actual inflation.

Figure 1 illustrates this idea. The figure plots the realised rate of price inflation, in any given month, against the realised value of the unemployment rate. Each of the three Phillips curves on this graph is associated with a different rate of expected price inflation, denoted by Δp^e on the chart. The vertical dashed red line represents the natural rate of

Figure 1 The expectations-augmented Phillips curve



unemployment. For each of the points A, B and C that lie on the NR line in **Figure 1**, inflation expectations (shown for each curve) are equal to realised price inflation (shown on the y-axis). For example, actual and expected inflation are both equal to 5% at point A.

How do agents form expectations about economic variables such as inflation? Early theoretical papers that used the NRH assumed a theory of **adaptive expectations**. According to that theory, next period's expected inflation rate is formed by taking a weighted average of this period's actual inflation rate and last period's expected inflation rate.

The combination of the NRH and adaptive expectations implied that, if the unemployment rate were held below its natural rate by expansionary fiscal or monetary policy, the outcome would be an inflationary spiral. Similarly, if policymakers were to keep unemployment above its natural rate, there would be a deflationary spiral. For that reason, the natural rate of unemployment is sometimes called the non-accelerating inflation rate of unemployment (NAIRU).

The fact that inflation expectations can influence actual inflation implies that managing expectations is critical. The NRH implies that, once high inflation becomes expected, it will persist, even when unemployment is at its natural rate. That is why inflation targeting is thought to be such an important tool for anchoring expectations. It provides an anchor to inflationary expectations; a role that was previously played by the gold standard.

The rise of rational expectations

When Phelps and Friedman wrote their seminal articles on the NRH, they were simply acknowledging the logical implications of the neoclassical synthesis. If the neoclassical synthesis is correct then the economy will always return to full employment as wages and prices adjust to clear markets. Unemployment cannot differ permanently from its natural rate and Keynes' original vision of high unemployment, as a persistent steady state, must be fatally flawed.

Keynes had argued that most unemployment is 'involuntary,' in the sense that households are not, in the language of economic theory, 'on their labour supply curves'. He meant that, at the prevailing wages and prices of the 1930s, most unemployed people would have preferred to be working. Franco Modigliani famously described the counterfactual: if unemployment were indeed voluntary, the Great Depression must have been caused by a 'severe attack of contagious laziness'.(1)

The orthodox view in the 1960s was that Keynes was right about this point but that involuntary unemployment is a temporary situation that occurs because there is a friction that prevents wages and prices from adjusting to clear all markets. Writing in the late 1960s, Phelps and Friedman both accepted this orthodox view.

In 1972, Robert E Lucas Jr published an influential piece that shaped the course of macroeconomics for the next 40 years. He argued that labour markets are always in equilibrium and in his 1978 article, Lucas claimed that the concept of involuntary unemployment, introduced by Keynes in the General Theory, is not a useful one.(2) The idea that the demand and supply of labour are always equal is called **continuous market clearing**.

In the same paper, Lucas introduced the concept of **rational expectations**, the idea that people's expectations about the future paths of key economic variables are subject to random errors but are correct on average. The introduction of continuous market clearing and rational expectations had important implications for monetary economics.

What is wrong with the NRH?

The data rejects the NRH when combined with rational expectations

When the NRH was first proposed, Friedman assumed that expectations are adaptive. The combination of adaptive expectations and the NRH led to a theory where variations in the unemployment rate are caused, primarily, by incorrect expectations. In this theory, households and firms forecast price inflation and their forecast determines which Phillips curve prevails in the period. Expected price inflation feeds into wages, and, through mark-ups, into realised inflation.

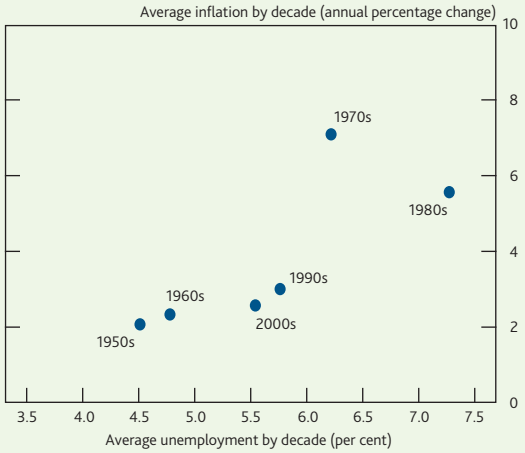
According to the NRH, unemployment differs from its natural rate only if expected inflation differs from actual inflation. If expectations are rational, we should see as many quarters when inflation is above expected inflation as quarters when it is below expected inflation. **That suggests the following test of the NRH.**

Because a decade contains 40 quarters, the probability that average expected inflation over a decade will be different from average actual inflation should be small. If the NRH and rational expectations are both true simultaneously, a plot of decade averages of inflation against unemployment should reveal a vertical line at the natural rate of unemployment. **In Chart 1, I show that this prediction fails dramatically.**

There is no tendency for the points to lie around a vertical line and, if anything, the long-run Phillips curve revealed by this chart is upward sloping, and closer to being horizontal than vertical. Since it is unlikely that expectations are systematically biased over decades, I conclude that the NRH is false.

(1) See Modigliani (1977).
(2) See Lucas (1978), page 353.

Chart 1 Average inflation and unemployment by decade for the United States



Sources: Bureau for Labor Statistics and author's calculations.

Defenders of the Natural Rate Hypothesis might choose to respond to these empirical findings by arguing that the natural rate of unemployment is time varying. But I am unaware of any theory which provides us, in advance, with an explanation of how the natural rate of unemployment varies over time. In the absence of such a theory the NRH has no predictive content. **A theory like this, which cannot be falsified by any set of observations, is closer to religion than science.**

The development of New Keynesian economics

Real business cycle theory and the birth of DSGE models

Soon after Lucas developed the theory of rational expectations, Finn Kydland and Edward Prescott (1982) and John B Long Jr and Charles Plosser (1983) introduced the — then radical — idea that business cycles can be explained by shocks to productivity. That theory of **real business cycles** (RBCs) began with simple equilibrium models where 'random shocks' to the level of technological innovation are the sources of swings in growth and employment. It soon developed into a much more ambitious programme.

In real business cycle theory there is no unemployment since RBC theorists assume that the demand and supply of labour are always equal to each other. There is continuous market clearing. They argue that unemployment is not a useful concept and that instead, we should represent labour market activity by the number of hours spent in paid employment by a representative household.

If there is no unemployment, how can there be a natural rate of unemployment? There too, RBC theory has a response. According to RBC economists, there is a natural rate of *employment*, which represents the hours of paid employment of a representative worker when productivity is at its average level over the business cycle.

Starting in the 1980s, the tools of rational expectations and continuous market clearing swept the profession. Classical ideas spread outwards from the Universities of Chicago and Minnesota and soon prominent graduate economics programmes throughout the world were training their students to study the macroeconomy using classical tools. This new approach was called dynamic stochastic general equilibrium (DSGE) theory.

Putting sticky wages and prices into the RBC model

Keynesian economists were initially resistant to the classical tools of rational expectations and continuous market clearing but their resistance did not last long. They began to use classical techniques, but they amended them by putting back sticky prices using Samuelson's neoclassical synthesis as an organising principle. With the publication of an influential volume of readings in 1991, edited by N Gregory Mankiw and David Romer, New Keynesian economics was born.

Gradually, New Keynesian researchers incorporated frictions and additional shocks into their models. These included sticky prices, shocks to confidence, monetary disturbances and news shocks. By the onset of the financial crisis in 2007, macroeconomists had developed mathematical equations that captured the ideas of 1920s' classical business cycle theories described by Pigou (1928).(1)

There is no involuntary unemployment in the New Keynesian model

Classical and New Keynesian economists both use DSGE models. The twin hallmarks of the DSGE agenda are the assumptions of continuous labour market clearing and rational expectations. These assumptions were made in the first RBC models and were incorporated into almost every DSGE model since. That includes almost all of the work on New Keynesian economics that predates the 2008 crisis.

In New Keynesian models, there are costs to changing wages and prices. Because of these so-called **menu costs**, wages and prices are not always at the levels that would be chosen in their absence. Nevertheless, households are still assumed to be able to find as much employment as they would like at existing wages and prices. **In New Keynesian DSGE models, just as in RBC models, there is no involuntary unemployment.**

(1) The pinnacle of the New Keynesian programme is the model developed by Frank Smets and Rafael Wouters (2007). That model fits pre-2008 data very well by incorporating large numbers of frictions and shocks into a DSGE structure. It is much less successful at explaining the Great Recession. Lakatos (1978) distinguished between a progressive and degenerative research programme. Based on that distinction, Farmer (2013b) argues that New Keynesian economics is a degenerative research programme. It is a programme that must continually modify a set of subsidiary hypotheses in order to explain new data.

We need to bring unemployment back into our models

In the wake of the Great Recession, continuous labour market clearing and rational expectations have both come under attack. In my view, the rational expectations concept is useful and, if applied carefully, can be incorporated into a model that will help us to understand what went wrong in the crisis.(1) But the assumption of continuous labour market clearing is seriously misleading. Based on this assumption, RBC models take account only of *employment*, proxied by the number of hours worked, with no explicit role for the rate of *unemployment*.

The distinction between employment and unemployment is crucial. In this section I draw on US labour market data from the past half century to argue that the RBC approach is fundamentally flawed, and that any model that aims to explain business cycle fluctuations must provide an explicit theory of the unemployment rate.

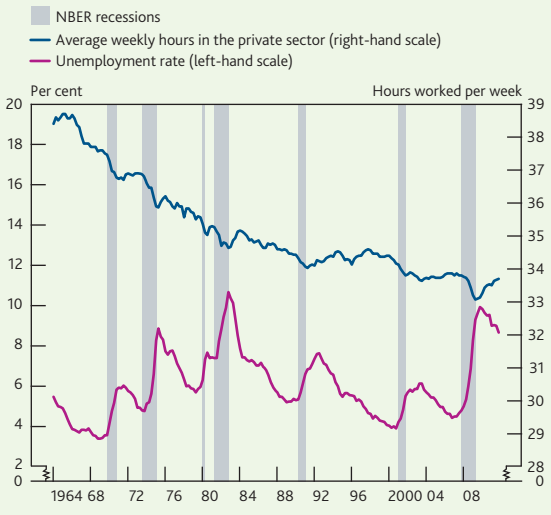
Hours worked varies for three reasons

RBC economists use hours spent in employment by a representative agent as their measure of employment. This measure varies for three reasons. First, households decide how many household members will participate in the labour market. Second, each potential worker must find a job. Finally, each employed worker must decide how many hours to work in a given week. Each of these three variables displays very different characteristics.

Average hours worked do not vary much at business cycle frequencies. **Chart 2** plots US unemployment, on the left-hand scale and average weekly hours on the right-hand scale. Unemployment is measured as a percentage of the labour force, and average weekly hours is a number. The grey shaded areas are recessions defined by the National Bureau of Economic Research (NBER) dating committee. This chart shows that there has been a secular downward drift in average weekly hours but very little movement in hours at business cycle frequencies. **Hours worked does not vary much at business cycle frequencies.**

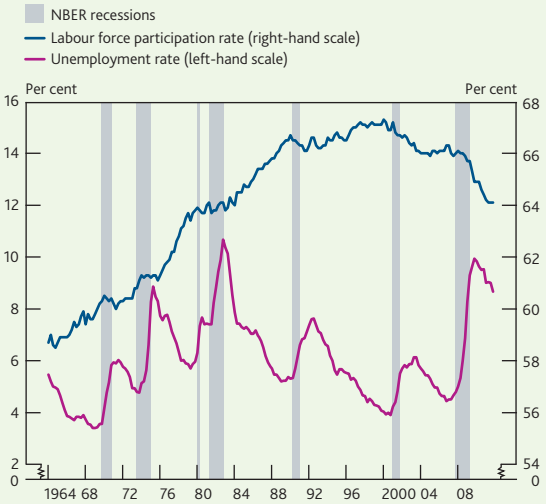
Chart 3 plots unemployment, on the left-hand scale and the labour force participation rate on the right-hand scale. The participation rate is measured as a fraction of the over-16 non-institutional population. **This chart shows that, like hours, most of the movements in the participation rate are secular. They are not strongly correlated with recessions.**

Chart 2 Hours and employment in the United States



Sources: Bureau for Labor Statistics and NBER.

Chart 3 Participation and unemployment in the United States



Sources: Bureau for Labor Statistics and NBER.

In both classical and New Keynesian theories, employment variation over the business cycle occurs through intertemporal substitution, by rational forward-looking households, of leisure today for leisure tomorrow. In both theories, households can work as many hours as they choose and the demand and supply of labour are continuously equated by adjustments of the money wage. **The facts contradict this assumption.**

Charts 2 and **3** demonstrate that **almost all of the variation in hours at business cycle frequencies occurs because of variations in the unemployment rate. If we want to understand the causes of business cycles, we cannot neglect the determinants of the unemployment rate.** In spite of this obvious fact, almost all DSGE models, pre-2008, did not contain unemployment.(2)

(1) For an important and interesting counterargument, see the work of Roman Frydman and Michael Goldberg (2011).
(2) Some notable exceptions are the papers by Merz (1995), Andolfatto (1996) and Hall (2005).

Houblon-Norman essay | Roger E A Farmer

Modelling unemployment

Using search theory to model unemployment

Although the concept of unemployment disappeared from modern mainstream macroeconomics, it did not disappear from economics entirely. One promising avenue, pursued by theorists, was the incorporation of search frictions into simple models of the labour market. This avenue is called **search theory**.(1)

The main innovation of search theory is the concept of a **matching function**, which models the process of finding a job as a **search technology** with two inputs. Just as a production technology combines labour and capital to produce a commodity, so a search technology combines the search time of an unemployed worker with the search time of the recruiting department of a firm to fill a vacancy.

Imagine that the labour force is constant and that every worker works a 35-hour week. Since neither hours nor participation varies much at business cycle frequencies, these assumptions are useful approximations if our goal is to understand recessions.

There are approximately 30 million workers in the UK labour force. Let's suppose that 40,000 of them lose their jobs every week, either because they quit voluntarily or because they are laid off. How can we replace those workers in a way that keeps the number of employed people constant?

According to search theory, the matching function connects the number of vacancies posted, the number of unemployed people, and the number of new positions that are filled.

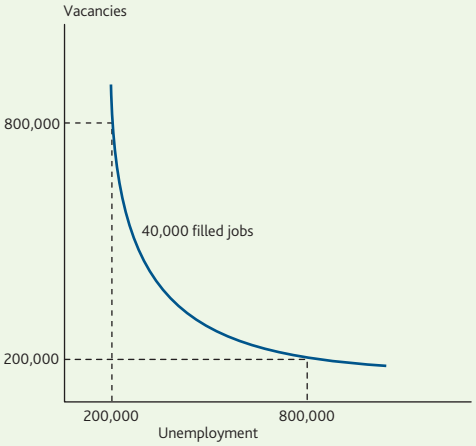
Equation **(1)** is an example. Here, J represents the number of filled jobs in a week; V is the number of unfilled vacancies that are available that week and U is the number of unemployed people.

$$J = \frac{1}{10}\left(V^{1/2}U^{1/2}\right) \qquad (1)$$

Figure 2 illustrates equation **(1)** in a graph. This figure shows that 40,000 new jobs can be created in many different ways. One would be if 200,000 unemployed people searched for 800,000 vacancies. Another would be if 800,000 unemployed people searched for 200,000 vacancies. Those different ways of matching workers with jobs have very different implications for the unemployment rate. To see this, suppose the economy in this example has a labour force of 1 million people. The first case would result in an unemployment rate of 80% and the second in an unemployment rate of 20%.

