BANK OF ENGLAND

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Stress testing the UK banking system: key elements of the 2014 stress test

1   Background

The Financial Policy Committee (FPC) recommended in March 2013 that, 'looking to 2014 and beyond, the Bank and Prudential Regulation Authority (PRA) should develop proposals for regular stress testing of the UK banking system. The purpose of those tests would be to assess the system's capital adequacy'.[1]

In October 2013, the Bank of England published a Discussion Paper that set out the main features of the proposed stress-testing framework over the medium term.[2][3] That paper noted that the 2014 exercise was expected to be a stepping stone towards the medium-term stress-testing framework. For example, the 2014 test would cover a smaller number of firms, be conducted over a longer timeframe and incorporate a more limited assessment of system-wide amplification mechanisms.

In January 2014, the European Banking Authority (EBA) announced plans for an EU-wide stress test to be conducted over the course of the year.[4] The EBA is an EU authority that works to ensure effective and consistent prudential regulation and supervision across the European banking sector. One of the key tools at its disposal is the power to initiate and co-ordinate EU-wide stress tests, in co-operation with the European Systemic Risk Board.

The EU-wide test seeks to provide supervisors, banks and other market participants with a common exercise that facilitates the comparison of outcomes across EU banks. As set out by the EBA, the EU-wide test is intended to complement, not substitute, other supervisory stress tests. The EU-wide stress-testing arrangements also make provision for national sensitivities and variations to allow relevant authorities to explore country-specific risks using their own scenarios and methodologies.

In line with those arrangements, the Bank of England will, in addition, conduct a variant of the EU-wide stress test in 2014, complementing the EU-wide exercise. The 'UK variant' test will explore particular UK macroeconomic vulnerabilities facing the UK banking system at the current conjuncture. Key parameters of the test — including the design of the UK elements of the stress scenario — have been designed by Bank staff and approved by the FPC and the PRA Board. Ultimately, the results of the stress test will inform both system-wide policy interventions by the FPC and firm-specific supervisory actions by the PRA.

The UK variant test will extend the EU-wide stress test in a number of areas. Specifically, it will:

- cover a larger number of UK banks and building societies relative to the EU-wide stress test;[5]

- assess the impact of a variant of the EU-wide stress scenario, focused on exploring vulnerabilities stemming from the UK household sector in particular;

- use a dynamic balance sheet definition, so that the size and composition of banks' balance sheets are allowed to vary over the projection horizon;

- use a suite of models to assess the impact of scenarios on firms' profits and capital ratios, including firms' own models as well as models run by the Bank; and

- use a definition of capital that is consistent with the PRA's capital regime and, correspondingly, a different hurdle rate framework to assess the need for supervisory and system-wide actions by the PRA Board and the FPC.

This document outlines two core elements of the 2014 UK variant test. First, the scenarios to be explored by the exercise, with Sections 2 and 3 covering the stress and baseline scenarios respectively. Second, the standards against which banks will be assessed as part of the stress test, often referred to as the 'hurdle rate', covered in Section 4. The severity of the stress scenario and the hurdle rate framework are both key determinants of the resilience standard that the UK banking system is being held to through the stress test. A separate document published today provides firms with methodological guidance for conducting their own analysis.[6]

2   Stress scenario for the UK variant stress test

Under the co-ordination arrangements with the EBA, the UK variant test in 2014 will, in addition, assess the combined impact of: (i) the global macroeconomic and market elements of the common, EU-wide stress scenario; and (ii) the UK macroeconomic elements of the stress scenario designed by the Bank of England. This document focuses on the latter. The description of the EU-wide stress scenario, and associated variable paths, can be found on the EBA's website.[7]

This section starts by summarising the conjunctural context motivating the risks being explored by the stress scenario. It then outlines the scenario narrative and describes the main

(1) See 'Financial Policy Committee statement from its policy meeting, 19 March 2013', available at www.bankofengland.co.uk/publications/pages/news/2013/013.aspx.
(2) Unless otherwise stated, references to the Bank of England throughout this document include the PRA.
(3) See 'A framework for stress testing the UK banking system: a Discussion Paper', available at www.bankofengland.co.uk/financialstability/fsc/Documents/discussionpaper1013.pdf.
(4) See 'Main features of the 2014 EU-wide stress test', available at https://www.eba.europa.eu/-/eba-announces-key-features-of-the-2014-eu-wide-stress-test.
(5) The terms 'bank' and 'firm' are used interchangeably throughout this document to refer to banks and building societies.
(6) See www.bankofengland.co.uk/financialstability/Documents/fpc/guidance.pdf.
(7) See www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2014.

features of the stress. Finally, it provides further detail on the severity of the stress scenario, including by comparing it to past UK and international episodes of adverse macroeconomic conditions. Box 1 explains how the scenario for the UK variant test relates to the common, EU-wide scenario for the EBA test. The full variable paths for the UK variant stress scenario are available on the Bank's website.[1]

The stress scenario is *not* a forecast of macroeconomic and financial conditions in the United Kingdom. It is *not* a set of events that is expected, or likely, to materialise. Rather, it is a coherent, 'tail-risk' scenario that is designed specifically to assess the resilience of UK banks and building societies, predominantly to a stress affecting the household sector.

2.1 Context to the risks explored by the stress scenario

As set out in the November 2013 *Financial Stability Report*, debt levels of households and private non-financial companies in the United Kingdom remain historically high, at around 165% of GDP (**Chart 1**). While the ratio of UK household debt to income has fallen since 2008, as nominal incomes have increased more rapidly than household debt, it remains high by historical standards and relative to similar metrics in other advanced economies. And survey data suggest that a substantial share of total mortgage debt is accounted for by households with higher debt to income ratios, which could be particularly sensitive to adverse shocks (**Chart 2**).

**Chart 1** UK non-financial private sector debt to GDP[(a)]
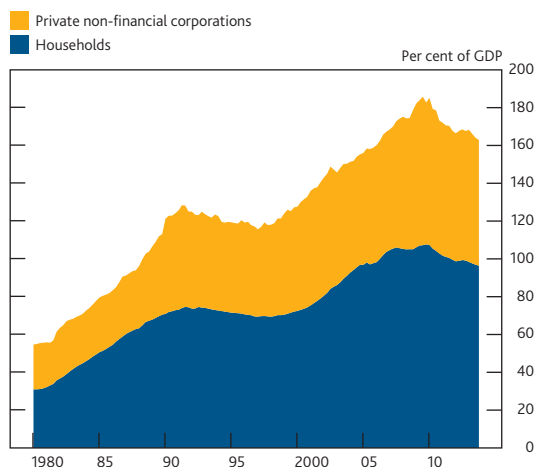
Sources: Bank of England, ONS and Bank calculations.

