



# **Financial System Resilience Index**

Building a strong financial system



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## Foreword by Professor Lord May

This report on resilience in financial systems, from the New Economics Foundation, richly repays reading.

The factors influencing how complex systems – be they ecosystems or banking systems – respond to shocks are many and varied, involving the specific kinds of interconnections among components, the overall size of the system, transparency, and other factors.

My own interests were as a physicist, at Sydney University and at Harvard. But early engagement with environmental issues led me to the study of stability and complexity in model ecosystems, first at Princeton and now at Oxford. When problems developed in the banking system, around 2008, there seemed to me to be significant read-across from work on ecological systems. During my term as Chief Scientific Adviser to the Major and Blair governments, I had come to know Mervyn King. He, in turn, introduced me to Andrew Haldane, and we worked together on issues of stability and complexity.

The New Economics Foundation's report significantly extends this work, defining how factors such as leverage, diversity, network structure, and connectivity influence resilience, drawing particularly upon recent past experience in the UK. This naturally leads to questions of how best to design such systems to optimise their resilience.

Even if they forego reading the whole report, policymakers and regulators should pay close attention to the excellent conclusion and recommendations, which convey the essential messages in a very lucid way.

### **Robert May**

Aka Professor Lord May of Oxford OM AC Kt FRS

## Summary

Our Financial System Resilience Index, based on insights from complexity science, reveals that the UK's resilience declined dramatically in the 2000s to levels far below those of other leading industrial economies. Despite some marginal improvements since the crisis of 2008, without major structural changes our financial system remains at risk of future crisis.

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The 2008 crisis underlined a series of weaknesses in the global financial system. Efforts to redesign and regulate the system must focus on ensuring resilience – the system's ability to continue to serve the economy well in the face of shocks that unfold suddenly from within, as in 2008, and also gradually emerging strains on the system, such as climate change.

While policymakers and regulators do talk about resilience, it is not always clear what they mean. Often it is implicitly assumed that, by making individual banks hold more capital, we can stop them from ever going bust – 'resilient' banks will equal a resilient system. This is a dangerous assumption; it also ignores our growing understanding that complex systems are about much more than the sum of their individual parts.

Drawing on academic and policy literature and a series of expert interviews and roundtables, we find seven key factors that influence system resilience and that can be measured:

- 1. Diversity** – healthy systems have a diversity of actors who occupy a variety of different niches in the system and employ different strategies to thrive.
- 2. Interconnectedness** and network structure – the way financial institutions are connected to each other affects the way a crisis spreads.
- 3. Financial system size** – financial systems that are large relative to their domestic economy pose a greater threat to economic stability.
- 4. Asset composition** – where banks invest matters, with some types of financial assets particularly prone to boom and bust.
- 5. Liability composition** – the way banks are funded also matters: short-term borrowing from other banks are more fickle and volatile than customer deposits.
- 6. Complexity and transparency** – the growing complexity associated with securitisation and the 'slicing and dicing' of loans can spread risks around the financial network and make those risks harder to judge, especially during a crisis.

**7. Leverage** - the ratio between banks' assets and their capital; this has been a key focus of post-crisis financial regulation.

### Comparing national financial system resilience

We compiled numerical indicators for each of these factors to compare different countries' financial systems, and whether they had become more or less resilient over time.

This analysis finds that the UK economy has low levels of financial system resilience, significantly trailing other leading industrial economies, including Japan, Germany, France, Italy, and Canada.

Although the UK's financial system resilience has improved slightly since the financial crisis, it remains the worst in terms of diversity, interconnectedness, financial system size, asset composition and complexity, and transparency. This has worrying implications for the UK's economic stability.

Since the financial crisis, governments have focused on increasing competition between commercial banks and requiring banks to hold more capital. Our analysis finds that these may have limited effects on overall financial system resilience. Specific policy implications of the analysis include:

- Competition policy must promote diversity, not simply more 'lookalike' challenger banks.
- Policymakers cannot rely on complex new capital requirements to ensure system resilience: structural reforms, such as separating retail from investment banking, could be more effective.
- The rise of peer-to-peer lending could significantly improve system resilience, but this depends on how the industry evolves.

A better knowledge of systems theory sheds light on vital characteristics of financial systems not currently reflected in policy, such as diversity, network structure, and the overall composition of banks' lending.

We recommend that regulatory bodies:

- explicitly define system resilience.
- measure and publish resilience indicators.
- apply multicriteria analysis to policy-making, including resilience indicators as criteria.
- assess the resilience of the system as a separate and distinct exercise from assessing the resilience of individual financial institutions.
- conduct further research on the impact of different network structures on financial systems performance and resilience.

It is vital that policymakers develop a more sophisticated understanding of resilience and use it to help reshape our financial system. Unless this is achieved, our economy and society remain at risk of a future financial crisis.

## Introduction

It is now almost seven years since the collapse of Lehman Brothers triggered a global financial crisis, but its impacts are still being felt in countries across the world. The question of whether we can expect another financial meltdown, and how the system would cope if so is of huge public policy importance.

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The term 'resilience', along with 'systemic financial risk', has been firmly established in the lexicon of central banks and policymakers since 2008. There have also been efforts to improve the availability of data on financial system risk, such as the G20's Data Gaps Initiative. Undoubtedly this reflects a more sophisticated understanding of the financial system and the risks it poses than we had before the crisis. But what do we really mean when we talk about resilience? How do we measure our progress towards a more resilient financial system? And have post-crisis reforms been sufficient to achieve this goal?

These are the questions which this research project set out to address. The material for our research included:

- A review of the key literature on financial system resilience and of existing datasets and indicators on aspects of financial system resilience.
- Two expert roundtables held in November 2014 and February 2015 (see Acknowledgements for attendee list).
- A series of individual interviews with regulators and academic experts.

Based on this, we identified seven key domains affecting financial system resilience, with one or more indicators for each domain. We calculated these indicators for G7 countries over several years and then combined them into a composite index. Full details of the index methodology are given in Section 3. We then applied this framework to various policy and market development scenarios to assess their likely impact on financial system resilience, and identified some key conclusions and recommendations for policymakers. These are summarised at the end of the report.

# 1. What is financial system resilience?

The term ‘resilience’ has become a staple of financial regulation. But what does it really mean? Financial system resilience is about more than the ability of individual banks to withstand shocks. It is about the system’s tendency to generate shocks in the first place, and its ability to adapt and evolve in response to them.

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The term ‘resilience’ is gaining currency among financial policymakers and regulators. The Financial Policy Committee has an explicit remit to protect and enhance ‘the resilience of the UK financial system’.<sup>1</sup> Official documents on Basel III repeatedly describe its goal as being a more resilient banking system.<sup>2,3</sup> The Bank of England’s June 2014 *Financial Stability Report* uses the word ‘resilience’ no fewer than 56 times.<sup>4</sup> Yet there is still no agreed understanding of what financial system resilience means, or of the key factors which affect it. In this first section, we explore these questions in preparation for considering how we might measure financial system resilience.

## 1.1 Defining ‘resilience’

In previous work on economic resilience carried out for the Friends Provident Foundation, the New Economics Foundation (NEF) identified three main conceptions of resilience which appear in the literature:

- Single equilibrium or ‘steady state’ (relating to the ability of a system to return to its original condition following a shock).
- Multiple equilibrium (the ability of a system to return to multiple different equilibria).
- Evolutionary or ‘complex adaptive systems’ models of resilience (where resilience is a capacity to adapt, rather than a state).<sup>5</sup>

Orthodox economics is generally associated with equilibrium approaches. But, drawing on insights from ecology and complexity science, there is a growing understanding that evolutionary or adaptive approaches are more suited to understanding complex socio-economic systems.<sup>6,7</sup> In addition, we suggest that the resilience of socio-economic systems must be considered in the context of the system’s *purpose*. A system that continues to exist but ceases to fulfil its basic functions cannot really be considered resilient – or at least, such a definition of resilience is not particularly helpful in public policy terms.

NEF therefore defines economic resilience as: ‘the capacity of an economic system to adapt in response to both short-term shocks and long-term changes in ecological, social, and economic conditions while supporting the community to thrive within fair ecological limits’. This requires the ability to absorb shocks while retaining system functionality, to self-organise, and to innovate and learn.<sup>8</sup>

## 1.2 Defining ‘financial system resilience’

But how does this definition apply to the financial system? The use of the term ‘resilience’ by financial policymakers and regulators raises a number of questions. We considered these questions in the context of our general definition of resilience and tested our provisional conclusions at our first expert roundtable.

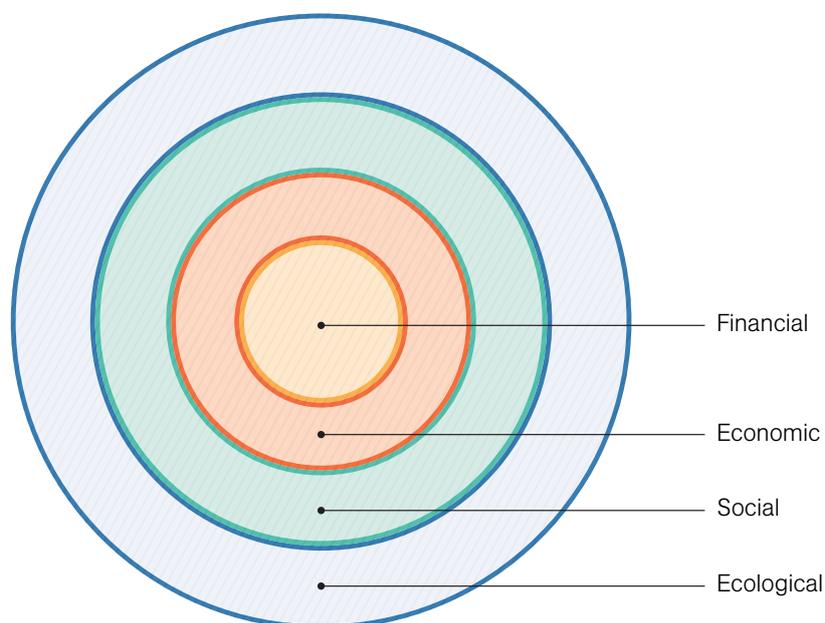
### *Q1. Is the sum of individual banks’ resilience the same as that of the system as a whole?*

Despite a growing appreciation of the nature of systemic risk and the need to apply new forms of analysis to the understanding of complex systems, the neoclassical economic framework still treats individual institutions as the unit of analysis – limiting the policy space for alternative approaches. There is a heavy emphasis in regulatory and political discourse on individual banks’ capital buffers as a measure of system resilience. For example, Andrea Leadsom, then Economic Secretary to the Treasury, claimed in 2014 that the fact that no UK banks failed the European Banking Authority (EBA)’s 2014 stress tests ‘shows our robust reforms to build a more resilient banking sector are working’.<sup>9</sup>

As we will see, one of the key insights of complexity theory is precisely that complex systems cannot be understood simply as the sum of their parts. Indeed, it is questionable whether we can meaningfully understand the parts themselves in isolation from system dynamics. The EBA’s stress test methodology has been criticised for using a ‘static balance sheet’ approach which bears little relation to the way a real stress scenario would unfold as a shock rebounded around the system (e.g. through asset fire sales or liquidity hoarding).<sup>10</sup> The Bank of England’s own recent stress tests attempted to address some of these effects by allowing bank balance sheets to evolve through the scenario.<sup>11</sup>

As was pointed out in our expert roundtable, we also need to recognise that the financial system is an open system that sits within, and interacts with, other systems – economic, social, and ecological (Figure 1). Of course, not all of these interactions can be captured in the way we measure financial system resilience – but we suggest they are important for a full conceptual understanding of the term. It was also pointed out in our first roundtable that there may be trade-offs between these different aspects of resilience (for instance, using short-term wholesale dollar-denominated debt to fund investment in windfarms in the UK might worsen financial resilience but improve ecological resilience).

Figure 1: A nested system of mutual dependencies. The economy is part of a larger social system that is bounded by ecological limits.



*Q2. Is resilience just about the system's ability to respond to exogenous shocks, or do we also need to consider its tendency to generate endogenous shocks?*

Policymakers often talk about financial system resilience in terms of banks' ability to weather an economic storm. In this model, shocks are treated as external factors, and improving resilience is a matter of boosting the system's ability to cope with them. But, as one expert argued in our roundtable, this is to fundamentally misunderstand the nature of financial crises: banks were not 'innocent bystanders' in the unfolding of the 2007/2008 sub-prime mortgage crisis, but rather 'the perpetrators'. More generally, there is a strong argument that capitalist financial systems generate endogenous shocks and crises, as the work of Hyman Minsky<sup>12</sup> illustrates. Clearly, macro-prudential regulation exists both to reduce the likelihood of shocks and to limit their impact when they do occur. We suggest that our understanding of financial system resilience cannot be confined to the second of these two objectives but needs to encompass them both.

Indeed, the separation between the two is not as clear-cut as it may seem. As was pointed out at our first expert roundtable, what counts as a 'shock' is not an objective fact which exists in isolation from system resilience, but is defined precisely by the system's ability to absorb it. For example, why was the US sub-prime mortgage crisis a major global shock rather than simply a 'little local difficulty'? It was in part because of the highly interconnected structure of the global financial system, and the way in which the opacity and complexity of the securities being traded exacerbated the transmission of confidence shocks through this system. In turn, these factors were inextricably bound up with the build-up of risk within the US mortgage market in the first place, via the 'originate and distribute' model pursued by US investment banks (see section on market-based finance).

*Q3. Is resilience just about the ability to return to business as usual following a crisis, or about the ability to adapt and evolve?*

There was overwhelming support among our expert group for an adaptive understanding of resilience over a more simplistic ‘equilibrium’ approach. Some suggested that on the latter definition, one might conclude that the UK financial system had been resilient after 2008 – although others contested this, pointing out that the system only remained standing thanks to a huge external injection of capital from governments. Either way, there was strong agreement that the UK financial system looks somewhat less resilient when seen through this adaptive lens: one of our interviewees remarked that many banks still seemed to want to return to a pre-2008 world, and showed little sign of adapting or learning as a result of the crisis.

*Q4. What is the relationship between resilience and system functionality?*

This raises the question of why we care about financial system resilience in the first place: as one of our interviewees put it, ‘are we trying to save the banks from the economy, or the economy from the banks?’ We have already argued that, from a public policy point of view, we care about resilience because we want systems to continue fulfilling their social functions – in the case of banks, facilitating the efficient creation and allocation of credit (i.e., the creation and supply of money to the economy), and the intermediation of financial capital and risk – and so resilience must be understood in terms of continuity of those functions, not simply in terms of the system in isolation (for instance, its ability to remain standing or to remain profitable). In our 2009 report *The Ecology of Finance*, we define the purpose of the financial system as ‘to facilitate the allocation and deployment of economic resources, both spatially and temporally, to environmentally sustainable activities that maximise long-term financial and social returns under conditions of uncertainty’.<sup>13</sup>

Conversely, there are some reasons to think that a financial system less focused on its social functions may also be less resilient: for instance, the higher the proportion of lending channelled into speculative activity, the more likely the system may be to generate asset price bubbles and crashes. Thus, although it is important not to confuse resilience with system functionality, the two are intimately connected.

*A working definition of financial system resilience*

Despite our emerging theoretical understanding of resilience in complex systems, too often policymakers implicitly equate financial system resilience with the ability of individual banks to withstand short-term, exogenous shocks without going bust. As one person we spoke to acknowledged: ‘[a]ll we meant by “resilience” was, we just didn’t want them to fall over again.’ We suggest that this approach, which fails to appreciate more recent advances in complexity economics, is far too narrow to be useful. Attendees at our expert roundtable agreed: as one put it, ‘It doesn’t help to think of resilience in the traditional way of just “how much capital are banks holding”.’

For the purposes of this report we define financial system resilience as follows:

**‘The capacity of the financial system to adapt in response to both short-term shocks and long-term changes in economic, social, and ecological conditions while continuing to fulfil its functions in serving the real economy.’**

We define the ‘real economy’ here as comprising non-financial companies, households, non-profit organisations, and the public sector, because the ultimate purpose of the financial system is to serve these sectors. Transactions that take place purely between financial sector companies should theoretically relate eventually to some benefit to the real economy. Therefore this definition of resilience requires not just that the financial sector can absorb shocks, but that it can do so whilst continuing to maintain its purpose – to serve the real economy.

This definition also emphasises the evolutionary nature of resilience – that the system can self-organise, innovate, and learn.

### **1.3 Resilience, stability, and competition**

Is resilience as we are defining it the same thing as financial stability? The two words are often used interchangeably – and, as we have seen, they are used in different ways by different people – most of those we spoke to interpreted stability as something closer to the equilibrium concept of resilience, i.e., the ability of the system to maintain a constant state in the face of disturbance. For instance, drawing an analogy with climate change, it was suggested that a *stability* approach might entail building a dam around the Somerset levels to preserve it unchanged, while a *resilience* approach might require steps to adapt the natural environment to the effects of climate change, whilst also seeking to mitigate those effects.

This accords with the dictionary definition of stability – ‘steadiness; fixity; the power of recovering equilibrium’<sup>14</sup> – but does not sit easily with the adaptive, evolutionary concept of resilience advocated in this report. Thus, although the concepts of resilience and financial stability are clearly closely linked, the terminology of resilience is useful insofar as it adds new dimensions to our understanding of what constitutes a healthy financial system.

Another key concept informing policy in this area is competition. The Prudential Regulation Authority (PRA) has a secondary objective to facilitate effective competition, the Competition and Markets Authority is currently investigating the personal current account and small business banking markets, and politicians across the spectrum frequently invoke a more competitive banking sector as the answer to many of the system’s failings. The assumption is that the UK banking sector has become so highly concentrated because competition did not operate effectively, that this high market concentration is largely responsible for the system’s lack of resilience (for instance, via the existence of ‘too-big-to-fail’ banks); and therefore that promoting competition will also improve resilience.

But is this true? As the Bank of England recently noted, research findings on the relationship between competition and stability are mixed: while some studies suggest a positive relationship, others find that there is actually a

trade-off.<sup>15</sup> For instance, one US study found that firms tend to adopt lower and more uniform capital levels as the intensity of competition increases.<sup>16</sup> The fact that the Canadian banking system, although very concentrated, was relatively unaffected by the global financial crisis of 2007/2008 whilst the UK was hit very hard by it, suggests market concentration is unlikely to be the key factor here. As we explore later in relation to diversity, one answer may be that the effect of competition on resilience depends on the *type* of competition. For instance, the Vickers Commission on banking reform recognised the risk of competition 'being directed in part to unduly risky activities, as was the case in the run-up to the crisis when misaligned incentives led banks to "compete" by lowering lending standards'. The 'right' sort of competition required that 'banks compete to serve customers well rather than exploiting lack of customer awareness or poor regulation'.<sup>17</sup>

Although we will suggest that market concentration is one factor to be considered when assessing financial system resilience (Section 2.1), it is just one of many relevant factors – and its impact may not be as clear-cut as policymakers often seem to assume. It would certainly be a mistake to treat competition policy as a panacea for the failings of the banking system, or as a substitute for measuring and monitoring broader indicators of financial system resilience.

#### **1.4 Efficiency versus resilience**

In addition to yielding a more nuanced understanding of the benefits of competition, insights from complexity science also highlight the potential trade-offs between greater financial system efficiency and greater resilience.<sup>18</sup>

We have defined resilience as the ability to adapt and evolve in response to shocks. Efficiency of a system can be defined in various ways, but drawing on the study of ecological systems, we can define it as the maximisation throughflow, or net production: in other words getting the maximum output from a given number of inputs.

In the case of economic systems, efficiency can be enhanced by increased standardisation and scale of operations. This can be observed in the UK not only by the consolidation of the banking industry into a small number of very large institutions, but also within these institutions the utilisation of information technology to standardise products and processes, including credit assessment.

However, as we shall explore in detail in Section 2.1, diversity (rather than standardisation) and dispersed and broadly connected (rather than tightly concentrated) institutions are crucial components of resilience.