Figure 2 resembles an empirical relationship, called the Beveridge curve, which characterises the UK and US data. According to search theory, the Beveridge curve is analogous

Figure 2 The Beveridge curve as an isoquant



to an isoquant in the microeconomic theory of the firm. In the theory of the firm, an isoquant gives different levels of capital and labour that can be used to produce a given amount of physical goods. In search theory, the Beveridge curve gives different combinations of vacancies and unemployed workers that can be used to fill a given number of jobs.(2)

If the theory of the firm can be used to help explain unemployment then perhaps we can also learn from welfare economics, which teaches us that the equilibria of competitive markets are efficient. That turns out not to be the case.

Search theory and market efficiency

One way of characterising the efficiency of markets is to write down a problem that would be solved by a fictitious social planner who knows the technologies available to produce goods and the preferences of all the people in the economy. In our example, the social planner would also know the technology for matching unemployed workers with vacant jobs.

Suppose we ask the social planner to maximise the utility of a representative household by choosing the best possible way of matching unemployed workers with vacant jobs. Microeconomic theory tells us that the decision of the social planner can be achieved anonymously by allocating goods through competitive markets. The idea that markets solve the planner's maximisation problem is called the first welfare theorem of economics. **But for the first welfare theorem to hold there must be enough markets and enough relative prices.**

(1) Search theory was recognised in 2010 with the award of the Nobel Prize in Economics to Peter Diamond, Dale Mortensen and Chris Pissarides. It began with a remarkable collection of papers (Phelps, Alchian and Holt (1970)) that explored the theoretical foundations of the Phillips curve. Important contributions include Diamond (1982), Mortensen (1970) and Pissarides (1976). My work is most closely related to Howitt and McAfee (1987), who point out that search models may contain a continuum of steady-state equilibria.

(2) For an interesting link to a real-time graph of unemployment and vacancies, see Farmer (2010c).

To apply the first welfare theorem to an economy with a search technology, there would need to be a large number of 'matchmaking' firms, as well as the usual assumption of a large number of production firms. Matchmaking firms and production firms would play different roles.

Matchmaking firms would pay unemployed workers for the exclusive right to find them a job. And they would pay the firms that produce commodities for the exclusive right to fill their vacancies. After matching suitable workers with commodity-producing firms, the matchmaking firm would sell the match back to the worker-firm pair.

In reality we do not see matchmaking firms that operate in this way because the market would be difficult to police. For the search markets to work well, the matchmaking firms would need to buy the inputs to the search technology in a pair of competitive markets. These firms would, in effect, be paying unemployed workers for being idle. It is easy to see that there is an incentive for these workers to cheat and to refuse to accept a job once it is offered.

Because it would be difficult or impossible to force a matched worker to accept a job, the factor markets in a search model are necessarily incomplete. There are not enough relative prices to send the correct signals to market participants. **This lack of enough relative prices leads to a fundamental indeterminacy in the labour market.**(1)

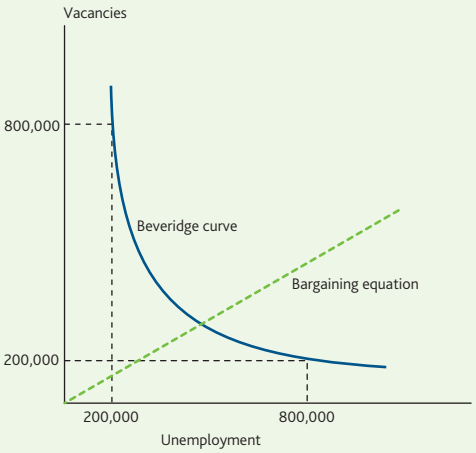
Search theory and the Nash bargain

Search theorists recognised that if firms and workers take wages and prices as given, there are not enough equations in a search model to determine all of the unknowns. To complete their model, they assume that when a worker and a firm meet, they bargain over the wage using a theory called Nash bargaining, after the economist John Nash. This assumption adds an additional component to the search model; the **Nash bargaining equation**.

The Nash bargaining equation introduces a new parameter to the model: the bargaining weight of the worker. This parameter captures features like the strength of unions relative to firms and it determines how profit-maximising firms will choose to allocate resources to the activity of recruiting. The Nash bargaining weight picks an equilibrium point on the Beveridge curve.

Figure 3 illustrates this idea. The downwards-sloping blue curve is the Beveridge curve. This represents the technological possibilities for filling a given number of jobs. The upwards-sloping dashed green line follows from the assumption that, when a worker meets a firm, they bargain over the wage. That assumption leads to a unique ratio of vacancies to unemployment with a slope that depends on the bargaining weight of the two parties. Equilibrium occurs at the point where the bargaining equation and the Beveridge curve coincide.

Figure 3 The Beveridge curve and the Nash bargaining equation



Search theory, closed with the Nash bargaining assumption, is mathematically consistent and has provided several generations of PhD students with elegant problems to solve. But it is not a good description of the data. The Nash bargaining equation picks a unique natural rate of unemployment and reasonable calibrations of standard search and matching models predict that unemployment will quickly converge back to this natural rate. **As I showed in Chart 1, this is not what happens in the real world.**(2)

A new paradigm for macroeconomics

The belief function: a positive theory of animal spirits

If we drop the Nash bargaining equation, as I have done in my work, our economic model will be left without enough equations to determine all of the unknowns. It becomes a model with multiple steady-state equilibria. In order to understand what would happen in a model of this kind, we must explain how human beings would react in any given situation.

Whereas standard search theorists close their models in the labour market with an arbitrary bargaining equation, I close my model instead in the asset markets. I capture Keynes'

(1) Farmer (2006, 2008, 2010a, 2012a,b) constructs a real model with incomplete factor markets and Farmer (2013b) develops a monetary model with incomplete factor markets where a belief function replaces the assumption that output is exogenous. That model provides a better fit to the data than the New Keynesian model because it is able to account endogenously for persistence in the unemployment rate.

(2) I am not the only economist who has recognised that we must develop new theories that include unemployment. Since the onset of the Great Recession, New Keynesian economists have also begun to incorporate unemployment into their models. Notable examples include Gertler, Sala and Trigari (2008) and Gertler and Trigari (2009) who introduce more sophisticated bargaining rules into search models in an attempt to provide more persistence to sticky wages. Building on Hall and Milgrom (2008), these New Keynesian models are closed with versions of the Nash bargaining equation. Because the Nash bargain imposes a natural rate of unemployment, to which the economy returns over time, these theories cannot account for the failure of the NRH.

notion of 'animal spirits' by providing an explicit theory of how animal spirits are determined. I model animal spirits as a new fundamental that I call **the belief function**.

The belief function is a mapping, from observations of the past to beliefs about the future. This new fundamental equation plays a similar role to the theory of adaptive expectations: it anchors beliefs.(1)

In models where there are multiple steady-state equilibria, the unemployment rate displays what Olivier Blanchard and Lawrence Summers (1987) have labelled hysteresis. In a model with hysteresis, I have shown that the belief function selects a unique path for the unemployment rate. This path wanders across the possible steady-state labour market equilibria. Because each of these unemployment rates is itself an equilibrium, so is the non-stationary path of unemployment rates that is realised. **The equilibrium in my model is fully consistent with rational expectations.**

The fact that the equilibrium in my model is rational, in the sense of rational expectations, is an important element of the theory that distinguishes it from the popular idea that animal spirits are expressions of 'irrational exuberance'. Since beliefs are rational in my model, they are correct on average, and no one in the model is consistently fooled when outcomes are realised.

By specifying what variables agents form beliefs about, and by providing a functional form for how those variables depend on present and past observables, I arrive at a complete theory that determines employment, prices, GDP and its components.

Using my new paradigm to explain the data

Putting the belief function through its paces

In my (2013b) paper I ran a horse race of a three-equation New Keynesian monetary model against a 'Farmer' monetary model and I showed that the Farmer model, closed with a belief function, does a much better job of explaining the data. Why might that be?

A model that is closed with the Phillips curve implies that the unemployment rate will show a tendency to return, over time, to its natural rate. The data show no such tendency. In contrast, a model where unemployment can wander around a set of possible values provides a better explanation for what we have observed in the past 60 years.

Equations **(2)** and **(3)** describe a parameterised example of the belief function that I used in Farmer (2013b). Here, x_t is nominal GDP, y_t is real GDP and p_t is a price index. All variables are in logs, Δ is the first difference operator and E is the expectations operator.

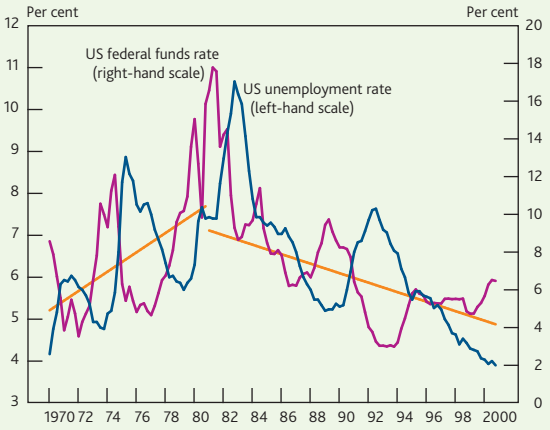
$$x_t = y_t + p_t \qquad (2)$$

$$E\left[\Delta x_{t+1}\right] = \Delta x_t \qquad (3)$$

The key assumption is equation **(3)**. This asserts that households expect that the growth rate of nominal GDP next period will equal the growth rate this period. When that assumption is inserted into a simple three-equation model of the macroeconomy, as a replacement to the Phillips curve, the resulting system provides a much better fit to data than the canonical New Keynesian model.

To see why that is the case, **Charts 4** and **5** illustrate the behaviour of the data. Data for unemployment and the short-term interest rate are trending up before 1980 and down since then. In joint work (Beyer and Farmer (2007)), Andreas Beyer and I show that unit root tests cannot reject the hypothesis that each individual series is a random walk and

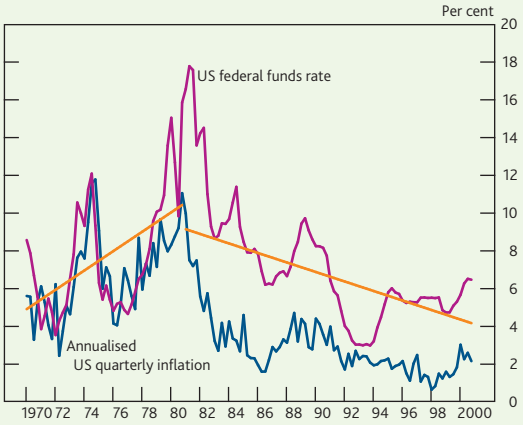
Chart 4 Unemployment and the interest rate in US data(a)



Sources: Bureau of Labor Statistics and the Federal Reserve Board of Governors.

(a) The two secular trends for the US federal funds rate are based on the period up to 1980 and the period from 1983 onwards.

Chart 5 Unemployment and inflation in US data(a)



Sources: Bureau of Labor Statistics and the Federal Reserve Board of Governors.

(a) The two secular trends for the US federal funds rate are based on the period up to 1980 and the period from 1983 onwards.

(1) Adaptive expectations may coincide with rational expectations when there are multiple equilibria. I have explored this idea in a series of books and papers. See Farmer (1999, 2010a, 2012a, 2013b) and Plotnikov (2013). Farmer (2014) compares this work with models that contain multiple dynamic rational expectations equilibria.

that, jointly, the series are connected by two cointegrating equations.(1) It is these facts that the Phillips curve model, an equation that incorporates the NRH, cannot explain.

The reason the Farmer model outperforms the New Keynesian model is because the New Keynesian model embodies the Natural Rate Hypothesis. The reduced form of the model consists of three stationary time series and it imposes the assumption that the unemployment rate, the interest rate and the inflation rate always revert back to the same levels in steady-state equilibrium. The fact that these time series are stationary implies that we would expect to see data that cluster around a single point in three-dimensional space.

By contrast, the Farmer model contains equation **(3)** as one of its explanatory equations. It does not embody the NRH and instead, the reduced form is a set of cointegrated time series that capture low-frequency comovements between unemployment and other macroeconomic variables over the course of the business cycle. The fact that these time series are non-stationary implies that we would expect to see data that cluster around a line in a three-dimensional space. This is in sharp contrast to the implications of the New Keynesian model.

Conclusion

Friedman (1970) claimed that there is 'no fundamental flaw in the price system'. I argue that he was wrong and that my work explains why. The stagnation that occurred in the United States during the Great Depression, in Japan during the 'lost decade' of the 1990s and throughout the Western world following the financial crisis of 2008, supports that claim.

At the outset of this article I offered not just to provide a critique of macroeconomic theory: but also to provide a constructive alternative with which to rebuild it. That alternative is based on a return to two central ideas of Keynes' General Theory. First, that high involuntary unemployment can persist as an equilibrium of a market economy and second, that the equilibrium that prevails is selected by the animal spirits of market participants.

Economists and central bankers can no longer afford to continue using the NRH. It is an idea that is past its sell-by date. I have offered a replacement that recovers Keynes' two central ideas and I have shown that this new paradigm outperforms the New Keynesian model when confronted with data.

By modelling the labour market with a search model where factor markets are incomplete, I have shown how to construct a logical microeconomic foundation to Keynesian economics. And by modelling beliefs as a new fundamental with the same methodological status as preferences, I have shown how to construct a complete DSGE model that provides a coherent explanation of macroeconomic data.

The research agenda that is implied by accepting my ideas is exciting. It raises new questions, answers old ones, and provides new ways of thinking not only about economic theory, but also about policy options.(2) But that is a story for another day.

(1) A pair of cointegrated random walks is a bit like two drunks walking down the street, tied together by a rope. The drunks can wander apart from each other in the short run, but in the long run they can never get too far apart.
(2) See Farmer, Nourry and Venditti (2012) and Farmer (2012b,c and 2013c).

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Recent economic and financial developments

Markets and operations

- Developed-economy government bond yields rose due to the growing view that the Federal Reserve would begin to reduce the size of, or 'taper', its monthly asset purchases following its September policy meeting. Strong economic data placed further upward pressure on market interest rates.
- The prospect of tapering by the Federal Reserve led to falls in risky asset prices. Emerging market economies were particularly affected.
- The Monetary Policy Committee announced its intention not to raise Bank Rate at least until the Labour Force Survey headline measure of the unemployment rate had fallen to a threshold of 7%, provided that such an approach remains consistent with its primary objective of price stability and does not endanger financial stability.
- Economists' expectations of the timing of the first rise in Bank Rate shifted out following the statement on forward guidance, while measures derived from short-term interest rates were brought forward.

