

NO STRESS II

The flaws in the Bank of England's stress testing programme

Kevin Dowd



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CONTENTS

Executive summary	iv
1 The Bank of England's Stress Testing Programme	1
2 Measuring Capital Adequacy	9
3 Stress-Testing Methodology	40
4 The Bank of England's 2014 Stress Test	76
Appendix to Chapter 4: Setting the Counter-Cyclical Capital Buffer	95
5 The Bank of England's 2015 Stress Tests	104
6 Overseas Experience of Central Bank Stress Testing	120
7 The 13 Fatal Flaws in the Stress Tests	150
8 An Alternative to Stress Testing	158
9 What Should be Done?	167
About the author	171

Executive summary

- The Bank of England's stress tests are designed to reassure the public that the UK banking system is safe. However, they beg the question of whether the banking system really is safe or not.
- This analysis of the Bank's stress tests suggest that they are undermined by a string of fatal flaws. These flaws include reliance on a single, insufficiently stressful, adverse scenario and their use of extremely low pass standards and inadequate metrics. The stress tests lack credibility because of conflicted objectives, and because political pressures on the Bank and the Bank's own institutional self-interest create incentives to engineer a pass result. The stress tests are also counterproductive in that they create new systemic risks that are invisible to everyone's risk management systems.
- The unreliability of stress testing methodology is confirmed by their appalling track record overseas. The relentless message was that the system is sound and policymakers were often lulled into a false sense of security. Again and again, individual institutions (such as Fannie Mae and Freddie Mac in the United States and Dexia Bank in Europe) and even entire national banking systems (Iceland, Ireland, Cyprus and Greece) were signed off as safe by stress tests only to collapse shortly afterwards.

- Nor is there a *single* case where regulatory stress testing has ever proven to be of any use by warning of an impending build-up. Instead, stress testing has repeatedly offered false risk comfort by blinding those involved to the real dangers they were facing.
- An elementary analysis of the UK banks' capital positions then shows that the UK banking system is actually very weak – a conclusion that the Bank of England's 'rocket science' stress tests completely missed.
- Far from providing credible assurance that the banking system is safe, the stress tests are worse than useless because they provide false comfort, suggesting that the UK banking system is safe when it is in fact highly vulnerable.

Chapter one: The Bank of England's Stress Testing Programme

1.1 INTRODUCTION

In 2014 the Bank of England initiated the first of what it anticipated would be an annual programme of stress testing the capital adequacy of the UK banking system. This programme is significant because its results are intended to help the Bank to come to a view regarding the financial health of individual banks and of the banking system as a whole. Reassuringly, both the 2014 stress testing exercise and its 2015 successor led the Bank to conclude that the UK banking system was robust enough to withstand another severe downturn.

But they would say that, wouldn't they? To the best of my knowledge, *every single* regulatory or central bank stress test ever carried

out has always given the same reassuring message: the system is safe. In the United States, stress tests of the government-sponsored housing giants, Fannie Mae and Freddie Mac, suggested that they were unsinkable, like the Titanic. Both then sank in 2008. Stress tests also suggested that the banking systems of Iceland, Ireland, Cyprus and Greece were all safe. Each collapsed shortly afterwards. So why would we expect stress tests conducted by the Bank of England to be reliable, when stress tests conducted by their counterparts overseas were spectacular failures?

The analysis presented here suggests that the UK stress tests are indeed unreliable. It suggests that they suffer from a string of fatal flaws that undermine any conclusions that the Bank draws from them. Worst of all, the stress tests disguise the true weakness of UK banks: they paint a rosy picture of the health of the UK banking system that is quite at odds with the facts on the ground. The stress tests provide false risk comfort: they tell us we are safe when we are not.

It is therefore imperative that the Bank's stress testing programme be aborted and that interested parties appreciate that the UK banking system is much weaker than the Bank of England would have us believe.

1.2 THE BANK'S STRESS TESTING PROGRAMME

In March 2013 the Financial Policy Committee (FPC) recommended that the Bank and the Prudential Regulatory Authority (PRA) should develop proposals for regular stress testing of the UK banking system. The Bank's proposals were subsequently published in October that year in a Discussion Paper, "A framework for stress testing the UK banking system", which proposed an annual programme

of concurrent stress tests involving the bigger UK financial institutions.¹ As it explained, the “main purpose of the stress-testing framework is to provide a quantitative, forward-looking assessment of the capital adequacy of the UK banking system and [of] individual institutions within it” (p. 9).

Amongst various secondary objectives, it was hoped that the programme would “provide a device through which the Bank can be held accountable to Parliament and the wider public, on its financial stability objective, by allowing the FPC and the PRA Board to articulate the resilience standard against which they hold the banking system” (*loc. cit.*).

A further objective – and de facto, *the* principal objective – was to “bolster public confidence in the stability of the system, by demonstrating the range of severe, but plausible [stress scenarios, note the plural] that authorities expect the banks to be able to withstand” (*loc. cit.*). How much capital constitutes adequacy is, however, a difficult question and would be a policy decision for the FPC and the PRA, but “[a]t the very least, banks would need to maintain sufficient capital to be able to absorb losses in the stress scenario and not fall below internationally agreed minimum standards” (p. 8).

Further details of the stress-testing programme for 2014 were published in a subsequent Bank Discussion Paper in April that year.² This document identified the banks to be included in the 2014 stress tests: Barclays, the Co-operative Bank, HSBC, Lloyds Banking Group, Nationwide, Royal Bank of Scotland, Standard Chartered Plc and Santander UK. As of end-2012, the combined capital of these banks

1 Bank of England, October 2013

2 “Stress testing the UK banking system: key elements of the 2014 stress test,” Bank of England, Discussion Paper, April 2014.

amounted to over 95% of the capital of the 30 significant banks comprising the UK banking industry.³ It also set the out the capital ratio to be used – common equity Tier 1 (CET1) as a ratio of risk-weighted assets (RWAs) – and the minimum threshold for this ratio, 4.5%.

The Bank's Discussion Paper also set out the Bank's scenario. Note the singular: the Bank quietly dropped its earlier emphasis on multiple scenarios with no explanation offered. Now for each annual stress test exercise, there was only going to be one adverse scenario.

The scenario to be modelled consisted of a series of mainly domestic shocks: a major housing downturn and major increases in interest and inflation, over the 3-year period to the last quarter of 2016.

The Bank's scenario produces the impacts on key macroeconomic variables illustrated in Figure 1, in which the stress scenarios for real GDP growth, unemployment and CPI inflation are superimposed on the Bank's 'fan chart' probability projections of those same variables. In these scenarios we have a severe fall in output with year-on-year real GDP growth falling to -3.2% before bouncing back to 1.2%, a near doubling of the unemployment rate from 6.6% to 11.8%, and a sharp upturn in annual CPI inflation, rising from 1.8% to 6%.

3 Bank of England, 2013, pp. 17, Table A.

FIGURE 1A: GDP IN THE STRESS SCENARIO RELATIVE TO THE FEBRUARY 2014 INFLATION REPORT PROJECTION

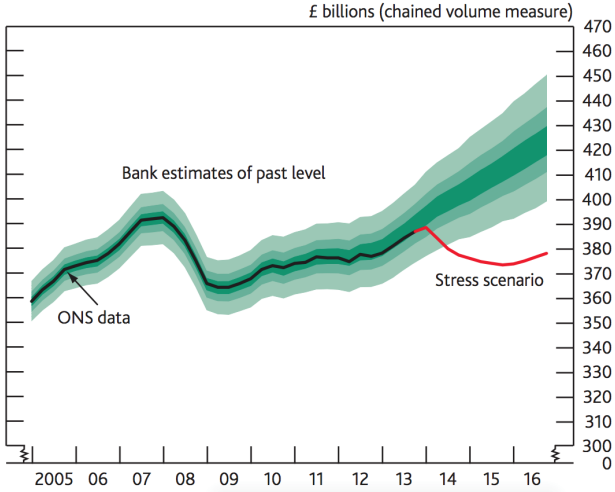


FIGURE 1B: UNEMPLOYMENT IN THE STRESS SCENARIO RELATIVE TO THE FEBRUARY 2014 INFLATION REPORT PROJECTION

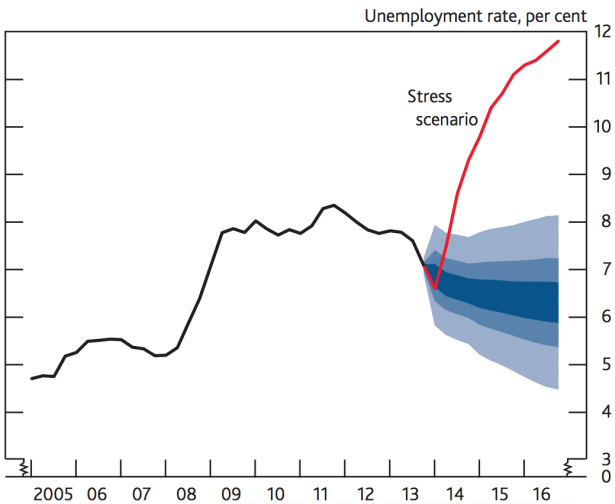
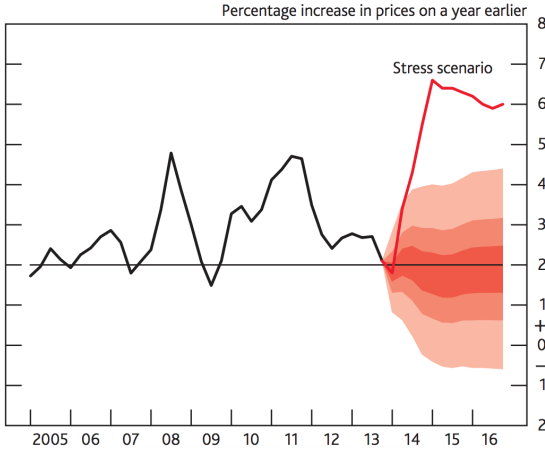


FIGURE 1C: CPI INFLATION IN THE STRESS SCENARIO RELATIVE TO THE FEBRUARY 2014 INFLATION REPORT PROJECTION



Note: Reproduced from Bank of England "Stress testing the UK banking system: key elements of the 2014 stress test," (April 2014), p. 7. Available on the web at <http://www.bankofengland.co.uk/financialstability/Documents/fpc/keyelements.pdf>.

The results of the first stress test were announced in December 2014. In terms of the Bank's headline CET1 capital ratio, all banks but one (the Co-op, which had a post-stress post-remedial action ratio of -2.6%) passed the stress test. Two banks, Lloyds and RBS, had uncomfortably low ratios (of 5.3% and 5.2% respectively) and the others easily passed.

On the basis of these results, the Bank of England rejected the Co-op's capital plan and concluded that the Co-op, Lloyds and RBS needed to strengthen their capital position further.

The poor performance of the Co-op was no surprise, even to its own management, but it is interesting that Lloyds and RBS were still

judged to be in need of further strengthening, 7 years after being bailed out at enormous expense by the taxpayer.

However, most banks came out looking fairly well and the aggregate capital ratio post the stress scenario was a supposedly healthy 7.5%. The take-home conclusion offered by the Bank was that *the banking system as a whole* was sound. As Governor Carney stated at the December 16 [2014] press conference, the results show “that the [UK banking system] has the strength to continue to serve the real economy even in a severe stress.”

But not everyone shared Carney’s optimism – not even his predecessor. Mervyn King, with classic understatement, told the *Today* programme on December 29 2014, less than two weeks after the publication of the Bank’s first stress test results, “I don’t think we’re yet at the point where we can be confident that the banking system would be entirely safe.” As if to emphasise his reservations, he pointedly failed to endorse his successor’s interpretation of the stress test results. So which Governor are we to believe? A year later, they were still at loggerheads, although of course neither would publicly criticise the other. One was saying that the post-financial crisis period was over, whilst the other was warning that serious problems remained and that major reforms were needed before the next crisis hit.

3.1 ORGANISATION OF THIS ANALYSIS

This policy analysis of the Bank’s stress testing programme is organised as follows. Chapter Two addresses the data and measurement issues involved with the assessment of bank capital adequacy. Chapter Three addresses the methodological difficulties associated with stress testing. Chapters Four and Five evaluate the 2014 and

2015 stress test exercises, and Chapter Six examines the experience of central bank and regulatory stress tests overseas. Chapter Seven summarises no less than 13 fatal flaws in the stress tests and suggests that the stress tests are unsalvageable. Chapter Eight outlines a much simpler and more reliable alternative to the stress tests and Chapter Nine suggests what should be done to fix the banking system.

Chapter Two: Measuring Capital Adequacy

We measure capital adequacy by means of the ratio of core capital to the total amount 'at risk'.

Let's first consider the numerator in this ratio.

2.1 THE CORE CAPITAL MEASURE

By core capital, we mean the 'fire-resistant' capital available to support the bank in the heat of a crisis. However, there are a number of different core capital measures available and some are more reliable than others. Their reliability is in inverse proportion to their broadness: the broader the capital measure, the more 'soft' capital it includes and the less reliable it is.

With any capital adequacy metrics, a major concern is cheating, or 'gaming', the more polite language to use in this area (bankers don't

‘cheat’, they ‘game’). In the case of the capital measure, the concern is with banks’ ability to exploit loopholes (e.g., by stuffing less expensive-to-issue softer capital items into the core capital measures approved by regulators) and, of course, with their lobbying to create such loopholes in the first place.

The narrowest and best is Tangible Common Equity (TCE). ‘Tangible’ here means that the equity measure excludes ‘soft’ items, such as goodwill and other intangibles, for example Deferred Tax Assets that cannot be deployed to help a bank weather a crisis. ‘Common’ means that it excludes more senior capital items, such as preferred shares and hybrid capital.⁴

The importance of TCE as the ultimate core capital measure was highlighted in a 2011 speech by the senior Federal Reserve official Daniel Tarullo. When reflecting on the experience of the GFC, Governor Tarullo observed that:

at least some of the instruments that qualified as “Tier 1 capital” [a core capital measure under Basel II] for regulatory purposes were not reliable buffers against losses, at least not on a going concern basis. It is instructive that *during the height of the crisis, counterparties and other market actors looked almost exclusively to the amount of tangible common equity held by financial institutions in evaluating the creditworthiness and overall stability of those institutions [and essentially*

⁴ DTAs allow a bank to claim back tax on previously incurred losses in the event that the bank subsequently returns to profitability. The acid test to qualify as core capital is this: if the bank were to fail tomorrow, what would the relevant capital instruments be worth? DTAs would be worth nothing.

ignored any broader capital measures altogether].⁵
 (My italics)

Amongst the measures used by regulators, the narrowest and the least ‘polluted’ by softer capital instruments is Common Equity Tier 1 (CET1) capital. One can think of CET1 as approximately equal to Tangible Common Equity plus realised earnings, accumulated other income and other disclosed reserves.⁶ However, one should keep in mind that in the UK CET1 is reported under International Financial Reporting Standards (IFRS) and these are subject to some serious flaws. These flaws include deficiencies in the provisions that IFRS makes for expected losses (see Tim Bush, *UK and Irish Banks Capital Losses – Post Mortem*, Local Authority Pension Fund Forum, 2011) and its vulnerability to the manipulation of retained earnings (see Gordon Kerr in his *Law of Opposites*, Adam Smith Institute, 2011). We shall have more to say on these deficiencies presently.

There is also an important distinction between the theoretically ‘clean’ CET1 definition and its regulatory equivalent, where the latter is the compromise result of hard bargaining between the regulators and the banks. This compromise is explained by Thomas F. Huertas:

Under Basel II, deferred tax assets, mortgage servicing rights and investments in the capital instruments of other financial institutions were all included in core Tier 1 capital [which was the most conservative capital

⁵ D. K. Tarullo, “The Evolution of Capital Regulation,” speech to the Clearing House Business Meeting and Conference, New York, November 9, 2011.

⁶ For a more complete definition of CET1 capital, see Basel Committee on Banking Supervision (BCBS) “Basel III: A global regulatory framework for more resilient banks and banking systems,” (Basel Committee, June 2011), p. 13.

measure used in Basel II]. Under Basel III, these assets are in principle deductible from CET1 capital.⁷

These assets are not *entirely* deductible, however. As he continues:

as a compromise the members agreed to put the aggregate of deductions under these categories into a so-called sin bucket and to restrict the deduction from CET1 capital to the amount in the sin bucket that exceeded a threshold equal to 15 percent of the bank's CET1 capital.

Got that? What it means is that the 'clean' definition of CET1 capital may be equal to only 85% of the CET1 capital reported for regulatory purposes. Consequently, the reported CET1 capital used for regulatory purposes can include softer capital instruments that may inflate the reported measure by up to $1/0.85 - 1 = 17.5\%$ relative to 'true' CET1.

Table 1 shows the CET1 capital figures for the 7 biggest UK banks (counting the Nationwide Building Society as a bank for convenience) as of the end of 2015 Q3:

7 T. F. Huertas, *Safe to Fail: How Resolution Will Revolutionise Banking*, New York: Palgrave, 2014, p. 23. For more on this 'sin bucket', see "Basel III: A global regulatory framework for more resilient banks and banking systems" (Basel Committee, June 2011), pp. 21-6 and Annex 2.

TABLE 1: BANK'S CET1 CAPITAL AS OF END-2015Q3

BANK	CET1
Barclays	42
HSBC	89.1
Lloyds	31
Nationwide	7.8
RBS	40
Santander UK Plc	10
Standard Chartered Plc	23.8
Sum =	243.7

Data based on that provided in Annex 1 of the Bank of England's 2015 stress report, where the data for HSBC and Standard Chartered have been converted from USD to £. All numbers in £bn.

The Basel III regulations also specify a second, somewhat broader, core capital measure, Tier 1 capital. Tier 1 capital is equal to CET1 capital plus Additional Tier 1 (AT1) capital. These AT1 capital instruments would be forms of preferred stock that meet certain conditions such as that they be issued and paid-in, be perpetual and be subordinate to depositors, general creditors and subordinated debt.⁸

To illustrate, consider p. 186 of Barclays' 2014 *Annual Report*. This page presents a table that starts with an item called 'Shareholders' equity (excluding non-controlling interests)'. It reports a value for that item equal to £59,567m. There are then some deductions and a little further below we get a figure for 'fully loaded' CET1 of £41,453m. ('Fully loaded' means that the number is constructed using Basel III rules when Basel III is fully phased-in.) There then

⁸ For a more complete treatment of the qualifying conditions for AT1 capital, see BaselCommittee on Banking Supervision (BCBS) "Basel III: A global regulatory framework for more resilient banks and banking systems" (Basel Committee, June 2011), p. 15.

follow some further adjustments and a couple of tables later, on p. 189, we get a number for fully-loaded T1 capital: £46bn.

2.2 TOTAL ASSETS

Then there is the denominator in the capital ratio, the total exposure or total amount ‘at risk’. Traditionally, total exposure was taken to be the total assets of the bank. However, for many years now the on-balance-sheet amounts at risk have been dwarfed by the amounts at risk off the balance sheet in derivatives, such as Credit Default Swaps (CDSs), and certain securitizations. These off-balance-sheet risks have long since made the total assets measure highly inadequate.

Consider Barclays again. If one looks at reported data for end-2014 on p. 279 of its 2014 Annual Report, one finds that the fair (or netted) value of Barclays’ total over the counter (OTC) derivatives was just under 30% of its reported total assets. However, these fair value numbers are based on a bunch of assumptions about hedge accounting and netting – many of which would unravel in a crisis. Any reasonable estimate of Barclays’ ‘true’ OTC derivatives exposure would then be over 30%. At the other extreme, the notional value of its OTC derivatives positions weighs in at 1,091% of total assets. This latter figure will be an over-estimate of the bank’s OTC derivatives exposure, as there would be some offsets even in a bad crisis and for some derivatives, the notional value bears little relationship to the exposure. So the ‘true’ OTC exposure in all likelihood will be well above 30% but well below 1,091% of total assets and probably only a small fraction of that latter amount. Beyond that, we have little real idea how exposed Barclays actually is.

2.3 RISK-WEIGHTED ASSETS

To make matters worse, the exposure measure long favoured by the Basel system is not total assets, which would be bad enough, but so-called ‘Risk Weighted Assets’ (RWAs). Indeed, we can even say that this principle of Risk Weighted Assets was the key design feature of the Basel system, from its very inception in 1988 with the original Basel Accord, now known as Basel I. At first sight, it seems to make sense to have risk-adjusted capital requirements, but in practice the adjustments create many more problems than they solve.