(a) ONS data are not available before 1990. Before then, ONS household and PNFC debt series are assumed to grow at the same rate as the Bank of England's household and PNFC lending series.

As the economic recovery has picked up in the United Kingdom, domestic housing market conditions have strengthened. According to the average of the Halifax and Nationwide measures, house prices rose by 7.2% nationally in the twelve months to December 2013 — the balance sheet date used for the test. The recovery in house prices has also broadened regionally, with prices in all regions rising over the

Chart 2 Distribution of mortgage debt by household indebtedness
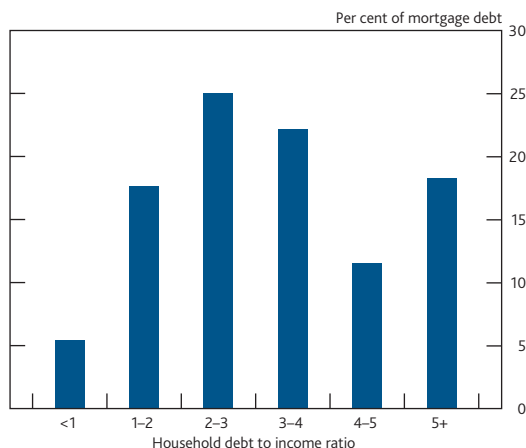
Sources: NMG Consulting and Bank calculations.

same period. And surveys indicate that house prices are expected to increase further going forward. Activity in the commercial real estate (CRE) market has also picked up recently, especially in the 'prime' segment of the market. In part, this has been due to substantial inflows of foreign capital.

These developments have taken place in the context of a prolonged period of low interest rates, both in the United Kingdom and globally. Low interest rates have eased debt burdens and helped support borrowers' incomes and economic activity more broadly. But the low interest rate environment can also pose risks to financial stability. For example, a sharp snap back in interest rates — especially if not accompanied by strengthening incomes — could increase borrower distress and lead to bank losses. Over 40% of respondents to the Bank of England's 2013 H2 *Systemic Risk Survey* highlighted interest rate risk as one of the main risks to UK financial stability.[2]

The combination of these factors means that UK household and corporate balance sheets are likely to be highly sensitive to fluctuations in property prices and sharp rises in debt servicing costs relative to incomes. Hence, a key part of the stress scenario for the UK variant test examines the resilience of banks and building societies to a housing market shock and to a snap back in interest rates.

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(1) See www.bankofengland.co.uk/financialstability/Documents/fpc/ukvariant2014.xlsx. The stress scenario and the associated UK macroeconomic variable profiles are owned by the Bank of England. All rights are reserved.
(2) See *Systemic Risk Survey: survey results 2013 H2*, available at www.bankofengland.co.uk/publications/Documents/other/srs/srs2013h2.pdf.

Box 1

The UK variant scenario in the broader context of the EBA scenario

Under the co-ordination arrangements with the EBA, the UK variant test in 2014 will assess the combined impact of: (i) the global macroeconomic and market elements of the EBA stress scenario; and (ii) the UK macroeconomic elements of the stress scenario designed by the Bank of England. This box explains how the scenario for the UK variant test relates to the common EU-wide scenario.

The stress scenario for the UK variant test examines the resilience of UK banks and building societies to a housing market shock and a snap back in interest rates. A particular feature of the UK mortgage market is that a large proportion of the stock of mortgages is on variable rates (**Chart A**). This means that the level of Bank Rate is an important factor influencing household income gearing. The EBA test is conducted under an explicit assumption of no changes to monetary policy in the stress scenario. To explore interest rate risks more fully, the UK variant stress scenario in 2014 assesses risks associated with a sharp rise in both short and long-term interest rates, thus complementing the EU-wide test.
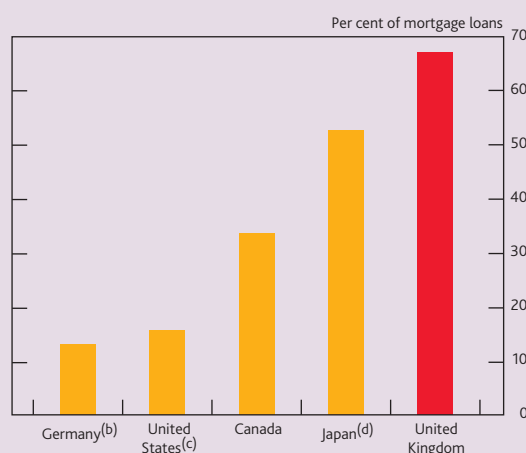
This has two key implications:

- First, household balance sheets become particularly stretched in the stress, as the scenario involves both rising unemployment and a rise in income gearing due to higher interest rates. This combination of shocks is expected to have a material impact on households' ability to repay their debts.

- Second, the sharp rise in interest rates in the scenario has an impact on a range of asset values in the stress, including house and CRE prices.

Chart A Estimated share of outstanding residential mortgages on variable rates[a]

Per cent of mortgage loans

Sources: Bank of Canada, Bank of England, Deutsche Bundesbank, Federal Housing Finance Agency (FHFA), Japan Housing Finance Agency (JHFA), US Mortgage Bankers' Association (MBA) and Bank calculations.

(a) Data as of end-2013, unless otherwise stated.
(b) Estimate of the proportion of the total stock of mortgages on fixed interest rates with maturity less than one year or on variable interest rates. Estimated using a combination of stock and flow data.
(c) Estimated using flow data only. Calculated as the ten-year average of the proportion of mortgage loans on adjustable interest rates. FHFA data are used up to end-2012. Data for 2013 are based on weekly survey data from the MBA. FHFA data excludes mortgages insured by the Federal Housing Administration.
(d) Data as of March 2013, based on a survey of private lenders.

The UK variant scenario is broadly consistent with the global elements of the EU-wide scenario. The latter involves a sharp downturn in economic activity internationally, triggered initially by a rise in investor aversion to long-term fixed income securities. In addition, the UK variant scenario also assumes that the United Kingdom is hit by a particular constellation of shocks that trigger a monetary policy response in the stress (see Section 2.2). That set of shocks naturally affects the paths for all key UK macroeconomic and financial variables in the stress.

2.2 High-level narrative of the stress scenario

This section provides a summary of the origin and manifestation of the stress in the scenario. This is important to ensure a broad degree of coherence in the scenario. **As mentioned above, the stress scenario is *not* a forecast of macroeconomic and financial conditions in the United Kingdom. It is a 'tail-risk' scenario that is designed specifically to assess the resilience of UK banks and building societies.**

Output growth in the United Kingdom starts to disappoint relative to expectations. In part, this is driven by continued weakness in productivity. Perceptions of a permanent productivity shock raise concerns over the sustainability of internal and external debt positions. This leads to a rapid re-assessment of the prospects for the UK economy. In turn, this is associated with a depreciation of sterling, which is persistent in the early parts of the scenario. Imported and domestically-generated inflationary pressures build up.