Overview

Towards the end of the previous review period in May, comments by the Federal Reserve Chairman added to market speculation regarding a possible reduction in the size of monthly asset purchases by the central bank. US Treasury yields rose in response, as did interest rates internationally, including in the United Kingdom.

The increase in developed-economy government bond yields continued during the review period as improving economic data led market participants to revise up their expectations for growth. And market expectations coalesced on the view that the Federal Reserve would begin to reduce its asset purchases following its September policy meeting, putting more upwards pressure on long-term yields in advanced economies.

Meanwhile, there were falls in risky asset prices as investors sought to exit trades that had been placed on the view that risk-free rates would remain low for longer than now seemed likely. Many such positions had involved borrowing at low rates in developed economies and then investing the proceeds in higher-yielding assets. Emerging market economies with the greatest macroeconomic vulnerabilities were particularly affected.

Later in the review period, growing nervousness surrounding a possible escalation of the conflict in Syria was associated with declines in developed market equity prices, while safe-haven flows put downward pressure on some developed-economy government bond yields.

Following its July policy meeting, the Monetary Policy Committee (MPC) commented that the rise in the path of Bank Rate implied by market rates was not warranted by developments in the domestic economy.(1) And, with the release of the August *Inflation Report*, the MPC adopted formal forward rate guidance, stating that it did not intend to increase Bank Rate until the unemployment rate had fallen to at least 7%, provided this remained consistent with the Committee's primary objective of price stability and did not endanger financial stability.(2)

A Reuters poll conducted at the end of the period indicated that the median of economists' expectations of the timing of the first rise in Bank Rate had shifted out six months following the MPC's forward guidance announcement, to the end of 2015. In contrast, the market-implied future path of Bank Rate suggested that it was expected to reach 0.75% around the middle of 2015.

(1) Further details are available at www.bankofengland.co.uk/publications/Pages/news/2013/007.aspx.
(2) Further details are available at www.bankofengland.co.uk/monetarypolicy/Pages/forwardguidance.aspx.

In discharging its responsibilities to ensure monetary stability and contribute to 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 own market operations. The Bank also conducts occasional surveys of market participants in order to gather additional information on certain markets.

The first section of this article reviews developments in financial markets between the 2013 Q2 *Quarterly Bulletin* and 30 August 2013, drawing on the qualitative intelligence gathered by the Bank in the course of meeting its objectives of monetary and financial stability. The second section of this article sets out usage of the Bank's operations since the previous *Bulletin*.

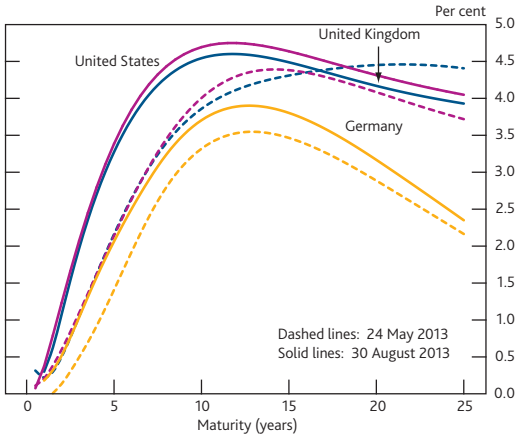
Financial markets

Monetary policy and interest rates

Towards the end of the previous review period, there was a marked and synchronous rise in developed market interest rates. This followed statements from the US Federal Reserve that it would moderate the pace of its asset purchases later this year, and end purchases next year, if data for the US economy evolved broadly as expected.(1) Market participants commonly refer to this reduction in asset purchases as 'tapering'.

UK, US and German forward government bond yields ended the review period higher (**Chart 1**), but remained low by historical standards. Contacts attributed some of this rise in interest rates to upward revisions to expected policy rates as well as greater uncertainty over their future path.

Chart 1 International government bond forward yield curves(a)

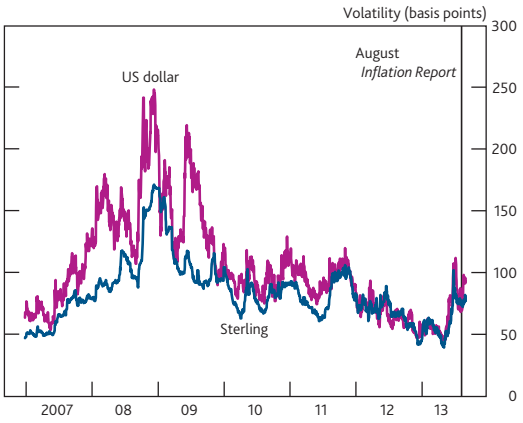


Sources: Bloomberg and Bank calculations.

(a) Nominal instantaneous forward interest rates derived from the Bank's government liability curves.

Measures of future interest rate uncertainty in the United States and United Kingdom rose over the review period. Although volatility remained low compared with 2009 levels (**Chart 2**), it contributed to a reduction in liquidity across a range of markets. Contacts suggested that this was due to the large number of trades that had been placed on the expectation that the US policy rate would stay low for longer than was now judged likely by market participants. Many of these positions were being unwound at the same time, and the associated decline in liquidity was particularly pronounced in emerging markets (the box on page 260 discusses this in more detail).

Chart 2 Uncertainty around US and UK interest rates(a)



Sources: Barclays and Bank calculations.

(a) Weighted average implied volatility of options maturing in one month's time, written on interest rate swaps with tenors of 2, 5, 10 and 30 years with weightings of 20%, 20%, 40% and 20% respectively.

Amid the generalised rise in volatility, the European Central Bank (ECB) took steps to quell expectations of any imminent rise in its main policy rate following its June meeting, and at subsequent meetings it stated that policy would remain low for an 'extended period'. But euro-area overnight interest rates continued to edge higher, which contacts attributed to the ongoing repayment by banks of funds borrowed under the ECB's longer-term refinancing operations — and the associated gradual decline in excess liquidity in the Eurosystem.

In contrast to other markets, volatility in Japanese government bond markets generally subsided relative to earlier in the year.(2) Contacts reported that liquidity began to improve as investors returned — albeit slowly — to trading more actively in the market.

There was, however, an episode of turbulence in the Chinese interbank money market in May, arising from a shortage of market liquidity. Contacts thought this was largely unrelated to changes in expectations for US monetary policy (the box on page 262 discusses this in more detail).

Throughout the review period the Monetary Policy Committee (MPC) maintained Bank Rate at 0.5% and the stock of asset

(1) For further details see www.federalreserve.gov/monetarypolicy/fomcminutes20130731.htm.
(2) For a discussion of the drivers of this volatility, see page 160 of the 2013 Q2 *Quarterly Bulletin*.

Illiquidity during the period of recent market stress

Statements from the Federal Reserve Chairman in May and June regarding the timing of possible tapering of asset purchases contributed to a rise in yields of US, UK and euro-area government bonds. Contacts suggested that some market participants had underestimated the possibility of such a change in policy in the near term, leading to a concentration of investments — or 'crowded trades' — placed on the assumption that short-term government bond yields would remain low for a long time.

Many of these trades involved advanced-economy institutions borrowing in low interest rate currencies, such as the US dollar, and investing in higher-yielding assets, often cross-border — the so-called 'carry trade'. But a rise in volatility in advanced-economy interest rates increased the risk associated with borrowing in US dollar and other 'funding currencies', prompting investors to exit these positions, either by selling their investments, or by taking offsetting positions in other instruments. As large numbers of investors rushed to unwind these positions simultaneously, there was a spike in volatility and a material reduction in liquidity across a range of markets, particularly those in emerging markets.

Some contacts had previously anticipated that there could be a reduction in liquidity in the event of stress in financial markets, because market makers — institutions which stand ready to either buy or sell a security in any given transaction in order to bridge gaps between the demand for, and supply of, that instrument — had scaled back their market-making activity since the start of the financial crisis. Such a reduction in market-making would mean less liquidity in the markets in which they operate.

Contacts had also expressed concerns in the past that the liquidity provided by some recently established market makers may fall sharply under stressed conditions.(1) For instance, if a large trade is executed, some automated market-making systems are programmed to withdraw their bid and offer prices, or transact only in limited size, on the assumption that a large trade indicates that another player in the market has more information than they do.

Despite being alert to the risk of a possible reduction in liquidity under stressed conditions, the magnitude and breadth of the fall was larger than had been anticipated by many market participants. Additional factors were thought to have contributed to the decline in liquidity. Facing impaired liquidity conditions, some investors sought to reduce their exposure to the least liquid assets by selling less illiquid securities in other, more liquid, markets. This caused the initial sell-off to become increasingly broad-based.

Contacts also pointed to the liquidity demands of leveraged hedge funds and exchange-traded funds, some of which exited trading positions particularly quickly. And market moves were thought to have been amplified by some dealers who were reported to have responded to the initial thinning in liquidity by hedging their exposures with greater speed, and in greater size, than many had anticipated.

Later in the review period, contacts reported that there had been a second phase of selling of emerging market assets. On this occasion, a more central role was thought to have been played by investors that have a particular focus on those markets. Contacts suggested that these investors were discriminating between different emerging markets, with continuing capital outflows tending to be associated with countries that have a weak external position.

(1) See also Bank of England *Financial Stability Report*, June 2013 (Section 2.2).

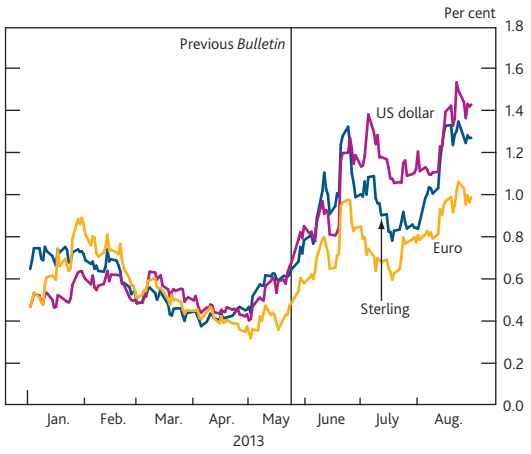
purchases financed by the issuance of central bank reserves at £375 billion. But following its July meeting, the MPC stated that the large upward move in UK market interest rates had not been warranted by recent developments in the UK domestic economy. This led market participants to anticipate that the MPC would introduce some form of forward guidance to coincide with the publication of the August *Inflation Report*.

Alongside the August *Inflation Report*, the MPC announced that it intended not to raise Bank Rate at least until the Labour Force Survey headline measure of the unemployment rate had fallen to a threshold of 7%, provided that this remained consistent with the Committee's primary objective of price stability and did not endanger financial stability. The MPC also stated that it stood ready to undertake further asset purchases while the unemployment rate remained above 7% if it judged that additional monetary stimulus was warranted. A Reuters poll conducted at the end of the review period indicated that the median of economists' expectations was for the MPC to maintain its final stock of asset purchases at £375 billion.

After a run of strong data on economic output, market interest rates increased during the latter part of the review period, particularly between the two and five-year maturities, with the UK one-year forward rate in two years' time ending the review period around 60 basis points higher than at the start (**Chart 3**).

As a result, by the end of the review period, Bank Rate — as proxied by forward overnight index swap (OIS) rates — was

Chart 3 One-year OIS rate two years forward for selected countries[a]

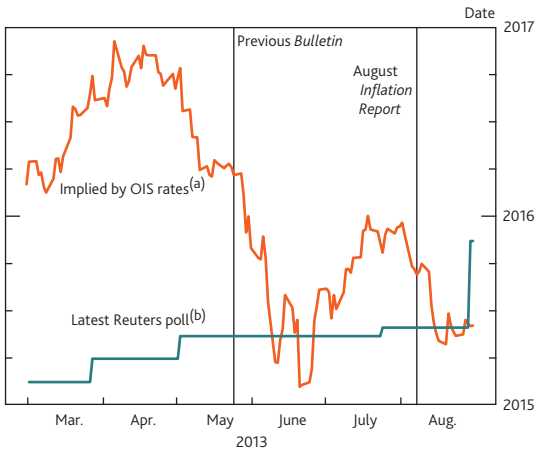


Sources: Bloomberg and Bank calculations.

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

expected to reach 0.75% in 2015 Q2 compared to late 2016 Q1 at the start of the review period (**Chart 4**). But, in contrast to market-implied rates, following the introduction of forward rate guidance by the MPC, the median expectation of economists shifted out by six months, with the timing of the first rate rise placed at around the end of 2015 (**Chart 4**).

Chart 4 Indicators of when Bank Rate is expected to have risen



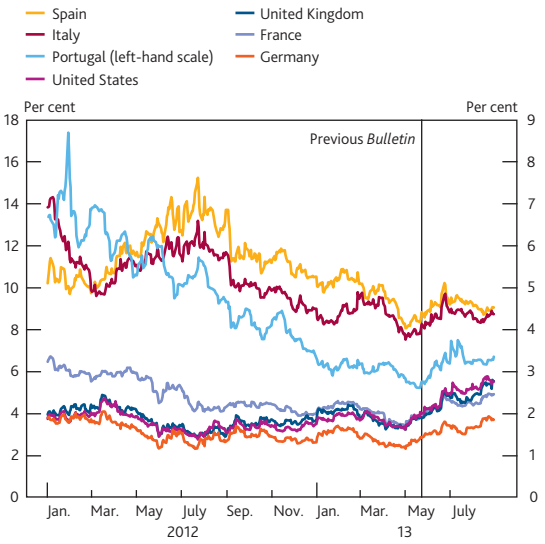
Sources: Bloomberg, Reuters and Bank calculations.

(a) Series is calculated as the first date at which instantaneous forward OIS rates equal or exceed 0.75%.
(b) Reuters poll shows the median of economists' expectations of the first rise in Bank Rate. This is based on a survey of economists' responses to the question: 'When do you expect the Bank of England to change rates next?'.

Long-term UK interest rates also increased over the review period, reflecting both the rise in short rates and the comovement between US rates and those in other developed markets. The ten-year UK spot rate ended the review period around 80 basis points higher than at the start.

Government bond yields in the euro area were also higher on the quarter (**Chart 5**). But there had been little sign of any spillover to euro-area periphery countries from either worries surrounding political instability in Portugal — and associated concerns about the ability of the government to meet the conditions required for future IMF programme disbursements — or volatility in emerging economies related to US tapering expectations.

Chart 5 Selected ten-year government bond yields[a]



Source: Bloomberg.

(a) Yields to maturity on ten-year benchmark government bonds.

Foreign exchange

The prospect of US tapering led to some volatility in the major currency pairs at the beginning of the review period, with the US dollar, in particular, appreciating between the end of May and mid-June. But by the end of the period, both the sterling and dollar effective exchange rate indices (ERIs) were broadly in line with their levels at the start of the review period, while there was a slight appreciation of the euro.