One can think of RWAs as a game to lower the ‘at risk’ numbers in order to get lower capital requirements. In this particular game, every asset is given a fixed arbitrary ‘risk weight’ of between 0% and 100% (and in exceptional cases, more). The ‘Risk Weighted Asset’ is then equal to the risk weight times the size of the position.

In the most egregious case, OECD government debt – including, at least until recently, Greek government debt – is assumed to be riskless and therefore attracts a risk weight of zero; bank holdings of such debt then attract a zero capital requirement.⁹ The debt of OECD governments would then be given a zero risk weight on the presumption that it is riskless whereas commercial debt would be given the normal full risk weight of 100%. Unfortunately, these government debt positions are not riskless and the Basel regulators’ treatment of them as if they were encourages banks to load up on such debt. This was a key aggravating factor in the European banking crisis.

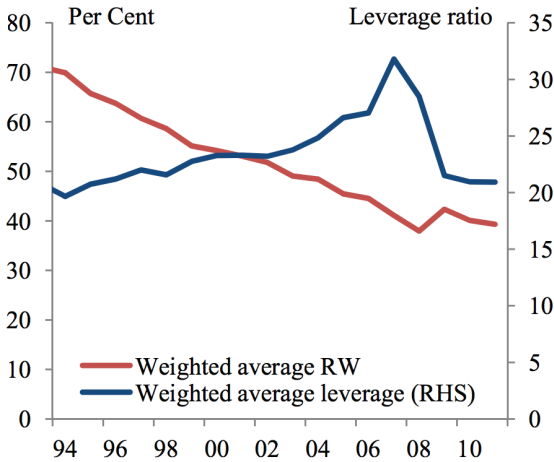
⁹ I believe the zero risk-weighting of Greek government debt is now under revision by the Basel Committee, five years after the riskiness of Greek government debt exploded on the scene in 2011.

The result is to create artificially low ‘Risk Weighted Asset’ measures that are much lower than total assets. To give an idea, latest available data for the UK banks that participated in the stress test show that their average ratio of RWA to total assets was a mere 33%. This means that on average across the system, two thirds of bank assets are deemed by this measure to have no risk at all! One institution, Nationwide, had a RWA to total assets ratio of just under 18%, meaning that no less than 82% of its assets were deemed to be entirely risk-free. So either these banks have indeed taken very low risks or they are just very good at playing the risk-weighting game. The evidence suggests the latter.

The performance of RWAs was illustrated by Andy Haldane (2013).¹⁰ He presents the following chart comparing RWAs with the simpler metric of bank risk, bank leverage or the ratio of bank assets to capital:

10 See A. G. Haldane, “Containing Discretion in Bank Regulation,” speech given at the Atlanta Fed conference, “Maintaining Financial Stability: Holding a Tiger by the Tail(s),” April 9, 2013), p. 10.

FIGURE 2: AVERAGE RISK WEIGHTS AND LEVERAGE^{(A)(B)}



Source: The Banker and Bank calculations

(A) Sample consists of Deutsche Bank, HSBC, BNP Paribas, Barclays, Citigroup, UBS, BAML, BONY, Commerzbank, ING, JPM, LBG, RBS, Santander, State Street, UniCredit, Wells Fargo. Data are not available for the remaining G-SIBs.

(B) Leverage ratio is defined as Total assets / Tier 1 capital.

The shapes of the two plots are virtually mirror images of each other. In the period from 1993 up to the crisis, average risk weights fell from 70% to 40%, whilst average leverage rose from about 20 to well over 30. The leverage ratio picked up the growing riskiness of the banking system, but the average RWA was a *contrarian* indicator of banking risk. As Haldane observed, as the crisis approached, “the risk traffic lights were flashing bright red for leverage [whilst] for risk weights they were signalling ever deeper green.” The explanation is that the risk weights do not reflect true riskiness, but instead reflect the increasing ability of bankers to game the risk-weighting system to hide the risks they are really taking. Thus, ironically, a *lower risk weight* translates into *greater risk taking*.

The RWA measure therefore violates a basic principle of scientific methodology – namely, that measures of the things we measure should actually measure the things that we think they measure. Instead, RWA is a pretend number that bears no useful relationship to the risks actually taken. Reliance on this pretend RWA number then has the effect of artificially boosting capital ratios that use RWA in the denominator, thereby creating capital that isn't really there, i.e., fake capital.

Part of the explanation for the declining RWA in Figure 1 is that banks were loading up on assets with low RWAs to reduce their capital requirements. Going further, this RWA system is tailor-made for gaming: a bank loads up on zero-weighted assets and is rewarded with a lower capital requirement because it is deemed to have low risk. In the limit, it could load up entirely on zero-weighted assets: it would then be deemed to have zero risk and incur a zero capital requirement.

The banks were gaming the system aggressively, too. When the higher Basel III capital standards were first announced in 2011, banks' first instincts were to comply by gaming the system. To quote an article by Tom Braithwaite in the Financial Times:

Jamie Dimon, JPMorgan's chief executive, said last week that he intended to "manage the hell out of RWA" to reach the higher levels. Morgan Stanley revealed that its risk-weighted assets had ballooned by \$44bn after the Fed said the bank was managing the hell out of its assets too much and told it to stop.

A senior executive at a third bank told me that it was scouring its balance sheet, looking for assets that could

be structured differently to achieve lower risk weights.

...

A senior regulator tells me officials are fully expecting various nefarious schemes to circumvent the rules, including structured transactions that do not reduce their risk but do reduce their RWA.¹¹

Banks were (and still are) engaging in vast financial engineering transactions to move assets from high to low weight classifications in order to reduce their capital requirements. Indeed, this game even has a name: Risk-Weight Optimisation (RWO). However, what RWO really means is Risk-Weight *Minimisation*. RWO was the main driving force behind the enormous growth in derivatives trading and securitization in the years running up to the Global Financial Crisis (GFC) – and, in so far as it led to (much) greater risk taking and (enormous) capital depletion, RWO was also a major contributing factor to the GFC as well.

A good example is the ‘how to destroy’ securitisation co-invented by my friend Gordon Kerr. This little beauty used Dark Side financial alchemy to game the Basel capital rules to magically transform a bog standard (big) bond portfolio held by a major UK financial institution into a (supposedly) almost risk-free credit derivative that warranted only one sixteenth of its previous capital requirement. Unfortunately, the risk reduction was only cosmetic and the bond portfolio remained as risky as it had been before. The transaction greatly reduced the bank’s required regulatory capital, which then allowed the banks actual capital to be greatly reduced too. Bonuses all round. The ‘how to destroy’ securitisation was soon widely copied and Gordon was left

¹¹ T. Braithwaite, “Banks turn to financial alchemy in search for capital,” Financial Times, October 24 2011.

wondering afterwards why it took so long for the banking system to fall over.¹²

Thus, zero or low RWAs do not mean that the assets involved are actually zero or low risk. Instead, they merely mean that Basel assigns zero or low risk status to the positions designated, which is an altogether different matter. Examples include not just Greek government debt but also carry-trade positions, which have zero risk weights, and many credit derivatives and securitizations, which have very low risk weights. What these positions have in common is that they are all highly risky, but the Basel system operates to make those risks all but invisible.

It was of course widely acknowledged that RWAs were flawed. The solution, it was claimed, was to make the capital requirements more risk-sensitive – and the way to do that was to allow banks with approved risk-modelling capabilities to use their risk models to help determine their capital requirements. This principle was first enshrined in the Market Risk Amendment to Basel I (1996). This Amendment allowed banks to use their risk models to help determine their capital requirements for their market risks. The use of risk models to help determine capital requirements for credit and operational risks was then the central feature of Basel II, which was rolled out to great fanfare in 2004. However, supplementing RWAs with risk models to determine capital requirements only made matters worse, as the risk models themselves are highly problematic:

- They are based on unreasonable assumptions (such as Gaussianity) and unreasonable risk measures (such as Value-at-Risk) that give enormous scope for creative traders and financial

¹² See G. Kerr, “How to destroy the British banking system – regulatory arbitrage via ‘pig on pork’ derivatives,” The Cobden Centre, January 21, 2010.

engineers to hide risks – traders can stuff risk into the tails and so on.

- They are based on huge numbers of parameters, many of which cannot be estimated with any reasonable precision. These parameters involve a great deal of model risk and just plain guesswork, all of which gives plenty of further scope for creative game-playing to drive the risk numbers down.
- There is an abundance of evidence from recent empirical studies to suggest that simpler models out-perform more complex ones.¹³

At a deeper level, Basel II created a model monoculture in which everyone was trying to do the same thing: model risks the same way to play the system. What none of the risk models could measure, however, was the risks created by all the banks acting as a herd, which is exactly how they then behaved.

There is also a version of Goodhart's Law operating by which risk models break down when used for control purposes, i.e., no model can take account of the ways in which it will be gamed. This interaction between the risk managers, the models they use to control risks and the responses of those being controlled by these models means that markets are not mathematizable. Risk modelling is then just a game: the bankers pretend to model risks, but they are really gaming

13 These include: A. Demirgüç-Kunt, E. Detragiache, and O. Merrouche, "Bank Capital: Lessons from the Financial Crisis," World Bank Policy Research Working Paper Series No. 5473 (2010); D. G. Mayes and H. Stremmel, "The Effectiveness of Capital Adequacy Measures in Predicting Bank Distress," mimeo (2012); A. N. Berger and C. H. S. Bouwman, "How Does Capital Affect Bank Performance during Financial Crises?" *Journal of Financial Economics* 109 (2013): 146–76; A. Blundell-Wignall and C. Roulet, "Business Models of Banks, Leverage and the Distance-to-Default," *OECD Journal: Financial Market Trends* 2012, no. 2 (2014); T. L. Hogan, N. Meredith and X. Pan, "Evaluating Risk-Based Capital Regulation," Mercatus Center Working Paper Series No. 13-02 (2013); and V. V. Acharya and S. Steffen, "Falling short of expectation – stress testing the Eurozone banking system," CEPS Policy Brief No. 315, January 2014.

the risk numbers – and the regulators openly encourage them to do so.

What then happened was that the banks hijacked the system and used it to ensure that their capital requirements became ever lower. The Basel system, which was meant to prop up banks' levels of capital, had become the means by which the banks were decapitalised instead – and by the bankers themselves. It was no coincidence that the financial crisis hit soon afterwards and much of the international banking system collapsed.

In short, the real (though seldom explicitly acknowledged) purpose of risk modelling is to use the capital regulation to decapitalise the banks. The cybernetic POSIWID principle applies: the purpose of a system is what it does, not what some regulator imagines it does. When the banks later go bust, the bankers play dumb and lobby for a bailout. The banks then get recapitalised, at public expense, and the game repeats itself. It is no wonder that the models don't work: they were not intended to.

One could give many examples of the inadequate performance of risk models but two in particular are positively stunning:

- Calculations performed by the Bank of England showed that for the four biggest UK banks, cumulative trading losses over the height of the crisis were up to *six times* the value of the model-determined capital set aside to cover against such losses.¹⁴
- UK bank losses between 2007-2010 – and these were primarily banking book losses – were nearly £100 billion, or over 183% of the banks' combined capital and reserves (LAPFF, 2011, p. 3).

¹⁴ A. G. Haldane, "Capital Discipline," speech given to the American Economic Association, Denver, Colorado, January 9, 2011), chart 3.

In each case, the risk models and resulting capital charges were signed off as compliant by regulators, but subsequent losses greatly exceeded the risk capital set aside to cover against them: the banks appeared to be capital adequate, but the model-based risk-weighted metrics merely disguised how weak the banks actually were.

2.4 THE LEVERAGE EXPOSURE MEASURE

To help mitigate these problems, the Basel III international bank capital adequacy regime introduced a new measure of the amount at risk known as the ‘leverage exposure’. This measure makes an attempt to incorporate some of the off-balance-sheet risks that do not appear in the total assets measure. However, large derivatives positions remain excluded from the leverage exposure because of rules that allow them to be excluded if they are offset by other positions, the theory being that the net position is hedged. Unfortunately, some hedges are very poor and not one is perfect: as we say in risk management, the only perfect hedge is in a Japanese garden. Hedges are imperfect for several reasons:

First, few (if any) hedge instruments are exact matches to the underlying position being hedged, which compensate exactly for losses on that position. Any *ex ante* assessment of the performance of a hedge instrument in an adverse scenario is dependent on a *lot* of assumptions, especially in very adverse scenarios (i.e., the ones that matter). There is always some slippage – known in the trade as basis risk – and some hedges involve a lot of basis risk. Even when a hedge looks good on paper, we often have little idea how well it would actually perform in a crisis. There is a lot of uncertainty about such matters – and I write as someone who knows the theory and has designed a few hedges myself over the years.

Most hedges involve contracts with counterparties and therefore create an exposure to counterparty credit risk. As we saw with AIG, if a key counterparty fails, the netting breaks down and the gross position can become net with miserable consequences for the party relying on the hedge.

There is also the possibility that such problems could create cascade effects. Suppose Bank A has some credit exposure to Bank B and institutes what appears to be a good hedging strategy to manage *that* exposure. Bank B, in turn, is exposed to Bank C, and institutes what appears to be a good hedging strategy to manage that exposure. Bank C then goes belly-up and Bank B experiences a gross-becomes-net disaster that is transmitted to Bank A, which was unaware of its indirect exposure to Bank C. Concerns about possible cascade effects were of course also a key feature in the AIG fiasco.

To give an example, over the period 2005 to 2009, it transpired that Deutsche Bank had a large – at one point, a \$130 billion large – position in leveraged super senior trades (‘super senior’ meaning theoretically safer than US government debt.) The main risks in these positions were credit risks, but it transpired that the bank was hedging them with S&P put options, i.e., it was hedging credit risks with market risks. Such a hedging strategy involves an amateurish mistake on a grand scale: market and credit risks are quite different, and there was a very real danger that both the original position and its supposed hedges could take massive hits at the same time. Indeed, such an outcome seems to have transpired. The same gross-becomes-net outcome proved fatal for Lehman and may well have proven fatal for Deutsche too – had the bank allegedly not hidden the problem until (some of) the truth emerged in 2012.¹⁵

¹⁵ T. Braithwaite, M. Mackenzie and K. Scammell, “Deutsche Bank: Show of strength or a fiction?” *Financial Times*, December 12, 2012.

Returning to the leverage exposure, we have all these problems plus the usual gap between theory and practice resulting from regulatory capture by the industry. In theory, the leverage exposure is meant to take account of off-balance sheet items that would not show up in traditional exposure measures such as total assets. However, the regulatory leverage exposure measure is a highly compromised measure that is the result of a lot of behind-the-scenes lobbying by banks keen to keep their measured exposures down in order to minimise their capital requirements. Given (a) that off-balance-sheet items considerably exceed on-balance-sheet ones and (b) that accounting netting rules tend to hide a great deal of financial risk, then we would expect any reasonable exposure measure to be much greater than reported total assets.

But they are not. When I looked into this matter, I was astonished to discover that the leverage exposures of UK banks are not only of the same order of magnitude as their balance sheet total assets, but are sometimes even lower. Consider Table 2, which compares the total assets and leverage exposure figures for the big 7 UK banks at end-2015 Q3:

TABLE 2: TOTAL ASSETS VS. LEVERAGE EXPOSURE, END-2015Q3

BANK	TOTAL ASSETS	LEVERAGE EXPOSURE
Barclays	1,236.5	1141
HSBC	1,684.6	1,916.2
Lloyds	817.7	723.2
NW	203.1	208.6
RBS	876.4	846.5
Santander	283.6	284
St. Chartered	444.8	516.2
Sum =	5,546.7	5,635.1

Notes: Total assets data are derived from the relevant institutions' 2015Q3 interim reports, with the exception of Standard Chartered. Its 2015Q3 interim statement was only a powerpoint presentation that did not include TA numbers, so the TA number for this bank was taken from its mid-2015 interim statement instead. The leverage exposure data are taken from Annex 1 of the Bank of England's 2015 stress test report. All data are expressed in £bn.

The average leverage exposure is less than 1.6% larger than average total assets. In the case of 3 banks (Barclays, Lloyds and RBS) the leverage exposure is less than the total assets, and in the most extreme case, Lloyds, the leverage exposure is only 88% of total assets.

Thus, the leverage exposure measure that takes account of (some) off-balance-sheet items can be less than the total assets measure that does not take account of any of them. If you don't understand that, then your brain is working.

What seems to have happened is that the problems posed by hidden off-balance-sheet risks and inadequate RWA measures led to regulatory pressure to find a new denominator measure that could be used as a basis for additional capital requirements. This response started as a worthy effort to patch up some of the more glaring loopholes in

the Basel system. However, the banking industry soon piled in to lobby against a broader denominator that would have increased their capital requirements – which was, of course, one of the objectives of the regulators in the first place.

Naturally, the banking lobby did not openly oppose the leverage exposure measure on the grounds that it would have led to higher capital requirements – that would have been in bad taste and all too obvious. Instead, the banks emphasised level playing field issues – which are fundamentally irrelevant. That is another story, however, relating primarily to the differences between US Generally Accepted Accounting Principles (GAAP) accounting standards and the IFRS accounting standards that apply in many countries outside the United States.¹⁶ The key point here is that the latter produce notably higher asset values and lower capital ratios than the former.

This US GAAP vs. IFRS issue provided a useful smokescreen, diverting the reform discussion towards harmonisation between the two sets of accounting standards over how to measure the denominator in the new regulatory leverage ratio that was to be introduced. In short, the banks hijacked the reform effort and the result was peddled as a solution to the off-balance-sheet problem when the reality was that it was anything but.

So, in practice, at least in the UK banking system, the net effect of moving from total assets to the leverage exposure, as the denominator in the leverage ratio, is all too small: the hype about the leverage exposure correcting the off-balance-sheet weaknesses of the total assets measure is belied by the data.

16 For more, see, e.g., A. Admati and M. Hellwig, *The Bankers' New Clothes: What's Wrong with Banking and What to Do about It*, Princeton: Princeton University Press, pp. 194-199.

Well, you might say, at least the leverage exposure gets us away from the evil of RWAs. In fact, it does not even do that. Instead, it reintroduces them through the backdoor under a different name. The relevant Basel Committee document handles derivatives exposures by means of a system of ‘Credit Conversion Factors’ – add-on factors that are not only arbitrary and fixed, but also completely senseless.¹⁷ For example, for standard interest-rate, FX, equities and commodity derivatives there are a series of add-on factors that vary from 0% to 15%, and for more exotic Total Return Swaps and Credit Default Swaps there are add-ons of 5% or 10%. The resulting numbers for off-balance-sheet positions are very low – which perhaps helps to explain why the reported leverage exposure numbers are not much different than the total asset numbers – and bear no relationship to the true risk exposures. These add-ons reintroduce the equivalent of new risk weights and take us back to the same RWA problems that the leverage exposure measure was supposed to escape from in the first place!

2.5 POOR DATA

There is also the problem that one cannot expect any capital adequacy metrics to be of much use if they are fed with poor data. Most stress test exercises involve stresses to a spreadsheet-based valuation model, and these are prone to a number of problems. These problems include a tendency to under-estimate the risks of complicated positions, such as those involving options, and the difficulties of handling unquantifiable factors, such as a bank’s exposure to misconduct and some forms of litigation risk. There is also the problem that a bank is likely to have thousands of different spreadsheet models and there will be no straightforward way of combining or standardising

¹⁷ See Basel Committee, “Basel III leverage ratio framework and disclosure requirements,” January 2014, pp. 18-19.

the information they provide across the institution as a whole. For all these reasons, and others, the data fed into any models will vary in quality and be prone to error. Indeed, the Bank itself acknowledged these issues in its 2014 stress test report, reporting that there was considerable variability in data quality across banks. Moreover, because of the asymmetric incentives involved, the tendency will often be for problems to be underestimated or hidden outright – until they suddenly come to light.