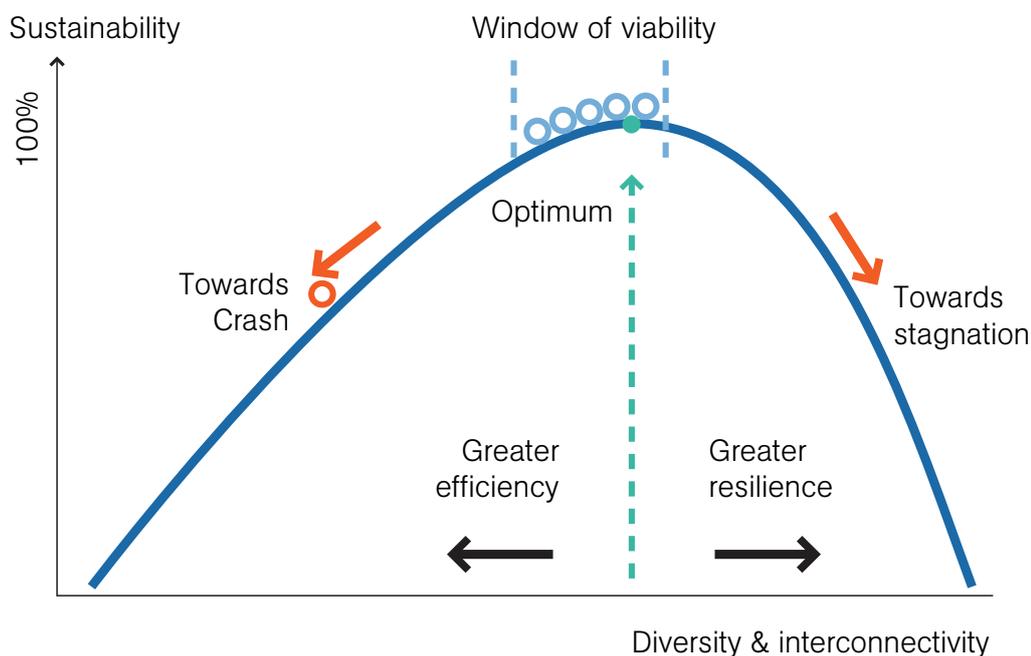
This analysis suggests that maximum efficiency and resilience are incompatible, and so rather than seeking to maximise either, we should seek find the optimal balance between the two.

To return to lessons from nature, ecosystems are at their most sustainable (or to put it negatively, most likely to remain viable) only if such a balance between resilience and efficiency is achieved. This is represented by the 'window of viability' in Figure 2. In this graphic representation, the left-hand

side represents maximum efficiency and minimum resilience (resilience being measured on the horizontal axis in terms of diversity and interconnectivity). As we travel over to the right-hand side, resilience increases and efficiency diminishes.

The vertical axis measures the sustainability of the system. If the system is hyper-efficient, it will be very vulnerable to collapse, and is therefore not a sustainable system. However, if maximum resilience is achieved the system will stagnate and be so unproductive as to also become unsustainable.

Figure 2. Optimising efficiency and resilience.



Source: Lietaer *et al.* <sup>19</sup>

What this suggests is that resilience and efficiency are not properties of systems that should be maximised, but rather that we need to find the optimal balance between them.

As one of our interviewees pointed out, if much of the volume of financial system activity is not socially useful, 'efficiency' in the sense of maximising volume may not correspond to maximum social utility.

This suggests a double flaw in financial system policy that aims only to promote efficiency. Not only might this undermine resilience to a dangerous extent, but the 'efficiency' achieved by the system might be partially illusory. As we explore in Section 2.6, beyond a certain point, increasing financial system activity may serve only to reduce resilience without any meaningful benefit to society. The implications of trade-offs between financial system efficiency and financial system resilience are worthy of further research, but at the very least provide further justification for policymakers to add a resilience 'lens' through which to view market- and policy-driven developments alongside the existing lenses of efficiency and competition.

## 1.5 Defining the financial system: scope of this report

The financial system as generally understood includes both banks and non-bank financial institutions such as pension funds, insurance companies, investment funds, and hedge funds.<sup>20</sup> In this report, we focus primarily on the banking system on the basis that banks have by far the largest potential impact on financial system resilience for a number of reasons.

First, bank lending involves the creation of 97% of the money supply.<sup>21,22</sup> The combination of high levels of leverage and maturity transformation (borrowing money on shorter timeframes than it is lent out) which characterises fractional reserve banking poses a unique set of risks.<sup>23</sup> This is reflected in the remit and supervisory focus of the PRA and is widely acknowledged in the literature on financial risk.

Secondly, debt-related shocks are much more disruptive to the real economy than equity booms and busts because equity is designed to absorb losses by continuous adjustment in its market value being passed on directly to equity holders. In contrast, debt is designed to maintain its nominal value. Where debt is held on bank balance sheets, losses cannot be passed on to depositors. Beyond a certain point, losses will therefore either wipe out the bank's own equity holders and bankrupt the bank, or force intervention by the government as the ultimate guarantor of bank deposits.<sup>24</sup>

Third, bank activities and capital market activities have become closely intertwined in a way that was not the case a few decades ago (see section on market-based finance). Innovations in capital market trading are often initiated by banks and affect bank balance sheets. For example, exchange traded funds (ETFs – tradable securities whose value is connected to other underlying assets such as commodities, debt, or equities) are often constructed using derivative contracts written by investment banks, including those that are part of universal banks that span retail and investment banking operations.<sup>25</sup> Therefore a severe disruption in the trading of ETFs on capital markets will also have an adverse impact for bank balance sheets.

### *Resilience and capital markets*

By focusing on banking we are not suggesting that other parts of the financial system are not relevant to resilience. The Bank of International Settlements (BIS) 2014 Annual Report notes that since 2008, asset management firms have become systemically more important as corporate bonds fill the gap left by the retreat of bank lending. On the one hand, it is argued that this provides greater diversity of funding channels to the real economy (though, as we discuss later, it is important to interrogate these claims); on the other, it means that the system is more exposed to short-termist and procyclical behaviour by asset managers which could exacerbate future shocks.<sup>26</sup>

The Bank of England's June 2014 *Financial Stability Report* concludes that 'while regulation may have addressed many of the risks associated with leverage in the financial system, unlevered funds can still amplify market risks. For example, any herding to the exit in response to a shock could cause risk premia and volatility to move sharply higher, and adversely affect the supply of market-based finance to the economy.'<sup>27</sup> A recent paper by the Bank of England's Procyclicality Working Group also concluded that the investment

strategies of pension funds and insurance companies could exacerbate procyclicality, with ‘important consequences for the economy as a whole’.<sup>28</sup> Emerging market corporate debt appears to be a particular concern among many commentators, especially given the currency risks involved.<sup>29,30</sup>

Global regulators are examining whether certain large asset managers should be designated as systemically important as a prelude to subjecting them to sharper oversight. However, the Bank of England’s June 2014 examination of the risks beyond the ‘core banking sector’ concluded that they did not at present warrant changes to the UK regulatory framework.<sup>31</sup> Given that these risks are also difficult to quantify, we treat them as beyond the scope of this report.

### *The rise of market-based finance*

There are more fundamental questions to be asked about the relationship between bank-based and market-based finance, and associated risks to financial system resilience. National financial systems have traditionally been conceptualised as either bank-based or market-based.<sup>32,33</sup> In *liberal market economies* such as the USA and the UK, firms are said to finance themselves primarily via issuing equity or debt instruments which are traded in deep and competitive capital markets. By contrast, in *co-ordinated market economies* such as Germany and Japan, banks play a much more important role in the long-term financing of companies as part of a broader ‘corporatist’ industrial structure.<sup>34</sup> Capital markets in such economies are considerably smaller.

Since the 1980s, however, this distinction has begun to blur – and, according to some, has broken down entirely – as a result of changes to banks’ business models, variously described in the academic literature as a shift to ‘securitised banking’<sup>35</sup> or ‘market-based banking’.<sup>36</sup> Traditionally, banks extend loans and keep these on their balance sheets until maturity, generating a profit through the difference between the interest rate charged on the loan and the interest rate offered to depositors. This model is held to buffer firms from changes in market conditions, since lending is based on the bank’s assessment of borrower creditworthiness and on long-term relationships between lenders and borrowers, rather than on short-term profitability. But two key changes mean that this model no longer reflects reality for major commercial banks:

1. On the asset side, **loans are increasingly made to be sold on** (the ‘originate and distribute’ model), either via direct trading or securitisation, where pools of loans are packaged up into asset-backed securities. This blurs the distinction between bank loans and tradable securities such as equities and bonds: ‘loans become simply another financial market asset’, increasing the pro-cyclicality of bank lending.<sup>37</sup> It also increases the importance of (non-bank) institutional investors as holders of risk – with the role of AIG in the financial crisis being perhaps the most obvious example.<sup>38,39</sup>
2. On the liability side, since the 1990s banks increasingly began to rely on market-based funding from other financial institutions. The ‘funding gap’ between deposits and loans widened for some institutions, and was filled by (often very short-term) borrowing in the wholesale markets.<sup>40</sup> Banks’ key liquidity risk is no longer a run by depositors, as in traditional banking, but

a withdrawal of interbank lending, as happened during the financial crisis. This creates another source of fragility and means that a decline in market conditions can quickly translate into a squeeze on bank lending.

Political economist Iain Hardie has also pointed to a third factor in the marketisation of lending: the increased marking-to-market of loans which remain on banks' balance sheets (i.e., loans are valued based on estimates of their market price). This means that 'even if a loan is not sold, its market value determines its terms.' It also amplifies the impact of changes in market conditions on bank solvency.<sup>41</sup> For instance, Hardie notes that estimates of losses on US sub-prime mortgage securities based on market prices in 2008 were nearly 60% greater than those implied by the Bank of England's assumptions about actual default-related losses.<sup>42</sup>

### *Shadow banking*

The rise of shadow banking can be seen as the corollary of the marketisation of lending. The shadow banking system is sometimes defined as banking activity carried out by 'institution[s] outside the banking system's regulatory framework', including hedge funds and money market funds, as well as special purpose vehicles used by banks themselves to engage in off-balance-sheet lending activity – such as 'asset-backed commercial paper' (ABCP) programmes.<sup>43</sup> These vehicles are themselves often financed by short-term borrowing on wholesale markets – thus exposing banks to another source of market pressure. A seminal 2010 paper described the role of this system in the 2008 crisis as follows:

*“The shadow banking system provided sources of inexpensive funding for credit by converting opaque, risky, long-term assets into money-like and seemingly riskless short-term liabilities. Maturity and credit transformation in the shadow banking system thus contributed significantly to asset bubbles in residential and commercial real estate markets prior to the financial crisis.”*<sup>44</sup>

A recent paper by the International Monetary Fund (IMF) focuses on funding rather than regulation, defining shadow banking as 'all intermediation that can be characterised as non-traditional from the point of view of the funding source'.<sup>45</sup> Thus the size of liabilities other than traditional deposits, both for banks and other financial intermediaries, is taken as a measure of the size of the shadow banking system. This better captures the involvement of banks themselves with shadow banking activities – for instance, by including securitisations that remain on the bank's balance sheet.

### *Blurring the boundaries*

The blurring of boundaries between bank and non-bank finance increases the difficulty of drawing hard and fast distinctions between banks and capital markets and of defining the scope of the system we wish to analysis. We focus on banks, but also include some measures that capture risks arising in the shadow banking system and from market-based finance, such as the effects of securitisation and increased reliance on short-term wholesale funding.

We should sound a note of caution about recent claims that measures to boost capital market financing will improve financial system resilience by diversifying sources of funding for the real economy and making us less reliant on banks.<sup>46</sup> Based on the trends outlined in this section, it can be argued that the adoption by banks of more complex business models based on securitisation and greater reliance on market valuations bred the systemic fragility that was exposed so dramatically in 2008. One major study by the ECB concluded that ‘banks with higher proportions of more profitable, but more volatile, non-interest income activities limited credit to borrowers to a greater extent’ during the crisis.<sup>47</sup>

## 2. Which factors affect financial system resilience?

What determines financial system resilience? Drawing on insights from complexity science and literature on financial systems, we identify a number of factors which are often overlooked in policy debates.

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As we argued in Section 1, resilience is often implicitly equated with banks' capital positions – measured either in terms of risk-weighted capital ratios or simple leverage ratios. Ensuring that banks hold enough high-quality capital to withstand shocks has been a major focus of post-crisis regulation, particularly via the new Basel III capital and liquidity requirements. The EBA and the Bank of England have each introduced their own stress testing regimes to assess how resilient banks are to economic shocks.

We agree that capital adequacy is important and include a measure of banking system leverage in our Financial System Resilience Index. However, in this section we set out to explore other factors relevant to financial system resilience. Drawing on relevant literature and on input from our expert roundtables and interviews, we identify six factors which we suggest are both important and measurable, as well as several other factors which we agree are important but do not believe are easily measurable at this time. In Section 3, we discuss measurement issues in more detail and present our list of selected indicators.

### 2.1 Diversity

Improving the diversity of the financial system has been an explicitly stated objective of both the UK's Conservative/Liberal Democrat coalition government of 2010-2015<sup>48</sup> and the previous Labour administration.<sup>49</sup> This objective is consistent with our growing understanding of the importance of diversity for system resilience – drawing on insights from ecology, where a biodiverse ecosystem with specialised players occupying different niches is known to be more resilient than a monoculture.

A lack of diversity is harmful for financial system resilience because similar institutions are likely to suffer from the same problems at the same time, increasing the chance of a systemic crisis (as opposed to isolated failures of individual banks). This will also exacerbate contagion effects, since bank failures are likely to occur when other institutions are already stressed.<sup>50</sup> As Haldane and May argue in their seminal 2011 paper, 'excessive homogeneity within a financial system – all the banks doing the same thing – can minimize risk for each individual bank, but maximize the probability of the entire system collapsing.'<sup>51</sup> For example, diversification may help to spread an individual institution's risk, but if all banks diversify in the same way, this paradoxically reduces the diversity of the system as a whole, thereby enhancing *systemic*

*risk*. From a systems perspective, what we want are different kinds of banks doing different things.

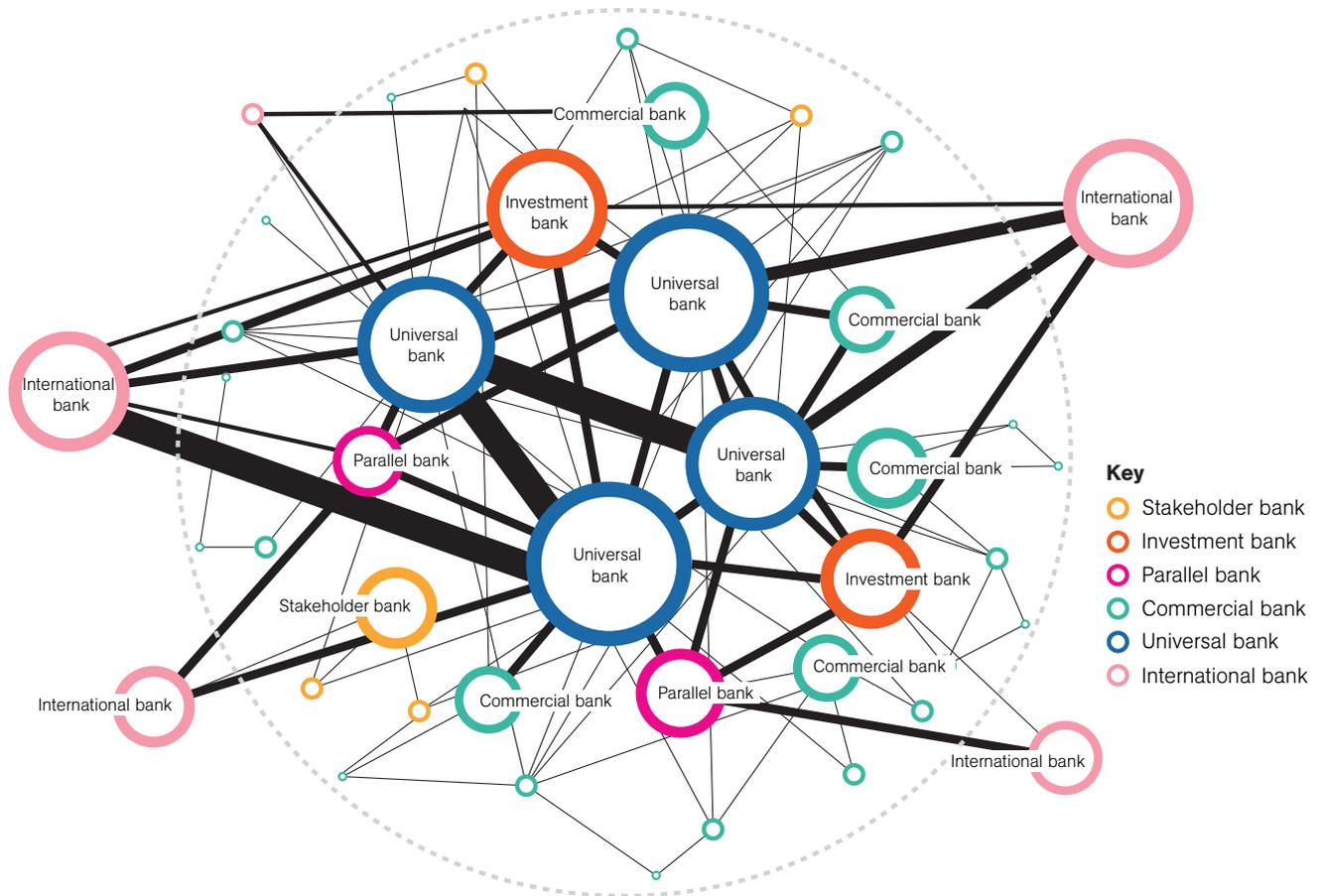
Although it has gained currency since the crisis of 2008, this idea is not entirely new: as long ago as 1999, the *Financial Times* published an editorial saying that ‘a pluralist approach to ownership is conducive to greater financial stability.’<sup>52</sup> However, it is now widely accepted that the financial system has become less diverse in recent decades and that this was a contributor to the crisis. A system made up of smaller, specialised players has evolved into one in which ‘the biggest institutions are now operating in the same global markets, undertake similar activities, and are exposed to the same funding risks’ (Goodhart & Wagner).<sup>53</sup> Andy Haldane, Chief Economist of the Bank of England, illustrates this point by showing that cumulative returns in different types of financial institution became increasingly correlated as the credit boom accelerated: ‘finance became a monoculture.’<sup>54</sup>

In the UK, demutualisation<sup>55</sup> and the ‘Big Bang’ deregulation in the 1980s have helped to produce a system dominated by large, London-based, shareholder-owned universal banks. As Andy Haldane has argued: ‘Under the old financial order, mutuals were a sub-structure, as were commercial banks, investment banks and investment funds [...] deregulation swept away banking segregation.’<sup>56</sup> We return to the implications of this later in this section in discussing network structure.

From a diversity perspective, however, this trend seems likely to have reduced the system’s resilience – both because it is a monoculture, and because the species which dominate that monoculture may be particularly prone to generate systemic risks. For example, lending by ‘stakeholder banks’ (such as co-operatives and mutuals) and by state-owned banks has been found to be less procyclical than lending by shareholder-owned commercial banks, indeed in many cases continuing to increase their lending during the downturn.<sup>57,58,59</sup> Mutual and co-operative banks have been found to have lower volatility of earnings and a lower risk profile, and were less affected by the banking crisis than shareholder- and privately owned banks.<sup>60</sup> There is also some evidence that local banks may be intrinsically less risky than large national banks: for instance, one study found that US local banks were less involved in sub-prime lending than non-local banks.<sup>61</sup>

As Professors Michie and Oughton point out in their work on the D-Index of diversity in financial services<sup>62</sup> (discussed further in Section 3), this means that regulators should be seeking to encourage competition between ‘species’ of bank, and not just between a greater number of shareholder-owned banks. Or as John Kay puts it, ‘there is less of a need for more banks than there is for more diversity of banks [...] the essence of competition is not just that several people do things. It is that people try to do things differently.’<sup>63</sup> Interestingly, the D-Index competitiveness measure actually improves in the run-up to 2008 as a result of sub-prime mortgage lenders entering the market – supporting the Independent Commission on Banking’s conclusion that the crisis was precipitated by unsustainable or ‘incautious’ competition, and not simply by an absence of competition.<sup>64</sup>

Figure 3. Stylised banking system showing disassociative network structure and potential 'super-spreader' universal banks.



## 2.2 Interconnectedness and network structure

It is increasingly clear that financial system resilience is affected not just by the system's component parts or aggregate risk exposure, but also by the pattern of connections between institutions. However, there is some debate in the academic literature as to what the most resilient network structure is, and the exact dynamics at play are still imperfectly understood.

Figure 3 presents a stylised map of a modern advanced economy financial system network – with similarities to the UK.<sup>65,66</sup> The coloured circles, representing different types of financial institutions (mainly banks), can be thought of as *nodes* in the network whilst the black lines show *relations* between these nodes. These relations consist of claims (assets) and obligations (liabilities) between the institutions. The thicker the lines, the larger the claims that exist between institutions. These claims and obligations take the form of different types of financial instruments and products, ranging from simple loans to complex derivatives (insurance or hedging products). The size of the bubbles and lines are stylised representations and not to scale.

The network has a classic 'core-periphery' structure, with larger institutions – most noticeably universal banks – at the centre having many inter-financial linkages and smaller institutions on the outside having fewer. In the UK, as with several other developed economies, a relatively small number of very large universal banks (blue circles) and investment banks dominate the core. These universal banks carry out multiple different activities and are related

to all the other types of financial institutions. As well as standard lending to households and firms, they make loans and provide liquidity to other banks and other financial institutions (e.g. hedge funds or investment banks) and also to foreign banks. They also buy and sell securities (e.g. government and corporate bonds and equities) on a large scale and engage in derivatives origination and trading.