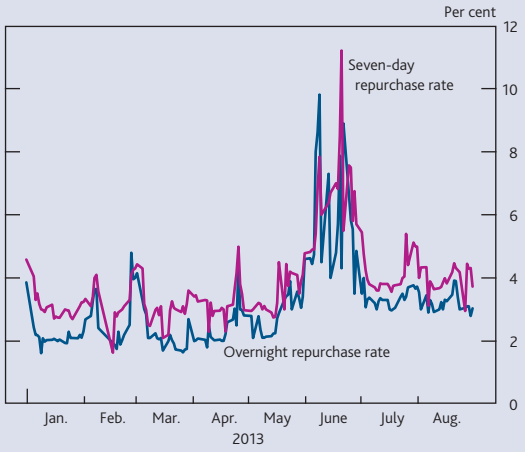
There was a fairly sharp sell-off in emerging market currencies, however, as participants unwound trades funded by borrowing at low rates in developed economies, to invest in emerging market assets (**Chart 6**). The result was a marked depreciation of a number of developing-country currencies against those of their primary trading partners, even as the major currency pairs, such as the US dollar versus sterling, and US dollar versus the euro, remained fairly stable.

Despite developments in the rest of the world, volatility of the Japanese yen subsided somewhat over the review period, after its sizable depreciation earlier in the year. Contacts thought that the lack of further major policy statements from the Bank of Japan and the greater focus on US monetary policy and emerging market vulnerabilities had diverted attention away from the currency. Towards the end of the period, however, the yen appreciated on safe-haven flows out of emerging markets.

Chinese interbank market liquidity

Chinese money market lending rates began to drift higher from around the end of May, before rising sharply to record levels in the middle of June (**Chart A**). The rise in rates was particularly acute at shorter maturities, with overnight rates briefly moving above seven-day rates. Contacts reported at the time that short rates were responding to a shortage of liquidity in the Chinese interbank market.

Chart A Chinese interbank borrowing rates



Source: Reuters.

The central bank can adjust the amount of liquidity in the interbank market in its open market operations, either by selling renminbi-denominated assets to withdraw money from the sector, or by purchasing renminbi assets to inject money. The rise in short rates in the Chinese interbank market followed smaller-than-usual open market operations by the People's Bank of China (PBoC) from around April. That will have tended to reduce the liquidity available on the interbank market, other things being equal.

Targeted liquidity provision by the PBoC from 21 June was associated with an easing in money market conditions, however, with the seven-day repurchase rate ending the day at 5.5%, down from 11.2% the day before. Liquidity conditions continued to ease during the following week. And PBoC Governor Zhou stated that the authorities remained committed to maintaining liquidity in the interbank market.

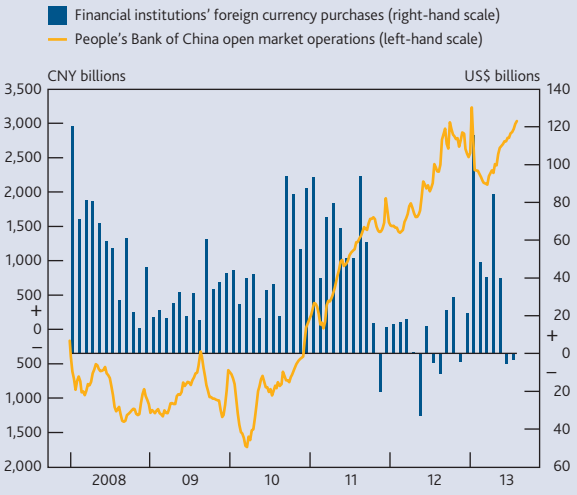
Influences on liquidity

A number of factors influence levels of liquidity in the Chinese interbank market. In particular, contacts report that bank demand for liquidity is typically higher than usual each June, coinciding with the regular assessment of lenders' loan to deposit (LTD) ratios by the CBRC, the Chinese regulator. According to contacts, it is common practice for Chinese lenders to transfer customer deposits from off balance sheet vehicles called wealth management products (WMPs), back onto their balance sheets, in order to raise LTD ratios. Customer deposit funding of the WMP is then replaced by borrowing from the interbank market, causing an increase in demand for liquidity by the banking sector as a whole. Other seasonal factors included an increase in the liquidity needs of corporates ahead of a corporate tax payment deadline in July, and a long public bank holiday.

Changes in foreign exchange flows can also lead to variations in the degree of liquidity in the Chinese interbank market. When Chinese corporations receive foreign exchange — either through trade or non trade-related capital flows — it is converted into renminbi with commercial banks, leading to an increase in the supply of renminbi in the domestic economy, other things being equal. Conversely, outflows of foreign exchange will cause the domestic money supply to fall.

Related to this, contacts noted that a few months prior to the episode, the Chinese authorities announced a crackdown on illicit capital flows into China via the practice of overinvoicing for exports to Hong Kong. This would tend to reduce the subsequent flow of foreign currency into the banking system. And the available data suggest that there was a net outflow of foreign exchange from the banking system in June, indicating a net outflow of renminbi liquidity (**Chart B**).

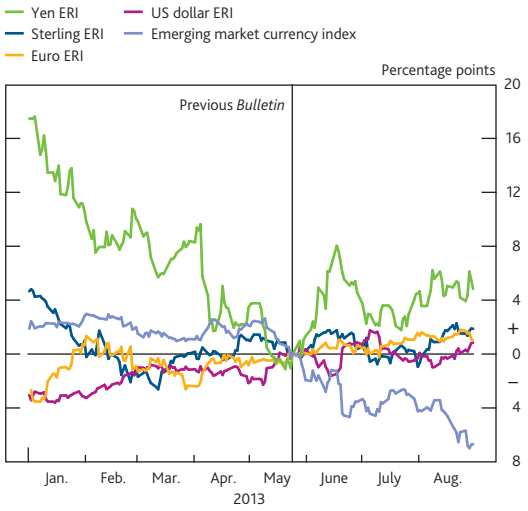
Chart B People's Bank of China open market operations[a] and Chinese financial institutions' purchases of foreign currency[b]



Sources: Bloomberg, CEIC and Bank calculations.

(a) Cumulative operations since 2008.
(b) Latest observation is for July 2013. Net monthly purchases of foreign exchange.

Chart 6 Changes in selected exchange rate indices since January 2013

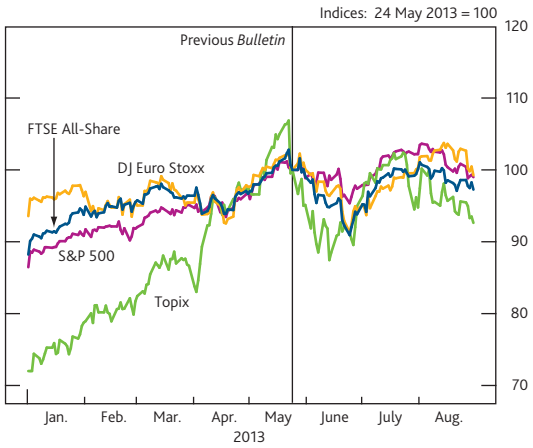


Sources: Bloomberg, European Central Bank, JPMorgan Chase & Co. and Bank calculations.

Corporate capital markets

Major international equity indices, including the FTSE All-Share, ended the review period a little lower, reflecting rising risk-free rates and worries about the possible escalation of the conflict in Syria (**Chart 7**). In the United States, the S&P 500 briefly reached an all-time nominal high in August before falling back.

Chart 7 International equity indices

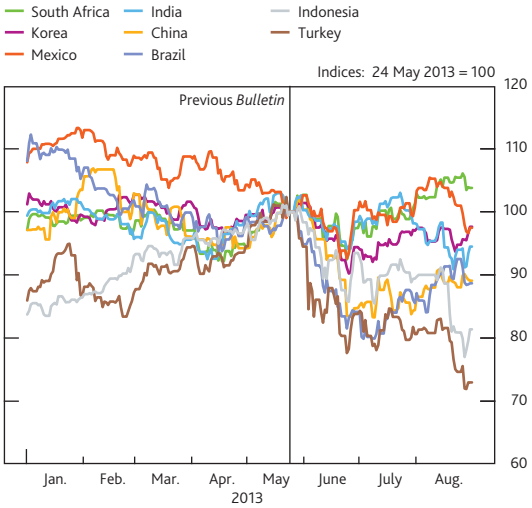


Sources: Bloomberg and Bank calculations.

In contrast, there was a marked decline in some emerging market equity indices due to capital outflows following talk of tapering in the United States (**Chart 8**). Contacts also expressed concerns about the prospects for economic growth in China, although Chinese equities rose toward the end of the review period as macroeconomic indicators pointed to an improving outlook for activity.

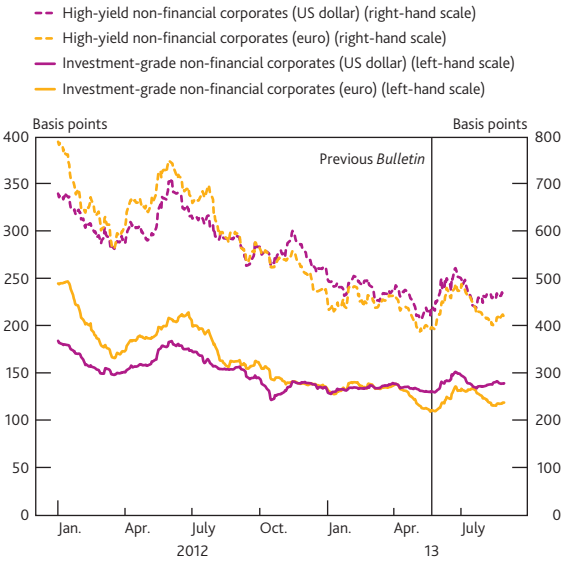
Corporate bond spreads in developed economies were fairly stable during the review period (**Chart 9**). Nevertheless, a combination of earnings blackout periods ahead of

Chart 8 Emerging market equity indices



Sources: Bloomberg and Bank calculations.

Chart 9 International non-financial corporate bond option-adjusted spreads[a]



Source: Barclays indices.

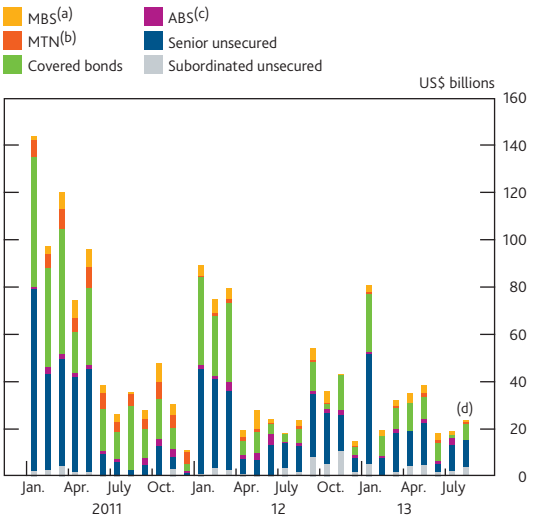
(a) Investment-grade non-financial corporate indices for US dollar and euro are constructed from a market-value weighted average of industrial and utility sub-indices.

quarter-end, the large amount of issuance undertaken earlier in the year, the onset of the quiet summer period, and the increase in volatility that began in May, all contributed to a slowing in the pace of issuance of corporate debt in the United States and Europe.

Bank funding markets

According to contacts, market volatility in June led to a rise in new issue premia for bank debt, resulting in the postponement of some issuance by European and US banks. European issuance of term funding remained subdued over the review period (**Chart 10**). Contacts emphasised that UK banks' funding needs remained relatively low, however, given increased deposit funding and relatively modest lending plans. Contacts also noted the availability of alternative sources of borrowing such as the Funding for Lending Scheme.

Chart 10 Term issuance by European banks in public markets



Sources: Dealogic and Bank calculations.

(a) Commercial and residential mortgage-backed securities.
(b) Medium-term notes.
(c) Asset-backed securities.
(d) Data up to 30 August 2013.

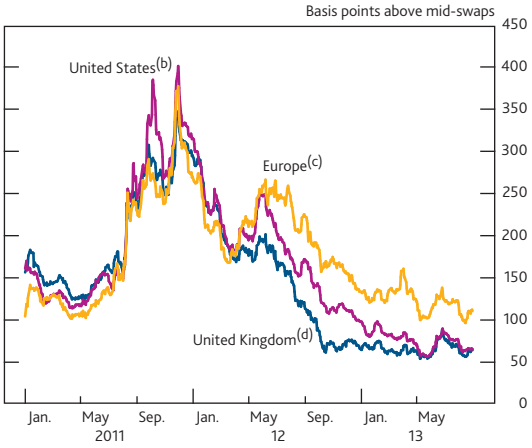
In contrast, primary issuance of both senior and subordinated instruments by US banks was relatively strong towards the end of August. Contacts thought the pickup represented an attempt by issuers to make up for lost ground in June, as well as to front-run the usual seasonal flurry of issuance in early autumn — and in case of any surprise to market expectations regarding US monetary policy, and possible knock-on effects for volatility.

In the secondary market, contacts reported some deterioration of liquidity in June and there was a temporary pickup in spreads on bank bonds (**Chart 11**). That said, strong institutional investor demand for bank debt had tended to limit the extent to which bank borrowing costs picked up during the recent period of volatility.

On the regulatory front, there were a number of significant announcements relating to banks' capital requirements and how the banks planned to meet them.(1) The Basel Committee on Banking Supervision published a consultation paper on different options for the calibration of a future leverage ratio. And in the United Kingdom, the Prudential Regulation Authority announced they had established plans with the major UK banks to achieve a 7% risk-weighted common equity ratio and a 3% core equity leverage ratio by the first half of 2014.(2)

The major UK banks committed to achieving these requirements either through retained earnings, asset disposals or balance sheet restructuring, or via the issuance of additional equity, rather than by cutting lending to the UK real economy. Meanwhile, a number of banks in other European jurisdictions, including Germany, Austria and Greece, raised significant amounts of capital via rights issues.

Chart 11 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 institutions' 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, Crédit Agricole, Credit Suisse, Deutsche Bank, ING, Intesa, Société Générale, UBS and UniCredit.
(d) Average of Barclays, HSBC, Lloyds Banking Group, Nationwide, Royal Bank of Scotland and Santander UK.

Some institutions also undertook transactions to swap liabilities that were no longer considered eligible as capital instruments under new regulations for equity capital. And there were further issues of contingent convertible instruments, with more reported to be in the pipeline.

Operations

Operations within the Sterling Monetary Framework and other market operations

This section describes the Bank's operations within the Sterling Monetary Framework 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 indexed long-term repo (ILTR) operations; 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 May, June and July maintenance periods. Average use of the lending facility was also £0 million.

(1) For a primer on the key concepts related to banks' financial resources and how these can mitigate various risks, see 'Bank capital and liquidity' on pages 201–15 of this edition of the *Bulletin*.
(2) For details see www.bankofengland.co.uk/publications/Pages/news/2013/081.aspx.

Table A Indexed long-term repo operations

	Total	Collateral set summary	
		Narrow	Wider
11 June 2013 (three-month maturity)			
On offer (£ millions)	5,000		
Total bids received (£ millions)[a]	0	0	0
Amount allocated (£ millions)	0	0	0
Cover	0.00	0.00	0.00
Clearing spread above Bank Rate (basis points)		n.a.	n.a.
Stop-out spread (basis points)[b]	n.a.		
9 July 2013 (three-month maturity)			
On offer (£ millions)	5,000		
Total bids received (£ millions)[a]	60	40	20
Amount allocated (£ millions)	60	40	20
Cover	0.01	0.01	0.00
Clearing spread above Bank Rate (basis points)		0	5
Stop-out spread (basis points)[b]	5		
13 August 2013 (six-month maturity)			
On offer (£ millions)	2,500		
Total bids received (£ millions)[a]	70	0	70
Amount allocated (£ millions)	70	0	70
Cover	0.03	0.00	0.03
Clearing spread above Bank Rate (basis points)		n.a.	15
Stop-out spread (basis points)[b]	n.a.		