A perfect example was when the *Wall Street Journal* revealed the contents of a strongly worded letter sent to Deutsche Bank’s U.S. arm on December 11 2013 by the New York Fed. This letter disclosed that the bank was suffering from a litany of serious financial-reporting problems that it had known about for years but not fixed. These shortcomings amounted to a “systemic breakdown” and “expose[d] the firm to significant operational risk and misstated regulatory reports”, said the letter.¹⁸ The problems highlighted by the New York Fed include:

- Regulatory reports were of “low quality, inaccurate and unreliable ... The size and breadth of errors strongly suggest that the firm’s entire US regulatory reporting structure requires wide-ranging remedial action.”
- The bank had a “fragmented and ineffective” technology infrastructure, which impaired its ability to produce accurate regulatory reports. Its weaknesses included coding errors, inadequate documentation, lack of transparency, a dependence on multiple manual adjustments (and hence vulnerability to human error), inability to reconcile totals or implement complex reporting

18 All quotes are taken from D. Enrich, J. Strasburg and E. Henning, “Deutsche Bank suffers from litany of reporting problems, regulators said,” *Wall Street Journal*, July 22, 2014.

requirements and “inadequate and ineffective” oversight by compliance and internal audit.

- The Fed identified significant financial reporting weaknesses that had been outstanding all the way back to 2002. There had been “no progress” – note the phrase, “no progress” not “inadequate progress” – on remediating prior supervisory concerns. “Most concerning is the fact that although the root causes of these errors were not eliminated, prior supervisory issues were considered remediated and closed by senior management.”
- Despite finding dozens of problems, the author of the letter, Mr. Daniel Muccia, the Senior Vice President of the New York Fed with responsibility for supervising Deutsche, felt the Fed team were “just scratching the surface”. Abundant rumours suggest that he was right and that these problems are pervasive across the bank’s worldwide operations.

One might add that abundant evidence suggests that all the big megabanks are subject to similar problems. To quote a recent article in the *American Banker*:

Big banks are making critical risk management decisions with data that is often old, incomplete or even inaccurate. In fact, roughly half of the 30 globally systemically important banks believe they will fail to comply with important risk data aggregation principles by the January 2016 deadline, according to a recent survey by the Basel Committee on Banking Supervision. The other 50% say they will not be able to comply with all the principles, and some will barely scrape by.

This is bad news for the safety of the global financial system. Banks’ regulatory reporting and public risk

data only have value to the market if the information is accurate and timely. And risk managers are unable to minimize their risks and make effective resolution plans without reliable data. ...

More than seven years have now passed since the crisis. But despite the billions of dollars that the financial industry has spent improving IT architecture, banks have failed to prioritize risk data management.¹⁹

The underlying causes are many and difficult to put right. They include: a silo mentality that inhibits the sharing of data, especially among banks that have merged; out-of-date technology; manual processes for inputting data; inadequate data governance procedures; delays and cost overruns in large-scale IT infrastructure projects; and the demands and complexity of financial regulatory compliance projects. In addition, as the article continued:

Some banks have yet to communicate with their boards about their risk reporting's current limitations, according to the survey. And although all 30 banks said they would be unable to comply with one or more principles in a timely manner, they still told the Basel Committee that they could provide accurate and timely reports to risk managers and regulators. Based on the survey results and my own professional experience, it's safe to say that senior risk managers — who often fail to understand the complexities of IT — are being overly optimistic. ...

19 M. R. Valladares, "Bad Risk Data Could Be Big Banks' Downfall," *American Banker*, February 27 2015.

Until the market has proof that bank data is accurate, appropriate, complete and timely, banks' stress tests and capital reviews are neither credible nor reliable. Banks' capital ratios, liquidity and leverage buffers and living wills also cannot be trusted.

Achieving such transparency is easier than done:

regulators ... rely on self-declaration; what is presented by a bank's internal management. The trouble ... is that a bank's internal management often doesn't know what's going on because banks today are so vast and complex. ... "The real threat is not a bank's management hiding things from us, it's the management not knowing themselves what the risks are."²⁰

2.6 ACCOUNTING ISSUES

Leaving aside these enormous data-integrity and reporting issues to which all the megabanks seem to be prone, the traditional defence against data problems was to use audited data constructed using GAAP. A trained accountant could then interpret the accounting data and make judgments accordingly. Under the rules regarding 'true and fair view', the primary consideration was prudent capital maintenance, i.e., prohibitions against overstating capital and reserves. Accordingly, under traditional UK GAAP, a position was to be valued at the lower of cost or net realisable value, i.e., the recoverable amount of the asset whether it is held to maturity or sold, and

²⁰ J. Luyendijk, "How banks ignored the lessons of the crash," The Guardian, September 30 2015.

not based on potentially over-optimistic valuation approaches such as ‘mark to market’.

Unfortunately, this critically important requirement was done away with when the UK adopted IFRS; these accounting standards allow various valuation fudges that have the effect of rendering accounts unreliable, especially for banks. In a sound accounting system, banks would be required to disclose their best estimates of expected losses on their portfolios and would face penalties if they failed to do so. However, under IFRS, banks were given much greater discretion: they could now select their own criteria for booking (expected?) losses based on observable data. This is the ‘incurred loss’ model: losses didn’t *have* to be disclosed till after they had been incurred. If the horse subsequently bolts, the auditors can claim that the horse seemed calm enough when they last inspected it and the rules didn’t require them to check the stable doors.

As Tim Bush explains, IFRS rules:

require holding loans at their cost, less an amount called “impairment”. However, the method in the standards to determine “impairment”, rather than looking at factors before the event to reflect the value of the loan (its recoverable amount), was instead looking at factors after the event, thus not taking into account the risk of the borrower not paying, due to his income status or lack of asset cover. Instead of building [this] risk into the value of the loan, the IFRS model waited until the customer stopped paying, i.e. bad loans are structurally overvalued and the higher the risk the higher the overvaluation. Put another way, accounts can be signed off, in accordance with IFRS, despite there being a fundamental uncertainty

whether the balance sheet can, in fact, be realised at the stated amount. Given that a bank that will not recover its balance sheet at the stated amount is likely to become insolvent, this is a significant hazard. Prudent accounting is in a sense a “stress test”, it is reducing the value of loans for the non-collection risk inherent in a loan. IFRS required leaving this risk out. In doing so it closes down lines of inquiry that should be hard-wired into the systems of a bank in order to get the audited numbers right. ...

The IFRS model is inconsistent with the going concern basis of preparing accounts as it can be impossible with a set of IFRS compliant accounts to determine whether the drivers of being a going concern, capital and profits, are in fact real or not. (LAPFF, 2011, pp. 6-7, my italics)²¹

A now notorious example was RBS’ use of IFRS to inflate its 2010 profits and capital by somewhere between £19bn and £25bn (see, e.g., Kerr 2011, pp. 44-45, 78-80).²² This problem only became apparent when Tim Bush, Gordon Kerr and MPs Steve Baker and David Davis compared the different valuations of the same loan assets prepared by RBS, which owned them, and the UK’s Asset Protection Scheme (APS), which insured them. It turned out that RBS used the relevant accounting standard, IAS 39, as a lender and only recognised losses when they occurred, whereas the APS used IAS 39 as an insurer, and ‘fair valued’ the assets taking into account expected loan losses. When confronted with this discrepancy, RBS initially

21 Local Authority Pension Fund Forum (2011) UK and Irish Banks Capital Losses – Post Mortem. London: Local Authority Pension Fund Forum.

22 G. Kerr, (2011) The Law of Opposites: Illusory Profits in the Financial Sector. London: Adam Smith Institute.

denied any problem, but later switched to the line that it was within its rights under IFRS rules. This latter claim is untrue, however: the UK Companies Act requires that accounts be materially correct and take into account unrealised as well as realised losses. To compound its malfeasance, RBS's accounts also 'fair valued' the APS insurance on its assets and then showed this latter figure as an additional asset, despite the fact that it could only be realized if losses were so high that they wiped out the bank's capital. As Kerr explains:

This accounting treatment may be [IFRS] rule-compliant but is clearly wrong. Imagine that two schoolboys board a train. One has £10 in his wallet and is concerned about losing it. The other has £5 and feels the train to be safe from robbers. In exchange for a sweetie the second schoolboy offers to hand over his £5 if the first schoolboy loses his £10. Under RBS' interpretation of IFRS accounts, the first schoolboy would record his assets as £14. (Kerr, 2011, p. 80)

My main point, however, is simply this: even the audited accounts, the best data available, cannot be trusted.

A second example comes from recent testimony at the UK Treasury Committee. With a still incomplete investigation going on into the failure of HBOS in 2008, the Committee was recently able to extract from its auditor, KPMG, that they were debating the sufficiency of IFRS provisions of the order of £1bn to £1.5bn. The actual outcome was £53bn, and PRA chief executive Andrew Bailey confirmed that the true losses were in excess of shareholder funds and bail-in capital (i.e., subordinated debt): HBOS was bust several times over. The authorities then encouraged Lloyds to take over HBOS to keep it

going, but HBOS's losses sunk Lloyds as well, and Lloyds was subsequently bailed out by UK taxpayers.²³

Another example is provided by recently come-to-light transactions between Monte dei Paschi Bank (MDP), the world's oldest bank, and Deutsche and Nomura.²⁴ MDP's counterparties gamed weaknesses in the IFRS accounting architecture to transact Credit Default Swaps designed in such a way – and this is the clever bit – that *the transactions did not appear on the balance sheets of either party*.

The origins of this deal go back to the height of the crisis in December 2008, when MDP management was incentivised to hide some €557 million in losses. Revealing those losses would have been inopportune as MDP was negotiating a state rescue at the time. The CDS transactions enabled MDP to roll over the position, hiding its insolvency until details began to emerge in early 2013, by which point the bank had accumulated a loss of €730 million and was seeking a second state bailout. By this time, Deutsche and Nomura had earned over €180 million in profits at MDP's expense. This type of transaction is hugely significant because it renders published accounts potentially useless as a means of revealing banks' true positions. We therefore have little solid idea of how strong *any* of the banks really are: again, the accounts cannot be trusted. One presumes that there must be many similar transactions out there that have yet to be come to light: once one finds one cockroach, there are usually others.

23 See T. Bush, The state of banks and banking regulation, PIRC Analysis and Research, April 2016.

24 See E. Martinuzzi, "Monte Paschi Says Nomura, Deutsche Bank Helped Mask Losses," Bloomberg April 2, 2013, and Gordon Kerr, "How Deutsche Bank (and others?) trade credit default swaps without accounting entries," paper presented to the Ravda Conference on International Economics, Ravda, Bulgaria, May 2014.

As a final example, in 2013 Frank Partnoy and Jesse Eisinger went through the 2011 Annual Report of one of the better US banks, Wells Fargo, to see if a careful read could produce anything intelligible about the risks the bank was taking, how it valued its assets and liabilities and, indeed, what those assets and liabilities actually were.²⁵ They found that these public disclosures were virtually useless.

Like many other banks, Wells Fargo uses a three-level hierarchy to report the fair value of its securities. The safest, Level 1, applies to traded assets and fair-values them at their market prices. Level 2 assets (such as some mortgage-backed securities) are not traded on open markets and are fair-valued using models calibrated to observable inputs such as other market prices. Level 2 fair-values can be described as being based on an educated guess. The murkiest, Level 3, applies to the most esoteric instruments (e.g., CDSs and CDOs) and are fair-valued using models not calibrated to market data, i.e., in practice, mark-to-myth. The scope for error and abuse involving Level 2 and especially Level 3 assets is too obvious to need spelling out. Given the bank's reputation, one might have imagined that most of its assets were Level 1, but it turned out that only a small fraction of their assets were Level 1. Most assets were Level 2 and their Level 3 assets were a whopping \$53bn: 36% of the bank's total shareholder capital of \$148bn. The problem is that there is no way to check the bank's Level 2 and Level 3 valuations. Outside analysts then have no choice but to take the numbers on trust, despite the incentives on the bank's part to goose up the numbers.

Banks also have large off-balance-sheet positions known as 'variable-interest entities' or VIEs, and Wells Fargo reported that the "maximum exposure to loss" of its VIEs was just over \$60bn or 40%

²⁵ F. Partnoy and J. Eisinger, "What's inside America's banks?" *The Atlantic*, January/February 2013.

of its shareholder capital. However, it also acknowledged that it did not report its entire VIE exposure, nor how it arrived at its reported \$60bn maximum exposure figure. The suspicion then lingers that these VIEs were accounting gimmicks to avoid full disclosure – and this suspicion was reinforced by the bank’s refusal to provide any explanations when the authors challenged them to. At the same time, the notional assets involved in these VIEs amounted to \$1.4 trillion; we are then talking about nearly \$1.5 trillion in exposure to complete unknowns.

These authors also cited a number of leading experts who all claimed that not a single US bank provided financial statements that gave *any* meaningful indication about the risks it was taking.

This last example illustrates arguably the biggest problem with current accounting standards: the treatment of off-balance-sheet activities by which risk exposures can be hidden away. To quote a perceptive analysis by Frank Partnoy and Lynn Turner:

Abusive off-balance sheet accounting was a major cause of the financial crisis. These abuses triggered a daisy chain of dysfunctional decision-making by removing transparency from investors, markets, and regulators. Off-balance sheet accounting facilitated the spread of the bad loans, securitizations, and derivative transactions that brought the financial system to the brink of collapse. ...

Off-balance sheet problems have recurred throughout history, with a similar progression. Initially, balance sheets are relatively transparent and off-balance sheet liabilities are minimal or zero. Then, market participants argue that certain items should be excluded as

off-balance sheet. Complex institutions increase their use of off-shore subsidiaries and swap transactions to avoid disclosing liabilities, as they did during both the 1920s and the 2000s. Over time, the exceptions eat away at the foundations of financial statements, and the perception of the riskiness of large institutions becomes disconnected from reality. Without transparency, investors and regulators can no longer accurately assess risk. Finally, the entire edifice collapses. This is the story of both the 1920s and today.

As in the past, the off-balance sheet complexity and exceptions have gone too far. The basic notion that the balance sheet should reflect all assets and liabilities has been eaten away, like a piece of Swiss cheese with constantly expanding holes.²⁶

What is off the balance sheet swallows up what is on the balance sheet. Off-balance-sheet abuses render banks' financial statements virtually useless and their true exposures become impenetrable.

It is not for nothing that the balance sheets of the big banks have been described as the 'blackest of black holes'.

26 F. Partnoy and L. E. Turner (2010) "Bring transparency to off-balance sheet accounting," *Make Markets be Markets*, Roosevelt Institute.

Chapter Three: Stress-Testing Methodology

This chapter goes through the methodological issues involved in central bank/regulatory stress testing and highlights a number of major problems with these exercises.

3.1 INTRODUCTION

The primary purpose of central bank stress testing is (supposedly) to assess the banking system's capital adequacy, i.e., the ability of banks to withstand financial stress.²⁷ A stress test has three key components:

²⁷ I emphasise that I am concerned in this study only with stress tests for bank solvency; stress tests for bank liquidity adequacy are another subject on which there is much to be said. An introduction to those stress tests is L. L. Ong and M. Žihák, "Of Runes and Sagas: Perspectives on Liquidity Stress Testing Using an Iceland Example," IMF Working Paper 10/156, July 2010.

- An assumed adverse stress scenario – essentially a guess scenario generated by modellers at the central bank.
- A metric to gauge the strength of each bank. This metric is the bank's capital ratio – the ratio of 'core' capital to some measure of the total amount 'at risk' - the intuition being that core capital provides a buffer to absorb potential losses and keep the bank solvent in a crisis.
- A pass standard by which to determine whether the post-stress value of the capital ratio is (or is not) high enough to merit a pass mark in the test.

There is a natural analogy with a school exam, the purpose of which is to assess a student's academic strength. It too has three key components:

- There is an exam paper based on a set of questions and the underlying issue of how easy or tough the exam paper might be. The easiness/toughness of an exam paper is comparable to the severity (or otherwise) of the stress scenario.
- There is the performance of the candidate in the exam, i.e., the mark or grade they receive.
- There is the pass standard, i.e., the minimum mark that a student must achieve in order to pass the exam.

One then draws one's conclusions. For example, if one had an easy set of questions, a low pass standard *and* a student who achieved a low mark, then one would conclude that the student was academically weak.

Similarly, if one had a stress test with a mild stress scenario, a low pass standard and generally low post-stress capital ratios then the test would prove that the banking system was financially weak.

Central bank stress tests also have a second objective – to promote public confidence in the banking system and, implicitly, to promote confidence in the central bank’s policies towards the banking system. Indeed, this objective is stressed so frequently by central banks that one often gets the impression that the promotion of confidence is actually the primary objective.

But the question is whether that confidence is justified or not.

The problem is that these two objectives are often in conflict. If the banking system is weak then a bona fide stress test with a severe scenario and a rigorous pass standard should reveal that weakness. Unfortunately, revealing that weakness would undermine confidence in the banking system and undermine the second objective. In such circumstances, the only way to achieve the confidence-boosting objective is to water down the stress test exercise to engineer an undeserved pass result.

If the stress tests give the banking system a clean bill of health, the clash between these two objectives gives the central bank a credibility problem: it needs to persuade potential critics that the test really was demanding, and reassure them that it is not putting its confidence-boosting objective ahead of the integrity of the test itself.

This credibility problem is *the* central issue with the stress tests.

This problem is heightened further by the fact that the central bank has a vested interest in the confidence-boosting objective: apart from anything else, for the central bank to suggest that the banking system was in poor shape would be to admit that its own policies had failed.

However, it is still possible for an outside observer to make an informed judgment on the integrity of any stress test: the key is to

look for evidence that the test is demanding. So if there is strong evidence that the adverse scenarios are genuinely severe and if there are a reasonable number of them, if the pass standards are high, if there are no obvious major biases or weaknesses, and so forth, one might incline to believe the results; conversely, one might not.

We now consider some of the key methodological problems in stress testing, bearing in mind that we have already covered the measurement and data issues in Chapter 2.

Let's begin with the pass standard.

3.2 THE PASS STANDARD

The pass standard needs to be high enough to be demanding or else the exercise serves no useful purpose. But how high should it be? The answer depends, in part, on whether one wishes to assess the banking system against a minimum solvency standard or against some higher standard, e.g., a 'good health' standard opposed to a 'death's door' standard. One might infer a pass standard from regulatory practice (e.g., from minimum regulatory capital standards), from historical experience or from expert opinion (e.g., on what minimum required capital standards should be). We shall come back to these issues in later chapters.

3.3 THE STRESS SCENARIO(S)

A stress scenario is a hypothetical adverse event – essentially, it is a model-based guess of what might happen in the future. The first question that then arises is how severely adverse should a stress-scenario be? There are no hard and fast rules here, but one needs a

scenario that is seriously severe but not off-the-chart severe. If a scenario is too mild, then the usual stress test result – that the banks pass the stress test – is of no use beyond an attempt at propaganda. A stress test based on a mild scenario is like an exam with a very easy set of questions: it tells us nothing useful because even a poor candidate will pass. At the other extreme, an impossibly severe scenario is of no use either. The corresponding exam analogy also applies: an exam with an impossibly demanding set of questions tells us nothing useful because even the best candidate will fail.

Then there is the question of the type of scenario to use in a stress test. Again, there are no hard and fast rules, but one is looking for plausible ‘what if’ adverse events. These could be based on suspected vulnerabilities: if one suspects that a bank is heavily exposed to, say, real estate, then one might use stress tests that attempt to gauge the bank’s ability to withstand a severe real-estate downturn. One can also select scenarios based on hypothetical repeats of historical experiences or contemporary experiences overseas. Most obviously, one might compare the severity of a scenario with the 1930s, the East Asia crisis, 2007-2009 or the recent experience of countries in the Eurozone.