#### *Interconnectedness: good or bad for resilience?*

In finance theory, up until the financial crisis of 2008, it was widely believed that greater interconnectedness led to more stable systems by dispersing risks:<sup>67</sup> in the event of a shock, each bank takes a small 'hit'; the impact is dissipated and there is no contagion. By contrast, when banks have exposure to only a few counterparties, the initial impact of a shock is concentrated among neighbouring banks, making defaults and resulting stresses more likely. However, it is now suggested that, whilst this may be true for small idiosyncratic shocks, highly interconnected structures are in fact more vulnerable to extreme shocks cascading around the system: they are 'robust yet fragile'. This has led ecologist Robert May to suggest that 'highly connected structures are best avoided.'<sup>68</sup>

This matters because a large proportion of the recent growth in bank balance sheets represents *intra-financial* system claims, much of it driven by the growth of derivatives. This is particularly so in the UK: a recent Bank of England paper finds that only around half of UK-owned banks' assets are loans to non-bank borrowers – for the largest foreign subsidiaries in the UK, this falls to less than 10%, with derivatives and reverse repos representing 60% of assets.<sup>69</sup>

#### *Super-spreaders' of contagion: the role of large universal banks*

Similar arguments have been applied to the role of large universal banks within the system. Before the financial crisis, it was argued that a 'core-periphery' network structure was highly resilient because the banks with the most connections (the 'core' nodes) – universal banks in Figure 3 – are large and diverse enough to survive most shocks. In contrast, smaller institutions, whilst less able to survive shocks, do not pose system-wide threats as they are relatively disconnected. In this way, large universal banks act as a fire-stop against default contagion, preventing it from spreading across the system.<sup>70</sup>

But it is now argued that beyond a certain tipping point, these very same features – i.e., size, diversification, and interconnectedness – can turn such institutions into shock transmitters rather than shock absorbers.<sup>71,72,73</sup> Drawing an analogy with the spread of infectious disease, they have been termed 'super-spreaders' of financial contagion.

To understand this fully, we need to understand that financial networks are not just about financial linkages themselves, but also about people and their levels of confidence. Financial relationships are essentially claims and obligations whose value and risk are uncertain. Changes in market confidence can result in herd-like behaviour that can rapidly cascade and create positive feedback. As a report by the US Federal Reserve puts it, 'the odds on a 100-year storm do not change because people think that such a storm has become more likely' – but the same is not true of financial storms.<sup>74</sup> Shocks spread not just via the direct propagation of defaults, but also via

'firesales' of assets (rapid selling of assets at well below their previous market price) and liquidity hoarding (refusal to lend due to concerns about other parties' creditworthiness). Both of these channels are affected by levels of confidence in the system, which can be disproportionately affected by the failure of a large, highly interconnected bank. Arinaminpathy *et al.* model these interactions and find that '...the importance of relatively large, well-connected banks in system stability scales more than proportionately with their size: the impact of their collapse arises not only from their connectivity, but also from their effect on confidence in the system.'<sup>75</sup>

This is what we saw during the 2007/2008 crisis, where the collapse of a Systemically Important Financial Institution (SIFI) – Lehman Brothers – led to a collapse in the inter-bank lending market, which fed back into firesales of assets. The perception that Lehman was in trouble led to a system-wide seizure in bank funding as uncertainty about the true value of Lehman's liabilities spread across the network. As this example highlights, network structure is not just another consideration to be bolted on to a conventional understanding of finance, but requires a fundamentally new framework of analysis.

#### *Patterns of connections*

Robert May notes that the impact of 'super-spreaders' will depend not just on their size but on the pattern of their connections with the rest of the system. Today's major banking networks appear to have *disassociative* network structures, whereby 'big banks are disproportionately linked to smaller ones, and vice versa.' For instance, in the USA, where 79% of the assets are held by the largest 1.4% of banks,<sup>76</sup> 75% of payment flows involve fewer than 0.1% of the nodes.<sup>77</sup> In epidemiology, this type of 'wiring up' is known to be the one which maximises the spread of infection.<sup>78</sup>

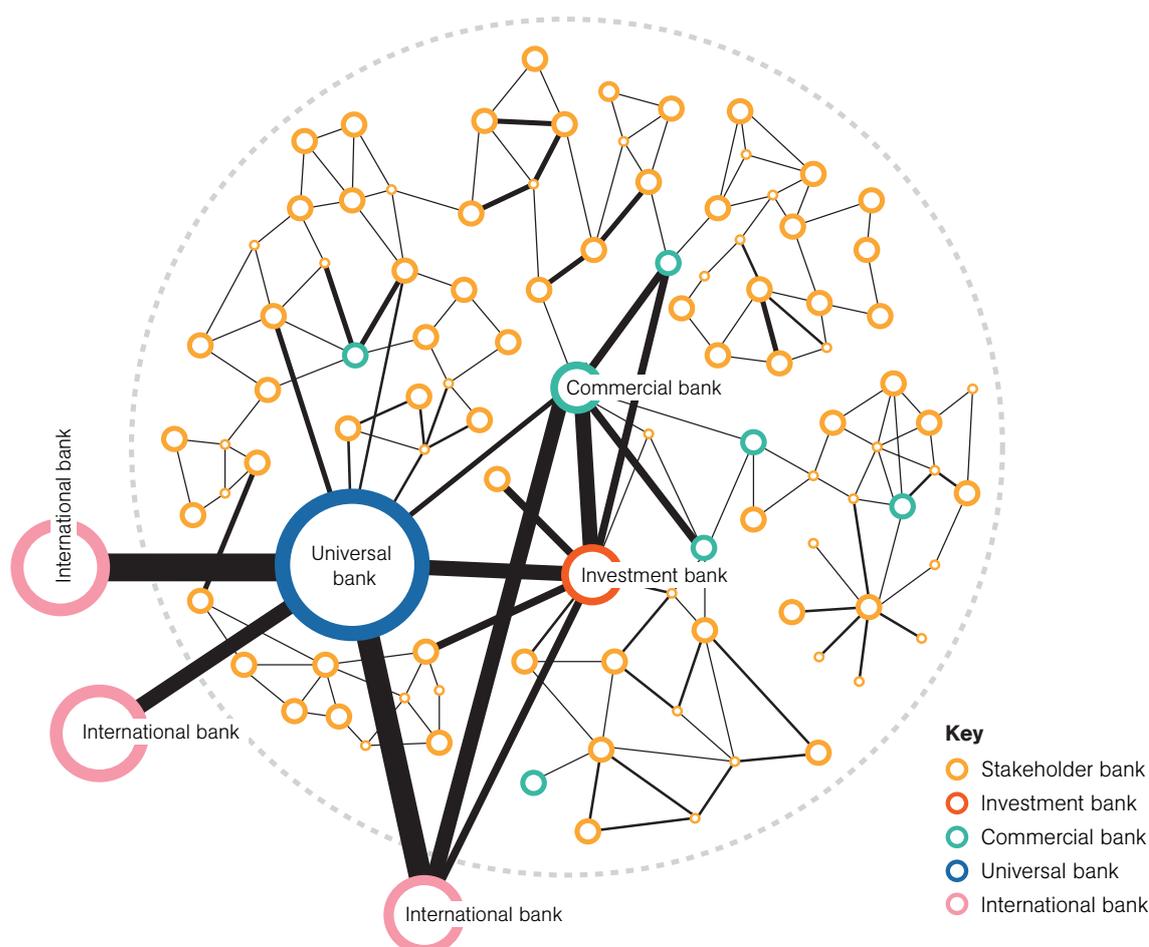
More generally, May suggests that *modularity* – 'the degree to which the nodes of a system can be decoupled into relatively discrete components' – makes systems more robust:

*'If there is strong interconnection among all elements, a perturbation will encounter nothing to stop it from spreading. But once the system is appropriately compartmentalised – by firebreaks, or vaccination of 'super-spreaders' – disturbance or risk is more easily countered.'*

Andy Haldane notes that the UK financial system has become less robust over time in this respect: deregulation 'swept away banking segregation and, with it, decomposability of the financial network'.<sup>79</sup> Haldane and May find that a structure which 'very roughly corresponds to banks substantially engaged in both retail and investment activity' will tend to maximise the fragility of the system.<sup>80</sup> On this basis, it has been suggested that 'ensuring a diversity of players and restricting the scope of business in which they can engage' (for instance, by separating retail and investment banking operations) could contribute positively to the resilience of the system.<sup>81</sup> As May points out, this involves making trade-offs between localised risks to part of a system (which might benefit from being supported by the wider network) and risks to the whole system (which might benefit from the localised problem being isolated).

Figure 4 shows a more modular banking system, characterised by multiple relatively separate networks. In such a system, failure or loss of confidence in the universal bank (blue circle) is less likely to have contagion effects on the rest of the system since the majority of banks in the system are not heavily linked to it either in terms of assets or liabilities. Rather they are linked to each other in separate, self-contained, but still quite large networks. This type of arrangement might be said to describe the German banking system where, although there are two very large universal, globally systemically important banks (Deutsche Bank and Commerzbank), the majority of real economy lending is conducted within regional networks of stakeholder banks (cooperative and savings banks). In such regional networks, liquidity, funding and back office infrastructure is shared between many relatively small banks.<sup>82</sup> In contrast, in the UK most real economy lending is conducted by one of five<sup>83</sup> very large and systemically important universal or retail shareholder owned banks, as illustrated in figure 3.

Figure 4. Stylised map of banking system with modular network structure.



### Foreign exposures

The balance between domestic and overseas intra-financial linkages may also be relevant to resilience. The free movement of financial capital is enshrined in EU treaties as well as international trade agreements. Some capital takes the form of investments in illiquid assets, such as industrial, intellectual, or human capital. However, financial capital held in liquid assets, such as traded financial

securities and bank deposits, can be moved quickly across borders and currency zones in response to changes in market conditions and sentiment. Rapid cross-border flows can be destabilising to domestic economic and financial systems, exacerbating the impact of domestic economic shocks, or transmitting shocks from elsewhere.

As the Bank of England has noted, 'foreign banks are a particularly large part of the UK banking system. This is arguably its defining feature.' Foreign branches account for around 30% of total UK-resident banking assets and around a third of UK interbank lending. Meanwhile, UK-resident banks' foreign assets and liabilities account for over 350% of UK GDP, more than four times the median figure for OECD (Organisation for Economic Co-operation and Development) countries.<sup>84</sup>

There is evidence that such cross-border financial linkages may be more vulnerable in the event of shocks. Foreign loans are generally considered to be more risky since they expose banks to currency risk – i.e., if the debtor currency depreciates against the creditor currency this could result in defaults – as well as to less well understood regulations and macroeconomic dynamics. Meanwhile, a Bank of England study has found that provision of credit to UK borrowers from foreign branches, including to the UK corporate sector, fell sharply during the crisis and by much more than that from UK owned banks and foreign-owned subsidiaries. The Bank suggests that this may reflect the more fragile funding structure of foreign branches, and the fact that their lending is concentrated in more procyclical sectors, such as commercial real estate.<sup>85</sup>

## 2.3 Financial system size

As we have already argued, financial system resilience is best understood as both the tendency of the system to generate shocks, and its ability to cope with shocks when they do arise. On both counts, there is evidence that the overall size of the financial system relative to its host economy is relevant to resilience.

### *Coping with shocks*

As the Bank of England has found, larger banking sectors are likely to impose larger direct fiscal costs in times of crisis.<sup>86</sup> The collapse of a larger financial system imposes greater pressure on the wider economic system within which it sits. Beyond a certain size, financial systems may become 'too big to save', with system failures likely to trigger a sovereign debt crisis.

This issue is mediated through the problem of individual banks which are 'too big to fail' (TBTF) because of their systemic importance. Such institutions no longer compete on a level playing field with other market participants as they are able to borrow at a lower rate (the 'implicit subsidy'), since lenders know they will not be allowed to fail.<sup>87</sup> This gives these institutions an even greater competitive advantage, allowing them to grow larger and more systemically important and engage in even riskier behaviour. In other words, the implicit subsidy may generate a positive feedback loop which enhances system fragility and leads to an 'oversupply' of banking services.

TBTF is a function of the size of individual large banks, and not just of the system as a whole: at least in theory, a large financial system could be made up of lots of relatively small or specialised banks, none of which were individually too big to fail. It is therefore worth noting the conclusion of a recent European paper that the near-doubling in size of the EU banking system relative to GDP since 1996 is almost entirely attributable to the largest 20 banks: ‘the large size of the EU banking system and the size of the EU’s largest banks are [...] two sides of the same coin.’<sup>88</sup> In practice, therefore, the TBTF question and the issue of overall financial system size are inextricably linked.

In addition, high levels of private debt increase macroeconomic fragility to shocks and impose constraints on monetary policy. The ability of non-government sectors to bear financial system losses may also be constrained in the case of a particularly large economic exposure to the financial sector. This is because feedback loops between the real and financial economy might prolong the recovery period among the business sector from financial sector shocks, for example if business confidence is so constrained that investment and therefore the *demand* for credit fails to recover. As we argued in Section 1, these issues matter to financial system resilience because the financial system is not a closed system which can be understood in a vacuum, but an open system which interacts with, and is part of, the wider economic system.

#### *Increasing the likelihood of shocks*

There is evidence that oversized financial systems are associated with financial instability – i.e., the system’s tendency to generate shocks in the first place. The Bank of England has studied this, using total bank assets as a measure of financial system size.<sup>89</sup> It found that there is a correlation between system size and financial stability outcomes – but that this correlation is explained by two other variables, the leverage ratio and the presence of a credit boom (measured as change in the credit-to-GDP ratio). The authors argue that this shows it is ‘the resilience of the system’, and not system size, which is relevant for stability. However, if system size is a relevant factor in determining overall system resilience, this is a circular argument that emphasises the need to study all the different components of resilience in order to place the question of system size in context.

Several other studies take the credit-to-GDP ratio as a measure of financial system size.<sup>90</sup> On this measure, there is good evidence that an oversized financial system is bad for financial stability and for the host economy. For example, an IMF study found that countries with a credit-to-GDP ratio of more than 100% exhibit lower growth.<sup>91</sup> Higher levels of bank credit are also associated with higher levels of bank risk and systemic risk.<sup>92</sup> Alessi and Detken show that a credit-to-GDP ratio above 92% provides an important early warning of impending financial crisis,<sup>93</sup> and faster than usual increases in credit creation, in particular for real estate, are historically among the strongest predictors of crisis.<sup>94</sup>

This links to the question posed by Robert May and others about the explosion of bank balance sheets in recent decades: ‘Can such an increase in assets be real?’<sup>95</sup> As we suggest in our consideration of asset composition, high volumes of non-GDP<sup>96</sup> transactions in the banking system may indicate the presence of asset price bubbles which are unsustainable and will ultimately result in a

crash. This applies at individual bank level as well as at system level: if banks become oversized by engaging in high volumes of speculative ‘casino-style’ activities, they become not only too big to fail but also more *likely* to fail.

Finally, the Bank of England notes that other ‘aspects of banking sector size [...] might have a bearing on financial stability, such as the possibility that the banking system becomes more opaque and interconnected as it grows in size’. This links to our discussion of network structure and complexity and transparency.

## 2.4 Asset composition

All the factors we have considered so far have been properties of the financial system as a whole – its size, diversity, and interconnectedness. The next two factors focus more on the aggregate activities of individual financial institutions – what is actually on their balance sheets, both on the asset and the liability side.

The composition of credit aggregates is significant for resilience because of the risks which bad debt poses to bank balance sheets. We suggest that excessive allocation of credit to financial or asset-market (non-GDP) transactions enhances the risk of asset bubbles developing as increasing quantities of credit chase limited quantities of assets. This is the process described by Minsky’s Financial Instability Hypothesis,<sup>97</sup> where ever-increasing credit drives a self-reinforcing bubble – known in systems science as a ‘positive feedback loop’. Lending is secured against the price of an asset, so as asset prices rise lenders become more confident and are willing to lend more. The cycle continues, giving rise to speculative lending, where the income derived from the asset is only expected to cover the cost of borrowing and not the repayment of the loan itself, because the lender and borrower both expect a profit to arise from the increase in the capital value of the asset. The final stage of the bubble gives rise to ‘Ponzi’ borrowing, where the borrower is relying on rising assets prices to pay both the original loan and the accumulated interest. This stage is inevitably followed by a market correction which can threaten the stability of the whole system as speculative and Ponzi borrowers are unable to renew their loans and forced sales of assets bring prices crashing down.

For example, there is evidence that during the period from 1984 to 2007, credit towards the financial and real estate sectors was driven more by past credit performance than by growth in economic output – an indication of a speculative boom and of rising financial fragility.<sup>98</sup>

In addition to tracking the split between GDP and non-GDP credit allocation, the composition of GDP credit allocation can vary in risk. This is in part a diversity issue: if banks are all herding into the same or similar assets, then risks are concentrated and there is a greater likelihood of systemic collapse. There may also be particular risks attaching to particular types of assets: for example, exposures to market externalities, such as the risk of asset mispricing caused by unrecognised ecological liabilities and risks. There is growing acceptance that fossil fuels in particular are exposed to significant risk of repricing in the event of regulation to meet internationally agreed climate change targets (the so-called stranded assets problem<sup>99</sup>). The Bank

of England has acknowledged this issue<sup>100</sup> and is currently investigating the systemic risks it may pose;<sup>101</sup> the G20 has asked the international Financial Stability Board to do the same.<sup>102</sup>

It is important to note that the riskiness of asset composition at a system level may not be the same as that which is considered risky by individual banks. For instance, the Basel III risk weightings treat mortgage lending as much safer than small and medium enterprise (SME) lending, and so it is rational for banks to weight their assets towards this type of activity. At a macroeconomic level, however, there is a risk that this simply pumps up house prices whilst eroding the resilience of the real economy to future shocks originating in the financial system.

As one of our interviewees observed, it may also be that *changes* in asset composition are particularly relevant for resilience, particularly if they indicate that banks are suddenly beginning to herd into a particular asset class: regulators will want to understand why this is happening and what systemic risks it may entail.

## 2.5 Liability composition

As discussed in Section 1, the fact that banks make use of leverage and engage in maturity transformation means they are exposed to solvency risks (i.e., their capital is not sufficient to cover losses on their assets) and liquidity risks (i.e., they do not have enough liquid assets to cover short-term outgoings such as deposit withdrawals). The way banks fund themselves (i.e., their liability composition) is critical to their resilience to such risks, both individually and at a system level.

Again, this is partly a diversity issue: if banks rely on similar sources of funding, there is a risk that these could all dry up at the same time. However, there is also the separate issue that some funding models are riskier than others. As we saw in Section 1, in recent decades there has been a shift from banks funding themselves primarily from deposits to an increasing reliance on borrowing from other financial institutions, often very short-term. For example, only around half of UK-owned banks' liabilities are customer deposits (derivatives and interbank deposits are the next largest liabilities).<sup>103</sup> It is now widely accepted that this shift enhanced the fragility of the financial system and contributed to the crisis of 2008.

Indeed the IMF has described wholesale funding as 'a major source of instability',<sup>104</sup> because:

- Contrary to pre-crisis assumptions that wholesale lenders would be more effective than depositors at monitoring risky banks, in fact they had little incentive to do this, because much of the funding was so short-term: instead they could simply withdraw funding at the first sign of trouble, as happened during the 2008 crisis.
- Banks often used securitised assets as collateral against which to borrow from other financial institutions via 'repo' (repurchase) agreements – when the value of these assets became doubtful, this source of funding quickly

froze.<sup>105</sup> Effectively, banks' balance sheets were squeezed from both ends, as their assets were falling in value and they were also finding it harder to fund themselves.

- Wholesale funding made the financial system more interconnected – including connections between banks and other financial institutions. When markets began to freeze up, this became a source of contagion through the financial network.

As the IMF study notes, many empirical studies show that reliance on wholesale funding was a major source of bank vulnerability during the crisis.<sup>106</sup> One major international study by the ECB concluded that 'the type of bank funding is a key element in assessing banks' ability to withstand adverse shocks: dependence on short-term market funding and securitisation activity seem to be particularly important in this respect.'<sup>107</sup> More generally, there is evidence that this type of funding is volatile and strongly procyclical – i.e., it expands rapidly during booms and collapses following a crisis.<sup>108</sup> High levels of wholesale funding can therefore be a good lead indicator of vulnerability to crisis.<sup>109</sup>

## 2.6 Complexity and transparency

The final resilience factor relates to the nature of financial assets and liabilities, and in particular how inherently complicated they are and the quality of information about them.