(a) Due to the treatment of paired bids, the sum of bids received by collateral set may not equal total bids received.
(b) Difference between clearing spreads for wider and narrow collateral.

Indexed long-term repo open market operations

The Bank conducts ILTR operations as part of its provision of liquidity insurance to the banking system. These typically occur once every calendar month. Participants are able to borrow against two different sets of collateral: one set corresponds with securities eligible in the Bank's short-term repo operations ('narrow collateral'); the other set contains a broader class of high-quality debt securities that, in the Bank's judgement, trade in liquid markets ('wider collateral').

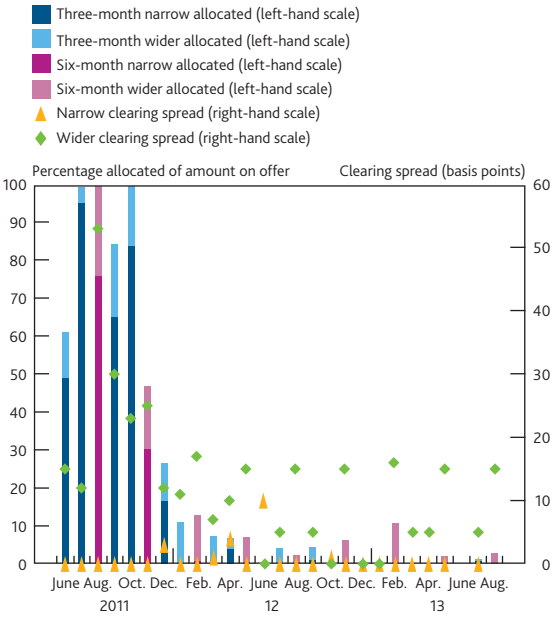
During the review period, the Bank offered £5 billion via three-month ILTR operations on both 11 June and 9 July, and £2.5 billion via a six-month operation on 13 August (**Table A**).

Over the quarter, short-term secured market interest rates remained below Bank Rate — the minimum bid rate in the ILTR operations — making the ILTR facility a relatively more expensive source of liquidity. Reflecting this, usage of the facility remained limited over the period, in line with recent quarters (**Chart 12**).

Extended Collateral Term Repo Facility

The Extended Collateral Term Repo (ECTR) Facility 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 reviews demand for use of the Facility on a monthly basis, in consultation with ECTR eligible institutions.(2) In the three months to 30 August 2013, the Bank did not conduct any ECTR auctions.

Chart 12 ILTR reserves allocation and clearing spreads



Discount Window Facility

The Discount Window Facility (DWF) provides liquidity insurance to the banking system by allowing eligible banks to borrow gilts against a wide range of collateral. The average daily amount outstanding in the DWF between 1 January 2013 and 31 March 2013, lent with a maturity of 30 days or less, was £0 million. The Bank also announced that the average daily amount outstanding in the DWF between 1 January 2012 and 31 March 2012, lent with a maturity of more than 30 days, was £0 million.

Other operations

Funding for Lending Scheme

The Funding for Lending Scheme (FLS) was launched by the Bank and the Government on 13 July 2012. The FLS is designed to incentivise banks and building societies to boost their lending to UK households and non-financial companies, by providing term funding at low rates. The quantity each participant can borrow via the FLS, and the price it pays on its borrowing, is linked to its performance in lending to the UK real economy.(3) The initial drawdown period for the FLS opened on 1 August 2012 and will run until 31 January 2014.

The Bank and HM Treasury announced an extension to the FLS on 24 April 2013, which will allow participants to borrow from the FLS until January 2015. The extended drawdown period

(1) Further details are available at www.bankofengland.co.uk/markets/Pages/money/ectr/index.aspx.
(2) Further details are available at www.bankofengland.co.uk/markets/Documents/marketnotice121120.pdf.
(3) For more details on the economics of the FLS, see Churm, R, Leake, J, Radia, A, Srinivasan, S and Whisker, R (2012), 'The Funding for Lending Scheme', *Bank of England Quarterly Bulletin*, Vol. 52, No. 4, pages 306–20.

will run from 3 February 2014 to 30 January 2015, following the initial drawdown period.(1)

The Bank publishes quarterly data showing, for each group participating in the FLS, the amount borrowed from the Bank, the net quarterly flows of lending to UK households and firms, and the stock of loans as at 30 June 2012. On 2 September 2013, the Bank published data showing that in the quarter ending 30 June 2013, 18 participants made FLS drawdowns of £2.0 billion, while one participant repaid £0.9 billion. This took the total amount of outstanding drawings under the Scheme to £17.6 billion, with 28 groups now benefiting from funding acquired under the Scheme.(2)

US dollar repo operations

Since 11 May 2010, in co-ordination with other central banks, the Bank has offered weekly fixed-rate tenders with a seven-day maturity to offer US dollar liquidity, and will continue to do so until further notice. And since 12 October 2011, the Bank has also offered US dollar tenders with a maturity of 84 days. 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 Bank's programme for taking CRDs is reviewed every five years. The most recent review recommended that the CRDs be increased, with that recommendation approved by Parliament on 21 May 2013, to take effect on 3 June. On 31 May 2013, the Bank announced its plans to invest the proceeds of these additional CRDs.(3)

Subsequently, the Bank made additional investments in accordance with the announcement, purchasing a total of £1.27 billion worth of gilts over the period. Following these purchases, the portfolio currently includes around £4.7 billion of gilts and £0.4 billion of other debt securities.

Asset purchases

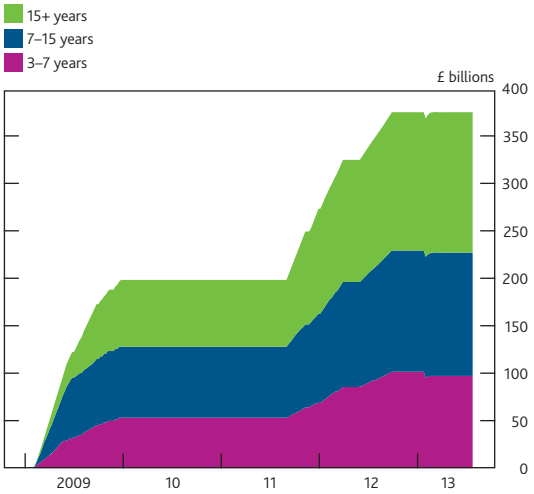
As of 30 August 2013, outstanding asset purchases financed by the issuance of central bank reserves under the APF were £375 billion, in terms of the amount paid to sellers. On 1 August, the MPC voted to maintain the stock of asset purchases financed by the issuance of central bank reserves at £375 billion. There were no asset purchases over the period.

Gilts

Alongside the publication of the August *Inflation Report* on 7 August, the MPC announced that it would maintain the stock of outstanding asset purchases by reinvesting the cash flows associated with all maturing gilts held in the APF. This reinvestment would continue while the Labour Force Survey unemployment rate remains above a 7% threshold, subject to the three knockout conditions outlined in the forward guidance document, published together with the August *Inflation Report*.(4)

The total stock of gilts outstanding, in terms of the amount paid to sellers, was £375 billion; of which £97.1 billion of purchases were made in the 3–7 year residual maturity range, £129.9 billion in the 7–15 year residual maturity range and £147.9 billion with a residual maturity of greater than 15 years (**Chart 13**).

Chart 13 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(5)

The Bank continued to offer to lend some of its gilt holdings via the Debt Management Office in return for other UK government collateral. In the three months to 30 June 2013, a daily average of £462 million of gilts was lent as part of the gilt lending facility. Average daily lending in the previous quarter was £287 million.

(1) Further details of the extension to the FLS are available at www.bankofengland.co.uk/markets/Documents/marketnotice130424.pdf.
(2) Further details are available at www.bankofengland.co.uk/markets/Pages/FLS/data.aspx.
(3) For more information, see the Market Notice at www.bankofengland.co.uk/markets/documents/marketnotice130531.pdf.
(4) For more information on the forward guidance threshold and the three knockouts, see www.bankofengland.co.uk/publications/Documents/inflationreport/2013/ir13augforwardguidance.pdf.
(5) 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.

Corporate bonds

There were no purchases of corporate bonds during the review period. The last corporate bonds held in the APF scheme that were eligible for sale were sold in 2013 Q2. Holdings of corporate bonds, which were ineligible for sale during the last review period due to having less than one year to maturity, have since matured. Future operations will be dependent on market demand. The Bank will review that in consultation with its counterparties in the APF Corporate Bond Secondary Market Scheme.(1)

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.(2) The facility remained open during the review period but no purchases were made.

(1) More information can be found in the Market Notice at www.bankofengland.co.uk/markets/Documents/marketnotice130627.pdf.
(2) The SCP facility is described in more detail in the Market Notice available at www.bankofengland.co.uk/markets/Documents/marketnotice120801.pdf.

Report

Monetary Policy Roundtable

On 10 July, the Bank of England and the Centre for Economic Policy Research hosted the tenth Monetary Policy Roundtable. These events provide a forum for economists to discuss key issues relevant to monetary policy in the United Kingdom.(1) As with previous Roundtable discussions, participants included a range of economists from private sector financial institutions, academia, public sector bodies and industry associations. There were two discussion topics:

- understanding recent developments in the UK labour market; and
- what can we say about the trade-offs currently facing monetary policy makers in the United Kingdom?

This note summarises the main points made by participants.(2) The Roundtables are conducted under 'Chatham House Rule' so opinions expressed at the meeting are not attributed to individuals. The views expressed in this summary do not represent the views of the Bank of England, the Monetary Policy Committee (MPC) or the Centre for Economic Policy Research.

Understanding recent developments in the UK labour market

The behaviour of the UK labour market since the financial crisis has been a key area of interest for monetary policy makers. Following the significant fall in GDP in 2008–09, output growth has been weak, while employment growth and labour force participation have been relatively resilient. Taken together, these developments have meant a prolonged period of unusually weak productivity growth. At the same time, wage growth has been subdued in a historical context. The first session of the Monetary Policy Roundtable explored the reasons for, and implications of, these recent developments in the labour market.

Roundtable participants discussed the causes of the relative strength of employment in the United Kingdom. It was suggested that one factor contributing to robust employment growth was a positive shock to labour supply. That largely appeared to reflect participation rates among older age groups — particularly in the over 50s — rising strongly, both in the years leading up to, and since, the crisis. Roundtable speakers pointed to several potential factors behind that increased participation: the removal of the compulsory retirement age; the increase in the age at which women are eligible for a state pension; and expected future increases in the age of eligibility for state pensions for both men and women.

There were differing views among participants as to the extent to which the relative strength of employment reflected stronger job creation than would have been expected. On the one hand, the low level of vacancies since the crisis, together with a historically low share of employment of duration less than one year, were cited as evidence that the strength of employment growth had not reflected unusually strong hiring by companies. On the other hand, elevated flows from unemployment to employment were cited as evidence of strong job creation. One participant reconciled these views by suggesting that job-to-job flows had fallen in the recession, and remained subdued.

Discussing the weakness in measured labour productivity over the past few years, one speaker considered the evidence that some companies had retained employees even though they were working well below full capacity. The speaker concluded that the evidence for such behaviour was thin on two grounds. First, one might have expected companies to have adjusted labour input through natural employee turnover given the length of time since the crisis. Second, companies may have chosen to increase the amount of labour used relative to capital in their production processes, given the fall in the relative cost of labour. That would be consistent with both weak investment and subdued labour productivity. Others noted that the modest fall in average hours in the recession seemed inconsistent with significant underutilisation of employees.

The ability of companies to increase output without hiring more staff, were demand to pick up, was therefore highly uncertain. By contrast, most participants considered the high level of unemployment as indicative of considerable slack in the labour market. Some participants also pointed to measures of underemployment, which they thought suggested an even greater degree of slack. Set against that view, one speaker argued that demographic trends were likely to mean that, unless participation and employment rates continued to

(1) This report was prepared by Venetia Bell, Chris Duffy and Alice Pugh of the Monetary Analysis area of the Bank. Roundtables are held twice a year. The next Roundtable is scheduled for Winter 2013.
(2) For both this and previous summaries, see www.bankofengland.co.uk/publications/Pages/other/monetary/roundtable/default.aspx.

rise within older age groups, there might not be a large amount of labour to call on during the recovery.

Participants noted that since the crisis there had been a large fall in real wages. It was suggested that this reflected weak labour productivity growth, high unemployment and an increase in labour supply. One speaker presented evidence that wages had become more sensitive to both national and regional unemployment since 2002. For that speaker, the level of unemployment was important for the level, rather than the growth rate, of wages (as suggested by the Phillips curve relationship in economic theory), and there was little evidence that wage growth responds to shocks to CPI inflation. His conclusion was that the evidence did not support the usefulness of 'non-accelerating inflation rate of unemployment' concepts for explaining wage growth and that, even in an environment of low and stable unemployment, underlying pressures on wage growth were likely to be weak.

The discussion touched on the role of migration in explaining recent labour market dynamics. It was noted that while migration had been important for developments over a longer time frame, most participants did not believe it could explain many of the features of the labour market since the financial crisis.

There was some discussion of the differences between the UK experience and those of other countries. The behaviour of UK unemployment appeared broadly similar to that in the United States, notwithstanding the greater initial increase in unemployment there, while movements in employment had differed due to distinct trends in labour force participation. The UK experience appeared to be different to the euro area in both respects. A variety of explanations were put forward for these differences, including: different financial systems; experiences with welfare-to-work policies; and legislative changes in relation to retirement. But there was no consensus on the relative importance of each factor.

In summary, Roundtable participants were largely in agreement that the United Kingdom had experienced a substantial increase in labour supply, although it remained unclear how persistent that increase would prove to be. This was thought to be an important driver of developments in both employment and wages. While there were mixed views on the degree of underused labour in employment, most saw the elevated unemployment rate as a sign of slack in the labour market more generally.

What can we say about the trade-offs currently facing monetary policy makers in the United Kingdom?

With inflation well above the 2% target and a sizable margin of spare capacity in the economy, the MPC faces a trade-off when judging how quickly it intends to return inflation to target. If it attempts to lower inflation too quickly, that would reduce the support it can provide to output and employment, and so may endanger the recovery. But if it does so too slowly, people may doubt the Committee's commitment to the inflation target, making it more costly to keep inflation close to the 2% target in the future. The second session of the Roundtable explored the nature of the trade-off between output and inflation, and the consequent implications for monetary policy.

A key aspect of this trade-off is the extent to which productivity can pick up as demand recovers. That will depend in part upon the degree of slack currently in the economy, over which Roundtable speakers expressed a range of views. One speaker argued that the output gap was relatively small, in large part reflecting a reduction in the rate of growth of potential output since the crisis. A sustained period of low interest rates was also thought to have discouraged the reallocation of resources within the economy towards their most productive uses. The speaker presented empirical estimates that suggested that accommodative policy during the post-crisis period might have permanently reduced the level of productivity by nearly 1%.