One should also bear in mind a glaring blind spot in central bank stress scenarios. A factor that each of the crises just mentioned have in common is central bank incompetence, not only in handling them but also in creating them in the first place. The history of Federal Reserve monetary policy is another good example:

much market instability arises from the erratic monetary policies of the Federal Reserve itself. ... By my count, there are 10 notable interest rate peaks [since the 1950s]. All but one—that of the mid ’90s—were followed by sharp falls. Among the highlights were

the massive, necessary-but-painful Volcker interest rate hike starting October 1979, which left much of the banking system insolvent in the early 1980s; the doubling of interest rates over 1994, which led to a wave of defaults (Orange County, etc.); Greenspan's warnings of "irrational exuberance" in 1996 followed by monetary easing, which stoked the tech bubble that burst in 2001; and after interest rates peaked again, another major volte-face occurred, in which interest rates became negative in real terms and stoked the subprime mortgage market. By 2007, interest rates had climbed again to just over 5 percent, but they were brought down to virtually zero in 2009 and have remained there since, well below inflation for nearly six years. If the past is anything to go by, these rates are stoking the mother of all booms and the mother of all busts as well. So, on the one hand, the Fed endorses – in fact, requires – the use of risk models, but on the other, it undermines them by its own erratic monetary policies: the models cannot pick up the Fed's sharp and unpredictable twists and turns. In fact, even the Fed itself can't predict its own erratic twists and turns ... it is the Fed that ultimately drives interest rates through its control of the money press, and the market merely reacts: the instability that everyone feared was created by the Fed itself.²⁸

There is, then, a curious irony: we are being asked to have confidence in the central bank's competence as a supervisor or stress tester when it is the central bank's *in*competence as a monetary policy maker

28 K. Dowd, "Math Gone Mad: Regulatory Risk Modeling by the Federal Reserve," Cato Institute Policy Analysis Number 754, September 3, 2014.

that creates the need (such as it is) to have these functions to begin with. Which consideration suggests that any central bank stress scenario is unlikely to include the biggest risk factor of them all, namely, the instability that the central bank itself creates. We can't reasonably expect any central bank to anticipate the consequences of its own incompetence, but it really should if the stress tests are to be credible.²⁹

There is a General Principle at work here: we cannot expect a central bank's stress tests to take account of the main risks facing the banking system, if only because it is the central bank itself that creates them.

There is also the question of how many scenarios to run. Since the future is uncertain, one wants a range of substantially different scenarios that one hopes might approximate the main risks that banks face as best one can perceive them. However, there is no magic formula to tell us how many scenarios to consider, i.e., one has to make a judgment about how many to use.

There is, however, one hard and fast rule: both the risk management literature and even common sense suggest that, at the very least, one should *not* rely on a single adverse scenario.³⁰ The chances of any particular scenario coming to pass are very small, and it is highly likely that one will get an outcome quite different to that envisaged.

So even if one conducts an otherwise flawless stress test that shows that the banking system is safe under the scenario considered, one

29 See also J. Alexander, "Who should stress test the stress testers?" *Historinhas*, July 31, 2015.

30 For more on the state of the art in financial stress testing, see, e.g., "Stress testing", pp. 291-307 in K. Dowd, *Measuring Market Risk*, 2nd edition, Chichester: Wiley, 2005 or D. Rösch and H. Scheule (eds) *Stress Testing for Financial Institutions*, London: RiskBooks, 2008.

cannot possibly know whether the banking system will be safe under all the other plausible scenarios that were not considered. This is so because:

- The impact of any scenario on a bank depends on the extent to which the scenario captures that bank's particular vulnerabilities – banks have different business models and different sectoral and geographical footprints.
- If one relies on just one scenario one could easily have a situation where a weak bank performs well in a stress test only because the scenario misses its main risk exposures. It is precisely to reduce this danger that the stress testing literature advises that, if one are to do stress testing at all, one should rely on multiple and substantially different scenarios in the hope that if a bank has a major vulnerability, then at least one of the scenario analyses will flag it.

To illustrate, in the 2014 stress test exercise, the Bank's scenario highlighted the housing risks that were a particularly noticeable issue for the Co-op, Nationwide and RBS; at the same time, it downplayed the risks of the overseas exposures of banks such as Barclays, HSBC and Standard Chartered. An alternative scenario that downplayed the former risks but highlighted the latter would likely have had quite a different impact across the banks – and we saw exactly this with the Asian-based adverse scenario in the 2015 stress tests. However, neither scenario gives us much guidance on how the banking system would respond to any of a large range of *other* plausible adverse scenarios such as geopolitical shocks (e.g., from the Middle East, Russia, etc.), a worldwide liquidity shock (e.g., in the US Treasuries market), a renewed Eurozone crisis (e.g., a Greek default, the impact of Eurozone deflation or the failure of a big European bank). If one wishes to know how the banking system might respond to any of these scenarios, one actually has to carry out the scenario analyses for them.

No single scenario can *ever* give you confidence that the banking system is safe. A recent article put this point much better than I could:

A key principle underlying the Bank's approach to stress testing is to explore a range of scenarios. Any single scenario is almost certain not to materialise. And it is not desirable from a regulatory perspective that the banking system as a whole is only assessed against a single 'bad state of the world'. Moreover, from a practical perspective, differences in banks' business models imply that scenarios that might be stressful for one bank might be much less so for another. To make the framework useful for policymakers, stress tests should explore different vulnerabilities and manifestations of possible future stresses.

And where does this admirable advice come from? It comes from the Bank of England's own 'framework' paper on the stress tests!³¹

Imagine your doctor is giving you a health check-up: they wouldn't run a test for bowel cancer, say, and then use a negative result to conclude that you were free of heart disease, let alone of anything else that you might have as well. If your doctor did that, they would be struck off. No one medical test can reassure you that you are in perfect health, and yet this is exactly what the Bank is trying to do with its stress tests: it is trying to use one test (and a weak one at that!) to demonstrate that the banking system is in good health. It just can't be done.

To repeat: we cannot draw general inferences about the robustness of the banking system to a range of possible future shocks from any

31 See Bank of England, "A framework for stress testing the UK banking system," October 2013, p. 19.

exercise based on a single hypothetical scenario. Yet this is exactly what the Bank's stress testing programme is attempting to do.³²

Apart from anything else, if the Bank only considers one scenario a year, then there is an excellent chance that the scenario that matters will have occurred before the Bank got around to thinking about it: the whole point of these exercises is to assess risks in advance so something can be done before the ship hits the rocks.

In stress testing, what is important is to model a range of different scenarios in a simple broad-brush manner, not to fine-tune any one scenario to the n^{th} degree whilst ignoring other scenarios entirely. To quote risk expert Christopher Finger

we do not look at any single scenario carefully, but rather hope that the set of scenarios covers the spectrum of risks we might face.³³

Indeed, one might say that this is the first fundamental principle of good stress testing.

3.4 STRESS MODELLING PROBLEMS

The Bank's approach makes use of a suite of models, some its own, others the models of the individual banks involved – though in using the banks' own models, the Bank has to take into account an important moral hazard involved: the incentive that banks face to

32 See Bank of England, "A framework for stress testing the UK banking system," October 2013, p. 19.

33 C. C. Finger, "Epilogue – Fishing for complements", p. 444 in D. Rösch and H. Scheule (eds) *Stress Testing for Financial Institutions*, London: RiskBooks, 2008.

under-estimate the impact of adverse scenarios to improve their score in the test. Leaving aside for the moment how it would address this moral hazard problem, the Bank would carry out partial-equilibrium analysis of each model on a stand-alone basis to gauge first-round effects. This analysis would then be supplemented by system-wide analysis that attempts to capture feedback, interaction or amplification effects across institutions and markets – these might include effects on market interest rates, liquidity, credit or confidence, as well as interactions between the real and financial sectors of the economy – in an attempt to model the resulting general equilibria (GE); these effects would primarily be modelled by the Bank itself.³⁴ However, the Bank acknowledges that research in this latter area is still at an early stage and the systemic GE effects of scenario modelling are far from well understood.

These latter claims are understatements. The current generation of models is a long way from providing a plausible picture of the dynamics of financial distress. Most analysis is partial-equilibrium, non-linearities are limited and feedback and amplification effects are mild, to the extent they are even modelled at all. To quote Borio *et alia* (2011)

All this shifts the burden of producing any damage from the properties of the models to the size of the shocks, which end up being “unreasonably” large. Market participants complained loudly that the crisis was generating twenty-plus standard deviation moves. But this was not, to put it mildly, an accurate reflection of the rarity of the event.

34 For more on the Bank’s scenario modelling, see Bank of England “A framework for stress testing the UK banking system”(2013, Box 4, pp. 26-27).

As yours truly once pointed out, we would have to wait a period many trillions of billions of times longer than the entire history of the university to expect to observe a single day with a 25 sigma event under the Gaussianity assumption that is still standard in risk modeling.³⁵ As a result, this dependence on large shocks to produce stressful outcomes reflects

serious shortcomings in the models, for both micro and macro stress tests. No matter how hard one would shake the box, little would drop out.

More generally, the models are the antithesis of what financial instability is all about ... The very essence of financial instability is that normal-size shocks cause the system to break down. An unstable financial system is a fragile financial system; it is not one that would break down only if hit by severe macroeconomic shocks. And yet this is typically what stress tests need to assume.³⁶

The same authors go on to summarise a large volume of empirical evidence from past crises. The gist of this evidence is that financial crises tend to begin at the peak of the medium-term financial cycle, typically exemplified by the joint behavior of credit and property prices, *not* during the depth of the bust.

This evidence amounts to a very tall order: to be empirically realistic, one needs a model that *depends* on non-linearities and feedback

35 K. Dowd, J. Cotter, C. Humphrey and M. Woods, (2008) "How Unlucky is 25-Sigma?" *Journal of Portfolio Management*, Vol. 34, No. 4: 76-80.

36 C. Borio, M. Drehman and K. Tsatsaronis, "Stress-testing macro stress testing: does it live up to expectations?" Bank for International Settlements, 29 November 2011.

effects to generate systemic financial instability: their nearly linear nearly partial-equilibrium equivalents will not do. But let's suppose that the Bank *has managed* to solve this problem. How then does it persuade skeptics that they should take seriously a model that suggests that a relatively *small shock* will produce a *major* crisis, especially in the empirically relevant circumstances where the major indicators suggest that the banking system is safe and there is nothing to worry about? The Bank of England would be caught in a Catch 22: to be empirically realistic, it needs a model that shows how a small shock could bring about a crisis, but no skeptic would believe it and the Bank could not possibly defend such a position.

To paraphrase Borio *et alia* as they continue:

Consider the context. The key concept here is what one might call the “paradox of financial instability”: the system looks strongest precisely when it is most vulnerable. Credit growth and asset prices are unusually strong, ... profits and asset quality especially healthy, risk premia and volatilities unusually low precisely when risk is highest. What looks like low risk is, in fact, a sign of aggressive risk-taking. ... [Risk] measures were unusually subdued ahead of the crisis and showed signs of trouble only once overt financial market stress emerged in mid-2007. Indeed, ahead of the crisis the most common question was: “where has the risk gone?”; no one could find it, regardless of where one looked.

Moreover, the temptation to argue that “things are different this time”, that risks have disappeared, is especially strong when, as is typically the case, these booms go hand-in-hand with rapid financial

innovation. Financial innovation holds out the promise of a much better management of the risks and, at the same time, stacks the deck against disproving this proposition. By construction, no historical data exist for new products and extrapolating reliably from the performance of similar ones can be very difficult.

All this means that macro stress testing faces an uphill struggle. Technically, not only does the size of the shock have to be very large to get any action in the model, regardless of initial conditions in the system. Now those initial conditions, both balance sheets and earnings capacity, appear unusually strong, compounding the problem. No wonder the macro stress tests carried out ahead of the crisis did not identify serious vulnerabilities. Behaviourally, even if the stress tests were successful in pointing to potential vulnerabilities, it would be hard to have participants take them seriously. The tests would be run precisely when hubris was at its highest and prudence at its lowest. ...

The bottom line is simple. The fact that (macro) stress tests lulled policymakers and market participants into a false sense of security in the run-up of the recent crisis was not happenchance. It was an accident waiting to happen. ... But one thing is certain: as devices to identify vulnerabilities in tranquil times, stress tests have a huge challenge ahead. The deck is stacked against them.

There is also another almost impossible-to-resolve stress-modelling problem: the macro scenarios used by central banks in their stress tests are way too orderly and tidy. As Morris Goldstein explains, they

don't capture adequately the chaos, contagion, and adverse feedback and amplification effects from the financial sector to the real sector- all of which make financial crises much costlier than normal recessions ...

He gives a nice example, paraphrased below:

(a) when former Fed Chairman Bernanke (2007) testified to Congress in 2007 about the sub-prime crisis, he estimated that it would generate total losses in the neighborhood of 50-100 billion dollars; but (b) Bernanke recently explained that, by September and October of 2008, 12 of 13 of the most important financial institutions in the United States were at risk of failure within a period of a week or two. The question for stress test architects and model-makers is how do you make your models generate a transition from (a) to (b) in the course of say, a year or two. *This is not a technical sideshow. In stress modeling, it is the main event.*³⁷
(My italics)

Then there are the moral hazard issues. The Bank discusses systemic modelling issues as if they were simply technocratic problems that could be solved by further academic research and by the

³⁷ M. Goldstein, Banking's Final Exam: Stress Testing and Bank-Capital Reform, draft manuscript, February 2016, pp. 4 and 191.

Bank assuming greater control and throwing more resources at them. However, any such solution has the potential to be highly counterproductive.

Consider the modelling moral hazard problems between the banks and the Bank. At first sight, the Bank's solution of taking control over the banks' stress modelling might seem a reasonable one: the Bank has more expertise, a wider view and a wider remit, etc.

However, increasing Bank control exacerbates the problems of genuine risk management. Model-based risk control is problematic even in the best-case scenario when there is local risk management. Risk takers such as traders will always respond to any risk management system by exploiting its blind spots – exploiting under-estimated risks – and no risk model can take into account how it will be gamed by those whose behaviour it attempts to model: there is a Goodhart's Law at work by which any risk model has a tendency to break down when used for risk management purposes. These control problems tend to worsen as risk control becomes more centralised and more divorced from actual risk-taking decisions: the control system becomes more complicated, more standardised, more rigid and more gameable. The natural response from the central bank is then to become more prescriptive about the risk-taking as well, and the banking system moves further and further towards central planning – a process we can already observe well under way in the United States (of which more in Chapter Six below).

There is also another moral hazard problem – that between the Bank and its stakeholders, i.e., Parliament and indirectly the public – and giving the Bank greater responsibility makes this moral hazard worse. To illustrate, consider what would happen if the Bank were to publish results that suggested that the banking system was in bad shape. Such results would immediately undermine the Bank by highlighting

that it had failed to restore the health of the banking system despite all its past promises and the massive public expenditures devoted to doing so. Publication of the results would also have the potential *in itself* to shatter public confidence in the banking system and trigger a renewed banking crisis. Remember, too, that promoting public confidence in the banking system is not only one of the purposes of the stress tests, but also one of the core duties of the central bank. It follows, then, that we cannot realistically expect the Bank to publish results that are too negative: even if the Bank had severe doubts about the strength of the banking system, it cannot be expected to admit to them – and everyone knows this. The stress tests cannot then be credible, because only a reassuring answer can ever be allowed.

It is therefore naïve to assume that the Bank is some disinterested public servant committed to selflessly pursuing the ‘public interest’ whilst lesser players selfishly put their own interests first. Instead, we should see it for what Public Choice economics tells us that it is – a public agency with its own institutional self-interest and agenda.³⁸ Public Choice also tells us to expect the same self-serving party line: lessons learned so don’t bother us with past mistakes, you can trust us in the future, give us more power and more resources, etc. – which, by a curious coincidence, is what the Bank always says.

3.5 DISCLOSING STRESS-TEST RESULTS

I have presumed hitherto that when it had finished conducting its stress tests, the central bank would simply publish its results and be done with it. However, this presumption begs the question of how

38 John Allison provides a compelling public choice analysis of the Federal Reserve along just these lines: see J. A. Allison, *The Financial Crisis and the Free Market Cure: How Destructive Banking Reform is Killing the Economy*. New York: McGraw Hill, 2013.

much the central bank *should* disclose. At the other extreme, any central bank is perfectly entitled to carry out private stress tests whose results might be kept secret, but which might inform its judgements about the health of the banks examined, and most central banks do so. Beyond acknowledging that such in-house tests might have a useful prudential purpose, I have little advice to offer beyond what is in the standard risk management literature on stress testing, which I have referred to elsewhere, e.g., Chapter 13 in my *Measuring Market Risk* or Rösche and Scheule's *Stress Testing for Financial Institutions* (London: Incisive Media, 2008): the stress tester should consider multiple simple scenarios and so forth. Needless to say, when they do identify a vulnerability – one thinks here of the Ghost of Northern Rock – they should then do something about it.

Once one gets into disclosure issues there are three points I would make. The first is that the Bank of England makes a *huge* deal about disclosing stress-test results to facilitate transparency and accountability, promotion of confidence and so forth. I don't buy any of it: I can't understand how conflicted black boxes promote transparency when there is no effective means of holding the central bank to account (of which more in the next section). But in this context, I take it as read that there is no useful point in central banks promoting a disclosure agenda and then refusing to release any details of their stress tests that would allow outsiders to come to their own independent views.

The second point is that disclosing results can complicate the central bank's prudential tasks and greatly distort the stress test itself. As Charles Goodhart recently argued:

any bank that is deemed to fail the stress test must be named, and is consequently shamed, and will, therefore, have markets turned against it. This causes the

whole process to become distorted; banks will try to game the exercise by setting their resources at levels that will just satisfy the authorities' presumed requirements; and the authorities will try to set their initial shock assumptions at levels that will just find a preordained set of banks failing the test, not too many, nor too few. If the exercise was done behind closed doors, without fear of leaks, the stress tests could be done honestly. As it stands, an outsider, like myself, reckons that there will be a modicum of stage management about the whole exercise. Insiders will protest that everything is clean and straightforward, but we will remain sceptical.³⁹

Well put. Again, one runs into the inherent contradictions in the stress-test agenda, i.e., the conflict between the integrity of the process and the confidence-boosting agenda. The net result is that the disclosed results are not credible: there will always be a whiff of stage management.

³⁹ C. Goodhart, "In praise of stress testing," mimeo, LSE August 2015.

The third concern is the question of the ‘optimal degree of disclosure’.⁴⁰ An example is a recent paper co-authored by a Bundesbank economist that suggests that stress tests should be used to manipulate depositor behaviour.⁴¹

If depositors know from the watchdog that banks are in trouble, they would withdraw their cash, threatening banks’ survival and causing the panic the supervisor is trying to avoid, they suggest.

This much is obvious, but instead of noting that this problem arises from the (intractable) clash between the two main objectives of the stress test (i.e., to investigate the financial health of the banking system and to promote confidence in the banking system) the paper instead attempts to offer a solution: it suggests that the amount of information disclosed by supervisors should decrease the more vulnerable the banking sector is expected to be:

40 There is a burgeoning literature on this subject applying asymmetric information models to determine how much a central bank should disclose the results of its stress tests: the typical finding is that the optimal degree of disclosure is contingent on the financial health of the banks concerned. For a well-cited example, see, I. Goldstein and Y. Leitner, “Stress tests and information disclosure,” Philadelphia Fed Research Department Working Paper 15-10, November 16 2015. However, there are a number of problems with this literature that undermine any usefulness it might otherwise have had: results are model- and sometimes calibration-specific, their model environments assume the stress tests are credible (ignoring the credibility problems raised, e.g., by the central bank’s own self-interest in promoting confidence in the banking system); they assume that the public is gullible enough to take ‘optimally disclosed’ results on trust and they ignore the extent to which the public can second-guess the ways in which they are being manipulated. In general, the rational response of the public faced with this sort of game-playing by the central bank is to ignore it completely.

41 W. Gick and T. Pausch, “Optimal disclosure of supervisory information in the banking sector.” This article was featured in a Reuters report by F. Canepa, “UPDATE1 –Supervisors should not tell whole truth about bank health – BuBa economist,” September 1 2015.

The optimal level of ‘informativeness’ ... depends on the objective probability that the banking sector is vulnerable ... the higher the latter probability, the less informative the optimal disclosure mechanism ...

In its defence, the Bundesbank said the paper does not *necessarily* reflect its own view and is based on a specific theoretical model.

It seems to me that this analysis is too clever by half.

If the public know that the central bank is playing such a game, then they could play along themselves: the less informative the stress test results, they might conclude, then the more vulnerable the banks. The central bank’s game would then amount to it having painted itself into a corner: if the banking system really was vulnerable, then the central bank would be unable to persuade the public otherwise. In fact, this description captures exactly the situation we are in.

It gets worse. Instead of playing along, the best response by the public would simply be to dismiss the whole exercise: once it was known that the results were being manipulated, then the integrity of the exercise would be seen to be compromised and so, too, would any credibility that the stress tests might have had. The central bank would then have failed to achieve *either* of its two principal objectives.

The credibility of the stress tests therefore hinges critically on the central bank successfully persuading the public that the exercise is anything *but* manipulated. Good luck on that.