A proliferation of complex and opaque financial instruments exacerbates the risk of mispricing – including 'systematic mispricing' as occurred with sub-prime mortgage-backed securities before 2008.<sup>110</sup> In addition, the securitisation process in particular separates the risk of a loan from the original lending decision, giving banks less incentive to worry about borrowers' true creditworthiness. In the run-up to 2008, this proved to be a toxic mix. The growth of securitisation and derivatives has also enhanced the complexity of interconnections between financial institutions (see earlier section on network structure). Drawing from ecology, it is increasingly argued that this is likely to reduce the robustness of the financial network.<sup>111</sup>

As Battiston *et al.* observe, 'proponents of derivatives have long argued that these instruments help to stabilise markets by distributing risk, but it has been shown recently that in many situations risk sharing can also lead to instabilities.'<sup>112</sup> In a paper published before the financial crisis, Brock *et al.* warned that proliferation of hedging instruments could destabilize markets.<sup>113</sup> A more recent study by Caccioli *et al.*<sup>114</sup> finds that, far from making markets more efficient by diversifying risk, growing complexity in derivatives markets can seriously erode systemic stability. The authors highlight the flaws in the theory typically used to price derivatives, which implicitly assumes that trading activity itself has no impact on the behaviour of markets. Building a more realistic model which takes these dynamics into account, they find that proliferation of derivatives is linked to strong market fluctuations, and that these fluctuations are strongly correlated across different derivatives – as indeed proved to be the case during the 2008 financial crisis, where risks which were thought to be uncorrelated became highly correlated.

In other words, the over-complexity of financial markets can have serious impacts on the functioning and resilience of those markets, which orthodox theory does not account for. Indeed, orthodox theory does not allow for the possibility of 'over'-complexity, assuming that the market is 'complete' once the supply of instruments meets the demand. But, as Battiston *et al.* point out, this does not hold as long as banks have financial incentives to keep on creating new products: past a certain point, 'subsequent trades will serve only to increase the complexity of the network at the expense of stability.'<sup>115</sup> Or as Robert May puts it, 'if the supply of derivatives expands beyond true hedging demand, serious problems can arise.'<sup>116</sup>

Lack of transparency adds to these problems, potentially exacerbating confidence shocks in the event of a crisis: uncertainty over the true nature of liabilities and costs within the financial system means that market participants do not know where in the financial network risks may be hiding. For instance, an absence of information about the individual loans underlying complex products exacerbated the panic in financial markets during 2007/2008, when the opacity of collateralised debt obligations (CDOs) and the inability to assess their value led to a collapse in interbank lending. Indeed, during the 2000s, many banks were deliberately hiring mathematicians to construct financial products so complex that those buying them would not understand them – in some cases with the bank itself actively betting against these products.

Policymakers and regulators have acknowledged some of these risks, and post-crisis regulatory reforms have made some attempts to address them. For instance, while European policymakers are keen to see a revival of securitisation markets, they have also been at pains to stress that they want to encourage 'good' securitisations which are simple, transparent and robust – although organisations like Finance Watch have raised doubts about whether proposed safeguards are sufficient.<sup>117</sup> Banks who engage in securitisation are also being required to keep 5% of the resulting assets on their balance sheets, in an effort to ensure they have a stake in maintaining good lending standards.

Meanwhile, the move towards central clearing of derivatives is designed to replace a complex cats-cradle of connections with a simple 'hub-and-spokes' model where everyone trades via central counterparties (CCPs). However, it is acknowledged that this creates its own problems, since risks will be concentrated in CCPs, who will need to be extremely robust to avoid the danger of becoming 'super-spreaders' of financial contagion themselves. At the same time, some regulatory changes appear to be adding complexity rather than reducing it: for instance, Basel III's increasingly finely-tuned risk weightings for different financial instruments, or the Dodd Frank Act's 848 pages of new regulation (the Glass Steagall Act ran to just 37 pages). We explore this further in Section 4. Arguably this is a result of regulators attempting to micro manage the complexity of the system rather than making structural changes to reduce that complexity, which might be more challenging to the industry.

## 2.7 Other factors

The six factors discussed are those we have taken forward to form the basis of our Financial System Resilience Index, since they are both important to resilience and (at least partially) measurable based on available data. These measurement issues are discussed fully in Section 3. However, these are clearly not the only factors likely to affect financial system resilience. We now discuss some other factors raised by our interviewees and participants in our roundtables, which we agree are relevant to resilience but which we have not been able to include in the index.

### *Risk management*

From a resilience perspective, there is arguably a trade-off between encouraging a diversity of risk management approaches to avoid concentrations of risk, and harmonising risk management to aid transparency for markets and reduce banks' discretion to make overly optimistic assumptions.

The diversity argument in this case is very much the same as the general argument discussed earlier: if banks are all using the same Value at Risk (VaR) models, based on the same orthodox finance theory, and being run based on the same management-school teaching, the likelihood of a system-wide risk management failure is much greater.<sup>118</sup> Convergence of banks' risk-management approaches – driven both by regulation and by received wisdom – was a factor in the collapse of 2008.<sup>119,120</sup>

This poses a dilemma for regulators, especially at international level: since 2008, regulatory reforms have sought to harmonise risk requirements to minimise regulatory arbitrage by large, internationally mobile banks. Whilst this logic is understandable, it may have the unintended consequence of concentrating risks and increasing the likelihood that certain types of risk go unnoticed. Of course, herding and blind adherence to models can produce the same effect, even in the absence of regulation.

This trade-off between comparability and diversity is particularly apparent when it comes to calculating banks' risk-weighted assets. The Basel Committee argues that its internal ratings-based approach 'permits a natural and welcome diversity of risk assessments', and that imposing a single regulatory model 'might encourage herding and risk concentration'. On the other hand, it recognises the need for stronger supervisory safeguards to ensure that banks' figures can be relied on and that their methodologies are transparent.<sup>121</sup> We discuss the impact of the Basel III requirements further in Section 4.

Perhaps ultimately, as one of our interviewees put it, 'what needs to be challenged is the whole idea that risk can be measured and controlled in an uncertain and unknowable world.' Certainly, we should not be placing too much weight on particular risk management models or methods to ensure the resilience of our financial system.

### *Political and regulatory factors*

Other relevant factors include the extent of political and regulatory capture by the financial services industry (for instance, ‘revolving doors’ between regulators and regulated entities, industry lobbying against regulation to reduce systemic risk, or dominance of financial firms in political party funding), and the quality of regulation. This is particularly relevant to the problem of banks that are too big or too interconnected to fail. As Battiston *et al.* argue: ‘It is clear that banks profit from being regarded as too connected, too correlated – and even too complex – to fail, giving them an incentive to engage in excessive risk taking and amplifying the degree of systemic instability. A prudent strategy would therefore not only tame interdependencies and risk taking, but also restrict the power of the financial sector.’<sup>122</sup>

The issue of structural reform to separate retail from investment banking provides just one example of how this dynamic plays out in practice. In the UK, banks lobbied hard against the Vickers recommendations for the ‘ring-fencing’ of retail from investment banking, and critics expressed concerns that the long implementation timetable (which stretches until 2019) would create too many opportunities for banks to water down the reforms. There is some evidence that these concerns are proving to be justified – for instance, with banks seeking to capitalise on the regulator’s promise of ‘flexibility’ in how they comply with the new rules, such as Lloyd’s Bank seeking a waiver on the requirement to have a separate board of directors for its new ring-fenced entity.<sup>123</sup> Meanwhile, industry lobbying seems likely to fatally weaken proposals to implement similar structural reform at European level – which in turn could leave the UK regime more vulnerable to being weakened or dismantled.

### *Cultural factors*

A culture of short-term profit seeking and regulatory arbitrage – the ‘greed is good’ mantra – is widely accepted to have played a part in the excessive risk-taking that preceded the 2008 financial crisis. Since the crisis there have been calls from many quarters to change the culture of banking. However, this concept is nebulous and difficult to quantify. It is also worth pointing out that culture often follows structure, and so it may be more fruitful for policymakers to focus on the more concrete measures already outlined – such as bank ownership, size, and interconnectedness, and the incentives these create towards excessive risk-taking – rather than on exhortations to ‘change the culture’.

Specifically, participants at our first roundtable suggested that shareholder value orientation is a relevant factor in understanding cultural risks to financial system resilience. As the Parliamentary Commission on Banking Standards concluded, pressure from shareholders to meet short-term targets for Return on Equity (ROE) was a large part of the story in the run-up to the crisis: ‘Institutional shareholders have incentives to encourage directors to pursue high risk strategies in pursuit of short-term returns and ignore warnings about mis-selling [...] In the run-up to the financial crisis, shareholders failed to control risk-taking in banks, and indeed were criticising some for excessive

conservatism [...] it would be a mistake to expect greater empowerment and engagement of shareholders to lead to the exercise of profound and positive influence on the governance of banks.’<sup>124</sup>

We agree with this assessment. However, in our view this issue is captured by the D-Index measure of ownership diversity, since systems which are dominated by shareholder-owned banks are likely to perform poorly on this aspect of the index.

### *Operational resilience*

‘Operational resilience’ refers to the resilience of banks’ IT systems to potential failures, including their vulnerability to cyber-attack. Policymakers and regulators are devoting some attention to ‘resilience’ in this sense at present,<sup>125,126</sup> and it has also entered the public consciousness after the failure of the Royal Bank of Scotland’s (RBS’s) computer systems in 2012 left millions of customers unable to access their accounts. However, in this project we are focusing primarily on financial system resilience in terms of the financial linkages that make up the system, rather than in terms of the physical infrastructure that supports these linkages.

## **2.8 Summary of factor framework and potential indicators**

Resilience factor	Potential sub-factors/indicators	Rationale
1. Diversity	‘D-Index’: ownership structure, market concentration, funding model, geographic spread	Diversity known to enhance resilience of complex systems
2. Interconnectedness/ network structure	Concentration of systemically important financial institutions (SIFIs), intra-financial system concentration, cross-border exposures, repo, securitisation	Pattern of connections affects transmission of shocks through financial network – for example large ‘super-spreaders’ connected to everyone else
3. Financial system size (relative to domestic economy)	Bank assets/GDP, debt/GDP, debt/income, ‘too-big-to-fail’ subsidy	High indebtedness increases fragility to shocks; v large financial sectors may become ‘too big to save’
4. Asset composition	Real economy lending ratio, financialisation of credit, stranded asset holdings	Excessive non-GDP credit creation inflates asset bubbles; specific risks attach to particular assets (e.g. fossil fuels, mortgages)
5. Liability composition	Leverage ratio, liquidity risk, foreign bank exposures and funding risks	High leverage and excessive reliance on short-term wholesale market funding increases fragility
6. Transparency/complexity	Securitisation, derivative exposure	Risk of mispricing, exacerbates confidence shocks and procyclicality

## 3. Financial System Resilience Index

We have developed an index to compare the financial system resilience of the G7 countries over time. The results make unhappy viewing for the UK. Despite post-crisis reforms, by 2012 the UK still performed worst on five out of our seven resilience factors, trailing other industrial economies by a wide margin.

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In this section, we develop a comparative financial system resilience index (FSRI) that allows us to undertake an analysis of the G7 major economies: the United States, Canada, Japan, Germany, France, the UK, and Italy.<sup>127</sup> We examine variables for each country through time on an annual basis from 2000 to 2012. This enables us to compare the resilience of each economy before, during, and after the financial crisis. The temporal dynamic is important when assessing the effectiveness of regulations and policies designed to improve financial resilience. Comparing countries at a static point in time only gives us a snapshot view.<sup>128</sup>

To construct the index, we identified one or two indicators for each of the six resilience factors outlined in Section 2 that are available for all the G7 economies. We also include the leverage ratio as a final indicator, because this has been a major focus of regulatory reform to increase the resilience of banks, making seven factors in total. In all cases, these indicators are ratios rather than absolute numbers in order ensure cross-economy comparability. To identify the indicators, we reviewed available data from credible international sources such as the IMF, the OECD, and the World Bank to construct a shortlist of potential indicators, which we then tested with attendees at our first expert roundtable as well as with individual expert interviewees. The final selection of indicators (and factors) was refined based on their feedback. Full datasets are available on request.

For each resilience factor we explain the indicators and why they were chosen and then present the findings across the G7 economies. Our composite index combines the six resilience factors plus leverage by averaging the index scores across all seven variables and is presented at the end of the section.

### 3.1 Corporate diversity and market concentration

This project takes the work of Professors Michie and Oughton on the D-Index measure of diversity in financial services<sup>129</sup> as the starting point for assessing diversity. The D-Index measures diversity in four key areas:

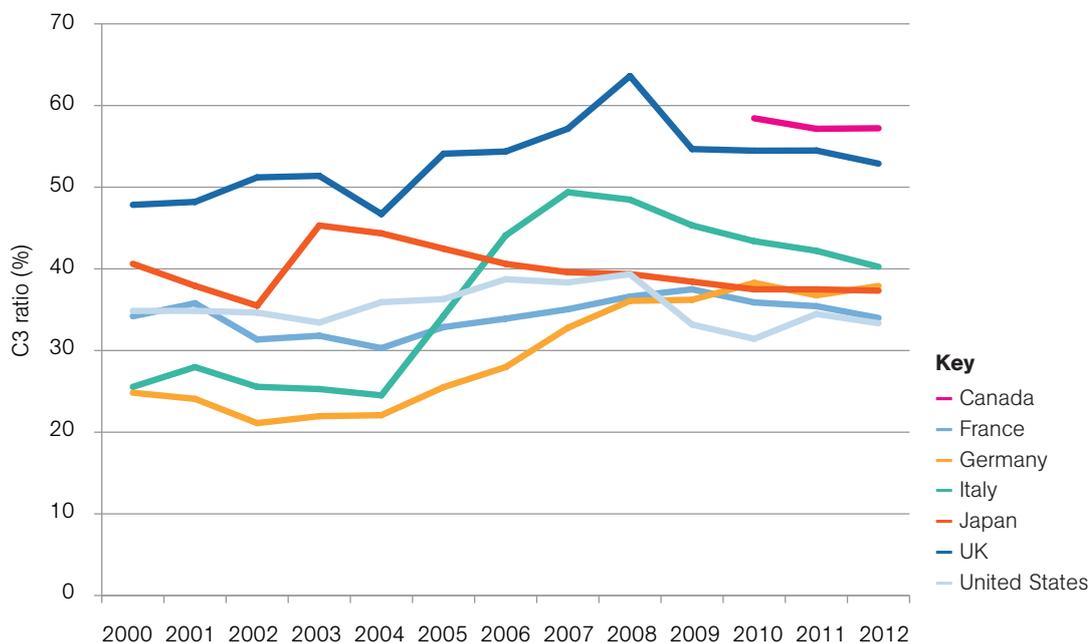
- **Ownership diversity.** The D-Index treats ownership types as analogous to different species in an ecosystem, drawing on the Simpson Index of Biodiversity to construct an index of ownership diversity.

- **Market concentration.** The D-Index uses two measures of market concentration (the Hirschman-Herfindahl index and the C5 concentration ratio) to produce a 'competitiveness index'. However, the authors emphasise that genuine competition is not just about market concentration but about all the other factors measured by the index.
- **Funding model diversity.** The D-Index includes a measure of banks' funding model concentration to capture the risk of all banks relying on similar sources of funding. Of course, some funding models may be less resilient than others; our indicator of liability composition captures the specific risks attaching to over-reliance on risky short-term wholesale funding.
- **Geographical diversity.** The D-Index includes an index of geographic dispersion calculated by measuring the distance of banks' headquarters from the City of London and weighting this based on market share. The authors acknowledge that this is a somewhat crude measure but suggest that this measure is important from a resilience perspective because 'concentration of strategic decision-making power' in certain localities also concentrates risk.<sup>130</sup>

We include two measures of geographical diversity in our international index. We have not been able to replicate the funding model concentration index or the diversity index internationally, but we have included indicators of market concentration and ownership diversity, drawing on the D-Index methodology. Our measure of market concentration includes the top 3 bank assets to total assets concentration ratio for each economy (for Canada we only have data available for the last three years). This is sometimes referred to as the 'C3 ratio' and shows the extent of market dominance by the largest firms in an industry. This data was collected by the World Bank up to 2011 for commercial banks and we combine this with more recent data from the IMF and Bankscope. Figure 5 shows the Top 3 bank asset concentration to total bank assets (including non-commercial banks).<sup>131</sup> We therefore include commercial, cooperative and public savings banks in our universe but exclude banks that are wholly or primarily investment banks with little or no retail banking activities.

The UK has the most concentrated banking sectors in the G7 (with the exception of Canada), with the Top 3 banks controlling over half of all bank assets. The mergers and acquisitions leading up to the financial crisis saw an increase in concentration which was also reflected in Italy and Germany although from lower bases. In contrast, France, Japan, and the USA were less affected by the crisis and their banking markets are more competitive with the top three banks controlling less than 40% of total assets. The general trend, however, is that banking sectors became more concentrated in the 2000s. The fact that Canada has one of the most concentrated banking sectors but experienced very little financial instability during the financial crisis raises some questions about the usefulness of looking only at the concentration or competitiveness when assessing banking resilience or stability.<sup>132</sup>

Figure 5: Ratio of top 3 bank assets to total assets (C3 ratio).



Source: Bankscope<sup>133,134</sup>

The second diversity indicator is an indicator of corporate diversity reflecting different forms of ownership in the retail deposits market. This measure is based on the Michie-Oughton Index of Corporate Diversity,<sup>135</sup>  $CD_d$ , given by,

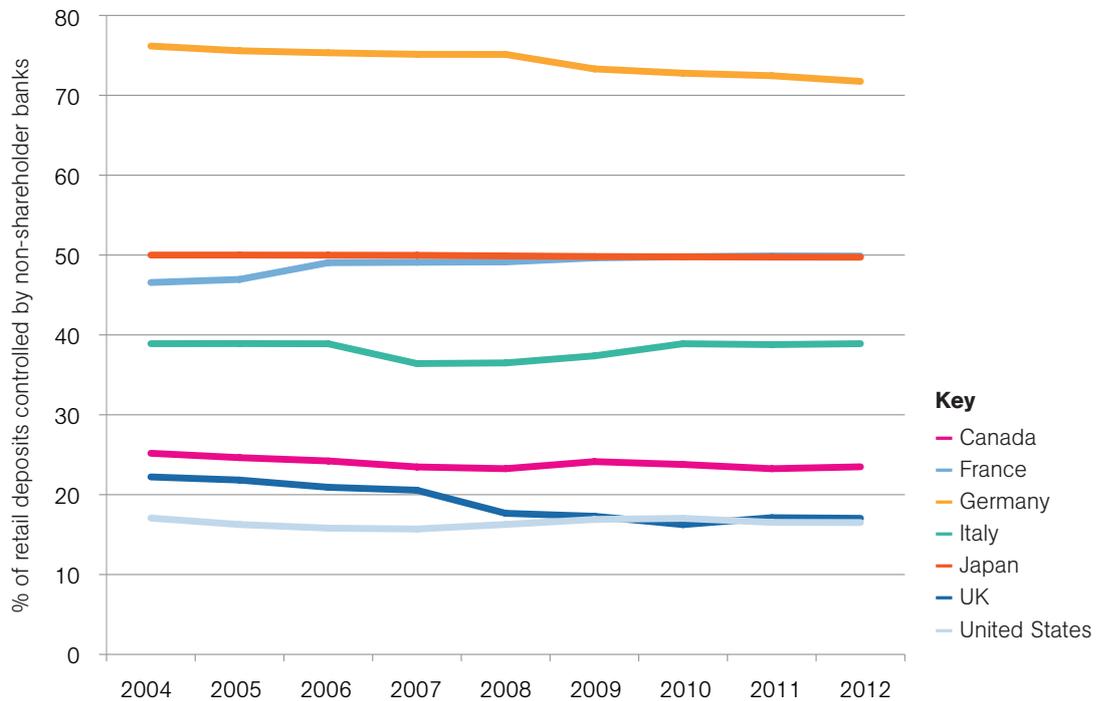
$$CD_d = 1 - \sum_{j=1}^Z \delta_j^2$$

where,  $j = 1, \dots, Z$ , denotes the number of distinct corporate forms and  $\delta$  represents the share of deposits held by each of the types. Based on current data availability for the G7 countries we distinguish two types – commercial banks, and non-commercial banks which comprise mutual, credit unions, and savings banks. The results are shown in Figure 6.

We can see that Germany is far ahead of the other advanced economies in terms of the diversity of ownership of its banking system, with stakeholder banks controlling 70% of retail deposits. The strength and resilience over time of Germany's cooperative and public savings banks – the *Sparkassen* – is evident here. In France and Japan there are also good levels of diversity in the retail deposits sector. This diversity affords these countries greater financial stability as different corporate forms follow different strategies, thus mitigating risk.

By contrast, the three Anglo-Saxon countries (the USA, the UK, and Canada) have a much less diverse retail deposit market. Shareholder-owned banks control between 65% and 85% of deposits in these countries. The UK position has worsened significantly post-crisis as a number of large banks collapsed or were bought up by other players.