In contrast, another speaker argued that there was no strong reason for a decline in potential output growth since the crisis, and thus the output gap might be reasonably large. Productivity growth had been relatively strong in the three decades preceding the crisis, without being driven predominately by the financial sector, and there was no clear evidence to expect that to have changed.

Another dimension of the trade-off currently facing monetary policy is the way in which inflation expectations respond to policy changes. One speaker argued that a rise in inflation expectations may be an important part of the monetary transmission mechanism with nominal interest rates at the zero lower bound: a rise in inflation expectations should reduce real interest rates and hence stimulate demand. Another noted, however, that a rise in inflation expectations could cause a rise in nominal rates rather than a reduction in real rates, in part offsetting the impact of the highly accommodative stance of policy. Others argued that if inflation expectations were to become less well anchored by the inflation target, a future monetary policy tightening that would prove costly in terms of output and employment might be required in order to regain control of inflation expectations.

Participants discussed the difficulties inherent in assessing how inflation expectations are likely to evolve. For example, one speaker used chaos theory to illustrate how, when feedback mechanisms between outcomes and expectations are complex, expectations can be extremely sensitive to small changes in conditions in the economy.

Some participants noted a potential trade-off between monetary policy and financial stability concerns. Participants discussed whether quantitative easing might risk an inappropriately large increase in asset prices. One Roundtable participant noted that lower nominal deposit rates discourage households from building up bank deposits, which puts pressure on banks to raise funds through other means.

The speakers discussed various policy options in light of these trade-offs facing monetary policy. There were mixed views on whether further monetary policy stimulus was warranted and, if so, how much.

Participants also discussed possible actions that the MPC could take in order to communicate how it views these trade-offs. One speaker argued that recent MPC policy decisions appeared more consistent with 'strict' rather than 'flexible' inflation targeting, on the grounds that the Committee had persistently forecast inflation to return to the target over the two-year horizon, despite apparently not expecting the output gap to close. The speaker argued that the MPC should signal to the public that it is prepared to tolerate a forecast of above-target inflation at the two-year horizon in order to achieve a smaller output gap, consistent with a flexible rather than a strict approach to inflation targeting.

Participants discussed other ways in which the MPC might conduct and communicate policy in view of the trade-offs it faces. Some argued in favour of forward guidance, although it was noted that this might constitute a limited change given an alleged reluctance of central banks to forecast a prolonged period of high inflation. An alternative suggestion was an intermediate target for the path of nominal GDP, although some participants expressed concerns over this idea. For example, difficulties in assessing the growth rate of potential output might result in an overambitious target for nominal GDP, which could in turn result in unexpectedly high inflation.

In summary, there was a range of views on both the nature of the trade-off facing monetary policy makers and the appropriate response.

Summaries of speeches and working papers

Bank of England speeches

A short summary of speeches and *ad hoc* papers made by Bank personnel since 1 June 2013 are listed below.

Crossing the threshold to recovery

Mark Carney, Governor, August 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech675.pdf

In his first public speech as Governor of the Bank of England, Mark Carney began by welcoming signs of renewed growth after a period in which the United Kingdom had endured its weakest recovery on record.

Over the past five years a pervasive sense of uncertainty had held the economy back. As a result around a million more people were unemployed than before the crisis, and capacity had lain idle in firms. The Bank of England's task was to secure the fledgling recovery, and allow it to develop into the period of sustained and robust growth that was required to begin to reduce that spare capacity.

The Bank was using its full suite of policy tools to help rebuild confidence. First, the Monetary Policy Committee (MPC) was removing uncertainty with its guidance that interest rates would stay low at least until unemployment fell to a threshold of 7%. That would boost demand, while ensuring that risks to price stability were contained. Second, the Bank was building confidence in banks and building societies by requiring them to repair their balance sheets, so that their capital ratios at least reached a threshold of 7% by the turn of the year. That would put them in a position to support the real economy and promote investment.

Crossing these two 7% thresholds was necessary to ensure that the economy could withstand the inevitable bumps along the road to full recovery. But they would be met in a disciplined way. The MPC would ensure that it brought inflation down as the recovery progressed. And the Bank would use its considerable policy tools to prevent new vulnerabilities, whether in the housing sector or financial sector, from arising during this critical transition period.

In these ways, the Bank of England was helping the British economy over the threshold and into strong, sustainable and balanced recovery.

Global aspects of unconventional monetary policies

Charlie Bean, Deputy Governor, August 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech674.pdf

In remarks delivered at the Jackson Hole Economic Policy Symposium, Deputy Governor Charlie Bean reviewed the domestic and international consequences of unconventional monetary policies. He called for a 'two-handed' approach to setting policy, in which supportive aggregate demand policies are complemented by policies that facilitate the necessary restructuring, particularly of the banking sector. He acknowledged that the risks associated with such accommodative monetary policies meant they were best suited to filling in a temporary hiatus in demand, not a long-lived shortfall. He observed that the international spillovers from these policies are diverse in nature and ambiguous in overall sign. He ended with a few words on the exit from unconventional monetary policies, noting that the heterogeneous nature of the recovery will complicate matters and it was such concerns that had prompted the MPC to offer explicit guidance on the future path of interest rates and asset purchases.

Meeting the challenges of a changing world — the view from the PRA

Andrew Bailey, Deputy Governor, July 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech672.pdf

Andrew Bailey spoke about the rationale behind singling out banks and insurers for prudential supervision by the Prudential Regulation Authority (PRA). Both insurers and banks provide critical services to the public, which need to be accessed on a continuous basis. The PRA has a second objective for insurance — the protection of policyholders — because continuity of insurance protection requires assurance that the policyholder has access to their specific contract. Andrew outlined the macroprudential responsibilities of the Financial Policy Committee and highlighted its interest in the stress testing of insurers. He also set out the PRA's approach to supervising insurers. Business model analysis, which involves answering questions such as how the firm makes money, was an important part of the new approach. Andrew noted that a list of global systemically important insurers (GSIIs) was expected to be published by the Financial Stability Board shortly and that the implications for being labelled as a GSII would then need to be considered.

Central bank asset purchases and financial markets

David Miles, Monetary Policy Committee member, June 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech671.pdf

In a speech delivered at the Global Borrowers and Investors Forum, Professor David Miles considered the impact of central bank asset purchases on financial market prices and demand. He found little evidence for the argument that asset purchases had created asset price bubbles. He argued that, instead, 'asset purchases helped to stop … a downward spiral in asset prices that would have … become dangerously self-reinforcing'. Considering the effect of asset purchases on demand Professor Miles concluded that by supporting asset prices quantitative easing 'caused spending to be higher than it would otherwise have been'.

Professor Miles also offered his thoughts on how the exceptional setting of monetary policy might be normalised. He suggested that the market environment is crucial: 'purchasing assets in times where financial markets are dysfunctional, and selling them when markets work well, might well be part of an optimal monetary policy strategy [and] a gradual unwind may be smooth'.

A Governor looks back — and forward

Sir Mervyn King, Governor, June 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech670.pdf

In his final public speech as Governor of the Bank of England, Sir Mervyn King began by noting the twin challenges of engineering an economic recovery and reforming the financial system. Though there were clear signs of a modest economic recovery in the United Kingdom, there remained considerable spare capacity. There was a powerful case for more monetary stimulus in the short run. But the present extraordinary monetary policies could not continue indefinitely. The challenge in returning to normality lay in rebalancing the world economy so that very low interest rates were no longer required for deficit countries to spend enough to absorb surpluses elsewhere.

Reform of the financial system was the second challenge to securing a sustainable economic recovery. In the United Kingdom, the Bank had acted quickly to make the banking sector more resilient, and better able to support lending to the real economy. Following discussions with the PRA, the major banks now had plans to fill the capital shortfall of around £25 billion identified by the Financial Policy Committee (FPC). The FPC had also recommended to commercial banks a loosening of regulatory requirements to hold liquid assets, given the liquidity backstop available in the Bank's market operations. And in future, the FPC and PRA would work together to conduct regular bank stress tests.

Though progress had been made on financial reform, further work was needed. Dealing with the problem of financial institutions that were too big to fail was an immediate priority for international regulators, as was further progress on managing cross-border resolutions. The Governor called for the implementation of the proposals of the Independent Commission on Banking, including the 'ring-fence' to separate commercial from investment banking, and the leverage ratio. Looking further ahead, the Governor noted that a change in the ethics and culture of banking would take time, but was a necessary precondition to rebuilding trust in the banking system.

The Governor concluded by wishing his successor, Mark Carney, the very best in his new role.

Inflation targeting and flexibility

Ian McCafferty, Monetary Policy Committee member, June 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech669.pdf

In this speech, Ian McCafferty reflected on the United Kingdom's inflation-targeting regime in place since 1992. By providing a credible framework for price stability, inflation targeting helps to anchor inflation expectations. The low and stable inflation of the past 20 years illustrates the importance of anchoring inflation expectations, in contrast to the United Kingdom's 1970s' experience of high and volatile inflation. Anchored inflation expectations have allowed the MPC to support the real economy by accommodating the first-round impact of temporary cost shocks — rising commodity prices, the depreciation of sterling and increases in administered prices — without leading to second-round inflationary changes in wages and prices. This flexible approach to inflation targeting is borne out by the MPC's new mandate announced in March. So far, above-target inflation has not unhinged survey measures of inflation expectations, but the greater responsiveness of market-derived expectations to inflation news suggests the MPC must remain vigilant.

Banking reform and macroprudential regulation: implications for banks' capital structure and credit conditions

Paul Tucker, Deputy Governor, June 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech666.pdf

Paul Tucker reviewed the economics of the capital structure of banks. Two micro-level regulatory reforms — a step change in equity requirements and credible resolution regimes — will

change how risks in banks' portfolios are distributed across shareholders, bondholders, depositors and taxpayers. He made the case for a richer regulatory Capital Accord, which would distinguish more carefully between the different phases of a bank's life and death. That would be an Accord with two parts: equity to absorb losses in a going concern, plus a requirement for a minimum level of term bonded debt to provide sufficient gone-concern loss absorbency to enable stabilisation via resolution. He also described how the primary objective of macroprudential regulation can be advanced by making the system more resilient and so able to absorb the bust phase of a credit cycle even if the credit boom was not itself tempered. Analysis of the effects of macroprudential interventions on the cost of finance was often oversimplified. The effect on credit conditions of a temporary increase in capital requirements would depend on whether the macroprudential policymaker's actions revealed information about the state of the banking system or about its own approach to policy, and on whether the market regarded the actions as warranted, insufficient or too much. This underlined the importance of transparency — from the banks and from the Financial Policy Committee.

The five ages of (sterling) man: prospects for the UK money market

Andrew Hauser, Head of Sterling Markets Division, June 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech668.pdf

Speaking to the London Money Market Association, Andrew Hauser assessed the outlook for the sterling money market, drawing lessons from the market's long and sometimes colourful history. The size of the market had fallen back since the height of the financial crisis, particularly in unsecured interbank trading, reflecting the combined effects of bank deleveraging, regulatory and market incentives to shift towards secured trading, the huge increase in central bank reserves and the unusually flat short-term yield curve. But concerns about the death of the market were overdone. Some of the factors depressing activity would unwind in time. And the market that re-emerged would differ in important respects from the one that went before: more heavily secured, less focused on the very short term, with new players from outside the banking system, and new instruments. The Bank of England needed to remain close to the markets, to understand the changing developments, and to ensure its operating framework was suitably designed — as it had been doing in its response to the Winters Review of its facilities.

The future of repo: 'too much' or 'too little'?

Andrew Hauser, Head of Sterling Markets Division, June 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech665.pdf

In a speech to the International Capital Market Association's conference on The Future of the Repo Market, Andrew Hauser set out the importance to policymakers of finding an appropriate balance between two key challenges: first, ensuring global repo markets were deep and liquid enough to supply the sharp increase in collateral required by new regulatory rules and market participants' strengthened focus on counterparty risk; while, second, ensuring that appropriate safeguards were in place to prevent the recurrence of the procyclical instability seen during the financial crisis. There was no 'global collateral shortage' in any aggregate sense — but markets did need to innovate to ensure that collateral was effectively mobilised. At the same time, it was important to understand how that innovation would affect various sources of potential macroprudential instability in repo markets. A key priority in this analysis, being led by the Financial Stability Board, was to improve market transparency. Central banks, which relied on effective repo markets for their monetary policy and liquidity insurance operations, had a key role to play in all aspects of this work.

The notes in your wallet

Chris Salmon, Executive Director for Banking Services and Chief Cashier, June 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech664.pdf

Speaking at the Plymouth Chamber of Commerce, Chris Salmon considered the challenges and opportunities that developments in technology present for the Bank's note issuance function.

Chris explained that the Bank sought to achieve confidence in banknotes by both ensuring banknote demand is met and safeguarding the physical integrity of banknotes. He described how technology, including the proliferation of ATMs, had had unintended consequences, such as helping to create the 'tatty fivers' problem and noted that the Bank, working closely with ATM providers, had recently made significant progress on this issue. He also explained how technology is encouraging the local recycling of banknotes and how the Bank is currently working with the industry stakeholders to introduce a Code of Conduct that will ensure that any notes distributed to the public via a cash-dispensing machine will be authenticated to the same high standards as a note processed in the more traditional model, by the wholesale cash industry.

Chris went on to discuss the impact of innovation on the physical nature of banknotes, noting the benefits of new technologies and how these would help the Bank to ensure that our banknotes remain resilient against the threat of counterfeiting in the future.

Challenges of prudential regulation

Andrew Bailey, Deputy Governor, June 2013.

www.bankofengland.co.uk/publications/Documents/speeches/2013/speech663.pdf

In this speech at the Society of Business Economists Annual Dinner, Andrew Bailey spoke about the major reforms to policymaking that have taken place in financial regulation. Andrew began by giving an overview of the major components of the UK regulatory landscape. He explained how it was essential that the policy committees worked together, and in that context spoke about how the FPC and PRA Board had been working together on the issue of capital. Andrew explained the rationale behind the FPC recommendation on capital, and why the FPC and PRA thought that it was important that banks increased their resilience by increasing the amount of capital they held. Andrew also explained the secondary objective of the FPC to encourage growth in the UK economy, and the steps the Bank had taken in order to encourage more lending, using the example of the extension to the Funding for Lending Scheme.

International capital flows and development: financial openness matters

Summary of Working Paper No. 472 Dennis Reinhardt, Luca Antonio Ricci and Thierry Tressel

This paper revisits the Lucas paradox by quantifying empirically the relevance of a specific set of policies — restrictions on international capital flows — in shaping the patterns of capital movements at various stages of economic development. The determinants of the direction of capital flows, and their relation to economic development, constitute an important topic in open economy macroeconomics. The study is particularly relevant at the present time, since the size and direction of capital flows have been central to the recent debate on global imbalances and will remain relevant in the aftermath of the global financial crisis. Indeed, it remains unclear, empirically, whether (and which) policies can result in capital flowing 'uphill'.