3.6 UNCERTAINTY, MODEL FIDDLE-ABILITY AND THE LACK OF ACCOUNTABILITY

Though the stress test outcomes are presented as being fairly precise – bank X gets a Y% post stress outcome, and so on – the outcomes of stress test exercises are actually subject to a considerable amount of behind-the-scenes guesswork. It is, therefore, highly inappropriate to conduct any such exercise and treat the results as being accurate to the fourth decimal point: the results are anything but precise. This imprecision is, in part, because the models involved – not just the Bank’s stress test model per se, but also the models that feed into it, such as the Bank’s own forecasting models (the famous ‘fan chart’ models) and the various valuation models used are full of parameters whose values are mere guestimates; they are subject to a lot of parameter uncertainty. Furthermore, the models themselves are also guestimates, as there will be considerable choice over which models to use, and different models will give different results.⁴² We therefore have both parameter and model uncertainty, and there will be lots of both. The upshot is that the precision with which results are presented is an illusion.

This spurious precision is further undermined by uncertainty: there are some things we just don’t know. For example, if a bank uses the incurred loss provisioning model, then the analyst reading the accounts has little idea what the expected loss might be. The same is the case with mark-to-market figures based on assumptions about model valuation or hedge effectiveness that the analyst will mostly be unaware of.

42 ???

Another area where there is enormous uncertainty relates to ‘conduct’ costs - how one loves these euphemisms! - the costs of setting claims related to banks’ past *misconduct*. This issue is a big one and there are various cases currently going through the judicial system: the banks undertaking the stress test paid almost £30 billion in fines and other related misconduct costs between 2009 and 2014, inclusive and, by the end of 2014, they had made provisions for further likely misconduct costs of just under £13 billion. The amounts involved are typically a substantial proportion of banks’ capital: for example, Tim Bush reports that the costs of misconduct amounted to 32.2%, 26%, 8.7% and 39.5% of shareholders’ equity for Barclays, RBS, HSBC and Lloyds respectively by the end of 2015.⁴³

These provisions are little more than guesses and any errors in these guesses could have very large impacts on banks’ capital and hence on their post-stress leverage ratios. So in its 2015 stress scenario, the Bank attempts to take account of the possible losses associated with banks’ past misconduct, but the problem is that no-one has much idea of what the ultimate losses might be. To be on the safe side, the Bank assumed that the aggregate stressed projection for misconduct costs above those provided for at end-2014 would be around £40 billion over the five years of the stress scenario. What the Bank did here was perfectly reasonable, but my point is that the Bank had no choice but to rely on a pretty big guess - and change the guess and you change the outcome.

It then comes down to this: the Bank’s stress test model does not generate a precise ‘point’ outcome that you can bet your life on. Instead, one should think of the modeler as using the model to attempt to peer into the future through a fog of uncertainty. From this perspective,

43 See T. Bush, The state of banks and banking regulation, PIRC Analysis and Research, April 2016.

the true outcome – the post-stress leverage ratio, say – is simply unknown, and the model only generates a seemingly random estimate of what that outcome might be. A different set of equally reasonable assumptions will produce a different outcome, and there is often no way to say that one set of assumptions is better than another. Furthermore, any errors (e.g., +/- 1% or 2% or even more in asset values) due to erroneous loan provisions or mark-to-market valuations can make a big difference to the post-stress leverage ratio, especially when the leverage ratio is already low to begin with.

It is therefore difficult to have confidence in the reported leverage ratio result, and one's confidence is further undermined by the uncertainties associated with the eventual costs of misconduct.

These uncertainties create huge scope for model fiddle-ability. The modelling itself involves a range of choices about modelling and reporting assumptions. Some choices push the results one way and others push the other way, and often there is no way to say that any one choice is better than another. It is then possible for modellers to play around with alternative sets of assumptions to get a feel for the modelling sensitivities involved. There is then the temptation, at least, to settle on those sets of assumptions that help to produce the results that fit their own preconceptions or what their managers wish to hear. Modellers wouldn't be human otherwise. The results would be presented to the public as 'hard' results they must accept, akin to the results of rigorous scientific studies. "These are the results of our model", they would be told; as far as the public is concerned, the model is an impenetrable black box whose results must be accepted on trust. There must then be at least a hint of suspicion that the modelling might be biased and there is no external validation to reassure us that it is not. Nor can we even be sure that any such bias would only be minor: I know from my own work on modelling that it would be easy – if one were minded to – for a decent modeller who understands

the sensitivities of their model to produce highly distorted results that even an expert outsider would have difficulty challenging.

These issues matter for three reasons:

First, the Bank in its stress tests often gets outcomes that are close to its pass standards. In fact, in its 2015 leverage ratio stress test, it projects outcomes for RBS and Standard Chartered that are exactly on the 3% pass standard. The Bank concluded that these banks pass the stress tests. But if results are sensitive to modelling assumptions (which they are, believe me) and if it would be convenient to pass the banks involved (which it certainly was), then we cannot be sure that these banks really should pass the stress test and the Bank's confidence in its conclusions – and hence, *our* confidence in *its* conclusions – is unfounded.

Second, there are rumours that stress tests *have* been fiddled. In one case known to me, a former central bank official overheard the governor of his central bank tell the official in charge of a stress test that he was to produce a particular result. One can then imagine what happened: the modellers fiddled around with the parameters in their model to get the 'right' set of parameter values and – hey presto! – the model produces the desired result. Black boxes are wonderful things.

This point takes us to my third concern. If the stress test model is a fiddle-able black box whose results one has to accept on trust (which it is) and if there is even the suspicion (which there is) that there might be an incentive to 'tweak' the results to produce a desired outcome, then there is a major accountability problem. Remember, too, that the stress tests are not audited, do not comply with any well-established ground rules for reporting stress test results (not the Bank's fault: these don't exist!) and violate some of the basic principles of good stress testing. So how can the Bank's scrutineers – the

press or the Treasury Committee – then have confidence in the Bank’s stress test results?

Of course, they can’t.

When it comes to the stress tests, there is a massive accountability gap – and therefore a massive credibility gap too.

3.7 STRESS TESTING CREATES NEW SYSTEMIC RISKS

An important feature of central bank stress tests – and of capital regulation in general – is that it pressures banks to work to the risk models approved by the central bank, the underlying assumption here being that ‘Nanny knows best’. Leaving aside the awkward problem of who supervises Nanny herself, this pressure has some unfortunate consequences:

To start, it exposes the entire banking system to the weaknesses in the central bank’s approved models – and all models have their weaknesses.

Nor can we assume that the central bank knows best: few central bankers at the mid-level that matters here have the commercial or investment banking experience that qualifies them to pontificate on what the best models might be. Instead, they are mostly quantitative econ or finance types who have little understanding of how models actually work in the real world. By contrast, bankers have a much better understanding of these issues – not least, because they have a strong vested interest in knowing how to game the models that for the most part the central bankers and regulators accept on trust.

There is also the danger that the central bank gets pressured to adopt the models that the banks themselves prefer, i.e., the models with the most gameable loopholes. This is exactly what happened with Basel II, whose primary theme was the regulatory endorsement of the banks' preferred risk models. As Alan Greenspan observed in 2008:

Financial regulators, in my experience, know far less than private-sector risk managers. Indeed, the open secret about regulation in the free-market world is that regulators take their cues from private-sector practitioners ... Basel II, the international consensus on bank regulation first published in 2004, mirrored the risk valuation models of the private markets.⁴⁴

None of this risk modelling then turned out to be of the slightest use when the banking system collapsed.

But even if the central bank resists capture and imposes its own preferred approach, the creation of any regulatory standard encourages banks to game the system in the same way that students will play to an exam whose questions they know in advance. In both cases, their rational response is to focus on passing the test with the least effort.

In the case of the banks, they will 'manage to model': they will adjust their investment strategies to take advantage of risk-taking opportunities that the regulatory system overlooks or under-estimates, and they will reduce their exposure to risks that the system heavily penalises. They will also adapt in other ways to take advantage of weaknesses in the regulatory system. For example, since regulatory stress tests highlight reported NPLs, they will look for ways to reduce

⁴⁴ A. Greenspan (2008), *The Age of Turbulence: Adventures in a New World*, New York: Penguin, p. 524.

reported NPL numbers, the most obvious being to adopt more forgiving ‘extend and pretend’ or ‘pray and delay’ forbearance policies to make loan portfolios look better, at least over the horizon period covered by the stress test. There is, in short, a Lucas Critique at work, by which the banking system will adjust its behaviour in response to the regulatory regime and thereby undermine the latter’s effectiveness.

There are also the dangers that a regulatory risk standard will suppress innovation and create new systemic risks. Til Schuermann, an acknowledged risk expert and former senior Fed official, put this point very nicely:

As the Fed’s models have become more and more important in deciding the fate of the biggest banks, those banks have focused more and more on trying to mimic the Fed’s results rather than tracing out their own risk profiles. This poses a real risk. ...

The incentives to get close to the Fed’s numbers are powerful enough to stifle genuine creativity, imagination and innovation by risk managers and their modelers. Deviating from standard industry practice is now increasingly viewed with suspicion and often discouraged by bank regulators.

I understand this suspicion from my own days at the Fed: The modeling machinery built for the first stress test was in no small part designed to have an independent view on the output of “innovative” but dangerously flawed bank risk models, such as those for mortgage losses. But if everybody uses the same scenario (which they do) and works hard to get the same numbers (and they are trying), then we have a very

narrowly specialized risk machine that is inflexible and unresponsive to unexpected shocks. That is, shocks that weren't previously subject to a stress-test.

The danger is that the financial system and its regulators are moving to a narrow risk-model gene pool that is highly vulnerable to the next financial virus. By discouraging innovation in risk models, we risk sowing the seeds of our next systemic crisis.⁴⁵

3.8 THE BANK OF ENGLAND'S FORECASTING TRACK RECORD

Central banks often talk about their 'forward-looking projections' and from this language we might easily overlook the point that they do not have access to some special crystal ball that the rest of us lack. However, no-one can actually foresee the future, and these 'forward-looking' projections are no more than *guesses* about what *might* happen.

So how credible are they?

To answer this question, we first need to appreciate how the scenario modelling actually works. The modelling begins with a baseline scenario – this is the outcome that the central bank considers most likely over the scenario period, and this scenario is, as the Bank says,

⁴⁵ T. Schuermann, "The Fed's Stress Tests Add Risk to the Financial System", Wall Street Journal, March 19, 2013.

“informed by ... the MPC’s forecasts as communicated in the Bank’s Inflation Report.”⁴⁶

Or, as Dennis Santiago put it when discussing one of the Fed’s baseline scenarios, the baseline is to

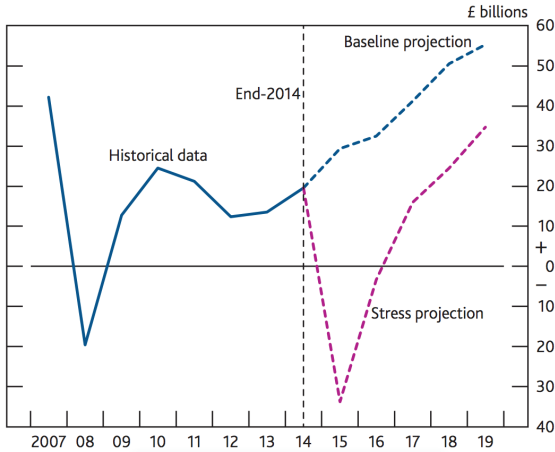
make the optics look perfect projection. Of course the probability that the future will go this way is one divided by a very large number. Its purpose is solely to create a reference datum, the equivalent of the 12 inch ruler one needs before putting one foot in one’s mouth.⁴⁷

The adverse scenario is then derived from the baseline scenario as a stress or negative shock applied to that latter scenario. A good example is given in Figure 3 which is a reproduction of a chart from the Bank’s 2015 stress test report (overleaf):

⁴⁶ Bank of England, “A framework for stress testing the UK banking system,” October 2014, p. 19.

⁴⁷ D. Santiago. “Diving into the FDIC’s Stress Test Scenarios,” The Bank Monitor Newsletter, December 9, 2012.

FIGURE 3: PROJECTIONS FOR AGGREGATE PROFITS BEFORE TAX, AFTER THE IMPACT OF 'STRATEGIC' MANAGEMENT ACTIONS



Sources: Participating banks' FDSF data submissions, Bank analysis and calculations.

(a) For HSBC and Standard Chartered, annual profits are converted from USD to sterling using exchange rates consistent with the scenarios.

(b) 2007 data include the profits before tax of Alliance & Leicester (subsequently reported as part of Santander UK). 2007 and 2008 data include the profits before tax of Lloyds TSB Group and HBOS (subsequently reported together as Lloyds Banking Group).

This chart shows both the baseline and stress projections of banks' aggregate profits before tax. The baseline scenario shows a fairly steady increase from about £20bn in 2014 to over £50bn by early 2018, whereas the stress projection shows a sharp fall to minus £30bn in 2015 followed by a strong recovery to about £35bn by early 2018.

My point is that the stress projection is driven off the baseline one – change the baseline and the stress projection changes too – and the baseline projection is simply the Bank's forecast of what will happen in the absence of any unexpected developments. Thus, the stress projections depend on the Bank's forecasts – and the credibility of the former depends on the credibility of the latter.

So how good was the Bank's forecasting performance since 2007?

Recent revelations from the publication of the minutes of the Bank of England's court – its board of directors – reveal that on the eve of the crisis and even afterwards the Bank had no idea of the scale of the impending meltdown in 2007/8:

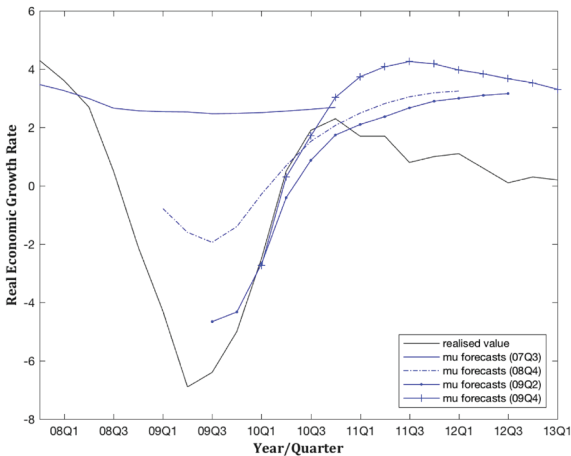
- As late as July 2007, the court had no idea of any impending trouble. There were some liquidity problems in the markets, they were told, but these were not sufficiently serious to warrant action. The crisis started the next month.
- September 12th, 2007: the court was told that despite some market turmoil, the tripartite regulatory system was working well and the banking system was sound. The very next day, they were called to an emergency meeting as the BBC announced that Northern Rock had applied for a rescue. The day after that, there was the run on the Rock – the first English bank run since 1866.
- Even after that, the Bank continued to downplay the scale of the crisis: it maintained that there was only a liquidity problem and that the banking system was adequately capitalised. “I do not believe that in a year’s time people will look back and say there was any lasting damage to the British banking system. It is very well capitalised, it is very strong”, even though it did have a little bit of a liquidity problem, King confidently told the Treasury Committee in January 2008.⁴⁸ In fact neither claim was true: the Government was then to intervene to put much of the banking system on life support to prevent a systemic collapse, and the big banks made losses that more than wiped out their capital.
- By October 2008, after the Lehman crisis, the Bank felt that it had solved the crisis: “there was now a real sense that a corner had been turned and the [B]ank could be proud of its work”, the minutes reveal. Some success: the UK went on to experience the

⁴⁸ Quoted in <http://www.publications.parliament.uk/pa/cm200708/cmselect/cmtreasy/56/5610.htm>.

longest recession since WWII and over seven years later the banking system is still very weak.

The Bank forecasting failures are also clear from Figure 4. This chart shows the MPC's mode forecasts – its forecasts of the outcomes it considered most likely – for year-on-year real economic growth at various points in time: the blue line gives the mode projections made in 07q3 for the 13-quarter period starting then, the blue dash-dot line gives the 13-month mode forecasts starting in 08q4, and so on. The chart also shows the subsequently realised real economic growth rates in black. The latter series shows a sharp fall to -6.9% in 08q4 before recovering to 2.3% in 10q3 and then falling back again.

FIGURE 4: THE MPC'S MODE PROJECTIONS OF REAL GDP GROWTH AGAINST SUBSEQUENTLY REALISED OUTCOMES



Notes: Realised values span 07q3 to 12q4 and are based on those from the spreadsheet 'ukvariant2014.xls', (<http://www.bankofengland.co.uk/financialstability/Pages/fpc/stresstest.aspx>), mode forecasts are taken from the spreadsheet 'Parameters for MPC GDP Growth Projections based on Bank Estimates of Past Growth from August 2007.xls' (<http://www.bankofengland.co.uk/publications/Pages/inflationreport/irprobab.aspx>). Spreadsheets accessed Jan 30 2015). Except where otherwise indicated, all charts are constructed using MATLAB.

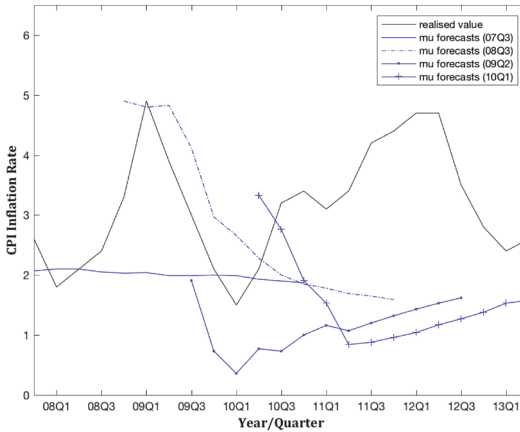
So how well did the MPC's forecasts anticipate these outcomes? The answer is not very well:

- In 07q3, on the onset of the crisis, the MPC was forecasting a very modest dip in the economic growth rate and was oblivious to the large fall that was about to occur.
- Even by 08q4, the MPC was still under-estimating the fall in growth by about 50%, and it took another two quarters before it got the magnitude of the fall anyway near right, by which time the lowest point had already passed.
- The MPC's projections for the period after 10q3 considerably overestimated the strength of the recovery, and by and large missed the subsequent dip after that.

Figure 5 shows that the Bank's corresponding CPI inflation mode projections did not perform any better:

- As of 07q3, the MPC was forecasting a barely notably decline in inflation and had no clue about the impending spike that was to take inflation up to almost 5%.
- A year later, it had got on to the inflation spike, correctly if tardily predicted the subsequent decline, but missed the second spike that was to peak in 12q1.
- By 09q2, it was back to under-predicting inflation by a considerable margin, again; and even by 10q1 it still had no idea of the second spike that was already under way.

FIGURE 5: THE MPC'S MODE PROJECTIONS OF CPI INFLATION AGAINST SUBSEQUENTLY REALISED OUTCOMES



Notes: Realised values span 07q3 to 13q1 and are taken from the spreadsheet 'ukvariant2014.xls' (<http://www.bankofengland.co.uk/financialstability/Pages/fpc/stresstest.aspx>), mode forecasts are taken from the spreadsheet 'cpiinternet.xls' (<http://www.bankofengland.co.uk/publications/Pages/inflationreport/irprobab.aspx>). Spreadsheets accessed Jan 30 2015.

In short, the Bank is pretty hopeless as a forecaster. And if it was unable to forecast what much of *did* happen to the economy over most of the last decade, this track record engenders little confidence in the Bank's ability to anticipate what *might* happen to the economy in the future.

One is tempted to suggest that if they are going to peer into the future with their 'forward-looking' projections, they may be better off using chicken entrails instead.

3.9 CONCLUSIONS

All of the issues discussed here raise serious concerns that undermine confidence in the stress tests.

But let's move on to the results.

Chapter Four:

The 2014 Bank of England Stress Test

This chapter examines the 2014 stress test and finds three main problems. First, the stress scenario is only moderately stressful and the exercise gives little idea of the resilience of the banking system in the face of a more adverse scenario. Second, the pass standard is very low, and when one stress tests the stress test using higher and more reasonable pass standards – including those coming through under Basel III and in the United States – one finds that the banking system fails the test. Third, the Bank failed to carry out any test based on a leverage ratio, even though UK banks were expected to meet a minimum leverage ratio requirement, and any reasonable leverage ratio stress test would have confirmed that the UK banking system was in very poor shape.