**Figure 6. Ownership diversity: Michie-Oughton Index of Corporate Diversity.**



Source: National central bank and banking association data and NEF calculations

However, we should be wary of assuming that these three Anglo-Saxon financial systems are homogeneous in how ownership structure translates into lending behaviour. First, the USA has over 7000 local community banks with a strong local focus and deposit base. In a range of ways, these smaller banks, often family owned or held by private shareholders rather than traded on public stock markets, act more like cooperatively owned banks – for example they engage in relationship banking and maintain more extensive branch coverage.<sup>136</sup> Their wide geographical dispersion introduces greater diversity to the US banking system than in the UK. Geographical diversity is a component of the UK D-Index but we have not been able to include this in the International index due to lack of available data.

A significant proportion of business loans to SMEs in Canada are made by credit unions, which collectively hold 17% of the SME lending market despite only having a 5% market share of deposits.<sup>137</sup> By contrast, the UK credit union sector does not lend to businesses at all and was only recently legally allowed to do so.

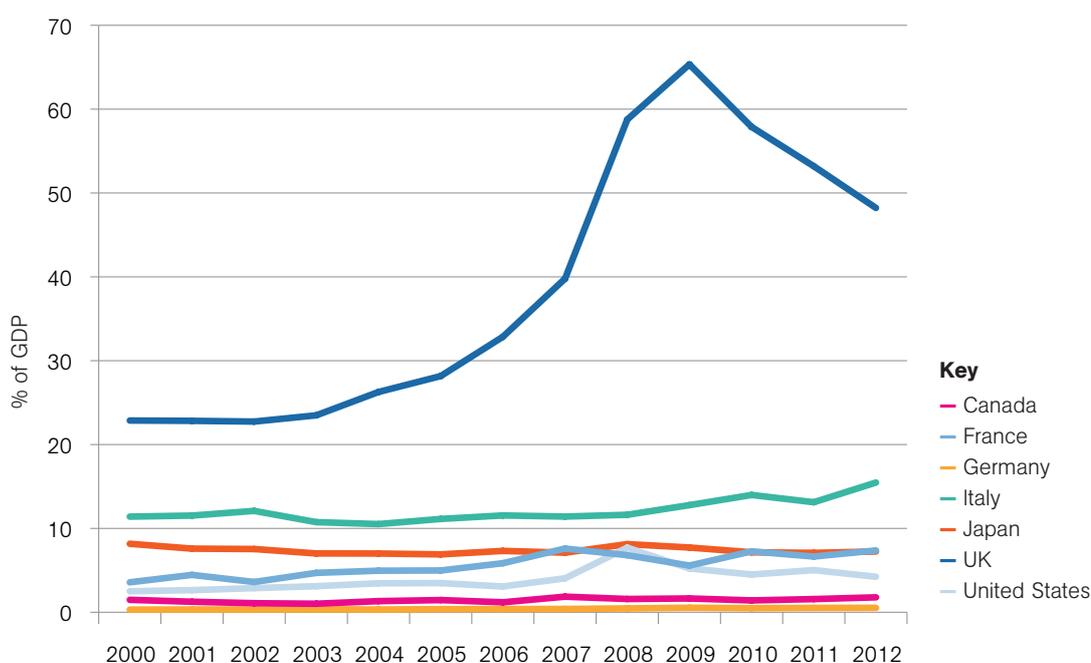
### 3.2 Interconnectedness and network structure

There is neither sufficient consensus nor sufficient data to satisfactorily measure the exact pattern of connections most conducive to resilience. However, it does appear that, contrary to pre-crisis received wisdom, high overall levels of intra-financial system connectivity can enhance the system's vulnerability to system-wide shocks. There is also evidence that cross-border linkages may be particularly likely to act as channels of contagion in such a scenario, as foreign branches withdraw lending.

We use two simple proxies for these factors, which are far from perfect but at least allow for some comparative analysis. However, we recognise that this does not capture all of the factors discussed in Section 2. Enhancing our understanding of network dynamics and improving the availability of data on network structure should be high priorities for researchers and regulators.

Our first indicator is bank lending to other financial corporations (OFCs) as a proportion of GDP. OFCs are defined as 'other financial intermediaries (excluding deposit-taking institutions, i.e., banks and central banks), financial auxiliaries and insurance corporations and pension funds'.<sup>138</sup> This category includes the shadow banking system – corporations engaged in financial leasing and commercial or consumer finance, security and derivatives dealers, special-purpose vehicles created by banks to hold securitised assets and holding corporations controlling financial sector subsidiaries.

**Figure 7. Lending to other financial corporations (excluding banks) as a % of GDP.**



Source: National Central Banks

As we can see in Figure 7, the UK has, by some distance, the most interconnected financial system according to this measure. Loans to OFCs hit 65% of GDP in 2009 before receding to 48% in 2012. Meanwhile the G7 average ratio was just 8% of GDP.

The second indicator captures banks' exposures to the international financial system, capturing foreign claims to all sectors (other financial corporations, households, businesses and governments) using data collected by BIS.<sup>139</sup>

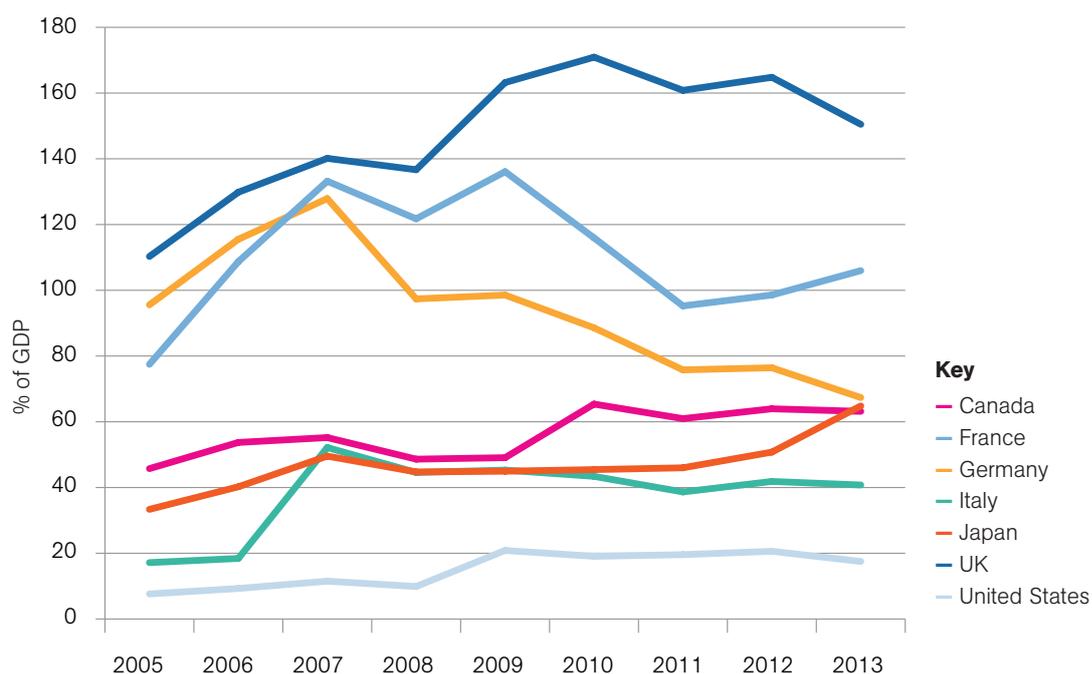
Cross-border banking claims have increased sharply since the mid-1990s, reaching more than half of global GDP in 2007 but then reversing following

the financial crisis to around one-third of GDP.<sup>140</sup> Within this global distribution, however, claims are highly concentrated in a few core economies, including the UK, the USA, and Japan, – as research by the IMF has shown.<sup>141</sup> The UK has high levels of exposure to its G7 neighbours Japan, the USA, France, and Germany, as well as the Netherlands. This makes UK banks vulnerable to further problems in the Eurozone.

As shown in Figure 8, UK banks' cross-border claims are around 150% of GDP, considerably larger than the other G7 countries. The UK financial system's foreign exposure has not decreased significantly since the financial crisis, in contrast to our European neighbours France and Germany. Equally worrying for the UK may be our banks' fast growing exposure to China, as noted by the Financial Policy Committee,<sup>142</sup> where there are perceived risks around real estate.

The existence of three international universal banks – Barclays, HSBC, and RBS<sup>143</sup> – as well as the City of London being an international financial centre – means this figure is unlikely to change in the near future.

**Figure 8. Banks' foreign claims by country as % of GDP.**



Source: BIS, Locational banking data, accessed from <http://www.bis.org/statistics/bankstats.htm>

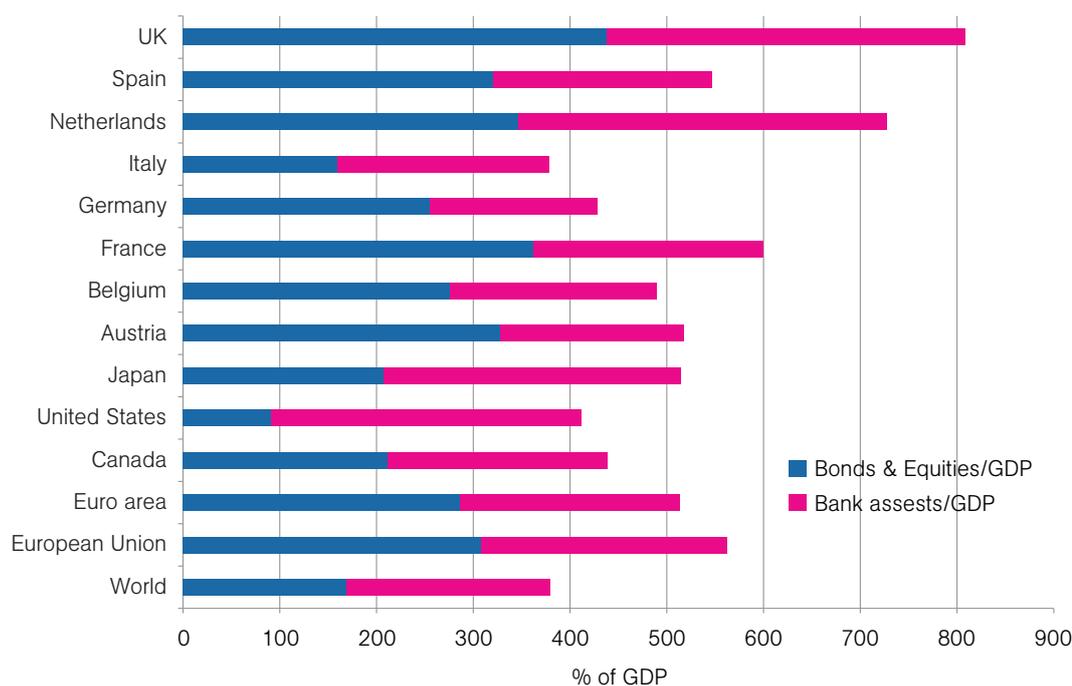
### 3.3 Financial system size

One approach to measuring financial system size is to measure total bank assets relative to the size of the domestic economy. Measures of total bank assets are typically based on either ownership (i.e., including assets of overseas branches and subsidiaries owned by UK banks, but excluding assets of UK branches and subsidiaries of foreign-owned banks), or on residency (i.e., including assets of all financial institutions located in the UK regardless of ownership). As one of our interviewees pointed out, from the point of view of

direct fiscal costs, neither of these measures will give a completely accurate picture, since what really matters is which parts of a bank the UK taxpayer stands behind. However, this depends on individual banks' resolution plans, which are not made public, so it is not currently possible to measure financial system size in this way. The fact that the Bank of England finds evidence of a link between the standard measures of financial system size and the direct fiscal costs of bank failure suggests that these cruder measures are nonetheless a reasonable proxy.

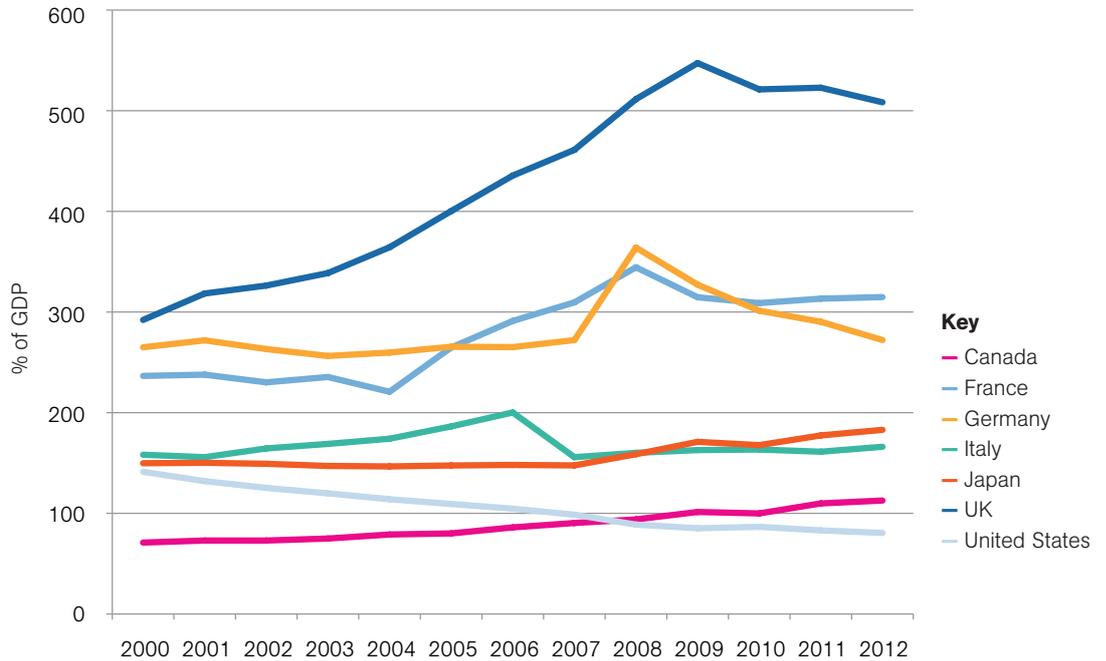
On all these measures, the UK has one of the largest financial systems in the world in relation to this size of its economy (measured as a percentage of GDP; Figure 9). Although the City has always been a global centre of finance, it is only since the turn of the twenty-first century that the UK's banking system has grown significantly larger than the other G7 members, as shown in Figure 10. Indeed France is the only other G7 nation to have experienced significant growth in bank assets to GDP since 2000, whilst the USA has actually shrunk by this measure.

Figure 9. Financial system size in 2012 as % of GDP.



Source: IMF<sup>144</sup>

Figure 10. Total bank assets to GDP (%).

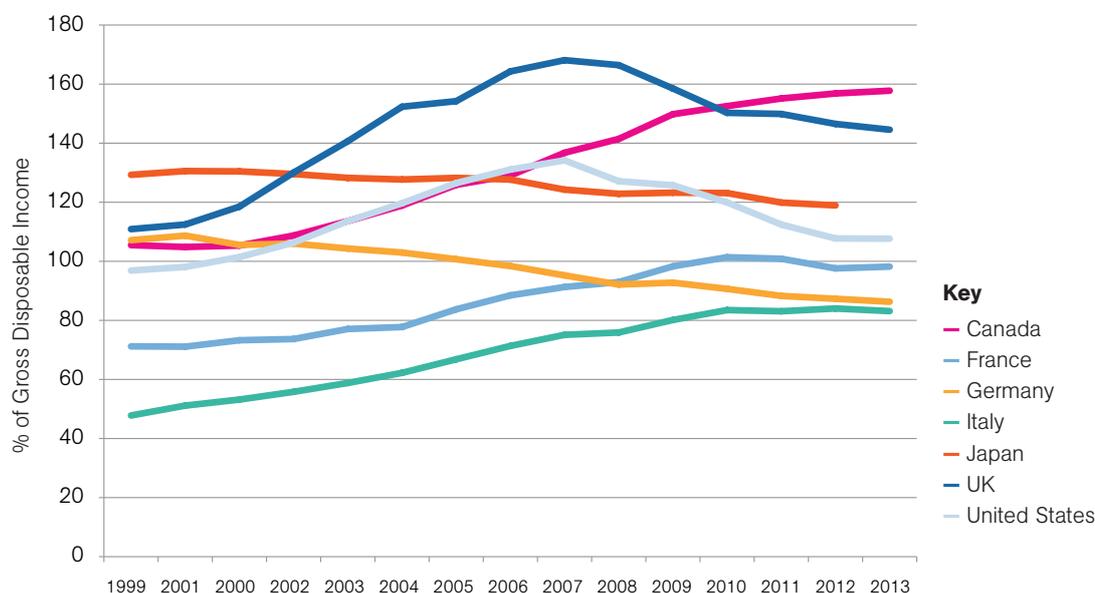


Source: IMF, ECB, Canadian Statistics (CANSIM)

Of course, total-bank-assets-to-GDP is a very broad measure. Not all bank assets are equal and some forms of debt expansion are considered more sustainable than others.

The level of private household debt to income is often viewed as a good measure of the fragility of an economy. Hence we include the debt of households as a percentage of gross disposable income (from the OECD) as our second financial system size indicator. As shown in Figure 11, the UK had the highest household-debt-to-income ratio in the G7 until quite recently, when it was overtaken by Canada. Although there is some evidence of UK households reducing their debt exposure after the financial crisis, in contrast to other G7 members, the most recent data shows that unsecured personal debt is increasing again<sup>145</sup> and the Office for Budget Responsibility is forecasting household debt as a proportion of GDP to exceed pre-crisis levels by 2020. Household debt at 140% of income and rising means the UK economy remains vulnerable to macroeconomic shocks and limits the options for monetary policy.

Figure 11. Debt of households as % of Gross Disposable Income.



Source: OECD<sup>146</sup>

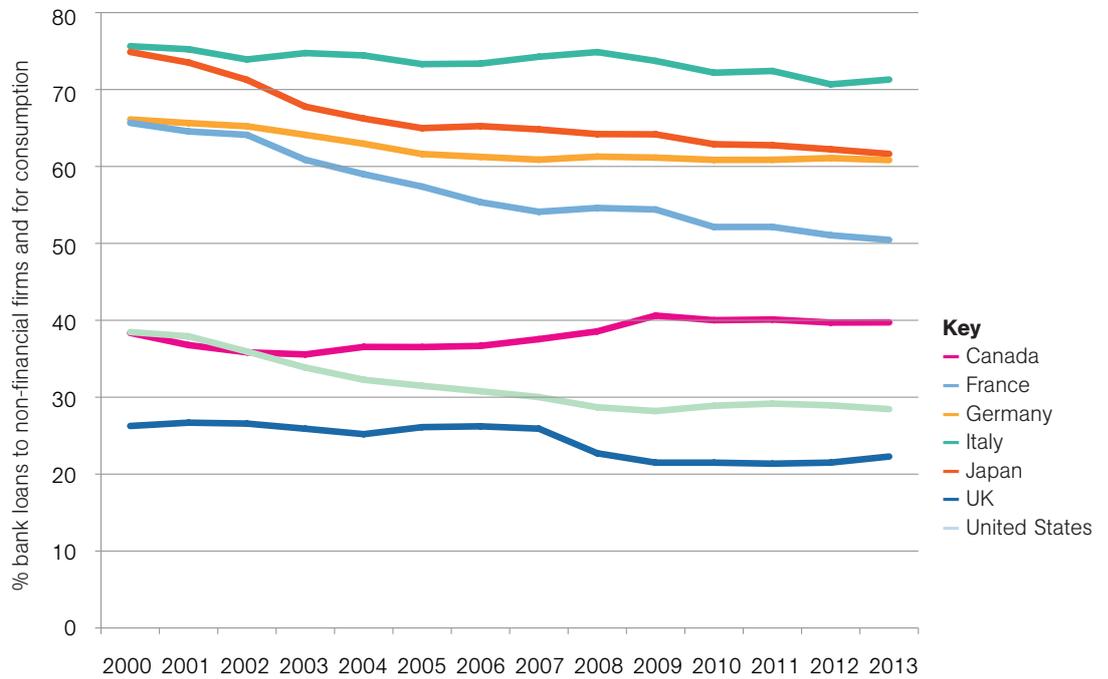
### 3.4 Asset composition

To measure the type of lending banks engage in, we use a 'narrow real economy credit ratio' which takes the stock of lending to non-financial corporations and households for consumption and divides this by total bank lending. For this calculation, total bank lending includes mortgage lending and lending to OFCs but excludes lending to the public sector.<sup>147</sup> Although mortgage lending is included in our broad definition of real economy lending (Section 1.2), we exclude it from our narrow measure for assessing resilience because although mortgages serve a socially useful purpose in smoothing consumption and enabling home ownership, mortgage lending does not increase the nation's stock of productive capital or directly contribute to GDP and can contribute to the development of asset price booms and busts.

This can also be taken as a measure of financial system functionality, since the social purpose of bank lending is to support the real economy. But to be clear, in this instance we are concerned not with the question of functionality in and of itself, but with the potential impacts on resilience of a high level of 'non-real economy' lending (e.g. lending to other financial corporations and mortgages). In most cases, this type of lending is lending against existing rather than new assets and is likely to increase the price of those assets, whether they are existing homes, stocks, or commodities – thus inflating asset price bubbles.