Our starting point is the classic paper in which Robert Lucas remarked that too little capital flows from rich to poor countries, relative to that predicted by the standard neoclassical model ('Lucas' paradox'). According to neoclassical theory, when countries have access to similar technologies and produce similar goods, new investment — and therefore international net capital inflows — should take place more extensively in countries with lower stocks of capital per capita and therefore a higher marginal product of capital.

A large theoretical and empirical literature has provided solutions to the 'Lucas paradox', by extending the basic neoclassical model to encompass additional factors. A first group of factors include differences in technologies, factors of production, and government policies. A second group relates to the role of institutions and capital market imperfections, encompassing the quality of enforcement of private contracts, asymmetric information and moral hazard, risks of expropriation, and sovereign default.

In this paper, we step back and show that the 'failure' of the neoclassical model to predict international capital flows can also be explained by a violation of one of the model's key underlying assumptions ie that capital can flow freely across countries. Specifically, we find that the prediction of the standard neoclassical theory holds only when taking into account the degree of capital account openness, conditional on a set of fundamentals. Among countries with an open capital account, richer countries tend to experience net capital outflows, while poorer countries tend to experience net capital inflows. In contrast, in countries with a closed capital account, there appears to be no systematic relationship between the level of economic development and net capital flows. The results imply that capital account restrictions must have been effective in constraining capital flows when they were in place: rich countries liberalising their capital account should experience net capital outflows and poor countries net capital inflows.

In contrast to the recent literature that has sometimes emphasised long-term determinants of cross-sectional differences in capital flows, we focus mainly on the impact of capital account liberalisation on capital flows over time. At the time Robert Lucas was writing his paper, many developing countries still had significant capital account restrictions in place. Since then, however, countries across all income groups have progressively liberalised capital movements. High-income countries with restrictions in place initiated the process in the 1980s and, by the early 2000s, capital was flowing freely between advanced economies. Emerging markets followed the same process of liberalisation, but with a lag. Many restrictions were removed in the early 1990s, sometimes to prepare for entry to the OECD (as was the case for Korea and Mexico), or under the auspices of the International Monetary Fund. Liberalisation of capital movements started at a later stage in lower-income countries, mostly in the second half of the 1990s (some moderate restrictions are still in place). We show that this liberalisation process was associated with significant changes in the patterns of capital flows across countries at different income levels.

Our findings have important policy implications. Policies related to the capital account create externalities in the international monetary system by sustaining large current account imbalances. Our results suggest that liberalising the capital account would significantly reduce these distortions and allow capital to flow into the fast-growing emerging market surplus countries. The paper has no implications for the recent reintroduction of capital controls for potential prudential concerns, but studies the removal of pervasive capital controls.

Our paper also offers useful empirical implications: because of a global trend towards capital account liberalisation, and as more data become available over time, empirical studies will be less and less likely to detect the Lucas paradox for the average country.

The pitfalls of speed-limit interest rate rules at the zero lower bound

Summary of Working Paper No. 473 Charles Brendon, Matthias Paustian and Tony Yates

This paper looks at how well 'speed-limit' rules for setting central bank interest rates do at stabilising the economy when we consider the possibility that from time to time interest rates may get trapped at their natural floor of zero (the 'zero bound'). A more common approach taken by researchers is to study interest rate setting procedures such as Taylor rules, where the interest rate is (for example) raised if inflation exceeds target, or the output gap is positive. A speed-limit rule, by contrast, is a rule where it is decided how far to raise rates based not on the level, but the rate of change of some concept like the output gap. Interest in speed-limit rules stemmed from two lines of thought, both of which ignored the zero bound as a factor for policy (largely because at the time this work was done rates were so far above the zero bound that it was considered highly unlikely they would ever get there). One was that speed-limit rules seemed to provide a way to insulate central banks from policy errors that occurred through mis-measurement of key concepts like the output gap (the difference between actual and potential output); it was easier to measure the rate of change than the level. Another was that speed-limit rules were shown to be a way for central banks to implement what the academic literature has termed 'optimal commitment policies'. These are policies that stabilise inflation and the output gap (or whatever society cares about) as well as possible, and by using the power of inflation expectations to anchor inflation, through making commitments not to simply think afresh as each period and each new shock to the economy comes along.

Our paper provides a cautionary note to those contemplating speed-limit rules, to weigh against these benefits. We find that there is a chance that rates could end up pinned at the zero bound through self-fulfilling expectations of low inflation, even if there were no fundamental shocks depressing the economy. Normally, in models of rational expectations like ours, if rates followed a Taylor rule with interest rates sufficiently responsive to inflation, and the zero bound were not in play, self-fulfilling recessions would be ruled out. Anyone who contemplated the possibility of future low inflation would recognise that this would itself drive inflation down (through the Phillips curve, the relationship determining inflation which includes a large role for expectations). That alone would prompt a sharp cut in rates, and one that would not be reversed until the output gap that was opened up by the lower inflation was closed. However, under a speed-limit rule, and faced with the zero bound, agents in the economy would correctly surmise that things will be different. First, rates cannot fall so far to begin with to counter the fall in inflation. And second, agents would forecast that after the initial fall in inflation and opening up of the output gap, the central bank would tighten more quickly. This is because it would be concerned to make sure the output gap does not close too quickly (given its concern for the 'speed limit'). This means people forecast tighter policy tomorrow, which validates the initial forecast of low inflation. Inflation and the output gap fall, and interest rates are pushed to the zero bound, simply because agents in the economy believe it will. This problem of self-fulfilling attacks at the zero bound also afflicts policy rules that involve terms in the rate of change in house prices, in a New Keynesian model modified to include housing.

Not all capital waves are alike: a sector-level examination of surges in FDI inflows

Summary of Working Paper No. 474 Dennis Reinhardt and Salvatore Dell'Erba

After the global financial crisis capital flows started pouring back into emerging markets. This phenomenon is not new: capital flows often come in waves and have a strong cyclical component, as an extensive literature has documented. Capital inflows can bring many benefits such as compensating for limited domestic savings, increasing the extent of risk-sharing, and contributing to the development of financial markets. There is, however, a wide literature documenting the risks associated with the cyclical nature of capital inflows, showing that they can contribute to amplifying economic cycles, fuel credit booms, appreciate the real exchange rate, and can be subject to sudden reversals.

The perceived wisdom is that there is a pecking order among capital flows, with foreign direct investment (FDI) perceived as 'good' as it promotes growth in the receiving countries, while portfolio investment (PI) is seen as 'bad' as it is more volatile and can lead to excessive business-cycle fluctuations. While the theoretical literature shows the superiority of FDI over PI in a world of asymmetric information, the evidence from the empirical literature is mixed. Evidence from the latest financial crisis shows that large FDI flows in the financial sector appear to be related to greater macroeconomic instability in the receiving countries, suggesting that there exists heterogeneity across flows at the sectoral level, which is an aspect so far neglected in the literature.

Motivated by this evidence, this paper examines episodes of large gross capital inflows (which we will call surges) from a sectoral perspective. Specifically, we focus on surges in gross FDI at the sectoral level for emerging market economies during the period 1994–2009, employing a new data set for gross sector-level FDI inflows. The paper focuses on FDI because it has been the most important source of foreign capital for many emerging economies since the beginning of the 1990s.

We make three contributions. First, we show that while FDI surges occur across all sectors, only surges in FDI in the financial sector are accompanied by a boom-bust cycle in GDP growth. A possible explanation for this may be the expansion of credit in foreign currency that typically accompanies these flows, which might amplify the transmission of external shocks under the presence of collateral constraints.

Second, we document substantial sectoral heterogeneity in the explanatory power of the various global, contagion, and domestic factors identified by the literature as important determinants of capital flows. Global factors, chiefly global growth, have a particularly strong and positive impact on the emergence of FDI surges in the financial sector. We also find that contagion plays a stronger role in surges in the financial than non-financial sectors: countries are more likely to experience a surge in financial sector FDI (but not in the other sectors) if countries in the same region have experienced a recent surge in financial FDI.

Third, we document a role for policies related to the capital account. Restrictions on instruments that may constitute alternative sources of funding for subsidiaries of foreign banks (such as bonds) tend to increase the likelihood of FDI surges. We also find some tentative evidence that regulations restricting lending and borrowing in foreign currencies reduce the probability of surges in financial sector FDI. These findings may have implications for the design of future prudential regulation policies.

Policy multipliers under an interest rate peg of deterministic versus stochastic duration

Summary of Working Paper No. 475 Charles T Carlstrom, Timothy S Fuerst and Matthias Paustian

By how much does economic activity increase when government spending goes up a little bit? This is the marginal fiscal multiplier. In normal times, this multiplier is typically smaller than one as private demand is partially crowded out by public demand. This occurs partly because government spending raises inflation, to which central banks react by raising nominal interest rates. However, it is well known that the multiplier can be larger than one when interest rates are temporarily fixed at some level, for example at the zero lower bound. The lower bound simply means that interest rates cannot become negative as people always have the option to hold cash, which earns a zero rate of return. Intuitively, this larger multiplier occurs because with fixed interest rates there is no crowding out of private demand. In fact, there is crowding in, because higher expected inflation lowers real interest rates which stimulate private demand.

This paper revisits the size of the fiscal multiplier under these special circumstances. It contrasts the usual assumption of an uncertain (stochastic) exit date from the fiscal expansion with a certain (deterministic) exit. We show that the simple modelling choice of a stochastic exit implies that the fiscal multiplier is substantially larger than that under a deterministic exit of equal mean duration. This result is surprising as the expected fiscal stimulus is the same in both cases. The explanation essentially follows from a mathematical relationship known as Jensen's inequality. When we take simple averages of two points on a straight line, the average lies halfway between them on the line. But if the line is curved, then that average will lie above or below the line (depending on whether it is curved outwards or inwards, known as convex or concave respectively). In our case, the deterministic exit fiscal multiplier is a convex function of the duration of the stimulus at constant interest rates. The fiscal multiplier under a stochastic exit averages the deterministic multipliers across all possible durations. It then follows from convexity and Jensen's inequality that this mean multiplier is larger than the multiplier evaluated at the mean duration. Overall, our findings suggest that the precise magnitude of the fiscal multiplier is very sensitive to seemingly minor modelling assumptions, which should lead to caution in the interpretation of results from similar models.

Fiscal multipliers are typically computed in linear approximations to non-linear models, because it is easier to solve and understand economic mechanisms in linear models. But it is well known that linear approximations can be inaccurate. We therefore check whether our key results also hold in a non-linear model. Although we find that stochastic exit multipliers are again bigger than the corresponding deterministic exit multipliers, the difference is much less pronounced. This is because the errors from the linear approximation are much larger in the stochastic exit model than in the deterministic exit model.

We note that our analysis assumes that the exit from the interest rate peg is exogenous. It is unaffected by choices of firms, households and the government. In particular, it is assumed to be invariant to the size of the increase in government spending. The results are therefore best interpreted as the marginal multiplier for very small changes in spending. In practice when monetary policy is constrained by the zero lower bound, large increases in spending would generally make the exit from the bound more likely as they increase inflation. The average multiplier in this very different scenario is typically smaller than the marginal multiplier we consider in this paper.

Finally, this paper and much of the related literature has assumed that there is no other monetary policy tool that could be used to stabilise inflation when interest rates are constant at the zero lower bound. In practice, central banks have used a range of tools to further loosen monetary policy. Since these tools are likely to have significant effects on the economy, it is probable that fiscal multipliers would be lower than those presented here. For that, and a host of other reasons not examined in this paper, the multipliers analysed here should not be interpreted as the authors' best estimate of the fiscal multiplier for any specific country.

Oil shocks and the UK economy: the changing nature of shocks and impact over time

Summary of Working Paper No. 476 Stephen Millard and Tamarah Shakir

This paper examines the impact of oil price movements on the UK economy, exploring how the impact of these movements may have changed over time. Ever since the dramatic oil price spikes of the 1970s, and the global recessions that ran alongside, policymakers have paid close attention to fluctuations in globally traded oil prices and worried about the potential impact on economic growth and domestic price inflation. Recent years have once again seen large fluctuation in oil prices, with prices rising from $15 a barrel in 1998 to nearly $140 a barrel in 2008. This rise and the volatility in both the oil price and economic performance since have reopened the debate about how, and by how much, oil shocks affect economies and how monetary policy ought to respond.

Over the past 30 years a wide range of studies have attempted to examine the impact of oil prices on the macroeconomy. Many of these studies have found that oil price movements appear to have large impacts on the economy, much larger than the share of oil in costs would imply. But alongside this headline finding, many of the same studies also find that oil price movements appear to have had a smaller impact on activity and inflation since the mid-1980s. A number of alternative explanations have been put forward to explain why the impact of oil price movements may have become smaller over time. These explanations include falls in the share of oil in the economy, more flexible labour markets, and a better or more credible policy response, together with changes in the oil market itself.

The majority of studies of the relationship between oil prices and output and inflation have focused on the United States. But, we might expect the United Kingdom to be different as it is an economy that has transitioned from net oil importer in the 1970s to net exporter in the 1980s and early 1990s and returned to be a net importer again in the mid-2000s. So, in this paper we consider the impact of oil movements on the UK economy.

We aim to answer two questions. First, how does the effect of oil price movements on the UK economy depend on the nature of the underlying shock, ie what caused the movement in oil prices in the first place? In particular, we identify three types of underlying source for oil price movements: oil supply shocks — which raise oil prices and reduce oil output and world output more generally — world demand shocks — which raise oil prices at the same time as world output is going up — and oil-specific demand shocks (essentially a residual) — which raise oil prices and output while reducing world output. Second, how have these effects changed over time? We do this by using a time-varying parameter structural vector autoregression (TVP-SVAR) approach to estimate these effects. A VAR is a set of equations which are each driven by lags of all the variables in the system and by error terms, modelling the dynamics of all the variables together in response to shocks. What makes it structural is that the assumptions listed above allow us to decompose (or 'identify') the fundamental shocks that together combine to make the equation errors, so that we can trace out the impact on the variables we look at from particular types of event. The time-varying aspect allows us to see how these effects might have changed over time by not restricting the estimated effects to be constant (unlike in normal SVARs).

We find that the source of the underlying shock to oil prices does matter for the response of the UK economy. Oil supply shocks lead to larger falls in output and increases in prices than world demand shocks, with the effects becoming much smaller from the mid-1980s onwards. World demand shocks are associated with a rise in output but had little effect on inflation prior to 2006, since when they have been associated with a rise in inflation. Oil-specific demand shocks have a much smaller effect on inflation than oil supply shocks, though their effect on UK output is now similar. As a small economy, all innovations in the oil price are generally considered as exogenous to UK economic activity. That may tend to suggest that the exact source of the exogenous oil shock is of little relevance for policymakers. However, the findings in this paper suggest that even if the shock is still exogenous understanding its causes is important, as the ultimate impact for the United Kingdom is likely to be different.

We also found that the impact of different types of oil shocks on UK activity and prices has varied over time. In line with many other studies we found a fall in the impact of oil supply shocks on UK output and inflation from the mid-1980s onwards. But more unusually, we also found evidence that the impact of oil supply and demand shocks has increased since the mid-2000s. This timing coincided with the United Kingdom's transition from a net exporter to a net importer of oil. And this suggests that it may be useful to explore which channels may have been most affected, for example, the extent to which the exchange rate may have appreciated in response to oil price shocks while the United Kingdom was a net exporter, cushioning the effects on inflation of oil price rises on the rest of the economy.