4.1 HOW STRESSFUL WAS THE BANK'S 2014 STRESS SCENARIO?

The first question about the 2014 stress tests is simply this: how stressful was the Bank's stress scenario?

Well, the stress scenario was certainly adverse, but not especially so:

- Real GDP troughs at about 3.5% below its end-2015 value and GDP growth falls to -3.2% before recovering. By contrast, real GDP growth fell to about -7% at the height of the Global Financial Crisis (GFC).
- Unemployment peaks at about 12% - a level not seen since the 1980s and early 1990s.
- Inflation rises to peak at 6.5% in early 2015 and 10-year nominal gilts peak at just below 6%.
- House prices fall by about 35% and Commercial and Real Estate prices by about 30%.

Of these, the unemployment and property price outcomes are perhaps the most severe, but the GDP outcome is much less severe and well below the severity of the GFC. Overall, this scenario is not especially severe when judged historically or by contemporary experience in parts of the Eurozone, where we have seen much larger falls in economic activity, much higher unemployment rates and much greater falls in property prices.

The impact on this adverse scenario on the banking system was also mild. The unweighted average of capital to risk-weighted assets falls from 10 percent to a low of 7.3 percent before bouncing back. Four of the banks – Barclays, HSBC, the Nationwide and Standard Chartered – were also projected to experience *increases* in their Tier 1 leverage ratios over the Bank's 'severe' adverse scenario! There is only a mild

increase in bank losses – banks are projected to make about £13 billion in losses before returning to profitability – as opposed to the almost £100 billion in losses they experienced over 2007-2010. I would have expected the rise in interest rates to inflict large losses on banks’ fixed-income positions and on interest-sensitive collateral positions – such is the usual consequence of sharp rises in interest rates. I was surprised that the Bank’s modellers envisaged a supposedly severe scenario in which a large interest rate hike did not produce a major casualty and associated systemic knock-on effects somewhere in the financial system. These considerations suggest to me that some parts of the stress test modelling exercise might have been less stressful than others.⁴⁹

4.2 RESULTS FOR THE CET1/RWA STRESS TEST

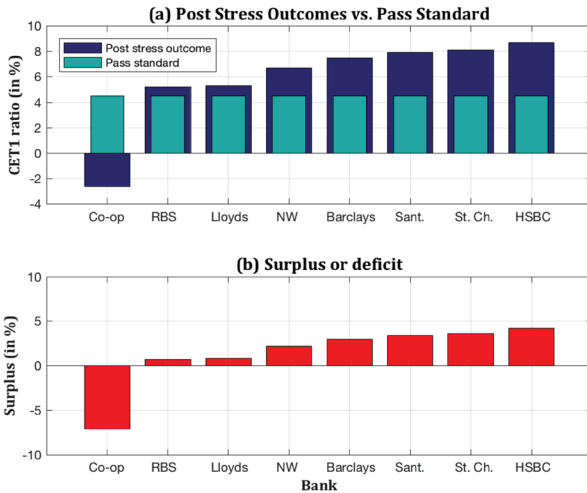
The stress test was based on the CET1 ratio, the ratio of Common Equity Tier 1 (CET1) capital to Risk-Weighted Assets (RWAs). In this test, the Bank set its pass standard equal to 4.5%.

The post-stress outcomes for the 8 banks involved – Barclays, the Co-op, HSBC Holdings, Lloyds Banking Group, the Nationwide

49 As an aside, I carried out a Monte Carlo (or brute force numerical) simulation to determine the probability of a scenario at least as severe as the Bank’s scenario according to the Bank of England’s own celebrated risk forecasting (or ‘fan chart’) model. This exercise revealed that the probabilities of any one of three sub-scenarios in the fan chart model – those for GDP growth, inflation and unemployment – were so low as to be effectively zero. There can only be two possible explanations for this result. The first is that the Bank’s stress is so severe that it is off the chart. However, this explanation is inconsistent with the evidence in the text showing the mildness of the adverse scenario. The other possible explanation is that the fan chart forecasts are no good. This latter explanation gives further evidence to distrust the Bank’s forecasts – and, therefore to distrust anything based on them, including the stress tests.

Building Society, the Royal Bank of Scotland Group, Santander UK and Standard Chartered - are given in Figure 6:

FIGURE 6: 2014 STRESS-TEST OUTCOMES FOR THE CET1 RATIO WITH A 4.5% PASS STANDARD



(a) The pass standard is the bare minimum requirement (4.5%), expressed in terms of the CET1 ratio - the ratio of Common Equity Tier 1 capital to Risk-Weighted Assets.

(b) The outcome is expressed in terms of the CET1 ratio post the stress scenario and post any resulting management actions. The data are obtained from Annex 1 of the Bank's 2014 stress test report.

The Co-op is a basket case with a CET1 ratio of -2.6% and a deficit of 7.1%. RBS and Lloyds had surpluses of under 100 basis points, but the other 5 banks performed well. Ignoring the Co-op, the average post-stress CET1 ratio was just over 7% and the average surplus 2.6%. By this test, the UK banking system might look to be in reasonable shape.

Now the fun begins ...

At first sight, one might form the impression that the Bank of England must have chosen the 4.5% pass standard because 4.5% was the minimum capital requirement. After all, the exercise wouldn't make sense otherwise: what would be the point of carrying out a stress test exercise to determine if banks would be capital-adequate post a stress scenario, if the pass standard used in the stress exercise was less than the minimum capital standard that determines if the banks are capital-adequate? But that is exactly what the Bank did.

The first point to note is that the Basel (or UK) regulations do *not* simply state that the minimum CET1/RWA ratio is 4.5%. Instead, the rules are much more complicated. In fact, they stipulate that the minimum CET1/RWA ratio is (or eventually will be, once the system is fully implemented) the sum of the following four elements:

- a bare minimum of 4.5% plus
- a 2.5% Capital Conservation Buffer (CCB) plus
- a Counter Cyclical Buffer (CCyB) plus
- a buffer for Globally Systemically Important Banks (G-SIBs).⁵⁰

I will come back to the latter two components of the minimum capital requirement presently.

For the moment, let's focus on the capital requirements as they existed in 2014 when the stress test was carried out.

The points at issue are whether the capital requirement does or does not include the Capital Conservation Buffer and, relatedly, whether the pass standard in the stress test should be 4.5% or 7%.

50 For a good overview of this highly complicated subject, see R. Raman (undated), *Basel III – An Easy to Understand Summary* (iCreate Software, Bangalore), p. 6.

To quote one of the Bank's background documents on the stress tests, in evaluating the stress test results, banks

need to maintain sufficient capital resources to be able to absorb losses in the stress scenario and remain above [internationally agreed] minimum requirements.

The Bank then explains these minimum requirements as they apply to the UK:

Consistent with the Basel III Capital Accord, CRD IV [the EU Capital Regulation Directive] *requires* banks to have at least a 2.5 percentage point buffer of capital [referring to the CCB] above the 4.5% minimum. (My italics)

The key word here is “requires” as in the noun “requirement”. The CCB is an *additional* minimum requirement *on top* of the 4.5% minimum capital requirement.

Therefore, the overall minimum capital requirement is the sum of these two minimum capital requirements and $4.5\% + 2.5\% = 7\%$.

So the pass standard must be at least as high as internationally agreed minimum capital requirements and these must be at least as high as 7%.

I also consulted a number of experts for independent opinions. Not a single one was willing to defend the Bank's interpretation of its own rules.

Consider for example this response from my friend, the Canadian economist Basil Zafiriou:

I read the standard the same as you, Kevin. The CCB is a mandatory buffer, so it has to be added to the CET1 minimum for an overall capital requirement threshold. Suppose a fire safety code requires commercial establishments to have a front and back exit plus a sprinkler system: having a front and back exit meets the exits requirement, but an establishment would not meet the fire code standard unless it also had a sprinkler system.

Still, I doubt you can win this argument with the BoE. You're relying on logic and they rely on argument by assertion. And since they make the rules, like Humpty Dumpty they can make any rule to mean "just what [they] choose it to mean."

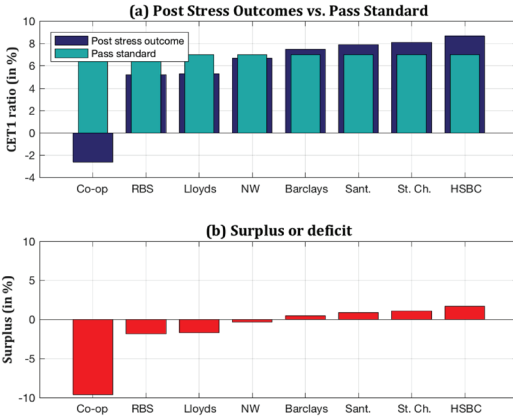
Basil's analogy with a fire safety code is spot on, ditto the Humpty Dumpty - and we all know what happened to him. The Bank's

interpretation of its own document is like Humpty himself, scrambled.⁵¹

If one applies the Bank's stress test to a 7% pass standard, one then gets the outcomes shown in Figure 7:

51 For a more elaborate discussion of this issue of whether the pass standard in this test should be 4.5% or 7%, see K. Dowd "What Should Be the Absolute Minimum Pass Standard in the Bank of England's Headline Stress Test?" ASI blog, March 8th 2016. In this context, I should also note that in personal discussions, Bank of England officials emphasise that the reason that they chose the 4.5% pass standard is that 4.5% is the absolute minimum and an outcome below this minimum indicates a urgent and major problem that warrants a 'fail' in the stress test; whereas an outcome in the CCB range between 4.5% and 7% is less of a problem, as it merely indicates that a bank needs to 'conserve' capital, e.g., by not paying dividends. This position might be a reasonable one if one accepts the RWA metric and if one accepts that the absolute minimum required ratio should be 4.5% expressed in terms of the CET1 to RWA ratio, neither of which I do accept for reasons stated elsewhere. In any case, this argument ignores the point that the Bank's own 'framework' document (as quoted in the text) gives a quite different account of the factors by which the Bank claims to determine the pass standard.

FIGURE 7: 2014 STRESS-TEST OUTCOMES FOR THE CET1 RATIO WITH A 7% PASS STANDARD



(a) The pass standard is the sum of the bare minimum requirement (4.5%) and the Capital Conservation Buffer (2.5%), both expressed in terms of the CET1 ratio - the ratio of Common Equity Tier 1 capital to Risk-Weighted Assets.

(b) The outcome is expressed in terms of the CET1 ratio post the stress scenario and post any resulting management actions. The data are obtained from Annex 1 of the Bank's 2014 stress test report.

One now gets a different picture: four banks (the Co-op, RBS, Lloyds and Nationwide) fail the test, and two (Barclays and Santander) of the four that pass have surpluses of under 100 basis points. The overall average surplus ignoring the Co-op is under 10 basis points. This is *not* a good performance overall.

But instead of applying its own guidance rules, the Bank chose only the bare 4.5% minimum as its pass standard, ignoring the other elements of the minimum capital requirement, leading to a pass standard that falls below the standards to which Basel aspires over the next few years - and coincidentally producing the best possible set of results for anyone with a vested interest in trying to show that the banking system is in good shape.

In doing so, the Bank undermined the credibility of the whole exercise.

It is also interesting to note that the Bank's 4.5% pass standard was below the low standards of even the ECB, which used a 5.5% pass standard in its widely discredited 2014 stress test exercise, of which more below in Chapter Six. By the ECB's pass standard, Lloyds and RBS would have failed as well.

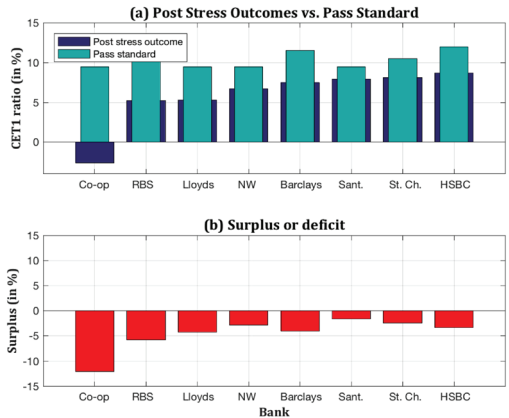
It would appear that the Bank of England was caught in a bind: however much it may have wanted to, it had little room to raise the pass standard without producing headline results that would have contradicted its core message that the banking system was sound.

Furthermore, even a 7% pass standard is (potentially) less than the minimum required CET1 ratio that will be implemented under Basel III by the end of the stress period, as it ignores the two additional components of the total minimum capital requirement that will be in place by then: the Counter-Cyclical Capital Buffer (CCyB) and the Global Systemically Important Banks (G-SIB) Buffer. The first of these is an additional buffer meant to counter cyclical factors and is set at the discretion of the Financial Policy Committee (FPC). During 2014 it was set at 0% reflecting the FPC's view that "threats to financial stability [were] low" – I will come back to this issue in the Appendix to this Chapter – but it could be set as high as 2.5% under the Basel III rules. The second is an additional buffer applied to institutions that the FPC deems to be globally systemically important and the values of these buffers were subsequently announced in February 2015: 2% for Barclays, 2.5% for HSBC, 1.5% for RBS and 1% for Standard Chartered. These buffers will be implemented as additional capital requirements by the start of 2019.

It would therefore be prudent to include these components in the pass standard as well, and in so doing, to set the Counter-Cyclical Capital Buffer to its maximum possible value of 2.5%.

Figure 8 shows the outcomes if one applies these more stringent capital requirements as the pass standard in the stress test:

FIGURE 8: 2014 STRESS-TEST OUTCOMES FOR THE CET1 RATIO WITH THE POTENTIAL MAXIMUM BASEL III PASS STANDARD



(a) The pass standard is the sum of the bare minimum requirement (4.5%), the Capital Conservation Buffer (2.5%), the maximum Counter-Cyclical Capital Buffer (2.5%) and the Global Systemically Important Banks Buffer, which varies across the banks. These percentages are expressed in terms of the CET1 ratio - the ratio of Common Equity Tier 1 capital to Risk-Weighted Assets.

(b) The outcome is expressed in terms of the CET1 ratio post the stress scenario and post any resulting management actions. The data are obtained from Annex 1 of the Bank's 2014 stress test report.

These results are fairly clear: even ignoring the Co-op, the average pass standard is 10.5%, the average post-stress CET1 ratio is 7.1% and every bank fails the stress test.

Pulling all these results together the UK banking system passes the stress test exam if one takes the Bank's preferred (low) pass standard

of 4.5%, which just happens to support its preferred narrative that the system is sound. The banking system performs far less well if one takes a pass standard to be 7% (which was the minimum required CET1 ratio already in force by the end of 2013) and it unmistakably fails the test if one takes the pass standard to be the maximum requirements that could be in place under Basel III by the end of the stress period.

At the risk of belabouring the obvious, there are two further points about the Bank's credibility that jump out from these results:

First, if the outcome of the stress test happens to depend critically on the choice of pass standard, then the outcome of the Bank's stress test is not robust and therefore neither reliable nor credible – and this is especially so if the Bank's preferred pass standard happens to coincide with its own self-interest/preferred narrative which is to reassure us that the banking system is sound.

Second, the plausibility of the Bank's view that the UK banking system is in good shape should not be contingent on such finer issues as whether the pass standard should be 4.5% (i.e., the pass standard implemented by the Bank) or higher (e.g., the pass standard promised by the Bank). If the UK banking system really were in good shape, its resilience should shine through in all the tests, not just the least demanding test that happened to be the one that the Bank used. Moreover, for the test to be credible, the pass standard should be as high as is reasonably plausible. Conversely, for it to even *appear* that the Bank might have applied the minimum pass standard they thought they could get away with – when higher pass standards would give more negative outcomes – is to undermine the credibility of the whole exercise. The Bank's stress tests need to be above suspicion if they are to be convincing.

If you don't find this argument convincing, consider the medical analogy. A doctor is performing a medical check-up on a patient. He has a choice of tests to conduct: Test 1 has weak power to detect a particular problem, Test 2 has more power and Test 3 is more powerful still. By Test 1 there is no sign of any problem, by Test 2 there are hints that there could be a problem and hence a need to follow-up and by Test 3, the patient is revealed to be seriously ill. Moreover, Test 1 is so weak that the doctor is not allowed to use it, the weakest test he is allowed to use is Test 2, and the best practice advice among medical practitioners is to use Test 3 or something stronger.

So what does the doctor do?

He tells the patient the results of test 1 and the patient thinks she is fine.

4.3 RESULTS FOR A TIER 1 LEVERAGE RATIO STRESS TEST

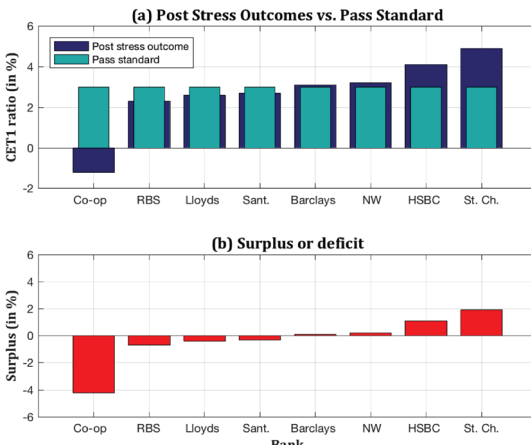
It would also have made sense to have carried out a leverage ratio stress test as well. The (big) advantage of the leverage ratio is, of course, that it avoids the weaknesses of RWAs, especially their vulnerability to gaming. A leverage ratio test is also appropriate because a key feature of Basel III is the introduction of a minimum regulatory leverage ratio to sit along other minimum capital ratios. The absolute minimum leverage ratio requirement is to be 3% and this requirement is due to come into force by January 2018. More importantly, a leverage ratio stress test was definitely appropriate here because in

November 2013 the PRA announced that it expected the big banks to meet this minimum.⁵²

It is odd, then, that the PRA didn't choose to include such a leverage ratio test in the 2014 stress test exercise.

Fortunately, we can easily set this omission right: Figure 9 shows the post-stress Tier 1 leverage ratios against a 3% pass standard.

FIGURE 9: 2015 STRESS-TEST OUTCOMES USING THE TIER 1 LEVERAGE RATIO WITH A 3% PASS STANDARD



(a) The pass standard is the bare minimum requirement (3%), expressed in terms of the Tier 1 leverage ratio - the ratio of Tier 1 capital to leverage exposure.

(b) The outcome is the Tier 1 leverage ratio post the stress scenario and post any resulting management actions. These data are obtained from Annex 1 of the Bank's 2014 stress test report.

⁵² Prudential Regulation Authority (2013b), "Capital and leverage ratios for major UK banks and building societies," Supervisory Statement SS3/13, November.

By this test the UK banking system looks distinctly unhealthy: four banks fail (Co-op, RBS, Lloyds and Santander), two scrape through (Barclays and NW), and only HSBC and Standard Chartered look any good. Leaving aside the Co-op, the average post-stress leverage ratio is 3.3% and the average surplus 0.3%.

I would add, too, that a 3% leverage ratio is actually a very low standard: a bank with such a leverage ratio only needs to lose 3% of its measured exposure to be insolvent.

This test is also the weakest of leverage ratio stress tests when viewed against the regulatory standards. The 3% standard is meant to be a bare minimum and took no account of the additional leverage ratio requirements that will be phased-in under Basel III: these are the additional leverage ratio requirements corresponding to the Counter-Cyclical Capital Buffer and the Globally Systemically Important Banks Buffer.

This pass standard is also low when judged against better regulatory practice in the United States:

- The Federal Reserve has been enforcing a minimum required leverage ratio of 4% on all U.S. banks since 2014, and this 4% requirement is one of the pass standards used in its Comprehensive Capital Analysis and Review (CCAR) stress tests.⁵³
- Banks there have to meet a 5% minimum leverage ratio to be regarded as ‘well-capitalised’ under the Prompt Corrective Action (PCA) framework – and a bank with a leverage ratio of 2%

53 See Board of Governors of the Federal Reserve System, “Comprehensive Capital Analysis and Review 2014: Assessment Framework and Results,” pp. 8-9.

or less is regarded as so badly capitalised that it must be put into receivership.