Monetary policy responds in the face of these material adverse shocks. The tightening of monetary conditions (both through the rise in Bank Rate and a sharp pick up in long-term gilt yields) leads to a contraction in domestic demand. This is exacerbated as vulnerabilities in the housing market are exposed, leading to falls in house and other asset prices.

Given the deterioration in the UK economy, concerns over the potential scale of bank losses intensify. This reduces the availability, and increases the cost, of bank funding. In turn, this has knock-on implications for the availability of new credit to households and companies.

Households become more cautious, aiming to raise their precautionary savings relative to the baseline, which in turn leads to a contraction in consumption. Business optimism also falls sharply, which — coupled with the fall in demand and rise in economic uncertainty — leads to a contraction in business investment and a significant rise in unemployment. This is exacerbated by a delayed labour market shake-out, as the net benefits of retaining labour diminish due to higher interest rates. Corporate liquidations also increase, partly due to the rise in the cost of forbearance in a higher interest rate environment.

2.3 Detailed description of key scenario features

The scenario starts in the first quarter of 2014 and extends through to the fourth quarter of 2016. It is initially characterised by a sharp depreciation in sterling, as investors demand a higher risk premium to hold sterling assets in light of growing concerns over debt sustainability in the United Kingdom. In trade-weighted terms, sterling falls by about 30% over the first year, before stabilising in the latter parts of the scenario.

The sharp depreciation in sterling is associated with a build-up of inflationary pressures. Annual CPI inflation rises sharply over the first two years of the scenario, peaking at a little over 6.5% in early 2015. In response to the build-up of inflationary pressures, Bank Rate starts rising from the second quarter of 2014. Gilt yields also rise sharply, partly due to a rise in risk premia. Ten-year gilt yields peak just below 6% in 2015, before starting to fall slightly. The yield curve steepens in the early parts of the scenario and then flattens as Bank Rate is tightened.

The scenario features a sharp contraction in economic activity. The expansionary effects of the fall in sterling are more than offset by the contraction in world demand (embedded in the global elements of the EBA scenario); the tightening of monetary and credit conditions in the United Kingdom; as well as weaker productivity growth. Real GDP troughs at about 3.5% below its 2013 Q4 level in late 2015, before starting to recover. The level of real output remains about 2.5% below its 2013 Q4 level at the end of the scenario.

The contraction in economic activity is associated with a sharp pick up in unemployment. A delayed labour market shake-out takes place, as the net benefits of hoarding labour diminish due to higher interest rates. The headline unemployment rate rises steeply, peaking at around 12% at the end of the scenario — levels not seen since the 1980s and early 1990s. The

distribution of the unemployed by age group is more akin to the experience of the early 1990s, implying that mortgagors see a proportionally bigger rise in unemployment relative to the recent crisis. Real wages decline throughout the scenario, reflecting the sharp rise in unemployment, weaker productivity and the exchange rate depreciation leading to higher inflation.

The combination of these macroeconomic shocks triggers vulnerabilities in the housing market. Household finances become particularly stretched due to the combined fall in real incomes and rising interest payments. This leads to a sharp correction in the housing market. From their 2013 Q4 level, house prices fall by about 35%. In nominal terms, house prices reach levels last seen in 2002. There is a differentiation across different market segments, with regions where house prices appear particularly inflated — for example, judged by historical experience in relation to earnings or rents — seeing the largest falls. London and the South East are particularly badly hit relative to the rest of the country.

The CRE market is also adversely affected. From their 2013 Q4 levels, CRE prices fall by about 30%. Liquidity conditions in the market deteriorate as the supply of credit to the CRE market is reduced. There is also a clear differentiation across market segments. Falls in prices in the 'prime' market are larger than those in the 'secondary' market. In part, this reflects an abrupt halt in the flow of foreign capital in the prime CRE market, consistent with foreign investors demanding a higher risk premium to hold sterling assets.

Prices of other UK financial assets also see sharp falls. Equity prices decline by almost 30% from 2013 Q4 levels and remain subdued, before starting to recover towards the latter parts of the scenario. Corporate bond credit spreads also widen sharply. This reflects both higher expectations of defaults — given deteriorating prospects for the economy — and a rise in liquidity premia on corporate bonds.

Rising concerns over the potential scale of bank losses, and increased uncertainty over future bank profitability, contribute to a disruption in bank funding markets. UK banks face a higher cost of long-term and short-term unsecured wholesale funding. And the decline in collateral values leads to a rise in the cost and fall in the availability of secured funding, especially for sources of financing using UK mortgages as collateral.

2.4 Scenario severity in a broader context

The remainder of this section sets out the stress scenario in a broader context. It compares the key features of the stress scenario with the Monetary Policy Committee's (MPC) forecasts for the UK economy as well as historical episodes of adverse macroeconomic and financial conditions, both in the United Kingdom and internationally.

Charts 3 to **6** show the main macroeconomic variables in the stress scenario relative to the latest projections of the MPC as communicated in the February *Inflation Report*.(1) The fans are graphical representations of the probability attached to different macroeconomic outcomes. In the collective judgement of the MPC, each variable would be expected to lie within the fan on 90 out of 100 occasions over the forecast horizon. The paths for the key macroeconomic variables in the stress scenario lie outside these fans, showing that the scenario is clearly in the tail of the distribution of possible future macroeconomic outcomes.

But this does not mean that such adverse macroeconomic outcomes could never happen. **Charts 7** to **9** show the main macroeconomic variables in the stress scenario against the long-run history of data. Of course, the structure of the

economy has changed significantly over that period, which also includes extreme events such as wars. Still, taking a long-run perspective can provide a useful benchmark to assess scenario severity.