As shown in Figure 12, the UK has the lowest real economy credit ratio of the G7 nations at just over 20%. In contrast, in Italy, Japan, Germany, and France the ratio is over 50%.

Figure 12. Real economy credit ratio.



Source: National central banks

As regards the issue of 'stranded assets' (Section 2.4), some data are available on bank lending to fossil-fuel companies based on voluntary disclosure initiatives, but it tends to be patchy and often of poor quality.<sup>148</sup> At present there is no comprehensive disclosure process for assessing banks' exposures to carbon assets.<sup>149,150</sup> This factor is not, therefore, represented in our FSRI.

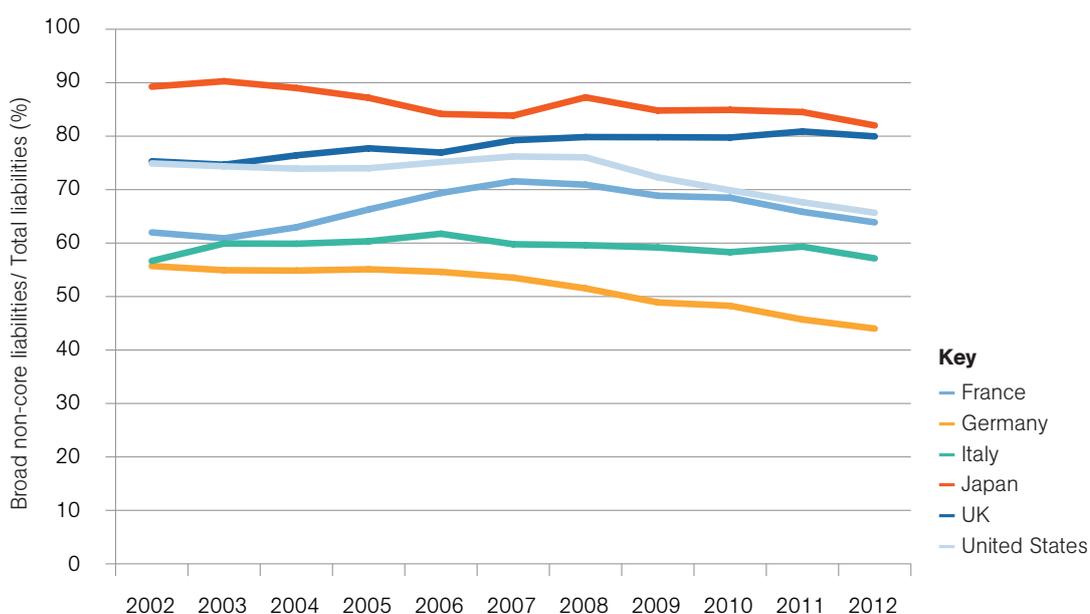
### 3.5 Liability composition and risk

The IMF has recently developed a new and comprehensive measure of 'risky' funding which it refers to as 'non-core liabilities'.<sup>151</sup> It defines core liabilities as regular retail deposits from domestic creditors, all of which are originally issued by banks. Non-core liabilities are defined as foreign deposits, funds raised by issuing debt securities, loans, Money Market Fund (MMF) shares, and from 'certain types of restricted deposits, which due to their nature do not qualify as core funding (e.g. compulsory savings deposits)'. This broad definition encompasses the shadow banking system, since such non-core liabilities may be issued not only by banks but also MMFs and OFCs. Inter-bank and central bank borrowing is excluded from this definition.<sup>152</sup>

The IMF publishes two versions of this metric: *broad non-core liabilities* are gross of intra-financial system relationships (i.e., where one bank's asset is another's liability), while *narrow non-core liabilities* net these out against each other. The IMF regards the broad measure as the better indicator and so we have used this for our FSRI. In addition to serving as an indicator of funding risk, this measure also gives an indication of the size of the shadow banking system, and of intra-financial interconnectedness.

With the exception of Japan, the UK's banking system has the highest ratio of non-core to core liabilities in the G7 as shown by Figure 13.<sup>153</sup> It also has the highest ratio on the narrow IMF metric as shown by Figure 14. UK banks can thus be seen to be more vulnerable to financial shocks generated within the domestic and international financial system. It is also notable that the UK is the only G7 economy that has actually expanded its non-core funding ratio since the 2008 financial crisis, whilst the other economies have been deleveraging in this area.

**Figure 13. Broad non-core liability ratio (excluding Canada).**

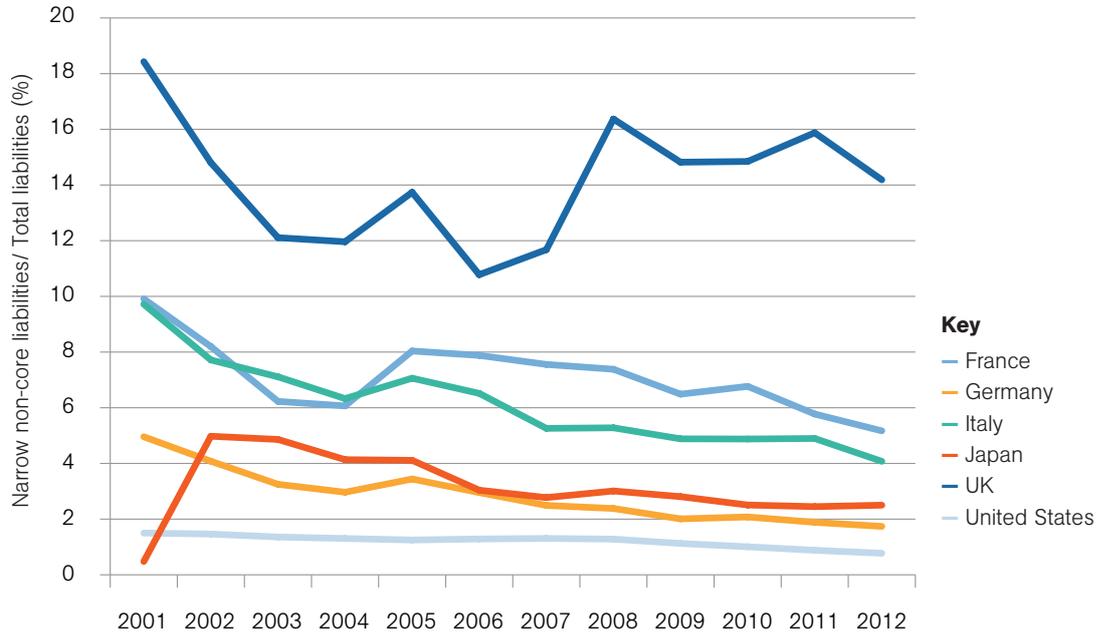


Source: IMF, Harutyunyan et al (2015), 'Shedding Light on Shadow Banking', Working Paper No. 15/1

### 3.6 Complexity and transparency

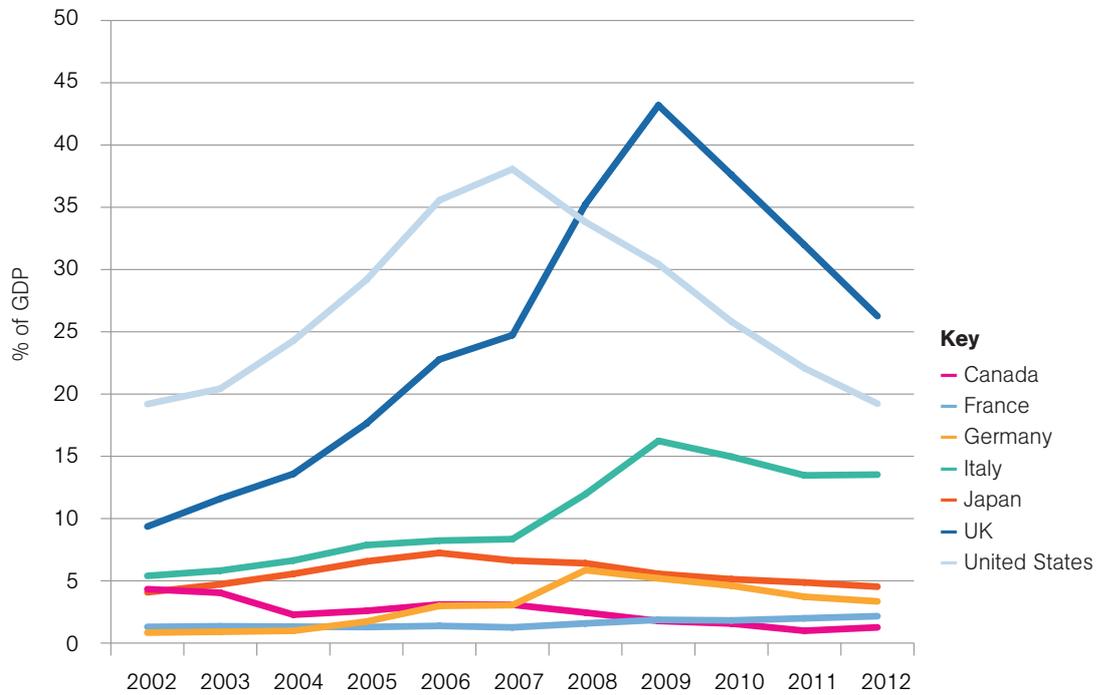
Andrievskya and Semenova<sup>154</sup> have developed a transparency index based on banks' answers to the World Bank's Banking Regulation and Supervision Survey.<sup>155</sup> However, this focuses largely on the transparency of banks' own policies and procedures, whereas we are more concerned with the transparency and complexity of the financial network. We suggest that derivatives exposure and securitisation are reasonable proxies for this, given the particular risks associated with these instruments and their ability to act as a barometer of financial system complexity. Since we were unable to find a good cross-country measure of derivatives exposure, we look at securitisations only in this report.

Figure 14. Narrow non-core liabilities ratio (excluding Canada).



Source: Source: IMF , Harutyunyan et al (2015), 'Shedding Light on Shadow Banking', Working Paper No. 15/1

Figure 15. Securitisation outstanding as % of GDP.



Sources: Europe & USA: SIFMA <http://www.sifma.org/research/statistics.aspx>, Canadian Statistics Office (CANSIM Table 176-0023 & 176-0069), Bank of Japan (Flow of Funds, code FF'FOF\_FFAB100L320)

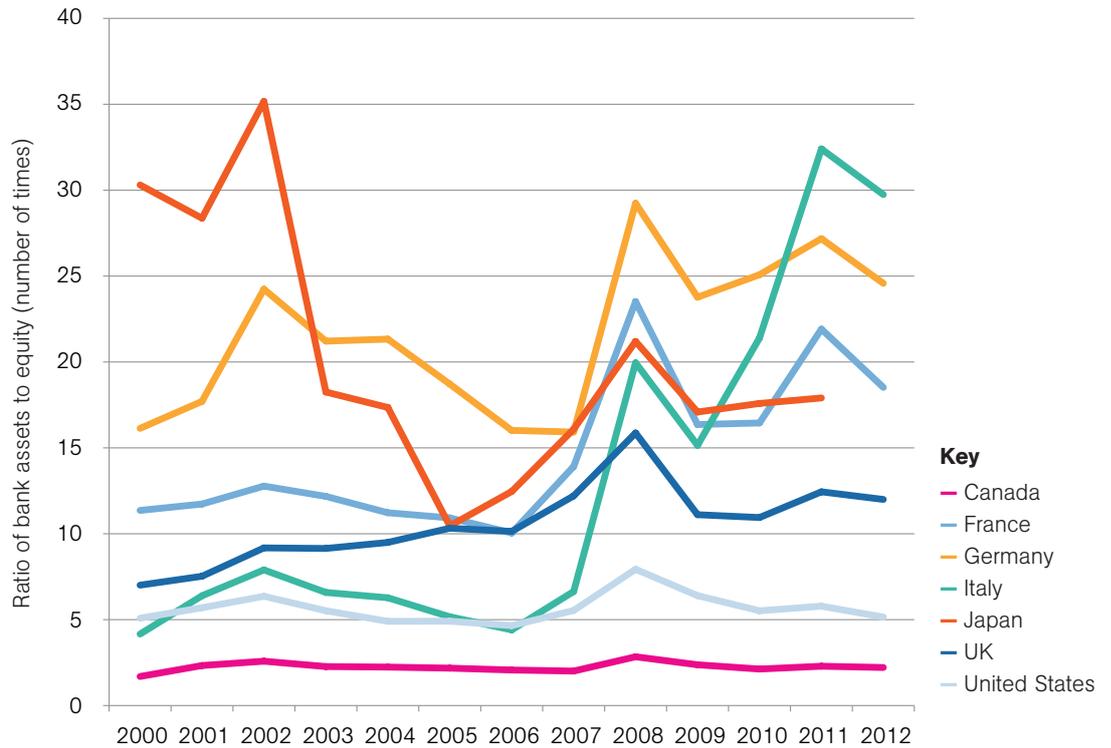
We collected data on outstanding securitisations as a percentage of GDP as an indicator of the complexity of our G7 banking systems (Figure 15). This total measure includes short-term asset-backed and longer-term mortgage-backed securities. Of course, a considerable portion of securities may be considered ‘vanilla’ and fairly transparent. However, it was not possible to find a more precise measure of complex securitisations (e.g. Collateralised Debt Obligations) across the G7 economies. In addition, as argued in Section 2, there are reasons to think that excessive volumes of securitised assets may increase system fragility even if they are relatively simple and transparent.

Figure 15 shows the UK has the largest level of securitised assets relative to GDP in the G7, overtaking the USA<sup>156</sup> which significantly deleveraged following the 2008 crisis. The UK securitisation market has also been declining rapidly since 2009 but remains much larger than our G7 competitors.

### 3.7 Leverage

Perhaps the most widely accepted measure of bank risk and resilience to shocks is a simple leverage ratio, which is a bank’s capital (or equity) to total assets. Studies show that simple leverage ratios perform much better than complex risk-weighted capital ratios as a predictor of bank failure,<sup>157</sup> and at a macroeconomic level, the Bank of England has found that leverage is associated with financial instability.<sup>158</sup> However, different approaches to calculating bank assets can make international comparisons of leverage difficult. We use the OECD’s definition of assets which includes ‘currency and deposits, securities and loans as recorded on the asset side of the financial balance sheets of these financial sub-sectors’ whilst equity refers to ‘shares and other equity, except mutual fund shares, as reported on the liability side of their financial balance sheet’.<sup>159</sup> This is because the OECD was the most reliable source of internationally comparable data we were able to find.

As shown in Figure 16, the UK banking system is not as highly leveraged as its European neighbours or Japan but both the USA and Canada have lower leverage. The UK also did not experience as rapid an increase in leverage as these other countries during the financial crisis on average across the sector, but this covers up the fact that several institutions did actually become insolvent. This is one of the weaknesses of looking at average leverage across national banking sectors – it can disguise highly leveraged institutions which, if large, can cause systemic problems if they run in to trouble. In the UK, the quick recapitalisation of the banks from Government bail outs and fresh equity raised through huge rights issues on the London Stock Exchange helped bring down the UK leverage ratio.

**Figure 16. Bank assets to equity (Leverage).**

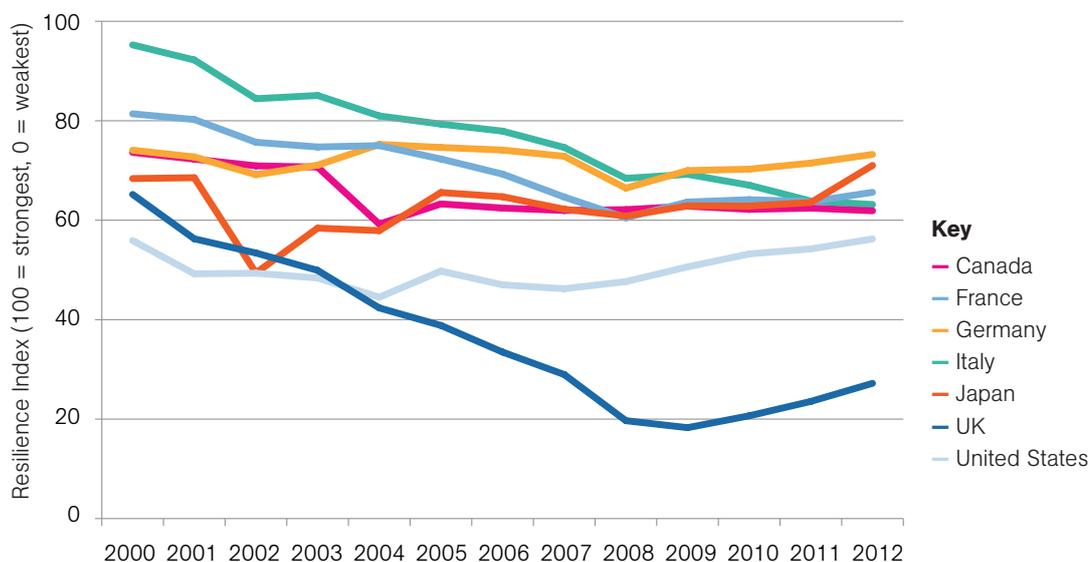
Source: OECD (2015).<sup>160</sup>

### 3.8 Overall International Financial System Resilience Index

Finally, we present our composite International Financial System Resilience Index, combining all seven resilience factors and giving equal weight to each. We surveyed our expert participants on the relative importance of our six core domains; whilst they tended to rate diversity and network structure as slightly more important and asset/liability composition as slightly less important, the differences were not large enough or consistent enough to justify applying weights. Of course, this could change in the future as our understanding of system dynamics and/or the available data becomes more sophisticated, and this is an area for further research.

To index each indicator on a scale of 1–100, we made the worst (least resilient) score across all countries for all years equal to zero and the highest score equal to 100. So, to take the case of Household Debt, where we use household debt to gross disposable income as our ratio, we made 0 equal to 186.79%, which was the highest ratio across all the countries for all years (the USA in 2012) and 51.44% was the lowest ratio, equal to 100 (Italy in 2000). The results are shown in Figure 17.

Figure 17. International Financial Systems Resilience Index chart.



Source: NEF calculations

The composite index does not make for happy viewing for the UK. The UK's overall financial system resilience deteriorated significantly, and more sharply, than our fellow G7 nations in the period leading up to the financial crisis. This trend weakens one of the standard arguments in defence of the UK financial system – that its size and related periodic fragility are features of long-standing historical developments with the City of London being a global financial centre. In fact, whilst the UK was never likely to have the most resilient financial sector according to our definitions, the very rapid deterioration in the mid-2000s shows the current situation is the result of recent developments. For instance, the period was a time of huge mergers and acquisitions and a huge expansion of speculative and complex bank activities, trends which seem likely to have driven the marked changes in many of our indicators – from market concentration to liability composition to transparency and complexity.

As our index shows, the result is a system that is unusually large and homogenous, highly interconnected (both domestically and internationally), highly complex, and highly reliant on wholesale market funding when compared to other countries. In addition, levels of indebtedness are high and the proportion of real economy lending is strikingly low.

This suggests that the domestic economy remains highly exposed to vulnerabilities in the financial system while, conversely, the financial system is not performing well in terms of its basic social and economic functions.

Indeed, the only one of our seven indicator categories where the UK fares better is on leverage which, fortunately perhaps for the UK, is the measure most commonly used by regulators, along with capital adequacy requirements. Although there are signs of improvement in the post-crisis period (2009–2012), there remains a very large gap to other advanced economies (see Table 2)

The fact that the UK retains its own central bank and a sovereign currency of course gives us considerably more flexibility than some of our European neighbours. The Bank of England's Quantitative Easing programme and the government's massive bail-outs are important explanations as to why the UK economy survived the financial crisis of 2007/2008 despite having a less resilient financial system.

By drawing on the historical empirical data presented in this section, we can confidently state that the UK currently has the least resilient financial system of any G7 country. In the next section we apply our resilience indicator framework to a forward-looking assessment of a number of scenarios for market and policy developments in the UK. Can we expect the UK's financial system resilience to improve?

**Table 2. Financial System Resilience Index: Country Ranking (2012).**

Country	Rank	Resilience Rating (max=100)
Germany	1	73
Japan	2	71
France	3	66
Italy	4	63
Canada	5	62
USA	6	56
UK	7	27

Source: NEF Financial Systems Resilience Index

## 4. Financial system resilience in the UK: looking ahead

The UK has failed to recover the ground it lost during the 2000s, but can we expect our financial system's resilience to improve in future? We examine five realistic policy and market development scenarios, concluding that those which introduce real diversity into the current system – such as new local banks, P2P lending or separating big banks – are the most promising.

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We have identified various factors known to affect financial system resilience, set out how they can be measured, and used this to construct an international comparative index. Measurement is only useful, however, if it aids policymakers in diagnosis, prognosis, and prescription. Accordingly, in this section we consider what impact various policy and market developments might have on future trends in UK financial system resilience. We draw on evidence from our second expert roundtable, in which we asked participants to consider five scenarios in the context of our resilience framework.