- The Federal Reserve is in the process of imposing a 5% minimum leverage ratio requirement on the 8 US G-SIB bank holding companies and a 6% minimum leverage ratio on their federally insured subsidiaries effective on 1 January 2018.⁵⁴

Then there is the question of what the required minimum leverage ratio should be as assessed from first principles. Curiously, this issue is one of the few subjects in economics and finance on which there exists a considerable degree of consensus among experts: their view is that minimum standards should be *much* higher than they currently are, a minimum that is close to *an order of magnitude* greater than current minimum capital requirements anywhere in the world. There is of course no magic number but one wants a minimum requirement that is high enough to remove the overwhelming part of the risk-taking moral hazard that currently infects our banking system. As John Cochrane put it, it should be high enough until it doesn't matter – high enough so that we never again hear calls for the banks to be recapitalized at public expense.

This consensus was reflected in an important letter to the *Financial Times* in 2010, in which no less than 20 renowned experts – Anat Admati, Franklin Allen, Richard Brealey, Michael Brennan, Arnout Boot, Markus Brunnermeier, John Cochrane, Peter DeMarzo, Eugene Fama, Michael Fishman, Charles Goodhart, Martin Hellwig, Hayne Leland, Stewart Myers, Paul Pfleiderer, Jean-Charles Rochet, Stephen Ross, William Sharpe, Chester Spatt and Anjan Thakor – recommended a minimum ratio of equity to total assets of *at least*

54 See Board of Governors of the Federal Reserve System, "Agencies Adopt Enhanced Supplementary Leverage Ratio Final Rule and Issue Supplementary Leverage Ratio Notice of Proposed Rulemaking." Press release, April 8 2014.

15%, and some of these wanted minimum requirements that are much higher still.⁵⁵ Independently, John Allison, Martin Hutchinson and yours truly have called for minimum capital to asset ratios of at least 15 percent; Allan Meltzer recommended a minimum of 20 percent for the largest banks; Admati and Hellwig recommended a minimum “at least of the order of 20-30 percent”; Fama and Simon Johnson recommended a minimum of the order of 40-50 percent; and Cochrane and Thomas Mayer 100 percent.^{56, 57, 58, 59, 60, 61, 62}

Returning to the stress tests: if one includes the additional Basel III elements and set the Counter-Cyclical Capital Buffer to its maximum possible extent, one would get the post-stress outcomes shown in Figure 10:

55 A. Admati, F. Allen, R. Brealey, M. Brennan, A. Boot, M. Brunnermeier, J. Cochrane, P. DeMarzo, E. Fama, M. Fishman, C. Goodhart, M. Hellwig, H. Leland, S. Myers, P. Pfleiderer, J.-C. Rochet, S. Ross, W. Sharpe, C. Spatt and A. Thakor, “Health banking system is the goal, not profitable banks.” *Financial Times*, November 9, 2010.

56 J. A. Allison, 2014, *The Financial Crisis and the Free Market Cure: How Destructive Banking Reform is Killing the Economy*, New York: McGraw Hill, p. 351.

57 Cited in A. Admati and M. Hellwig, 2013, *The Bankers’ New Clothes: What’s Wrong with Banking and What to Do about It*, Princeton: Princeton University Press, p. 311.

58 *Op cit.*, p. 179.

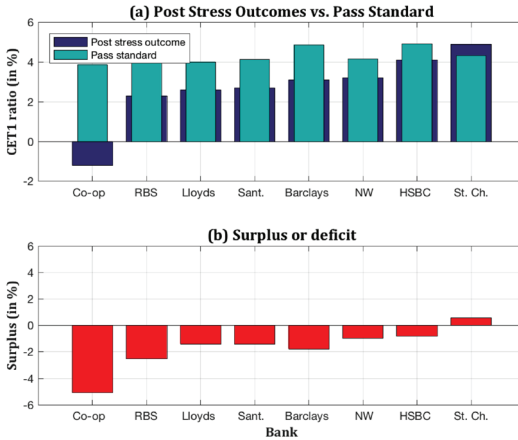
59 *Op cit.*, p. 308.

60 *Op. cit.*, p. 311.

61 J. Cochrane, “Running on empty,” *Wall Street Journal*, March 1, 2013.

62 Personal discussion (Mayer).

FIGURE 10: 2014 STRESS-TEST OUTCOMES USING THE TIER 1 LEVERAGE RATIO WITH THE POTENTIAL MAXIMUM BASEL III PASS STANDARD



(a) Author's calculations based on information provided by the Bank of England's 'The Financial Policy Committee's review of the leverage ratio' (October 2014) based on the assumption that the pass standard is the potential maximum required minimum leverage ratios under fully-implemented (or, to use the jargon, 'fully loaded') Basel III. However, they do not include the new Systemic Risk Buffer, which will have a potential maximum value of 3% and which would further raise the pass rate.

(b) The outcome is expressed in terms of the Tier 1 leverage ratio - the ratio of Tier 1 capital to leverage exposure - post the stress scenario and post any resulting management actions. These data are obtained from Annex 1 of the Bank's 2014 stress test report.

If the earlier outcomes reported in Figure 9 were bad, these are very poor: seven banks fail and only Standard Chartered gets through.

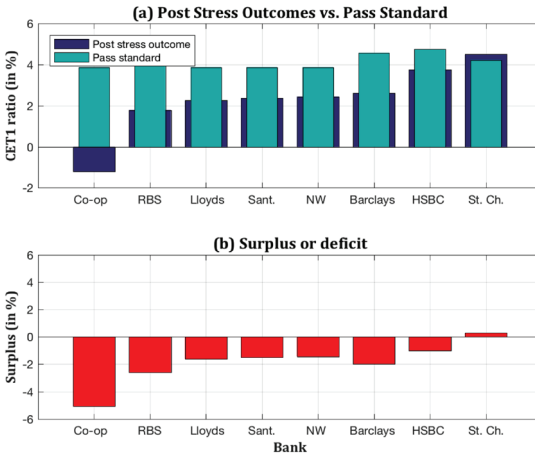
Remember too that the pass standards in this test are still below the 5% to be regarded as well capitalised under the PCA framework, not to mention the 5%/6% minima to be imposed by the Federal Reserve on the biggest US banks, let alone the much higher minima recommended by many experts.

4.4 RESULTS FOR A CORE EQUITY TIER 1 LEVERAGE RATIO STRESS TEST

There is also the problem that this leverage ratio stress test uses an unduly soft numerator – Tier 1 capital instead of CET1. It would therefore be prudent to re-replace the leverage ratio stress test using CET1 instead of Tier 1 capital as the numerator.

Figure 11 shows the outcomes we would get if used CET1 in the numerator and set the pass standard equal to the potential maximum under fully implemented Basel III:

FIGURE 11: 2014 STRESS-TEST OUTCOMES USING THE CET1 LEVERAGE RATIO WITH THE POTENTIAL MAXIMUM BASEL III PASS STANDARD



(a) Author’s calculations based on information provided by the Bank of England’s ‘The Financial Policy Committee’s review of the leverage ratio’ (October 2014) based on the assumption that the pass standard is the potential maximum required minimum leverage ratios under fully-implemented Basel III.

(b) The outcome is expressed in terms of the CET1 leverage ratio post the stress scenario and post any resulting management actions. These data are obtained from Annex 1 of the Bank’s 2014 stress test report.

Seven banks fail and the other bank (Standard Chartered) only scrapes through. The banking system clearly fails the stress test.

To spell out the obvious, if the UK banks fail against these pass standards, they would perform even worse when judged against higher standards such as the Federal Reserve's forthcoming 5%/6% G-SIB minimum leverage ratios and the recommendations of many experts, who call for at least 15%, i.e., *five times larger* than the 3% leverage ratio test that the Bank did not conduct.

By these higher and much more reasonable standards, the UK banking system comes out of the 2014 stress tests not so much underwater as stuck as the bottom of the ocean.

APPENDIX TO CHAPTER FOUR: SETTING THE COUNTER-CYCLICAL CAPITAL BUFFER

The Counter-Cyclical Capital Buffer (CCyB) is set at between 0% and 2.5% at the discretion of the Financial Policy Committee (FPC). To quote the FPC in October 2014, the CCyB

is currently set at zero, and this is intended to be its default setting when the FPC judges that threats to financial stability are low. When the FPC judges that system-wide risk is rising ... the FPC will raise the CCB [by which it means the CCyB, having subsequently changed its preferred acronym]. If and when these risks crystallise, the FPC intends to release the

CCB so banks can use their previously accumulated buffers to absorb losses and continue lending.⁶³

Just in case you missed that point, let me spell it out again: the CCyB was set at zero reflecting the FPC's party line that *threats to financial stability were low*.

One wonders whether anyone at the Bank of England actually looks out of the window to see what is going on out there. The FPC's optimistic assessment of the threats to financial stability was way out of line with the views of a host of informed observers, including, most notably, the Bank for International Settlements (BIS) in a well publicized report that it could hardly have failed to notice.

In its 2014 Annual Report, the BIS describes a world so different to that in the Bank's stress test reports that it may as well be another planet.⁶⁴ Here is a selection of quotes:

"Overall, it is hard to avoid the sense of a puzzling disconnect between the markets' buoyancy and underlying economic developments globally." (p. 3)

"... despite an improvement in aggregate profitability, many banks face lingering balance sheet weaknesses from direct exposure to overindebted borrowers, the drag of debt overhang on economic recovery and the risk of a slowdown in those countries that are at late stages of financial booms." (p. 5)

63 Bank of England, "The Financial Policy Committee's review of the leverage ratio," (October 2014), p. 18.

64 84th Annual Report, Bank for International Settlements, Basel, June 29 2014.

“Financial markets have been exuberant over the past year [...] dancing mainly to the tune of central bank decisions. Volatility in equity, fixed income and foreign exchange markets has sagged to historical lows. Obviously, market participants are pricing in hardly any risks.” (p. 15)

“Debt burdens have increased, as has the economy’s vulnerability to higher policy rates. After rates have stayed so low for so long, the room for manoeuvre has narrowed. Particularly for countries in the late stages of financial booms, the trade-off is now between the risk of bringing forward the downward leg of the cycle and that of suffering a bigger bust later on.” (p. 17)

“... long-term prospects are not that bright. Financial markets are euphoric, but progress in strengthening banks’ balance sheets has been uneven and private debt keeps growing. Macroeconomic policy has little room for manoeuvre to deal with any untoward surprises that might be sprung, including a normal recession.” (p. 19)

“There is a common element in all this. In no small measure, the causes of the post-crisis malaise are those of the crisis itself – they lie in a collective failure to get to grips with the financial cycle. Addressing this failure calls for adjustments to policy frameworks – fiscal, monetary and prudential – to ensure a more symmetrical response across booms and busts. And it calls for moving away from debt as the main engine of growth. Otherwise, the risk is that instability will

entrench itself in the global economy and the room for policy manoeuvre will run out.” (p. 8)

The BIS report repeatedly puts much of the blame on central banks’ monetary policies:

“Accommodative monetary conditions and low benchmark yields – reinforced by subdued volatility – motivated investors to take on more risk and leverage in their search for yield.” (p. 38)

Forward guidance “could encourage excessive risk-taking and foster up a build-up of financial vulnerabilities.” (p. 90)

“Never before have central banks tried to push so hard.” (p. 9)

“As history reminds us, there is little appetite for taking the long-term view. Few are ready to curb financial booms that make everyone feel illusively richer. Or to hold back on quick fixes for output slowdowns, even if such measures threaten to add fuel to unsustainable financial booms. Or to address balance sheet problems head-on during a bust when seemingly easier policies are on offer. The temptation to go for shortcuts is simply too strong ...” (p. 21).

Even if the FPC were not convinced by these warnings, they presumably believed their own models and might at least have cross-checked against their stress test model: they could easily have done so by assuming conservative settings to the other elements of the capital requirement – by taking account of the CCB Buffer, the G-SIB Buffer

and setting the CCyB to its maximum possible Basel III level of 2.5% - and looking at the post-stress outcomes much as I have done. They would then have seen that the banking system was vulnerable and would have hopefully noticed that this contradicted their belief that the threats to financial stability were low. But apparently they didn't.

Instead, the FPC convinced itself that threats to financial stability were low despite these warnings from their colleagues at the BIS and from many others.

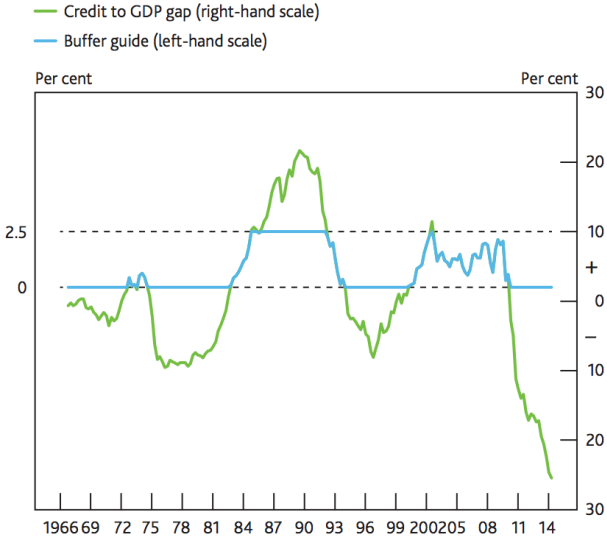
So why were they so confident that the threats to financial stability were so low? The answer is provided in the following passage:

To make its judgement over the degree of system-wide risk, the FPC will employ its core indicators for setting the CCB [read: CCyB, to use the Bank's later acronym] alongside any other relevant risk assessment, market and supervisory intelligence. The credit to GDP gap [see chart below] is one of the FPC's core indicators and the FPC has a legal obligation to take account of a buffer guide, which translates the credit to GDP gap into a suggested setting of the CCB [CCyB] rate. Had the CC[y]B rate followed the buffer guide before the recent global financial crisis, it would have reached 2.5% well ahead of the crisis (in 2002). And if the FPC had set the countercyclical leverage ratio buffer rate in proportion, using the 35% conversion factor it would have reached 0.9% at the same time.⁶⁵

65 "The Financial Policy Committee's review of the leverage ratio," October 2014, p. 18.

To translate: they were relying on some model that they think would have given the ‘right’ answers had it been used in 2002.

FIGURE 12: UK CREDIT TO GDP GAP AND COUNTER-CYCLICAL CAPITAL BUFFER GUIDELINES



Naturally, the FPC caveats these claims by pointing out that no indicator is perfect, that the FPC takes into account a much broader range of indicators in setting the Counter-Cyclical Capital Buffer, etc. Nonetheless, there is no mistaking that in practice this chart is what they were primarily relying upon.

However, one should never rely on a single chart or single indicator to drive policy decisions that are fundamentally matters of judgement and of keeping an eye on a multitude of diverse indicators. History is full of cases where chart-based relationships inconveniently change and deceive policymakers – think of the Philips curve, for example.

But if one *insists* on using emphasizing any single indicator, there is one that stands out head and shoulders from the rest: the leverage ratio. Instead of trying to assess how risky the world out there actually is – and the Bank of England’s forecasting record belies any claims it might have to pronounce on that subject – all we can realistically hope to do is to assess the ability of the system to withstand shocks. The leverage ratio is the obvious choice.

As for the Bank’s chart, it suggests that risks since 2008 have fallen off a cliff – the Eurozone crisis notwithstanding. It also suggests that the risks facing the financial system in 2014 were way below any such risks dating all the way back to the mid-1960s and do we really believe this?⁶⁶

There is an hilarious sequel. In the financial stability press conference on December 1st 2015, Governor Carney announced that

The shift in financial conditions out of the post-crisis phase means that the FPC is now actively considering

66 I should however point out that Bank of England economists did carry out a careful investigation of the forecasting power of the credit-to-GDP ratio. (See, J. Giese, H. Andersen, O. Bush, C. Castro, M. Farag and S. Kapadia (2014) “The credit-to-GDP gap and complementary indicators for macroprudential policy: Evidence from the UK,” *International Journal of Finance and Economics*, Vol. 19, Issue 1, pp. 25-47). They compared this series to some alternative indicators and their conclusions are more circumspect than some of the ‘official’ Bank literature (e.g., “The Financial Policy Committee’s review of the leverage ratio,” October 2014). They concluded nonetheless that put through a Hodrick-Prescott filter (which, among other things, takes out the trend effect), this series provided timely signals for policy tightening over the past 50 years in the UK. Even so, this conclusion was heavily caveated by Goodhart’s Law considerations, the difficulties of counterfactual analysis and so forth. Personally, I am still not convinced that any well-filtered well-fitted time series can be counted on to continue to perform well in the future: there are simply too many cases where such relationships have broken down, especially when they have been used for policy purposes.

the appropriate setting of the countercyclical capital buffer.

The FPC intends to set the countercyclical buffer above zero before the level of risk becomes elevated. More specifically, the Committee expects to set a countercyclical capital buffer in the region of 1% when risks are judged to be neither subdued nor elevated.⁶⁷

A few weeks later, however, the then Chancellor of the Exchequer, was taking a different tone: “Anyone who thinks it’s mission accomplished with the British economy is making a grave mistake,” Mr. Osborne said.

Last year was the worst for global growth since the [financial] crash and this year opens with a dangerous cocktail of new threats.

I worry about a creeping complacency in the national debate about our economy.

A sense that the hard work at home is complete and that we’re immune from the risks abroad. A sense we can let up, and the good economic news will just keep rolling in.

We are only seven days into the New Year, and already we’ve had worrying news about stock market falls

67 “Opening remarks by the Governor,” Financial Stability Report Press Conference, “1st December 2015, p. 4.

around the world, the slowdown in China, deep problems in Brazil and in Russia.⁶⁸

So of the two major UK economic policymakers, one thinks that we have now entered a safer post-financial crisis era, whilst the other is warning of the dangers of complacency regarding the risks facing the UK economy.

But how can we have confidence in UK policy on this matter if the two principal UK policymakers can't agree on the issue?

In the meantime, we can only hope that the FPC will get a move on when setting the CCyB: it would be unfortunate if a new crisis hit whilst the CCyB was still at zero and it wouldn't be the first time that a crisis hit whilst the Bank of England was asleep at the wheel.

68 K. Ahmed, "George Osborne warns of dangerous cocktail of economic risks," January 7 2016: <http://www.bbc.co.uk/news/business-35248628>.

Chapter Five: The 2015 Bank of England Stress Tests

This chapter goes through the Bank of England's 2015 stress tests and explains that the reassuring conclusion that the Bank drew from them – that the UK banking system is in healthy shape – cannot be taken seriously because the stress scenario was too mild and because the Bank set the pass standards way too low. On the contrary, if one repeats the Bank's stress tests but impose more reasonable but higher minimum pass standards, one finds that the UK banking system is in very poor shape.

5.1 INTRODUCTION

On December 1 2015, the Bank of England released the results of its second round of annual bank stress tests.

The 2015 stress tests differed from the 2014 exercise in three main respects:

- The Co-op was dropped from the stress tests and the new tests covered the remaining seven institutions from the 2014 tests – Barclays, HSBC, Lloyds, the Nationwide, RBS, Santander UK and Standard Chartered.
- The 2015 exercise included a second stress test – a test based on a 3% minimum Tier 1 leverage ratio – to complement the CET1 capital to RWA ratio headline test used in the 2014 exercise.
- The 2015 stress scenario envisaged an Asia-based global downturn and then traced through its potential impact on the UK economy.

These new stress tests had been billed as severe. Here are some of the headlines:

“Bank of England stress tests to include feared global crash”

“Bank of England puts global recession at heart of doomsday scenario”

“Stress tests: the Bank of England’s doomsday scenario”

“Banks brace for new doomsday tests”

Fortunately, the banks on the whole came out of the exercise in apparent good shape. As the headlines announced:

“UK banks pass stress tests as Britain’s “post-crisis period” ends”

“Bank of England signals end of the financial crisis era”

“Bank shares rise after Bank of England stress tests”

“Bank of England’s Carney says UK banks’ job almost done on capital”

At the press conference announcing the stress test results Governor Carney couldn’t have been more reassuring:

UK banks are now significantly more resilient than before the global financial crisis. ...

This year’s test complements last year’s effort. It is focused on an emerging market stress that prompts reassessments of global prospects and asset prices; considers the implications of deflation not inflation; and places greater emphasis on exposures to corporates rather than households. It also includes an unrelated but important stress of costs for known misconduct risks.

Known misconduct risks? I don’t think so.

The stress test results, taken together with banks’ capital plans, indicate that the UK banking system would have the capacity to continue to lend to the real economy even under such a severe scenario.