Each of the long-run charts is accompanied by a shaded diagram. The latter is a graphical representation of the historical distribution of each of the macroeconomic variables over the past 150 years. The shading is constructed so that the darkest point represents the median: as many historical outturns have fallen above that, as they have below. The shading lightens in either direction to illustrate observations further away from the median. The legend at the bottom of the panel illustrates how the shading changes at different points, or percentiles, along the distribution of historical outcomes. The red line on the shaded diagrams shows where

Chart 3 GDP in the stress scenario relative to the February *Inflation Report* projection
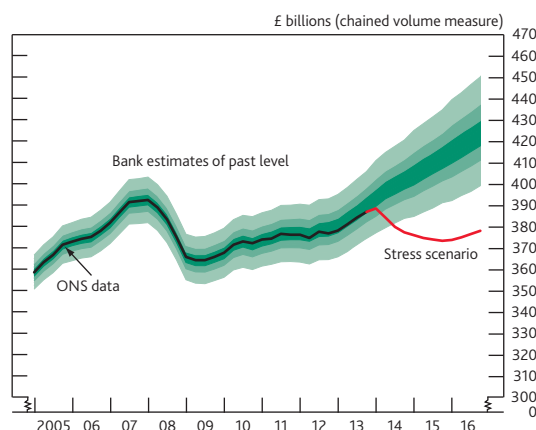

Chart 4 GDP growth in the stress scenario relative to the February *Inflation Report* projection
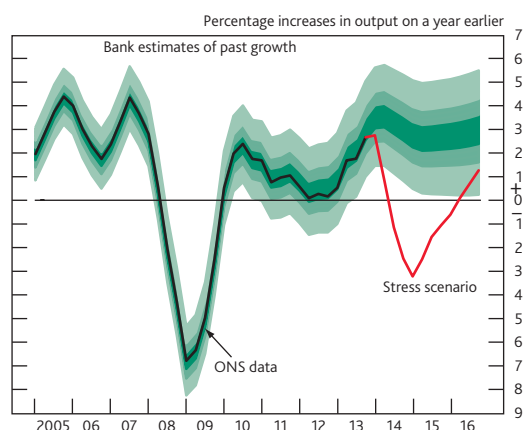

Chart 5 Unemployment in the stress scenario relative to the February *Inflation Report* projection
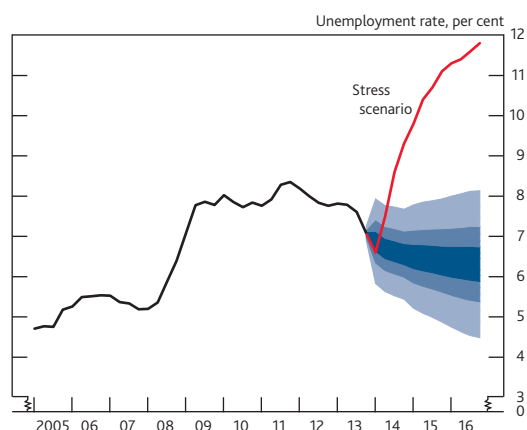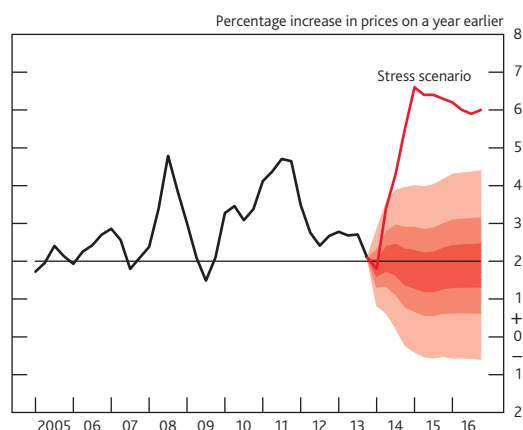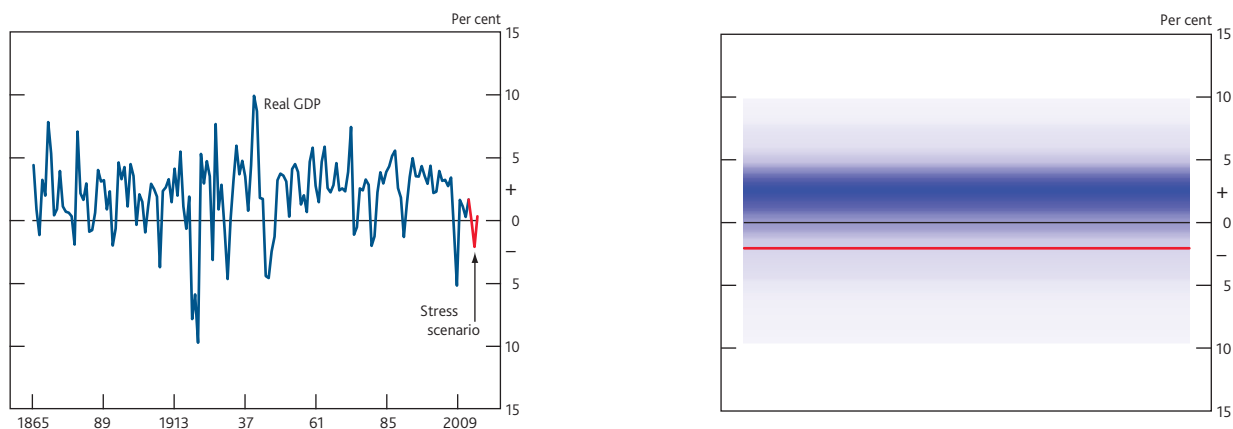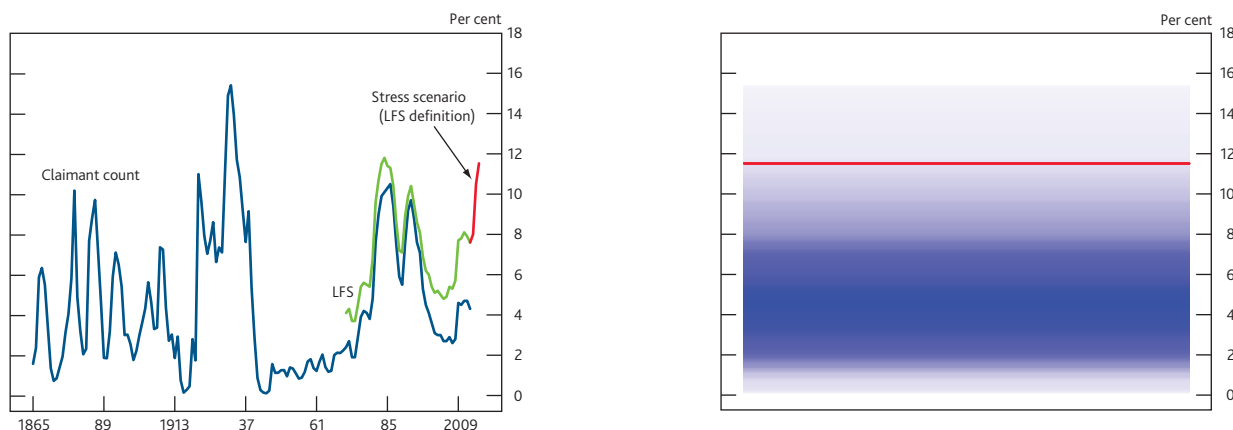

Chart 6 Inflation in the stress scenario relative to the February *Inflation Report* projection

Sources: ONS and Bank calculations.