The general UK picture painted by our comparative FSRI is supported by more detailed UK-only data. For instance, the recent update of Michie and Oughton's D-Index finds that diversity in the savings and mortgage markets have both declined by around 20% from the peak in 2004.<sup>161</sup> There are a number of reasons for this. Many overseas specialist mortgage providers left the UK market after the financial crisis. The merger of HBOS with Lloyds Banking Group removed a significant bank headquartered outside London, reducing location diversity, and most recently, the sale by the Co-operative Group of a majority stake in its banking subsidiary, Co-operative Bank PLC, to private shareholders significantly reduced diversity of ownership.

All of this suggests that we cannot be complacent about the impact of post-crisis developments on UK financial system resilience.

But what might be the impact of reforms yet to be fully worked through, such as Basel III's capital requirements or the ring-fencing of retail from investment banking, or of policy proposals not yet on the table? And how might market developments such as the rise of challenger banks, or of more innovative alternative financial providers such as peer-to-peer (P2P) lenders, impact on our resilience factors? We consider five possible scenarios.

## 4.1 Scenario 1: a rise in P2P lending

### *The scenario*

P2P lending refers to online platforms that connect borrowers and lenders directly without the use of an official financial institution as an intermediary (although these platforms are themselves now regulated by the Financial Conduct Authority (FCA)). The umbrella term P2P covers a number of different platforms with different models. Although lenders choose the amount they want to lend and the duration, platforms vary beyond this in the extent to which lending decisions are genuinely decentralised, with some P2P platforms looking and feeling very much like bank accounts. P2P lenders are still responsible for assessing borrowers' creditworthiness and mainly use credit scoring algorithms similar to high street banks rather than 'relationship banking'. Some consumer lending platforms (such as Zopa and Ratesetter) also use algorithms to automatically allocate lenders' money across a pool of different borrowers, and maintain special funds to protect lenders from borrower default. This means that the platform, rather than the individual lender, is the main locus of risk management. However, the ultimate risk of default is still distributed among individual lenders.

The UK P2P lending market is growing rapidly, and has more than doubled in size year on year from £267 million in 2012 to £666 million in 2013 to £1.74 billion in 2014.<sup>162</sup> P2P business lending, the majority of which goes to SMEs, is growing at an even faster rate than consumer lending, increasing from £200 million in 2013 to £902 million in 2014 (Table 3).<sup>163</sup> If P2P business lending reached the £1 billion level by the end of 2014 this would be around 2.3% of total bank SME lending according to 2013 data.<sup>164,165</sup>

**Table 3. P2P lending 2013/2014.**

£s	Consumer lending		Business lending	
	Stock	Gross flow	Stock	Gross flow
2013q3	486.6	80.1	201	52.8
2013q4	579	92.8	370.9	100.3
2014q1	704.9	115.8	502.4	131.5
2014q2	832	128	650	184
2014q3	986	153	902	253

If the P2P lending market continued to expand to around ten times its current size (which, if current growth rates continue, could happen within the next five years) it would make up around 25% of total bank SME lending (based on 2013 figures). What would be the impact of this scenario on resilience?

### *Potential impacts on financial system resilience*

Advocates of P2P argue that it enhances system resilience, and point out that P2P lenders such as Zopa performed better than commercial banks during the financial crisis of 2008. From a **diversity** perspective, P2P lending does involve a different business model from that of banks: P2P lenders generate profits not from the interest charged on leveraged loans and maturity transformation but from charging customers a fixed fee for connecting lenders and borrowers. A recent survey also found the geographical spread of P2P lenders and borrowers to be broadly representative of the population distribution of the UK, suggesting that this development could be positive for geographical diversity.<sup>166</sup>

In theory, P2P lending disperses both lending decisions and the associated **risk** throughout the network of individual lenders and borrowers, rather than concentrating them in large financial institutions. Typically, each lender will be connected to many different borrowers and vice versa (on average it takes 796 micro-transactions from individual lenders to fund one P2P business loan).<sup>167</sup> As well as avoiding concentrations of risk, this should mean that lending risk is not distorted by deposit insurance or TBTF subsidies as with banks. P2P lenders are not protected by deposit guarantees – although, as one of our roundtable experts pointed out, a major crisis in P2P could test this, particularly if it affected vulnerable or politically important consumers.

P2P lenders do not create money when they make loans in the way that banks do. This means that a transfer of market share from the banking sector to P2P would decrease the **size of the banking sector relative to GDP**, to the extent that banks did not react by expanding their lending in other sectors of the economy. In the short term this would have potential deflationary impacts which could weaken resilience elsewhere in the system, for example by affecting monetary policy or by giving banks a stronger hand to lobby for lower capital requirements.

The same would not necessarily apply if P2P lenders were serving borrowers hitherto excluded by mainstream banks (evidence suggests that this is true of P2P business lending, although less so for unsecured personal lending). However, such a shift might still have indirect impacts on banking system size. For instance, in terms of **bank liability composition**, a major shift of savings to the P2P sector would put pressure on the liability side of bank's balance sheets as term funding (i.e., money deposited for fixed time periods such as fixed rate bonds and ISAs, as opposed to sight deposits available for immediate withdrawal) would be withdrawn from the banking and building society sectors, making it likely that banks would contract their lending.

Having said all this, as we discuss later, the monetary impacts of securitised P2P would be different from those of simple P2P. The Bank of England has indicated that it may be conducting research on the implications of innovations like P2P for money creation and monetary policy, and we suggest that this may be a particularly fruitful area for examination.<sup>168</sup>

With regard to **asset composition**, there is strong evidence that SMEs are able to access loans from P2P lenders that they could not get from retail banks.<sup>169</sup> This gives weight to the argument that P2P lending is more focused

on productive lending and less likely to fuel speculative asset price bubbles. Having said this, secured lending for real estate mortgages is one of the fastest growing areas of P2P business lending; this sector is clearly not immune from these risks.<sup>170</sup> There is still the danger that many P2P platforms could suffer similar losses at the same time. The systemic impacts of this would depend in part on how these platforms were connected to the rest of the financial network.

The impact of P2P lending on **interconnectedness** would depend very much on how the industry evolves, and in particular whether it remains dominated by a simple retail model (i.e., connecting individual lenders and borrowers) or evolves into something more 'industrialised' and financially engineered. Two trends are particularly important here: securitisation/the development of a secondary market in P2P loans, and the growing involvement of existing financial institutions with P2P platforms.

In conventional P2P, the contract is between the lender and borrower: the platform itself is not a party to the contract and so cannot sell on the loan. However, some forms of P2P lending (notably in the USA – e.g. Lending Club and Prosper) actually involve P2P platforms making loans themselves and issuing lenders with notes backed by the income stream from the loans, using a special purpose vehicle (SPV). In this case, the platforms themselves can securitise the original loans: for example, in November 2013, US student lender SoFi announced a deal with Barclays and Morgan Stanley to create a bond backed by P2P student loans.<sup>171</sup>

This has very different implications for network structure from a simple P2P lending model: the P2P platform becomes an important 'node' in the system in its own right, rather than simply a means of connecting lots of minor nodes, while the claims and obligations associated with P2P loans could end up anywhere in the system. In important ways, this model breaks the direct link between lender and borrower which distinguishes P2P lending from shadow banking: borrowers are dealing with the platform's SPV rather than the end investor, while investors simply derive income from owning a bundled security and do not have the power to sell or adjust individual loans. Securitised P2P reopens the door to many of the risks associated with commercial banks. As the Financial Times notes, 'For investors, securitisation promises a higher degree of leverage.'<sup>172</sup> It also enables maturity transformation and collateralised lending.

For these reasons we rate the impact of P2P growth on **leverage** as indeterminate. Simple P2P lending should reduce overall system leverage because P2P investors directly absorb the full extent of defaults by P2P borrowers. However, new P2P models reintroduce leverage when P2P companies take risk onto their own balance sheet.

A related trend is for the P2P market to attract large institutional investors, such as hedge funds and wealth managers, as well as retail customers (i.e., individuals wishing to lend their surplus cash). These are now said to account for over half of all loans made via the US platform Lending Club.<sup>173</sup> Experts at our roundtable felt that P2P lending in the UK was only likely to reach the size given in the scenario with an influx of institutional money. This could effectively

turn P2P into part of the shadow banking system where it can fuel procyclical leverage among investors and create new channels of contagion in a crisis. The impact of a rise in P2P lending driven by retail customers, who are unlikely to be using leverage and will probably hold on to their loans, would clearly be very different from one driven by highly leveraged institutional investors who then securitised their loans or used them as collateral on the repo market.

The arrival of institutional money would also create different pressures on lending criteria. For instance, SMEs that were rejected by banks could end up being rejected by P2P platforms as well if they do not fit the credit scoring criteria demanded by institutional investors; or platforms could face more pressure to offer socially undesirable but highly profitable loan products. This would neutralise many of the benefits of P2P in terms of asset composition. Finally, the systemic impacts of a P2P failure would be much greater if its creditors included systemically important financial institutions; in the extreme, this could make P2P platforms themselves too big or too interconnected to fail. To sum up, the impact of P2P lending on resilience will, perhaps unsurprisingly, depend very much on the profile of the lenders.

Finally, a rise in P2P lending might be expected to improve the **transparency** of the financial system and reduce its **complexity**, although this is less true of securitised P2P lending. P2P advocates argue that securitised P2P loans are still safer than conventional securitisations due to the greater transparency of loan-level data, reducing risk of mispricing. However, as we saw in Section 2, the risks to financial system resilience arising from over-complexity go far beyond the lack of transparency.

## Policy Implications

### Scenario 1: a rise in P2P lending

Our analysis suggests that the extent to which P2P lending remains focused on simple contracts between individual lenders and borrowers, rather than the creation of complex financial instruments to be traded amongst large institutions, will be a key factor determining its impact on system resilience. This suggests a new set of considerations for policymakers to bear in mind when taking steps to promote or encourage P2P lending. For instance, the promotion of securitised P2P lending may not be desirable from a resilience perspective since it significantly erodes the distinctiveness of P2P. Regulation may also need to distinguish between straightforward retail P2P and institutional P2P, and regulate the latter much more like banks.

## 4.2. Scenario 2: emergence of a challenger bank

### *The scenario*

The UK retail banking sector remains highly concentrated. The Big 5 major UK lenders<sup>174</sup> account for around 70% of the stock of lending to businesses, 75% of the stock of mortgage lending, and 50% of the stock of consumer credit (excluding student loans) at end-September 2014.<sup>175</sup> The Competition and Markets Authority (CMA)<sup>176</sup> recently reported that:

- The largest four providers account for over 77% of Personal Current Accounts (PCAs) and 85% of Business Current Accounts (BCAs) for SMEs and 90% of business loans. There are 65 million active PCAs and 3.5 million BCAs.
- Barriers to entry remain significant, including the need for a network of local branches, with over half of personal customers using them once a month and 70% of SMEs agreeing that having a local branch 'is still important'.
- Genuine new entrants have gained just 0.8% of market share of PCAs, if we exclude TSB which was divested from Lloyds in order to comply with EU state aid rules (TSB has 4.2% of the PCA market).
- Metrobank is the only new entrant into full-service SME banking, although other banks such as Aldermore and Cambridgeshire and Counties Bank have entered the market for SME loans and term deposits.

Here we assume that a challenger bank with a similar business model to the existing UK universal banks, for example Metrobank, breaks in to the Big 4 banks' market share, for example takes more than 10% of retail deposits. This is the key scenario seemingly being relied on by policymakers to address many of the problems with the retail banking market (currently under investigation by the CMA). But what impact would it have on our broader framework for thinking about financial system resilience?

#### *Potential impacts on financial system resilience*

The most obvious impact of the emergence of a challenger bank would be to reduce market concentration, one of the measures of **diversity** included in the D-Index. As we saw in Section 1.3, however, the evidence on the direct links between market concentration and financial stability is mixed. And, even if market concentration is bad for resilience, it does not necessarily follow that all competition is good for resilience. As the authors of the D-Index note, to assess the effect of increased competition on resilience, we need to know something about the *type* of competition.<sup>177</sup>

In this scenario, we are assuming that the challenger bank in question is shareholder-owned, and therefore does not affect the ownership component of the diversity index. This matters because, as discussed in Section 2, pressure from shareholders to maximise short-term returns was an important factor in the 'misaligned incentives' which tipped the system into destructive and destabilising competition (i.e., banks competed to maximise return on equity by taking on more risk, rather than competing to provide a better service to consumers). It is therefore open to question whether greater competition between shareholder-owned banks would have a net positive or negative impact on resilience, particularly in an environment where consumer pressure remains weak and shareholder pressure remains strong.

Shareholder-owned challenger banks could seek to differentiate themselves from the incumbents in other ways, for example by focusing on local lending or on 'safe' banking. In this case, our scenario might have a more positive impact on the other elements of the D-Index (funding diversity and geographic diversity). Banks such as TSB and Handelsbanken seem to be making simplicity a point of differentiation, suggesting that the rise of such a

challenger could have a positive impact on **transparency** and **complexity**. However, such developments would be constrained by the imperative to deliver returns to shareholders, and so arguably might introduce less diversity of business models into the market than the emergence of a stakeholder bank.

Having an additional large 'node' in the UK banking system might be expected to impact positively on **interconnectedness** by reducing the concentration of contagion risks within existing 'super spreaders' – in particular if the challenger bank maintained a focus on retail banking, thus increasing the 'modularity' of the network. It is not clear that a new challenger bank would improve **asset and liability composition** unless it had a strategy that was clearly distinct from incumbents, for example by focusing on particular types of loans and liabilities. TSB is an example of a challenger bank which has imposed strict rules on its funding, as it claims not to borrow on wholesale markets. Equally, there is no reason to expect any change in overall system **leverage** from a challenger bank and the exact impact would depend on whether the business strategy and funding model of the challenger were significantly different from those of incumbents.

## Policy Implications

### Scenario 2: emergence of a challenger bank

The key conclusion from this analysis is that the presence of a challenger bank cannot in and of itself be assumed to have a significant positive impact on resilience: its impact would depend crucially on the new bank's business model and ownership structure. Policymakers seeking to promote competition in retail banking should, from a resilience perspective, pay much greater attention to the *type* of competition they wish to foster, and in particular to the desirability of introducing diversity into the market rather than simply another look-a-like bank.

### 4.3 Scenario 3: the Vickers ring-fence

#### *The scenario*

The Vickers Commission proposed that retail banking services of large UK universal banks should be ring-fenced in separate subsidiaries, but stopped short of requiring complete structural separation.<sup>178</sup> The ring-fence is defined as follows:

- Certain activities (banking services to individuals and SMEs) are required to be inside the ring-fence.
- Certain activities deemed to increase exposure to international financial markets or not to be integral to the exercise of core domestic retail banking functions are prohibited from being inside the ring-fence (e.g. derivatives trading, secondary markets activity, 'trading book' activity<sup>179</sup>).
- Other activities are permitted but not required to be in the ring-fence – for example taking deposits from and lending to large non-financial corporations and high net worth individuals.

Ring-fenced subsidiaries must meet regulatory requirements (e.g. higher capital adequacy requirements – equity capital of 10% of risk-weighted assets compared with 8% under Basel III<sup>180</sup>) in their own right, have arms-length commercial relationships with rest of the group on the same basis as with any other third party, and ‘should normally’ have an independent board. The government accepted the Commission’s recommendation, although full implementation has been extended to 2019: banks are currently in the process of submitting proposals to the Bank of England for how they intend to comply with the new rules.

#### *Potential impacts on financial system resilience*

The Commission argued that ring fencing would ‘achieve the principal stability benefits of full separation but at lower cost to the economy’. It identified these benefits as

- ‘insulat[ing] retail banking from external financial shocks, including by diminishing problems arising from global interconnectedness’;
- avoiding the trade-off between safe retail banking and competitive wholesale banking, by enabling domestic retail banking to be regulated with tighter capital requirements, while wholesale banking can be regulated according to internationally agreed minima;
- along with transparency, assisting the monitoring of banks by regulators and market participants, improving macro-prudential regulation.<sup>181</sup>

The main mechanism through which the ring-fence should theoretically improve system resilience is by reducing the extent to which large universal banks are TBTF or ‘too interconnected to fail’. This is often spoken of narrowly as being simply a matter of preventing taxpayer bail-outs by enabling investment banking arms to fail safely: for instance, the UK government’s response to the Vickers Report focused on ‘how Britain can be the home of some of the world’s leading banks, without exposing the taxpayer to the unacceptable cost of those banks failing.’<sup>182</sup> But, as Finance Watch has pointed out in the context of the ongoing debate on parallel European reforms, such changes need to be considered in macro-prudential and not just micro-prudential terms: the resilience of the system is about more than the sum total of the resilience of individual banks.<sup>183</sup>

From this perspective, one of the key potential benefits of the Vickers reforms might be to **interconnectedness**: as we saw in Section 2, separating retail and investment banking activity is one of the key recommendations arising from some of the literature on network structure. The Vickers Commission argued that ‘a strong ring-fence can guard against contagion risks’ by ‘simplifying and limiting financial links between banks [...] reduc[ing] the likelihood of a shock triggering a system-wide crisis’. The UK government has also pointed to the Vickers reforms as evidence that it is addressing contagion risks.

In theory, ring fencing should reduce universal banks’ importance as super-spreaders of financial contagion, and improve the modularity of the network by creating firestops between retail and investment banking activities. However, whether this will indeed prove to be the case depends very much on how the ring-fence operates in practice, given that these activities will remain part of

a single corporate entity. It will also depend in part on the funding models of the new retail subsidiaries, and their connections to the rest of the financial network. In theory, ring-fenced entities will be prohibited from having exposure to other financial corporations, but there are some exemptions to this: for example, activity to hedge the bank's own risk or support securitisations. It is difficult to know how effective these safeguards will prove until they are implemented – and then tested in a crisis.

If successful, the reforms might also affect **financial system size** and **asset composition** by reducing the TBTF subsidy for large universal banks and thereby making speculative activity less attractive for these banks. This could help to address some of the risks arising from an oversupply of banking services by TBTF banks and perverse incentives for them to engage in unduly risky behaviour.

However, the extent of these impacts is not yet clear; in particular, whether ring fencing really will achieve the same benefits as full structural separation remains to be seen. NEF's most recent calculations suggest the TBTF subsidy still stands at £37.7 billion;<sup>184</sup> Moody's did not make any changes to UK banks' ratings in the wake of the proposals being announced, indicating that this reflected the likelihood of the proposals being watered down during the long implementation period.<sup>185</sup>

Roundtable experts pointed out that for many of the factors in our framework, the impacts on retail and investment banking activities need to be considered separately – and that this leaves the overall impact of the reforms on the system somewhat unclear. For example, in terms of **liability composition**, the reforms might be expected to improve the resilience of retail banking arms if they return to a 'safer' funding model with more reliance on deposits. However, investment banks' funding models could, if anything, become less resilient if the reduction of the TBTF subsidy increases their borrowing costs and drives them towards shorter-term, riskier forms of funding. As far as **transparency** and **complexity** is concerned, retail banking arms might be expected to adopt more straightforward business models, but investment banking arms could become even more complex as they search for financial innovations to shore up profitability.

The fact that ring-fenced subsidiaries will remain part of the same corporate entity means that the Vickers reforms would not have an immediate positive impact on the diversity index. However, a reduction in the TBTF subsidy could level the playing field for new entrants, thereby reducing market concentration in the longer term. Depending on the interplay of the impacts discussed, the reforms could also have a positive impact on funding diversity.

References in the Commission's report to 'sharing of expertise, information, operational infrastructure' between subsidiaries and parent companies suggest that the reforms are not designed to promote greater diversity in risk management or to improve operational resilience.<sup>186</sup> The Commission did express the hope that requiring retail subsidiaries to have separate boards could help to bring about changes in banks' **culture and governance**, thereby 'consolidat[ing] the foundations for long-term customer-oriented UK retail banking'.<sup>187</sup> However, recent developments such as Lloyds' bid to waive this

requirement and retain a single board suggest that bank culture may be more likely to affect the implementation of the ring-fence than the other way around.

Finally, in terms of **political** and **regulatory factors**, it could be argued that reducing the TBTF subsidy may somewhat reduce the lobbying power of large universal banks. However, the reverse argument could equally be made – namely that the long time period for implementation of the Vickers reforms enhances the opportunities for banks to water down the reforms or exploit loopholes as they negotiate with regulators about the operationalisation of the ring-fence. This is one advantage of simple structural reforms, such as complete separation, over more complex regulatory approaches such as ring fencing.

## Policy Implications

### Scenario 3: the Vickers ring-fence

The separation of retail from investing banking could in theory have significant benefits for a number of our resilience factors. However, the devil will be in the detail of implementation, and it is particularly important that the reforms are not further watered down between now and 2019. The key uncertainty is whether the safeguards which insulate ring-fenced entities from the rest of the financial network will prove strong enough in a crisis situation, given the various exemptions provided for. Recent developments in Europe, where bank structure reform proposals seem likely to be weakened or dropped, should worry UK regulators concerned to protect the robustness of the UK regime.