Non-uniform wage-staggering: European evidence and monetary policy implications

Summary of Working Paper No. 477 Michel Juillard, Hervé Le Bihan and Stephen Millard

Actual patterns of wage-setting are a key determinant of how economic shocks affect employment, unemployment and inflation. These patterns include the extent to which wages are indexed to past or future expected wage or price inflation, the extent to which they respond to movements in other costs, the extent to which wages are set differently for newly employed workers as opposed to existing members of staff, how often wages are renegotiated, whether this renegotiation occurs at regular intervals and whether wages are renegotiated at the same time for the bulk of workers in an economy or wage negotiations are evenly spread out over the year. Recent research by the Eurosystem's Wage Dynamics Network has generated much microeconomic and survey evidence on all of these issues, as well as looked at the macroeconomic implications of this evidence. Some particular findings from the cross-country survey carried out by researchers within this network were that there is substantial heterogeneity in wage-setting institutions across European countries, that wages are typically adjusted once a year, less frequently than prices, and that wage-setting is staggered and synchronised, with a large proportion of wages reset in January.

In this paper, we first document recent evidence on the degree of synchronisation among wage-setters in the euro area as a whole and in some individual euro-area countries. We then construct a simple model of the euro area to investigate the macroeconomic and monetary policy consequences of these patterns of wage-staggering. We construct a model in which, each quarter, a group of workers and employers set their wages for four quarters, but the proportion of workers doing this varies across quarters. With this model, we can study the case of full synchronisation of wage changes in a single quarter, or any particular breakdown of the probability of wage change across quarters that may match the actual bargaining pattern. We embed this set-up in a standard dynamic stochastic general equilibrium model of the euro area. We find that, when wage-staggering is uneven, then inflation and output are less persistent, both in general and, more specifically, in the way that they respond to monetary policy changes, than under an even wage-staggering scheme. Furthermore, inflation responds by more, and more rapidly, to a given interest rate change if the central bank makes this change in the quarter when most workers are renegotiating their wages, ie in quarter four, than in any other quarter. However, when calibrating the model with the micro data recently produced by the Wage Dynamics Network, which feature a significant degree of uneven staggering, we find that the quantitative outcome is close to that resulting from an even staggering scheme. And we find that this result is robust to using a US calibration for the degree of wage synchronisation, to alternative ways of modelling when wages are reset, and to reasonable variations in the degree of price stickiness: the quantitative difference between the effects of a monetary policy shock in Q4 and other quarters remained small.

Armed with these results, we then consider the consequence of non-synchronised wage-setting for optimal monetary policy. In particular we investigate whether the policy rule should vary from quarter to quarter as a result of seasonality in the wage-setting process. We find that the model has the potential to generate an optimal policy rule that varies considerably across quarters, especially in cases that get close to flexible prices and full synchronisation of wage changes. But, again, we find that under our baseline microeconomic calibration, in spite of some visible unevenness in wage-setting, there is little difference across quarters in the optimal policy response.

Capital over the business cycle: renting versus ownership

Summary of Working Paper No. 478 Peter N Gal and Gabor Pinter

How does the ownership of capital affect the aggregate behaviour of the economy? Does it matter whether firms own or rent production capital such as machinery and equipment, offices and structures? These questions have been somewhat ignored by macroeconomists, mainly because in a frictionless world the question of capital ownership becomes irrelevant as firms are indifferent between renting and owning. But in the presence of credit constraints the issue of leasing versus buying may become relevant for firms' investment decisions. The motivation of our paper is to show that the presence of credit constraints makes the question of renting versus owning relevant when attempting to understand the business cycle as well.

The empirical part of the paper reports three sets of evidence on the role of renting. First, we use US firm-level data to show that more financially constrained firms tend to rely more on renting, as indicated by their higher share of renting among capital expenditures. Second, we establish that renting is countercyclical, and we link it to cyclical changes in credit standards. Finally, using cross-country aggregate data, we show that countries with a larger rental sector experience a smaller output loss after financial crises.

The theoretical part of the paper develops a general equilibrium model, where firms' decisions to purchase capital are subject to credit constraints. In contrast, firms' decisions to rent capital are assumed to be unconstrained. The model is used to explain both the observed countercyclicality of rentals and why the presence of rentals mitigates crises. While a stylised model, it is able to match some key dimensions of the US economy.

The intuition behind the countercyclicality of renting is that in a crisis, when the real interest rate falls, the cost of renting (the rental fee) falls by the same magnitude as the real interest rate. By contrast, the cost of owning is reduced by falling interest rates only proportionally to the share that owning is credit financed. This asymmetric impact of the falling real interest rate on the cost of investment choices means that capital renting becomes relatively cheaper, and firms naturally substitute owned capital with rented capital.

Regarding the mitigating impact of renting, in the face of financial distress, the possibility of renting may serve as an extra margin of adjustment for both savers and borrowers. This extra margin serves the purpose of allocating the extra savings that cannot be absorbed by parts of the economy where credit conditions tighten and the capital accumulation process is impeded. This consideration involves not only the choices faced by producing firms, but also the potential suppliers of funds and rented capital.

Without the presence of rentals, equilibrium in the market of loanable funds is restored by further falls in the interest rate, which reduces savers' wealth and slows down economic recovery. With the presence of rentals, some of the extra savings in the economy are absorbed by capital investment which is then rented out for production purposes. Hence the downward pressure on interest rates is mitigated, the wealth of savers is protected and the economic recovery is faster. This general equilibrium mechanism is one of the key theoretical insights of the paper.

The implication is that well-developed rental and leasing markets may effectively offset the impact of malfunctioning credit markets.

Financial factors and the international transmission mechanism

Summary of Working Paper No. 479 Abigail Haddow and Mariya Mileva

Two striking features of the Great Recession of 2008–09 are the speed and synchronicity of the collapse in world output and trade in the wake of the sub-prime crisis. These observations provide compelling evidence that spillovers of shocks across national boundaries can be large. But standard macroeconomic models are unable to account for such strong linkages in real activity across countries. There is also little consensus in previous work on the impact that financial market shocks have on real activity and how they might spill over from one country to another. The aim of this paper is therefore to investigate theoretically the impact that financial frictions have on the transmission of shocks across countries and to investigate if incorporating financial factors into an open economy model could help these models to account for the large and synchronised declines in cross-country real activity, often observed following financial crises, not only the recent one. It also analyses how the nature of financial market shocks affect the way that shocks spill over to real activity.

To investigate the impact of financial factors on the transmission of shocks across countries we build a two-country model, with sticky prices and financial frictions. Our analysis is twofold. First we build a shadow version of the model without financial frictions that is used in conjunction with the baseline friction model to analyse how financial frictions affect the way that shocks propagate across countries. Then we introduce two financial market shocks that affect the premium which borrowers pay on their loans, the credit spread, to study how the source of the shock to this credit spread affects its impact on real activity. We introduce a risk shock and financial wealth shock that are calibrated to match the increase in credit spreads seen in the United States over the recent financial crisis period. These are used to consider whether the model's predicted movements in macroeconomic variables are similar to the rapid cross-country declines in output and trade seen over the recent recession period.

Using this modelling framework, we find that the international spillovers of shocks are driven by movements in the real exchange rate and terms of trade. Both the real exchange rate and terms of trade determine the responses of real international economic variables to shocks, such as exports and imports. Under certain conditions, we find that introducing financial frictions can magnify movements in these international relative prices and therefore the spillovers of shocks to real international economic variables. The source of the shock to the credit spread also matters. Results suggest that credit spread increases of equivalent size, but driven by different shocks, have different consequences for output and inflation in the Home and Foreign economy.

Our model can generate synchronised declines in output across the two economies, similar to that seen after financial crises such as the Great Recession, but the international spillovers following all shocks are relatively small. In addition, there is little evidence that financial variables across countries tend to move together in this model, even in response to shocks which are financial in nature. To generate spillovers more in line with the 2007–10 period the model requires a coincident widening of the credit spread across the two economies. This could be interpreted in two ways. On one hand, a richer framework that incorporates direct international linkages between financial sectors is needed to analyse how financial shocks spillover to activity across economies. On the other hand, our results could be consistent with the view that the global reach of the recent Great Recession is due to a common international shock rather than a contagious spread of a country-specific event.

Central counterparties and the topology of clearing networks

Summary of Working Paper No. 480 Marco Galbiati and Kimmo Soramäki

The 2008–09 financial crisis prompted reforms in important parts of the financial infrastructure. Central counterparties (CCPs) are playing a major role in this reform, especially for over-the-counter (OTC) derivatives. Notably, the G20 leaders agreed in Pittsburgh in September 2009 that 'All standardised over-the-counter derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and be cleared through central counterparties end-2012 at the latest'. Since 2009, a substantial amount of progress has been made in defining new standards and implementing infrastructure reforms.

The main function of CCPs is to novate contracts between trading parties, becoming the 'seller to every buyer, and buyer to every seller'. By so doing, CCPs concentrate counterparty credit risk on themselves, sitting at the vertex of what can be seen as clearing networks.

In the simplest, theoretical case, a clearing network comprises the CCP at the vertex and, directly linked to this, a number of general clearing members (GCMs). Almost invariably though, the clearing network is more articulated, as some GCMs may in turn work as clearing agents for other entities (be these banks or market participants in general), and so forth in a sequence of tiers.

What are the consequences of such stratification? More generally: how does the *topology* of a clearing network affect the systemic risk-reduction role of central clearing? This paper develops a stylised model to look into this question.

The topology of a clearing network will have an effect both on credit exposures and market participants' liquidity needs as margin calls are issued by the CCP in order to manage its exposures, and possibly also by GCMs when clearing for second-tier entities.

To analyse these issues we proceed as follows. First, we lay out a stylised but general model of central clearing. Then, we look at how *initial* bilateral *exposures* are transformed by the network into centrally *cleared exposures*, which in turn generate *liquidity demands*. The model allows exposures and liquidity demands for any network topology to be computed. We can look at the effects on exposures and liquidity demands arising in different topologies.

The model is highly simplified, flattening out fine but important detail of how, for example, exposures may be netted across the network, or how margins may be computed. Moreover, the model takes initial bilateral exposures as exogenous random variables, mechanically turning them into cleared exposures without including any behavioural component.

However, because of its simplicity, this work sheds some light on the properties of clearing networks. Its results give insights into the effects of tiering and concentration[1] on the systemic risk-reduction role of central clearing. Tiering appears to increase some key risks faced by the CCP. For example, it increases the likelihood of large exposures, and makes them more unpredictable. CCP exposures are on average smaller in concentrated systems, while extreme exposures become less frequent. The effects on margin needs are, interestingly, non-monotonic but, unfortunately, less clear-cut as they crucially depend on details of the margining methodology; in particular, on whether 're-hypothecation' is allowed or not.

(1) 'Concentration' here refers to the way second-tier members are distributed across GCMs.

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 2002 are available on the Bank's website at:

www.bankofengland.co.uk/archive/Pages/digitalcontent/historicpubs/quarterlybulletins.aspx.

Articles from Spring 2003 onwards are available at:

www.bankofengland.co.uk/publications/Pages/quarterlybulletin/default.aspx.

Articles

- 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

2012 Q4

- 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

- Changes to the Bank of England
- 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

2013 Q2

- Macroeconomic uncertainty: what is it, how can we measure it and why does it matter?
- Do inflation expectations currently pose a risk to the economy?
- 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

2013 Q3

- Macroprudential policy at the Bank of England
- Bank capital and liquidity
- The rationale for the prudential regulation and supervision of insurers
- 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

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/publications/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. 467 Factor adjustment costs: a structural investigation (October 2012)
Haroon Mumtaz and Francesco Zanetti

No. 468 Using Shapley's asymmetric power index to measure banks' contributions to systemic risk (October 2012)
Rodney J Garratt, Lewis Webber and Matthew Willison

No. 469 High-frequency trading behaviour and its impact on market quality: evidence from the UK equity market (December 2012)
Evangelos Benos and Satchit Sagade

No. 470 Long and short-term effects of the financial crisis on labour productivity, capital and output (January 2013)
Nicholas Oulton and María Sebastiá-Barriel

No. 471 The Bank of England's forecasting platform: COMPASS, MAPS, EASE and the suite of models (May 2013)
Stephen Burgess, Emilio Fernandez-Corugedo, Charlotta Groth, Richard Harrison, Francesca Monti, Konstantinos Theodoridis and Matt Waldron

No. 472 International capital flows and development: financial openness matters (June 2013)
Dennis Reinhardt, Luca Antonio Ricci and Thierry Tressel

No. 473 The pitfalls of speed-limit interest rate rules at the zero lower bound (June 2013)
Charles Brendon, Matthias Paustian and Tony Yates

No. 474 Not all capital waves are alike: a sector-level examination of surges in FDI inflows (June 2013)
Dennis Reinhardt and Salvatore Dell'Erba

No. 475 Policy multipliers under an interest rate peg of deterministic versus stochastic duration (June 2013)
Charles T Carlstrom, Timothy S Fuerst and Matthias Paustian

No. 476 Oil shocks and the UK economy: the changing nature of shocks and impact over time (August 2013)
Stephen Millard and Tamarah Shakir

No. 477 Non-uniform wage-staggering: European evidence and monetary policy implications (August 2013)
Michel Juillard, Hervé Le Bihan and Stephen Millard

No. 478 Capital over the business cycle: renting versus ownership (August 2013)
Peter N Gal and Gabor Pinter

No. 479 Financial factors and the international transmission mechanism (August 2013)
Abigail Haddow and Mariya Mileva

No. 480 Central counterparties and the topology of clearing networks (August 2013)
Marco Galbiati and Kimmo Soramäki

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. 39 Fiscal multipliers and time preference (January 2013)
Gilberto Marcheggiano and David Miles

No 40 Is the 'Great Recession' really so different from the past? (June 2013)
Adrian Chiu 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: Leslie Lambert, Statistics and Regulatory Data Division, Bank of England: telephone 020 7601 4544; fax 020 7601 5395; email leslie.lambert@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.

Payment Systems Oversight Report

The *Payment Systems Oversight Report* provides an account of how the Bank is discharging its responsibility for oversight of recognised UK payment systems. Published annually, the *Oversight Report* identifies the most significant payment system risks to financial stability and assesses progress in reducing these risks. Copies are available on the Bank's website at:

www.bankofengland.co.uk/publications/Pages/psor/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 framework for the Bank of England's operations in the sterling money markets (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/redbookjune2012.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 of England's assessment of the latest trends in lending to the UK economy. The report draws mainly on long-established official data sources, such as the existing monetary and financial statistics collected by the Bank of England. These data have been supplemented by the results of a new collection, established by the Bank in late 2008, to provide more timely data covering aspects of lending to the UK corporate and household sectors. 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 2013 are as follows:

Quarterly Bulletin

Q1	14 March
Q2	13 June
Q3	17 September
Q4	17 December

Inflation Report

February	13 February
May	15 May
August	7 August
November	13 November

Financial Stability Report

26 June
28 November

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