The fan charts depict the probability of various outcomes for GDP, GDP growth, the unemployment rate and CPI inflation. They have been conditioned on the assumption that the stock of purchased assets financed by the issuance of central bank reserves remains at £375 billion throughout the forecast period and that Bank Rate follows a path implied by market interest rates in the fifteen working days to 5 February 2014. In the GDP and GDP growth fan charts, the distribution until 2013 Q4 reflects the likelihood of revisions to the data over the past. Over the forecast period, the distribution reflects uncertainty over the evolution of GDP, GDP growth, CPI inflation or the unemployment rate in the future. If economic circumstances identical to today's were to prevail on 100 occasions, the MPC's best collective judgement is that CPI inflation, the unemployment rate or the mature estimates of GDP and GDP growth would lie within the darkest central band on only 30 of those occasions. The fan charts are constructed so that outturns are also expected to lie within each pair of the lighter coloured areas on 30 occasions. In any particular quarter of the forecast period, GDP, GDP growth, CPI inflation or the unemployment rate are therefore expected to lie somewhere within the fan on 90 out of 100 occasions. And on the remaining 10 out of 100 occasions they can fall anywhere outside the coloured area of the fan chart. See the box on pages 48–49 of the May 2002 *Inflation Report* for a fuller description of the fan chart and what it represents.

(1) See February *Inflation Report* available at www.bankofengland.co.uk/publications/ Documents/inflationreport/2014/ir14feb.pdf.

Chart 7 Annual GDP growth since the 1860s and in the stress scenario

Chart 8 Unemployment since the 1860s and in the stress scenario

Chart 9 Annual inflation since the 1860s and in the stress scenario
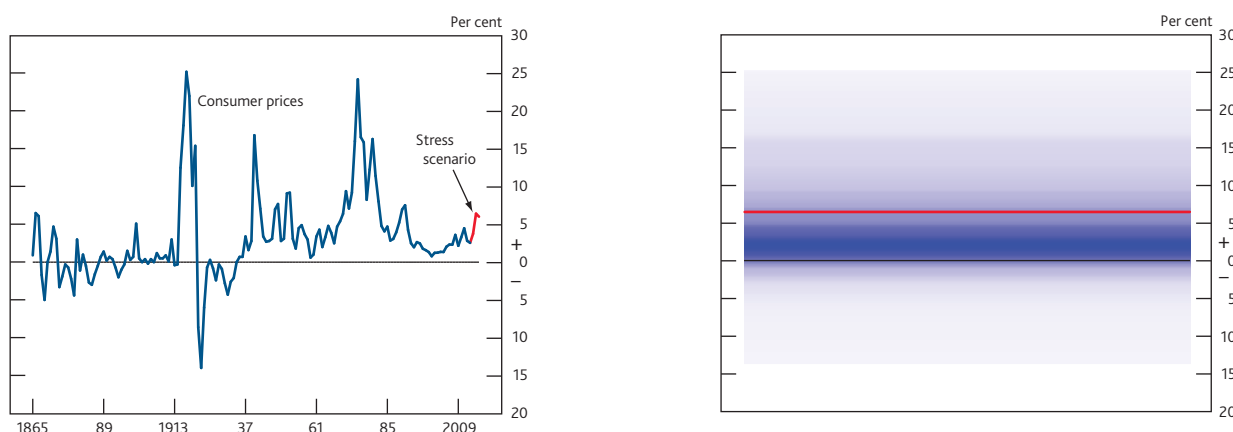
Legend: Mapping between shading and percentiles of the historical distribution.

Minimum   25th   50th   75th   Maximum

Sources: Dimsdale, N, Hills, S, and Thomas, R (2010), 'The UK recession in context — what do three centuries of data tell us?', *Bank of England Quarterly Bulletin*, Vol. 50, No. 4, pages 277–91, ONS and Bank calculations.

The shaded diagrams are a graphical representation of the historical distribution of each of the macroeconomic variables over the past 150 years. The shading is constructed so that the darkest point represents the median: as many historical outturns have fallen above that, as they have below. The shading lightens in either direction to illustrate observations further away from the median. The legend at the bottom of the panel illustrates how the shading changes at different points, or percentiles, along the distribution of historical outcomes. The red line on the shaded diagrams shows where the peak (or trough) observation in the stress scenario would lie in this distribution. The shaded diagram of unemployment is constructed using a spliced series, consisting of the claimant count measure until 1971 and the LFS measure thereafter. The red line in the shaded diagram of GDP shows the trough annual growth rate in the stress scenario.

the peak (or trough) observation in the stress scenario would lie in this distribution.

As shown in the charts, an annual contraction in GDP of the magnitude assumed in the scenario or larger has happened about ten times in the past 150 years. Put differently, there has been a larger contraction in GDP in 7% of historical outturns. Unemployment has been at levels similar to the peak level in the stress scenario or higher about six times in the past 150 years (4% of historic outturns). And inflation has been at levels greater than those seen in the scenario about 28 times over the same period (19% of historical outturns).

The contraction in economic activity implied by the scenario is smaller relative to that observed in the aftermath of the recent financial crisis. The fall in GDP in the scenario is also smaller than that assumed in previous stress tests conducted in the United Kingdom. This is by design, reflecting the fact that the United Kingdom has already experienced a deep recession recently. This is illustrated in **Chart 10**, which shows rolling ten-year growth rates in real GDP. A cumulative contraction in activity equivalent to that implied by the stress scenario or larger has happened only in a single episode over the past 150 years — and that was in the immediate aftermath of the First World War.

Chart 10 Ten-year cumulative GDP growth since the 1860s and in the stress scenario
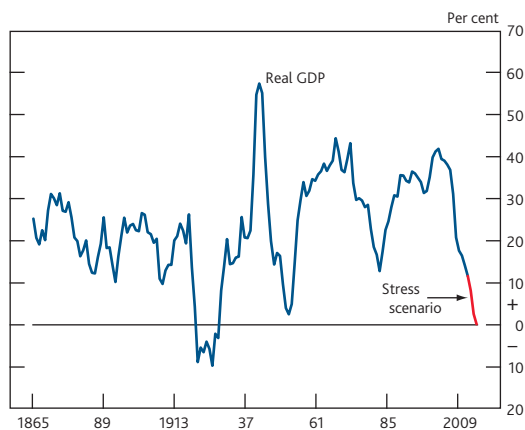

Sources: Dimsdale, N, Hills, S and Thomas, R (2010), 'The UK recession in context — what do three centuries of data tell us?', *Bank of England Quarterly Bulletin*, Vol. 50, No. 4, pages 277–91, ONS and Bank calculations.