## 4.4 Scenario 4: Basel III capital requirements

### *The scenario*

The Basel III capital requirements, which have been implemented in Europe via the CRD IV package, have been explicitly billed as helping to ‘strengthen the resilience of the EU banking sector’.<sup>188</sup> Most commentators agree that the improvements in quality and quantity of capital will help enhance the resilience of individual banks, in the sense of their ability to remain solvent during a crisis. However, there are big questions over how far this regime can be relied on to enhance the resilience of the system as a whole. The key elements of the CRD IV regulations are as follows:

- Stronger capital requirements: Total capital adequacy ratios increased from 8% to 10.5% of risk-weighted assets, plus a countercyclical buffer.
- Stronger criteria for instruments which qualify as Tier 1 and Tier 2 capital, designed to improve the quality of capital banks are required to hold.
- New liquidity requirements:
  - Liquidity Coverage Ratio: designed to ensure banks have enough liquid assets to cover their outflows during a 30-day ‘stress scenario’.
  - Net Stable Funding Ratio: designed to ensure banks have enough funding resources to cover their needs over the next 12 months – aimed at discouraging over-reliance on short-term wholesale market funding.

- Basel III included a 3% leverage ratio as a backstop to risk-weighted capital requirements; this was not implemented by CRDIV.<sup>189</sup> However, in the UK, the PRA has raised the existing leverage cap of 3% to 4.05% for major lenders, with an additional countercyclical buffer of 0.9%.

#### *Potential impacts on financial system resilience*

It is sometimes implied that higher capital requirements can solve the resilience problem by ensuring that banks do not fail. But, as Finance Watch points out, this is a highly dangerous assumption: 'The biggest banks need very little capital in good times but can never have enough capital in a system wide stress (the so-called regulators' paradox) [...] Hence no reasonable ex-ante amount of capital will protect the biggest trading-oriented banks from failing.'<sup>190</sup> For instance, an OECD study showed that the 69 largest US and European banks, which had \$1.6 trillion in combined capital in 2009, would have required an additional \$4.5 trillion – almost a quadrupling – to remain at a safe level during the crisis.<sup>191</sup> To fully understand the impact of the Basel reforms on financial system resilience, we therefore need to consider their indirect impacts on the various factors in our framework.

One key question is how far the Basel reforms address the risks associated with **interconnectedness**. Basel III documents claim that the requirements will 'contain systemic risks arising from pro-cyclicality and from the interconnectedness of financial institutions',<sup>192</sup> for example by changes to risk weights to incentivise banks to move to central counterparty arrangements rather than over-the-counter (OTC) derivatives contracts, higher capital requirements for some derivatives, and enhanced capital buffers for more systemically important banks. However, there are questions over whether this is sufficient to reflect the greater contribution of these 'super-spreaders' to contagion and systemic risk, or to address the TBTF problem. Finance Watch and others argue that the reforms in fact do little to address interconnectedness issues, and indeed that risk-weighted capital requirements can exacerbate problems with interconnectedness.<sup>193,194</sup>

There is also a deeper issue about whether the basic approach of the Basel rules – addressing specific risks via increasingly complex calibration of capital requirements – is the right approach to enhancing the resilience of a complex system. Andy Haldane has pointed out that simple leverage ratios perform much better than complex risk-weighted capital ratios as a predictor of bank failure, arguing that 'as you do not fight fire with fire, you do not fight complexity with complexity'.<sup>195</sup> The OECD came to the same conclusion in a 2013 study.<sup>196</sup> Despite the focus on capital adequacy rather than leverage we would expect that the impact of Basel III would be to reduce overall system **leverage**.

Basel's continued reliance on risk weights has attracted criticism on various other fronts:

- **Transparency.** As Finance Watch put it, 'an investor trying to assess the soundness of a financial institution would be as lost after Basel III as before.' This is a function of regulatory complexity and of the reliance on banks' internal ratings of their own assets. This means that the reforms do not address confidence-related factors in the development of crises.

- **Risk management models.** The ECB and others have defended the internal ratings-based approach on the basis that it encourages a diversity of risk management approaches. However, it has also been argued that this leaves too much to banks' discretion and creates incentives to use overly optimistic assumptions.<sup>197</sup> Finance Watch also notes that 'the Value-at-Risk methodology used to calculate risk weights suffers from a number of well-known flaws.'<sup>198</sup> More generally, over-reliance on any model introduces risks of its own, particularly in a complex dynamic system where historic data is unlikely to be a reliable guide to future risks that may emerge.
- **Asset composition.** In theory, risk-weighted capital requirements should encourage banks to hold safer assets, thereby reducing systemic risk. However there are a number of problems with this. First, the Basel regulations can be seen to support the trend since the 1970s towards personal and commercial real estate lending over business lending,<sup>199,200</sup> since they treat mortgages as less risky than business loans. This might be expected to have a negative impact on our 'real economy lending ratio'. Secondly, they do not address the dangers of 'uniformity of asset holdings' among major banks leading to bubbles and crashes – indeed, they may exacerbate this by creating incentives for banks to 'herd' into supposedly safe assets with lower capital requirements.<sup>201</sup> Finally, they may distort lending by creating incentives to game the system via financial innovation.<sup>202</sup>

Participants in our roundtable felt that the impact of the Basel reforms on banks' **liability composition** was still uncertain. In theory, the Net Stable Funding Requirement should help to reduce banks' dependence on short-term wholesale funding, but whether this is the case in practice remains to be seen.

More stringent capital requirements do little or nothing to improve **diversity**. Indeed, they may actually make it more difficult for new entrants to gain a foothold in the market and make it more challenging for smaller banks and building societies to expand their balance sheets; both developments could lead to greater market concentration and a reduction in diversity in the UK context. There is already emerging anecdotal evidence that the requirements are proving extremely onerous for smaller stakeholder banks.

Turning to **political and regulatory capture**, it is interesting to note that banks lobbied heavily against higher risk-weighted capital requirements, claiming they would 'result in lower lending volumes at a higher cost at a time when economic recovery is still fragile'.<sup>203</sup> These claims have since been disproven by the BIS, which found that 'banks in aggregate do not appear to have cut back sharply on asset or lending growth as a consequence of stronger capital standards';<sup>204</sup> a study by the ECB also found that banks with weaker capital positions restricted their lending more during the crisis.<sup>205</sup> Banks' opposition to the introduction of a simple backstop leverage ratio was even more intense, seemingly preferring the more complex risk-weighted capital ratio as the lesser of two evils. This might seem surprising given that it contradicts the usual industry narrative about the need to reduce regulatory burdens and 'red tape'. One could argue that this reflects the fact that complex regulations are easier to influence and to game – another argument in favour of regulatory simplicity.

## Policy Implications

### Scenario 4: Basel III capital requirements

Basel III capital requirements should indeed make individual financial institutions somewhat safer from collapse in the event of shocks, although they would not have been enough to prevent the crisis of 2008. However, their impacts on many of the other factors in our framework are at best uncertain (liability composition, interconnectedness) and at worst potentially problematic (asset composition, transparency and complexity, diversity). In particular, the continued reliance on complex risk-weighted capital requirements is unlikely to keep pace with emerging risks and could instil a false sense of security, as well as creating risks of its own.

More generally, regulation geared towards micro managing the activities of incumbent large banks paradoxically risks entrenching their dominance by making it harder for small banks to compete. Structural reforms to reduce the importance of large banks may be a better strategy for promoting system resilience. As US Senator Elizabeth Warren recently put it, 'When 11 banks are big enough to threaten to bring down the whole economy, heavy layers of regulations are needed to oversee them. But when those banks are broken up and forced to bear the consequences of the risks they take on [...] regulatory oversight can be lighter and clearer as well.'<sup>206</sup> All of this suggests that it would be a mistake to rely too heavily on new capital requirements to ensure UK financial system resilience.

### 4.5 Scenario 5: reforming RBS

#### *The scenario*

The economic benefits of local banking, providing strong governance and network structures are in place, are now well established, with the German Sparkassen and Swiss Cantonal banks providing excellent examples of how local banks can support local businesses and the SME sector in particular.<sup>207</sup> As we saw in Section 2, there is also reason to believe that a strong local banking presence may have wider benefits for financial system resilience. The UK's local banking sector is currently extremely small relative to comparable economies: just 3% of bank assets are locally controlled, compared to approximately 67%, 57%, and 34% in Germany, Japan, and the USA, respectively.<sup>208</sup>

UK politicians of various parties have committed to support the development of local and regional banks,<sup>209</sup> but to achieve the scale of local banking that exists in Germany, for example, could take many decades. An alternative solution might be to break up the already majority nationalised RBS into a local banking network of 130 banks based on local authority areas at city and county level, with a mandate to lend to only to people and businesses in the local region.

NEF has developed a proposal for this which would involve RBS divesting its private bank, its investment bank, and its US subsidiary, leaving it with total assets of £275.5 billion (down from £1,046.1 billion at present). The back-office infrastructure, and settlement and liquidity facilities would remain centralised but each of the 130 banks would be held in trust at the local level. This follows the Sparkassen model where the banks are legally independent public law institutions, overseen by trustees, with no one owning the assets.

Following best practice in other local stakeholder banking networks, a system of mutual guarantees would both improve the internal auditing and management of risk within the network, and provide the same diversification of risk that national banks achieve.

#### *Potential impacts on financial system resilience*

Our calculations suggest that this proposal would improve the **diversity** of the UK's banking sector on almost all measures covered by the D-Index. The proposed ownership model for RBS is not employed by any other banks in the UK, and so this would materially improve ownership diversity. Market concentration and geographic spread would also be hugely diversified given the creation of 130 new banks spread across the UK. And devolution of risk assessment to each of the 130 local banks in the new structure would significantly diversify risk management methods.

The hope would be that RBS local banks would evolve significantly different business models from existing universal banks. In terms of **asset composition**, they would be able to build strong relationships with local businesses and begin extending loans to previously unbanked customers, in particular SMEs. We would therefore expect the new banks to improve the real economy lending ratio. In terms of **liability composition**, RBS's current loan to deposit ratio is 106%; we would expect the new banks to fund themselves entirely from customer deposits with no need to go to financial markets, making them extremely safe.

The proposal also has potential benefits for **interconnectedness**: the policy would transform a SIFI attracting a substantial TBTF subsidy from the UK government into 130 non-systemically important retail banks that could be safely allowed to fail. At the same time, the system of mutual guarantees and centralised back-office infrastructure would make such banks less risky than if they stood alone. It would also separate real economy lending from more speculative activities; and, since the new banks would not need to borrow from wholesale markets, they would be less dependent on other banks in the UK and Europe. Separating off RBS's huge derivatives balance sheet would make the new bank a much simpler and more **transparent** organisation (although having 130 new banks could potentially increase regulatory **complexity**).

Of course, the impacts of this on the system as a whole, including overall **leverage**, would depend on where these assets went – i.e., what happened to RBS's divested investment banking arm (currently £572.9 billion in size, of which £298 billion is derivatives).<sup>210</sup> If it was bought up by large UK banks, this could increase those banks' size and **interconnectedness**. If it was bought by an overseas bank, this would materially reduce the **size of the UK banking sector** as well as its complexity. The loss of deposit-based funding might also make the investment bank more dependent on wholesale market funding and thus more risky, balancing out some of the positive impacts of the new bank on liability composition. However, the isolation of these activities from retail banking would still increase the modularity of the financial network and reduce the risks they pose to the rest of the system.

## Policy Implications

### Scenario 5: Reforming RBS

Based on the factors we have analysed, breaking up RBS into a network of local banks could have significant positive impacts on financial system resilience. Of course, ours is only one proposal for the future of RBS. More generally, creative approaches to the government's majority stake could reap benefits for diversity and network structure which would take decades to achieve through other means - simultaneously 'levelling up' the UK's under-developed stakeholder banking sector and 'levelling down' a dangerously large and interconnected universal bank. Particularly in light of the current probability of large taxpayer losses if the bank were to be returned to the private sector, this is not an opportunity that should be lightly passed over. We therefore recommend that the government should carry out a full, independent review into the options for the future of RBS before embarking on any share sale.

### 4.6 Summary

The summary table (Table 4) is based on NEF's judgements about the likely impacts of these scenarios on our key resilience factors, and the key uncertainties. As with the more detailed analysis above, this summary is informed by input from our expert roundtable, but the judgements are our own.

Looking across all five of our scenarios, some clear trends emerge. The two solutions often invoked by policymakers as the basis for a more resilient financial system – new capital requirements and enhanced competition – appear to have very uncertain impacts. Structural separation of banks (the Vickers reforms) may have somewhat more positive effects, but ironically this reform is currently being heavily resisted at European level, partly on the basis that new capital requirements and other reforms have addressed systemic risks. A rise in P2P lending and the reform of RBS could potentially have positive impacts across a much broader range of our resilience indicators, although in the case of P2P these impacts are heavily contingent on how the industry evolves.

There are of course many complexities and uncertainties at play here which make it impossible to make firm predictions about how these scenarios will affect financial system resilience. Nonetheless, in each case our analysis has introduced some considerations frequently left out of the policy debate, prompting lines of inquiry which point towards a meaningfully different policy approach as we set out in the following section.

Perhaps more importantly, this type of analysis also helps to highlight key uncertainties on which the impacts of different scenarios may depend. When dealing with complex, dynamic systems, we suggest that this can be much more useful than the false certainty offered by conventional tools of cost-benefit analysis.

In our view, multiple criteria analysis (MCA) is a much more suitable tool for policymakers and regulators seeking to improve financial system resilience. MCA is already used in several government departments, such as the Department for Transport, and tools such as multicriteria mapping place particular emphasis on identifying uncertainties. A full MCA was beyond the scope of this report, but we recommend that policymakers should be developing and using MCA tools to evaluate the likely impacts of new policy on our seven-factor framework.

Table 4. Summary of scenario analysis

Scenarios	Resilience factors							Key uncertainties
	Diversity	Inter-connectedness	Financial system size	Asset composition	Liability composition	Transparency & complexity	Leverage	
1. P2P lending	●	●?	○?	●	○?	●?	○?	Linkages with existing financial institutions Extent of securitisation Composition of lenders (retail vs institutional)
2. Challenger bank	●?	●	●?	●?	●?	●	●?	Business model and location of challenger bank
3. Vickers ringfence	●	●	●?	●	●	●	●	Balance/interplay of impacts on retail and investment banking activities
4. Basel III	●	●	●	●	●	●	●	Unknowable future risks could overwhelm assumptions of risk-weightings
5. RBS proposal	●	●?	○?	●	●	●	●	What happens to RBS's divested investment banking arm

KEY: ● Positive impact   ● Neutral impact   ● Negative impact   ○ Indeterminate impact   ? Key uncertainties

## 5. Conclusion and recommendations

To improve the UK financial system's resilience, we recommend that policymakers focus on structural reforms and innovations to reduce our reliance on large universal banks, rather than attempts to micro-manage the risks posed by those banks. Regulators should also define and measure resilience according to the framework set out in this report.

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The results of the Financial Systems Resilience Index make for unhappy reading for the UK, whose financial system is the least resilient of the G7 group of wealthy nations by some margin.

As our Index shows, the UK's system is unusually large and homogenous, highly interconnected (both domestically and internationally), highly complex, and highly reliant on wholesale market funding when compared to other countries. In addition, levels of indebtedness are high and the proportion of real economy lending is strikingly low.

This suggests that the domestic economy remains highly exposed to vulnerabilities in the financial system while, conversely, the financial system is not performing well in terms of its basic social and economic functions.

Considering our resilience indicators under a number of future scenarios suggests that there is no reason to expect any significant improvement to this position under current financial policy frameworks or resulting from current market developments. What the scenario exercise does yield are a number of insights into the design of financial policy and market structure which might otherwise be lost. Key findings include:

- Policymakers looking to support the P2P lending sector should distinguish between simple P2P (which could be extremely positive for resilience) and securitised P2P (whose impacts on resilience are much more doubtful).
- Policymakers should be extremely wary of relying on detailed, complex, risk-weighted capital requirements to ensure financial system resilience.
- Simple rules and structural reforms which alter the topology of the system (such as separation of retail from investment banking) may have more positive impacts: regulators should consider such reforms in terms of their macro-prudential impacts (e.g. on interconnectedness) and not just their micro-prudential impacts (e.g. protecting the retail activities of TBTF banks).

- The emergence of a challenger bank is not guaranteed to have meaningful positive impacts on resilience, unless its business model is clearly distinct from existing banks. Policymakers should consider more creative approaches to enabling genuine competition and diversity – such as a reformed RBS.

For decades before the crisis, the received wisdom was that large shareholder-owned banks would make more efficient use of capital than small banks, mutuals, and building societies; that deregulation would make financial markets work more efficiently; and that greater complexity, interconnectedness, globalisation, and reliance on wholesale funding were all positive developments which would transfer risk to parts of the financial network best able to bear it. We now know that this was the wrong prescription.

In hindsight, it is hardly surprising that the UK financial system failed so spectacularly or with such catastrophic consequences for the domestic economy.<sup>211</sup> To address these failings and build resilience for the future, a new policy prescription is needed. The kind of banks and banking activities which have been so enthusiastically encouraged in recent decades are exactly those which we now need to diversify away from. This demands a new conceptual approach.

While competition between individuals may promote efficiency, it is competition between species that promotes system resilience. Therefore, we argue that competition policy in banking must take a much broader approach, focusing on diversity of provision, not just market share. Meanwhile, macro-prudential regulation is about far more than forcing banks to hold more capital: increasingly, regulators need to look at a range of other factors, including what is actually on banks' balance sheets (asset and liability composition) and the topography of the system as a whole (interconnectedness, transparency and complexity, and overall financial system size).

We recommend the following actions to help financial policy to promote the overall resilience of financial systems:

- 1. Definition.** Regulators with a remit to promote financial system resilience, such as the Financial Policy Committee at national level, and the Financial Stability Board at international level, should explicitly set out their understanding of the term 'resilience' in the context of financial systems. This should be a broad one, distinct from financial stability and drawing on evolutionary or 'complex adaptive systems' approaches. Our recommended definition is set out in Section 1.
- 2. Measurement.** Central banks and other regulators should collect and publish data in each of the domains we identify, and should work towards establishing reliable metrics for those factors we have been unable to measure.
- 3. Decision-making.** Policymakers should develop tools, such as multiple criteria analysis (MCA), which are more suited to identifying key trade-offs and uncertainties when dealing with complex systems, to assess the likely impact of policy and market developments on the factors set out in our framework.

**4. Systems thinking.** Regulators must assess the resilience of the system as a whole as an exercise that is distinct from, and additional to, assessing the 'resilience' of individual banks. This would allow a separate focus on the impact of new developments on qualities possessed by the system as a whole: its diversity, its complexity, its interconnectedness, and its size.

**5. Further research.** Understanding the structure of the financial network, and the relationships between network structure and resilience, should be a key priority for further research.

We cannot guarantee that financial institutions will never fail. Indeed, the ability of some institutions to leave the market while new ones enter is an essential feature of dynamic markets.

Neither can we guarantee that financial systems will never fail. Unlike the failure of individual institutions, however, the collapse of a financial system is never desirable, as the economic and social consequences are severe.

It should therefore remain a priority to improve the resilience of financial systems, defined in this report as the ability to evolve and adapt while maintaining positive societal outcomes. Our efforts must not be allowed to ebb as the memory of the 2008 global financial crisis begins to fade.

The nature, extent, severity, and timing of the next financial crisis will in part be determined by decisions taken today about the design and regulation of financial systems. We believe that the conceptual resilience framework and the indicators set out in this report can play a role in supporting better decisions that support the development of a healthier financial system to the benefit of all.

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### *Participants in expert roundtables:*

Parma Bains	Financial Conduct Authority
Joel Benjamin	Move Your Money
Christine Berry	New Economics Foundation
Sue Charman	WWF-UK
Professor Victoria Chick	University College London
Bruce Davies	Abundance Generation
Simon Deane Johns	Keystone Law
Aline Fares	Finance Watch
Greg Fisher	Synthesis
Greg Ford	Finance Watch
Christopher Goodspeed	HM Treasury
Tony Greenham	New Economics Foundation
Dr Iain Hardie	University of Edinburgh
Chris Hewett	Finance Innovation Lab
Professor Jonathan Michie	Oxford University
Henrike Mueller	Financial Conduct Authority
Rob Nash	Oxfam
Professor Christine Oughton	School of Oriental and African Studies
Laurence Pawley	Department for Business, Innovation and Skills
Josh Ryan-Collins	New Economics Foundation
Luke Sussams	Carbon Tracker
Andrew Thompson	Friends Provident Foundation
Geoff Tiley	TUC
John Wrathmell	Head of Economic Policy, Labour Party

### *Individual interviewees:*

Ben Caldecott, Smith School of Enterprise and the Environment  
 Greg Fisher, Synthesis  
 Lord Robert May, University of Oxford  
 Martin Taylor, Financial Policy Committee  
 Lord Adair Turner, Institute for New Economic Thinking

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