Episodes of severe stress are, by definition, extreme events that happen infrequently. And the structures of economies and financial systems change over time. As a result, comparisons against a single country's past experience may provide a limited perspective only. It is, therefore, constructive to compare the stress scenario with previous episodes of stress that have occurred internationally as well. **Charts 11** and **12** look at changes in key macroeconomic variables in previous banking crises in advanced economies and newly industrialised countries since the 1970s. The fall in GDP and rise in unemployment in the stress scenario lie close to the centre of

the range of outcomes observed during these episodes. Overall, this comparison suggests that — conditional on being in a period of adverse macroeconomic and financial conditions (which is by definition a tail event, but is also the very nature of a stress test) — the hypothetical scenario would be well encompassed by the range of past international experience.

Chart 11 Fall in real GDP in international banking crises and the stress scenario[a]
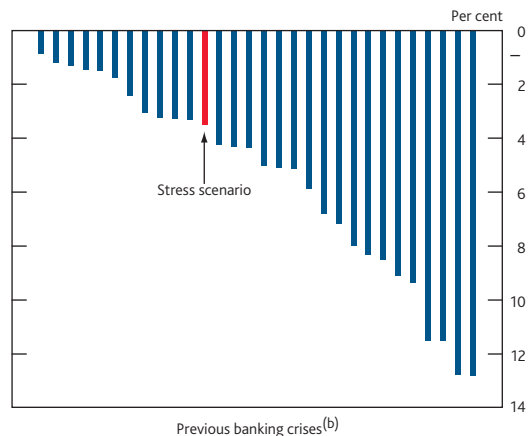
Sources: Thomson Reuters Datastream and Bank calculations.

(a) Peak-to-trough fall in real, quarterly GDP.
(b) Definition of banking crises and start dates as in Laeven, L and Valencia, F (2012), *Systemic Banking Crises Database: An Update* and Caprio, G, Klingebiel, D, Laeven, L and Noguera, G (2005), *Appendix: Banking Crisis Database in Systemic Financial Crises: Containment and Resolution*, subject to data availability. Covers banking crises in economies that are currently classified by the IMF as 'advanced economies'. This includes some countries previously classified as 'newly industrialised Asian economies' at the time of the crisis shown. Only crises associated with a fall in output are shown in the chart.

Chart 12 Rise in unemployment in international banking crises and the stress scenario[a]
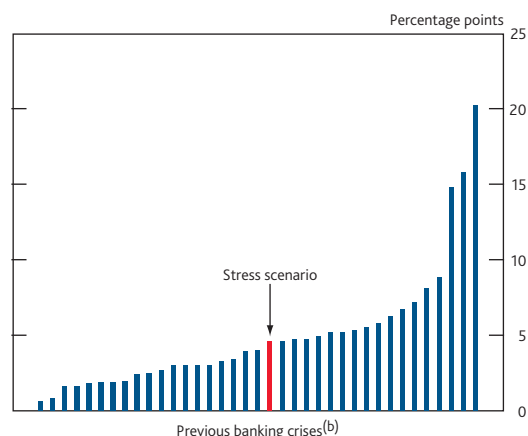
Sources: Thomson Reuters Datastream and Bank calculations.

(a) Trough-to-peak rise in the quarterly unemployment rate.
(b) Definition of banking crises and start dates as in Laeven, L and Valencia, F (2012), *Systemic Banking Crises Database: An Update* and Caprio, G, Klingebiel, D, Laeven, L and Noguera, G (2005), *Appendix: Banking Crisis Database in Systemic Financial Crises: Containment and Resolution*, subject to data availability. Covers banking crises in economies that are currently classified by the IMF as 'advanced economies'. This includes some countries previously classified as 'newly industrialised Asian economies' at the time of the crisis shown. Only crises associated with a rise in unemployment are shown in the chart. Trough of unemployment can be up to three years prior to the start of the crisis. Time from trough to peak is limited to five years.

In addition to the key macroeconomic variables discussed above, the profiles for UK property prices are important drivers of credit losses on banks' secured exposures. The falls in property prices in the stress scenario are consistent with a

Box 2

House price falls in the stress scenario in a broader context

The stress scenario incorporates a cumulative 35% fall in house prices in nominal terms. The United Kingdom has not experienced a house price fall of this magnitude since data became available in the 1950s, making the shock to house prices in the scenario unique in the available UK data. This box sets out the key considerations around the calibration of the house price shock in the stress scenario.

It is important to emphasise again that the stress scenario is _not_ a forecast of macroeconomic and financial conditions in the United Kingdom. It is _not_ a set of events that is expected, or likely, to materialise. Rather, it is a coherent, 'tail-risk' scenario that is designed to assess the resilience of UK banks and building societies.

Charts A and **B** show that house prices in the United Kingdom start from a relatively elevated level in a historical context, compared to frequently used benchmarks. For example, both in relation to earnings and to the level of rents, house prices remain above historical averages — and significantly above troughs observed in the past, including in the early 1990s recession. **Chart C** shows that the United Kingdom saw a smaller fall in house prices relative to some other advanced economies that experienced significant housing stress in the most recent financial crisis. According to the average of the Halifax and Nationwide indices, UK house prices fell by around 20% during the recent crisis.

**Chart A** Ratio of house prices to earnings[a]
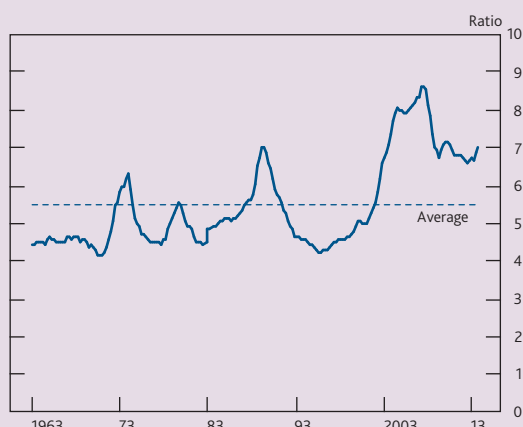
Sources: Halifax, Nationwide, ONS and Bank calculations.

(a) House prices defined using a spliced series, consisting of the Nationwide measure until 1983 and the average of lenders thereafter.

But the house price fall observed during the recent financial crisis was in the context of sharply falling interest rates, which — other things equal — would have acted to support housing
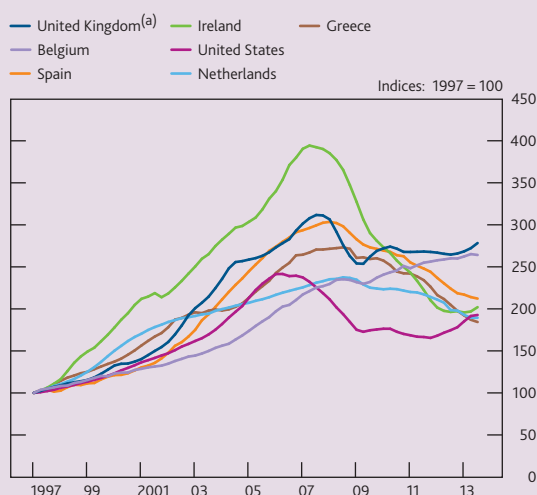
Chart B Ratio of house prices to rents[a]
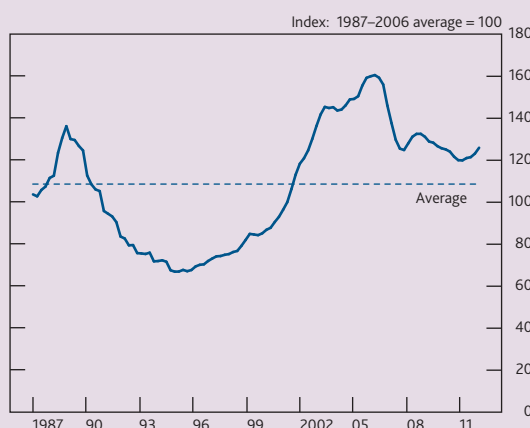
Sources: Halifax, Nationwide, ONS and Bank calculations.

(a) House prices defined using the average of lenders measure.

Chart C Historical trends in nominal house prices

Sources: Halifax, Nationwide, OECD, Federal Reserve and Bank calculations.

(a) House prices defined using the average of lenders measure.

valuations. The stress scenario, by contrast, involves a snap back in interest rates, both in the United Kingdom and globally, from very low levels. In addition, in a stress event, it is likely that risk premia on all assets, including housing, would increase.

Estimates from a simple dividend discount model of house prices attribute around three quarters of the assumed 35% fall in house prices to the sharp rise in interest rates in the stress scenario. The remainder of the fall is attributed to a rise in the estimated risk premium. The latter is consistent with the increase in the risk premium observed between 2007 and 2009. The level of the estimated housing risk premium in the stress scenario remains below its peak in the early 1990s when house prices fell sharply.

While nominal UK house prices have not fallen by as much as in the stress scenario in the recent past, there is precedent of

such declines internationally. **Chart D** shows falls in nominal house prices in previous banking crises in advanced economies and newly industrialised countries that have been associated with significant house price declines. The fall in house prices assumed in the stress scenario is shown by the red bar. Clearly, the fall implied by the stress scenario is an event that lies in the tail of the distribution. But, seen from an international perspective, there are precedents of similar — and even larger — house price falls.

Chart D Fall in nominal house prices in selected international banking crises and the stress scenario[a]
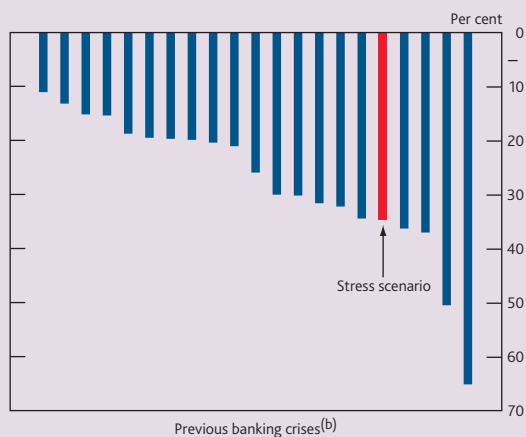

Sources: BIS, Central Bank of Iceland, Federal Reserve Board, Halifax, HK Ratings and Valuation Department, Nationwide, OECD and Thomson Reuters Datastream.

(a) Peak-to-trough falls in nominal quarterly house prices.
(b) Definition of banking crises and start dates as in Laeven, L and Valencia, F (2012), *Systemic Banking Crises Database: An Update* and Caprio, G, Klingebiel, D, Laeven, L and Noguera, G (2005), *Appendix: Banking Crisis Database in Systemic Financial Crises: Containment and Resolution*, subject to data availability. Covers banking crises in economies that are currently classified by the IMF as 'advanced economies'. This includes some countries previously classified as 'newly industrialised Asian economies' at the time of the crisis shown. Only crises associated with a nominal house price fall greater than 10% are shown in the chart. In most cases, the trough in house prices occurred within five years of the start of the crisis. In the case of Japan, nominal house prices have continued declining since the 1990s. For Japan, the fall is calculated as the difference between the level of house prices five years after the start of the crisis in 1997 and their previous peak. The cumulative fall in prices since the 1990s peak stood at 51% as of mid-2013.

Finally, **Chart E** provides a comparison with the early 1990s experience in the United Kingdom. The fall in nominal prices assumed in the scenario is larger than that seen in the early 1990s. But, in part, this reflects differences in the monetary policy regime between the two periods: the implied fall in the ratios of house prices to earnings and house prices to disposable income in the scenario are broadly similar to the experience of the early 1990s.
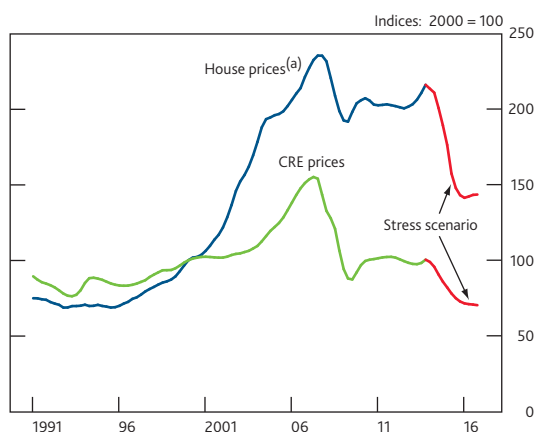
Chart E Falls in house price measures in the stress scenario and the early 1990s[a]
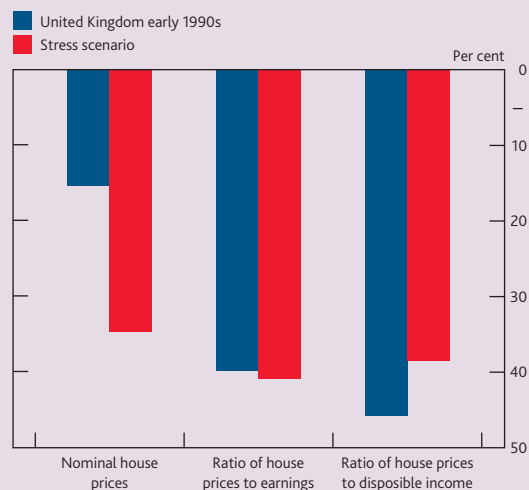
Sources: Halifax, Nationwide, ONS and Bank calculations.

(a) House prices defined using the average of lenders measure.

Chart 13 Past UK house and CRE prices and in the stress scenario

Sources: Halifax, Nationwide, IPD and Bank calculations.

(a) House prices defined using the average of lenders measure.

rapid deterioration in UK economic and financial conditions and a sharp rise in interest rates from very low levels. The latter is a key feature of stress scenario, intended to explore vulnerabilities emanating from the current, unprecedented, episode of prolonged low interest rates. Box 2 explains the calibration of the house price fall in the scenario in more detail.

A relatively unusual feature of the stress scenario — both with respect to UK historical experience and previous stress tests conducted in the United Kingdom — is that house prices fall by more than CRE prices. In part, this reflects the relative cyclical position of these two markets in the United Kingdom. The CRE market experienced a very large fall in prices during the recent crisis and capital values in that market have grown relatively modestly since their recent trough (**Chart 13**). By contrast, the fall in house prices during the crisis was much smaller — and the recent recovery has been relatively stronger. As a result, estimated risk premia — as implied by conventional asset pricing models called 'dividend discount models' —

remain close to historical peaks for the CRE market.[1] But the estimated housing risk premium is close to the median value observed over the past 25 years.

3   Baseline scenario for the UK variant stress test

In addition to the stress scenario, the UK variant test will also assess projections of banks' profitability and capital ratios under a baseline macroeconomic scenario. The baseline scenario will be the same as that used for the purposes of the EU-wide stress test co-ordinated by the EBA. As outlined earlier, though, the UK variant test departs from the core EBA methodology in some key respects (eg dynamic versus static balance sheet), so projections of capital ratios under the baseline scenario are also likely to differ.

The baseline macroeconomic scenario has been designed by the European Commission. It is, therefore, not consistent with the MPC's forecasts for the economy as outlined in the *Inflation Report*. The remainder of this section provides a short summary of the key features of the baseline scenario. The full variable paths — both for the United Kingdom and the rest of the world — can be found on the EBA's website.[2]

Under the baseline scenario, the UK recovery continues to gain momentum. Real GDP growth accelerates, reaching annual rates of around 2.5% in both 2014 and 2015, before moderating somewhat in 2016. Unemployment continues to decline, though at a more gradual rate than in the recent past. By 2016, the headline unemployment rate falls to an annual average of 6.4%. Annual CPI inflation remains close to the MPC's target of 2% throughout the projection horizon.

As economic conditions improve, long-term interest rates gradually start to revert to more normal levels. The steady economic recovery and increasing confidence is also reflected across a range of asset prices. House prices continue to rise, growing by about 5% in both 2014 and 2015, before decelerating somewhat in 2016. In cumulative terms, house prices rise by about 14% over the entire projection horizon. The commercial property market also sees continued growth. CRE prices rise by about 4% in 2014 and 2015, before growth moderates somewhat. In cumulative terms, CRE prices rise by around 12% over the entire projection horizon.

4   Hurdle rate framework for the UK variant stress test

The results of the stress test will be used to: (a) inform the PRA's judgement on the capital adequacy of individual institutions, and the appropriate supervisory response; (b) inform the PRA's judgement on firms' risk management and capital planning processes and the appropriate supervisory

response; and (c) inform the FPC's judgements on the resilience of the banking system as a whole and, in doing so, aid formulation of system-wide policy responses. Firms will be evaluated on their overall resilience over the whole period of stress.

A key threshold for the UK variant test will be set at 4.5% of risk-weighted assets (RWAs), to be met with common equity Tier 1 (CET1) capital in the stress. The definition of capital is CRD IV end-point CET1 in line with the UK implementation of CRD IV.[3]

The evaluation of stress test results will only allow for a limited set of credible management actions that firms could realistically take in a stress. Improving stressed capital ratios through deleveraging (in particular relative to firms' baseline plans) would be constrained, especially if it led to a material decline in aggregate credit supply.

If a firm's capital ratio was projected to fall below the 4.5% CET1 ratio in the stress, there is a strong presumption that the PRA would require the firm to take action to strengthen its capital position over a period of time to be agreed between the firm and the PRA. Firms that are already taking action to strengthen their capital position may not be required to take further action if, after considering the results of the stress test, the PRA is satisfied that the measures currently in place are sufficient.

If a firm's capital ratio was projected to remain above the 4.5% CET1 ratio in the stress, the PRA may still require it to take action to strengthen its capital position. Examples of factors the PRA might take into consideration in deciding whether action is needed include, but are not limited to: the firm's leverage ratio; Tier 1 and total capital ratios; Pillar 2A capital requirements; the extent to which the firm had used up its CRD IV buffers (eg the SIFI and capital conservation buffers); the adequacy and quality of its recovery and resolution plans; and the extent to which potentially significant risks are not quantified adequately or fully as part of the stress.

The FPC will consider the stress-test results as it evaluates the overall capital adequacy and resilience of the UK financial system. In making these judgments, the FPC will be looking at, among other things, the number of institutions that suffer very sharp declines or very low capital ratios post stress; indications that system-wide bank behaviour in a stress could adversely affect the macroeconomy or the stability of other

(1) For an application of the dividend discount model to CRE valuations see, for example, Benford, J and Burrows, O (2013), 'Commercial property and financial stability', *Bank of England Quarterly Bulletin*, pages 48–58.
(2) See www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2014.
(3) The definition of capital is set out in the PRA Rulebook and in Supervisory Statement SS7/13, 'CRD IV and capital', December 2013, available at www.bankofengland.co.uk/pra/Documents/publications/policy/2013/crdcapital713.pdf.

parts of the financial system; and widespread sectoral concentrations in losses. If the exercise reveals inadequate systemic resilience, the FPC will consider a variety of actions, depending on the sources of potential problems, including recommendations to the PRA and FCA, using its powers of direction to make adjustments to sectoral capital requirements and prospective powers to require a system-wide counter cyclical capital buffer in order, among other things, to put firms into a better position to withstand stress.

Under the baseline scenario, the PRA expects firms to meet the capital standard set out in 'Capital and leverage ratios for major UK banks and building societies — SS3/13'. That is, 7% of RWAs to be met with CET1 capital and a 3% leverage ratio using a Tier 1 definition of capital.

5   Publication of results

The results of the UK variant stress test will be published after the results of the EU-wide stress test have been released. The EBA expects to publish its results in 2014 Q4, with the UK results published towards the end of that quarter.