They testify to the value of the reforms that have rebuilt capital and confidence in the UK banking system.⁶⁹

The key point to take is that this [UK banking] system has built capital steadily since the crisis. It's within sight of [its] resting point, of what the judgement of the FPC is, how much capital the system needs. And that resting point - we're on a transition path to 2019, and we would really like to underscore the point that a lot has been done, *this is a resilient system, you see it through the stress tests*.⁷⁰ (My italics)

Well, it's a great story Mark, but it just ain't so – and you definitely *don't* see it through the stress tests.

Let's go back to the stress scenario. This scenario envisages a hypothetical global downturn emanating from China: economic growth there falls from 7% to 1.7%, and trigger a Chinese/Hong Kong house price crash. Financial markets freeze up, some trading counterparties fail, emerging currencies slide against the dollar, the UK and the Eurozone go into recession and the oil price tumbles. Plus various other bits and pieces including the misconduct issues that Carney mentioned in his remarks at the press conference.

But how severely would this scenario impact the UK?

Consider the main variables hitting the UK banking system as the scenario takes its course:

69 Financial Stability Report Press Conference, 1st December 2015, "Opening remarks by the Governor," p. 1.

70 Bank of England Financial Stability Report Q&A, 1st December 2015, p. 11.

- Bank Rate is projected to fall from 0.5% at the end of 2014 to 0% in 2015Q3 and then stay there.
- CPI inflation is projected to fall from 0.1% at the end of 2014 to bottom out at -0.9% in 2015Q1 and then recover to 0.5% by end-2019.
- Real GDP growth rate falls from 0.6% at the end of 2014 to bottom out at -1% in 205Q4 and recover to 0.5% by end-2019.
- Unemployment falls from 5.7% at the end of 2014 to peak at 9.2% in mid-2017 and then fall back to 7.2% by end-2019.
- UK residential and commercial property prices fall by 20% and 35% respectively.
- Bank lending *expands* by 9%: this looks odd for an adverse scenario, especially given the long contraction in bank lending post-2007.
- Impairments on lending to UK businesses remain modest.
- Bank pre-tax losses of £37 billion: this compares to UK bank losses of at least £98.4 billion over 2007-2010.⁷¹
- The Vix financial market volatility index – the ‘fear index’ – is projected to rise from just over 20% at the end of 2014 to peak at 46% in 2015 before falling back. This compares to its 2008 peak of just short of 70%.⁷²
- World GDP growth dips to -0.7% before recovering, compared to its fall to -2% in the Global Financial Crisis.

The rise in the unemployment rate and the falls in UK property prices are on the moderately severely side but are still lower than what we have witnessed in other countries in the EU since the onset of the Global Financial Crisis. For their part, the other projections in

⁷¹ Local Authority Pension Fund Forum, “UK and Irish banks capital losses – post mortem,” September 2011, p. 3.

⁷² <https://uk.finance.yahoo.com/q/bc?s=%5EVIX&t=my>. Accessed December 20 2015.

the Bank's adverse scenario range from mildly adverse to positively optimistic. Not exactly doomsday.

The banks' projected reaction to this scenario is also on the mild side. The capital ratio that the Bank prefers to cite when discussing the stress tests, CET1 capital divided by Risk-Weighted Assets, falls on average by 3.6 percentage points from 11.2% at end-2014 to 7.6% by end-2016; its secondary stress-test capital ratio, the ratio of Tier 1 to leverage exposure, falls on average from 4.4% to 3.5% over the same period; and the CET1 capital measure falls by £55.5 billion from £298.1 billion to £242.6 billion.

So, once again, as with the 2014 stress tests, the Bank's stress scenario is not especially stressful.

There is another problem: the 9% expansion in bank lending in the stress scenario. This expansion looks odd for what is supposed to be an adverse scenario, but what is even odder is that this 9% expansion looks to be hard-wired as an assumption imposed on the model rather than an output to be derived from it. This is a methodological no-no and is equivalent to sticking a big spanner in the works – and one that would serve to make the economy appear to perform much better than it otherwise likely would. The Bank's explanation is then positively weird:

An important macroprudential goal of stress testing is to help the FPC [Financial Policy Committee] assess whether the banking system is sufficiently well capitalised to maintain the supply of financial services in the face of adverse shocks. To that end, banks were required to assume that, even under stress, lending to the UK real economy expanded by 9% over the five

years of the stress scenario to meet the demand for borrowing.

Let me see if I get this right: in order to assess the capacity of the banking system to continue lending in a severe crisis, banks were *required* to assume that they would continue lending – and to a much greater extent than they have been lending over the last few years. Maybe this is just me, but if the FPC wanted reassurance that banks would expand lending to this extent over their, ahem, ‘doomsday’ scenario, it might have been more convincing if they had allowed their model to determine bank lending, and it would have been interesting to know what that model-determined bank lending might have been. Instead, for reasons I cannot begin to fathom, the FPC forced the model to spew out the reassuring numbers it wanted rather than let the model determine what they should be. Having forced this result on the model, the FPC is then in a position to claim that bank lending would rise by 9% over the scenario period because that is what the model says it will do!

Well, I suppose this is *one* solution to the problem of how to ensure that we can get lending moving again: the trouble is that this solution only works in the Bank’s model with the spanner attached.

Anyway, let’s put aside these seeds of doubt about the scenario and the way it is modelled and move on to the test results.

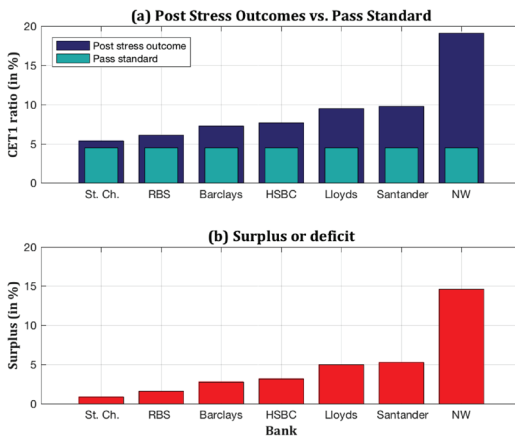
5.2 RESULTS FOR THE CET1/RWA STRESS TEST

The first stress test was based on the CET1 ratio, the ratio of CET1 capital to RWAs. In this test, as in the 2014 stress test, the Bank set its minimum pass standard equal to 4.5%.

The story here is much the same as it was in the 2014 stress tests, so I will skip through the results with minimal commentary.

The post-stress outcomes for the 7 banks involved – Barclays, HSBC Holdings, Lloyds Banking Group, the Nationwide Building Society, the Royal Bank of Scotland Group, Santander UK and Standard Chartered - are given in Figure 13:

FIGURE 13: 2015 STRESS-TEST OUTCOMES FOR THE CET1 RATIO WITH A 4.5% PASS STANDARD



(a) The pass standard is the bare minimum requirement (4.5%), expressed in terms of the CET1 ratio - the ratio of Common Equity Tier 1 capital to Risk-Weighted Assets.

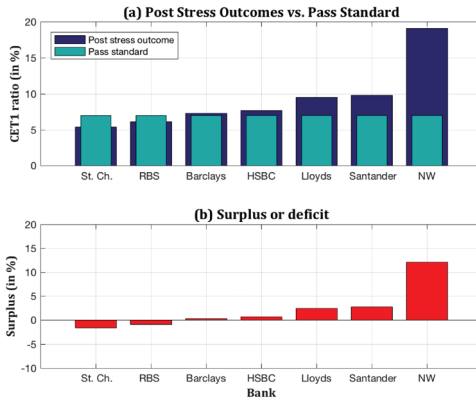
(b) The outcome is expressed in terms of the CET1 ratio post the stress scenario and post any resulting management actions. The data are obtained from Annex 1 of the Bank's stress test report (Bank of England, December 2015).

By this test, the UK banking system might look to be in reasonable shape. Every bank passes the test, although one (Standard Chartered) does so by a slim margin of under 100 basis points and another (RBS) does not perform much better.

However, as explained in the previous chapter, the choice of a 4.5% pass standard is odd, because the Bank itself acknowledged that the pass standard must be at least as high as internationally agreed minimum capital requirements and that these must be at least as high as 7%.

If one applies the Bank’s stress test to a 7% pass standard, one gets the outcomes shown in Figure 14:

FIGURE 14: 2015 STRESS-TEST OUTCOMES FOR THE CET1 RATIO WITH A 7% PASS STANDARD



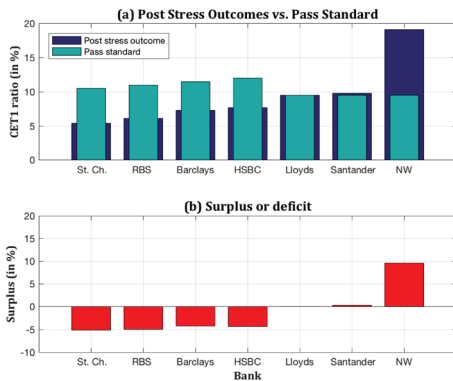
(a) The pass standard is the sum of the bare minimum requirement (4.5%) and the Capital Conservation Buffer (2.5%), both expressed in terms of the CET1 ratio - the ratio of Common Equity Tier 1 capital to Risk-Weighted Assets.

(b) The outcome is expressed in terms of the CET1 ratio post the stress scenario and post any resulting management actions. The data are obtained from Annex 1 of the Bank’s stress test report (Bank of England, December 2015).

One now gets a rather different picture: two banks (Standard Chartered and RBS) fail the test and two more (Barclays and HSBC) barely pass with surpluses of less than 100 basis points. Only three (Lloyds, Santander and Nationwide) are above the pass standard with room to spare.

Furthermore, even the 7% pass standard is less than the minimum required CET1 ratio that will be implemented under Basel III by the end of the stress period, as it ignores the Counter-Cyclical Capital Buffer (CCyB) and the Global Systemically Important Banks (G-SIBs) Buffer. If one includes these and set them at their potential maximum values – as would be prudent – one gets the outcomes shown in Figure 15.⁷³

FIGURE 15: 2015 STRESS-TEST OUTCOMES FOR THE CET1 RATIO WITH THE POTENTIAL MAXIMUM BASEL III PASS STANDARD



(a) The pass standard is the sum of the bare minimum requirement (4.5%), the Capital Conservation Buffer (2.5%), the maximum Counter-Cyclical Capital Buffer (2.5%) and the Global Systemically Important Banks Buffer, which varies across the banks. However, they do not include the new Systemic Risk Buffer, which will have a potential maximum value of 3% and which would further raise the pass rate. These percentages are expressed in terms of the CET1 ratio - the ratio of Common Equity Tier 1 capital to Risk-Weighted Assets.

(b) The outcome is expressed in terms of the CET1 ratio post the stress scenario and post any resulting management actions. The data are obtained from Annex 1 of the Bank's stress test report (Bank of England, December 2015).

73 The Supplement to the Bank's 2015 Financial Stability Report published on December 1 2015 indicated that a new Systemic Risk Buffer is to be introduced as well, and will take a value in the range 0%-3%. See Table A on p. 8. I have not included this additional buffer in any of my simulations, and this omission has the effect of making the stress test outcomes appear somewhat better than they would have been had I incorporated it into the pass standard.

In this case, no less than four banks (Standard Chartered, RBS, Barclays and HSBC) are clear failures with outcomes well below the pass standard. Lloyds is exactly equal to the pass standard, Santander is a wafer-thin slice over it and only Nationwide is comfortably above.

So once again, even if one accepts *all* the major features of the Bank's CET1 ratio stress test *but* the pass standard and merely alter the pass standard to come into line with what the minimum capital requirement might plausibly be under Basel III by the end of the stress period, then one gets a very different outcome to the one portrayed by the Bank: the UK banking system would be revealed to be massively capital-inadequate, again.

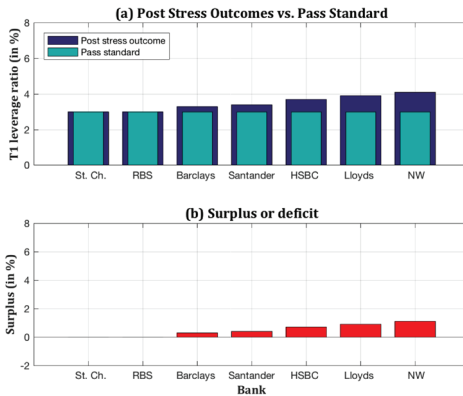
I would further note that the Federal Reserve intends to impose an even higher G-SIB surcharge than the 2.5% allowed for by the Bank of England: this surcharge could be as high as 4.5% and is due to be implemented in full by January 1 2019. This higher requirement would take the maximum possible required CET1 ratio in the US to 14%.⁷⁴ This capital requirement is over three times the pass standard used by the Bank of England in its stress tests!

⁷⁴ See Board of Governors of the Federal Reserve System, "Draft final rule regarding risk-based capital surcharges for systemically important U.S. bank holding companies," July 16, 2015.

5.3 RESULTS FOR THE TIER 1 LEVERAGE RATIO STRESS TEST

The second stress test in the 2015 exercise was based on the ratio of Tier 1 capital to leverage exposure and the pass standard was set at 3%. The outcomes for this stress test are shown in Figure 16:

FIGURE 16: 2015 STRESS-TEST OUTCOMES USING THE TIER 1 LEVERAGE RATIO WITH A 3% PASS STANDARD



(a) The pass standard is the bare minimum requirement (3%), expressed in terms of the Tier 1 leverage ratio - the ratio of Tier 1 capital to leverage exposure.

(b) The outcome is the Tier 1 leverage ratio post the stress scenario and post any resulting management actions. These data are obtained from Annex 1 of the Bank's stress test report (Bank of England, December 2015).

By this test the UK banking system looks to be in not the best of shape. The average outcome across the banks is 3.5%, making for an average surplus of 0.5%. The best performing institution (Nationwide) has a surplus (i.e., outcome minus pass standard) of only 1.1%, four (Barclays, HSBC, Lloyds and Santander) have surpluses of less than one hundred basis points, and the remaining two surpluses of exactly zero: had the stress been even a smidgeon more

severe, they would have gone under water and (presumably) failed the test.

However, the Bank was still upbeat in its assessment. Regarding the five best-performing banks (i.e., the ones that actually got a surplus) it reported that the PRA Board had judged that the “stress test did not reveal capital inadequacies” for these banks and saw no need to mention that their surpluses were rather on the small side: 0.3% for Barclays, 0.4% for Santander, 0.7% for HSBC, 0.9% for Lloyds, and only 1.1% for the star of the class, the Nationwide.

As for the two dunces that got surpluses of exactly zero in the leverage ratio test, the PRA Board carefully noted that their capital positions “*remain above the threshold* CET1 ratio of 4.5% and *meet* the leverage ratio of 3%”.

In the latter case, yes but only just: it might have pointed out that these banks would have failed the stress test if the stress scenario had been even a little more adverse or if the hurdle had been even a little higher.

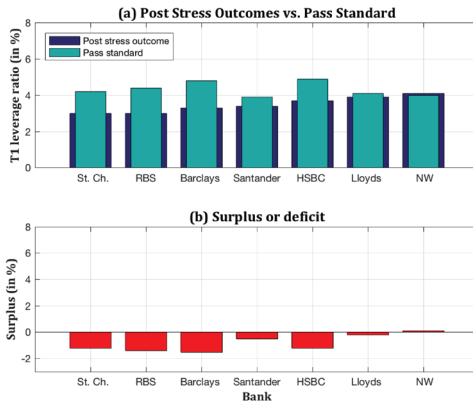
But it didn't. It fell into the spurious precision trap instead.

These two then got off with a slap on the wrist from the PRA and their capital plans were approved.

There is another problem as well: our old friend the pass standard. The 3% pass standard assumed in this test took no account of the additional leverage ratio requirements that will be phased-in under Basel III: these are the additional leverage ratio requirements corresponding to the Counter-Cyclical Capital Buffer and Globally Systemically Important Institutions Buffer. If one includes these and sets the pass standard to the potential maximum under fully

implemented Basel III, one then gets the outcomes shown in Figure 17 (overleaf):

FIGURE 17: 2015 STRESS-TEST OUTCOMES USING THE TIER 1 LEVERAGE RATIO WITH THE POTENTIAL MAXIMUM BASEL III PASS STANDARD



(a) Author's calculations based on information provided by the Bank of England's 'The Financial Policy Committee's review of the leverage ratio' (October 2014) based on the assumption that the pass standard is the potential maximum required minimum leverage ratio under fully-implemented Basel III. However, they do not include the new Systemic Risk Buffer, which will have a potential maximum value of 3% and which would further raise the pass rate.

(b) The outcome is expressed in terms of the Tier 1 leverage ratio - the ratio of Tier 1 capital to leverage exposure - post the stress scenario and post any resulting management actions. These data are obtained from Annex 1 of the Bank's stress test report (Bank of England, December 2015).

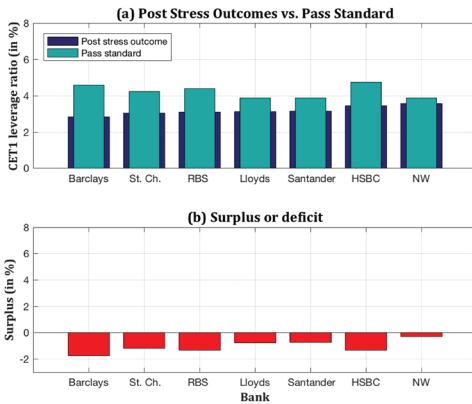
If the earlier outcomes reported in Figure 9 were bad, these are disastrous: the overall average shortfall is 0.85%, only one bank (Nationwide) scrapes through the test with a surplus of under 0.1% and the other six banks fail.

5.4 RESULTS FOR A CORE EQUITY TIER 1 LEVERAGE RATIO STRESS TEST

However, there is still the problem that the Bank’s leverage ratio stress test uses an unduly soft numerator – Tier 1 capital instead of CET1. It would therefore be prudent to re-do the leverage ratio stress test using CET1 instead of Tier 1 capital as the numerator.

If one takes the outcomes of the Bank’s stress test applied to the CET1 leverage ratio and take the pass standard to be the potential maximum under fully implemented Basel III, then one obtains the outcomes shown in Figure 18:

FIGURE 18: STRESS-TEST OUTCOMES USING THE CET1 LEVERAGE RATIO WITH THE POTENTIAL MAXIMUM BASEL III PASS STANDARD



(a) Author’s calculations based on information provided by the Bank of England’s ‘The Financial Policy Committee’s review of the leverage ratio’ (October 2014) based on the assumption that the pass standard is the potential maximum required minimum leverage ratios under fully-implemented Basel III. However, they do not include the new Systemic Risk Buffer, which will have a potential maximum value of 3% and which would raise the pass rate higher.

(b) The outcome is expressed in terms of the CET1 leverage ratio post the stress scenario and post any resulting management actions. These data are obtained from Annex 1 of the Bank’s stress test report (Bank of England, December 2015).

The average outcome is 3.18%, the average pass standard is 4.32%, the average shortfall is over a hundred basis points and every single bank

fails the test. By this test, the entire UK banking system is well and truly under water.

Then one must also consider that the true picture is even worse than reported here:

- The CET1 numbers are inflated because of the biases discussed earlier: IFRS, the Basel III 'sin bucket' and the fact that these numbers are book values rather than market values.
- The leverage exposure measure is likely to be (considerably) under-estimated.
- Even the maximum Basel III pass standard is below best practice capital requirements overseas (think of the Federal Reserve's forthcoming 5%/6% minimum leverage ratios) and the recommendations of many experts, who call for at least 15%, and in some cases, 20%/30%/50% etc.

So once again, the UK banking system is not so much underwater as stuck at the bottom of the ocean.

Chapter Six: Overseas Experiences of Stress Testing

It is instructive – and grimly entertaining – to examine the track record of regulatory stress testing overseas to see how this methodology actually works in practice. These experiences provide some object lessons in how (not) to go about such exercises.⁷⁵

75 Some of these case are covered further in my “Math Gone Mad: Regulatory Risk Modeling by the Federal Reserve”, Cato Policy Analysis 754, September 2014.

6.1 THE FANNIE AND FREDDIE STRESS TESTS

In 1992 the newly established US Office of Federal Housing Enterprise Oversight (OFHEO) was directed to establish a stress-based capital standard to determine regulatory capital requirements for the giant housing Government Sponsored Enterprises (GSEs), Fannie Mae and Freddie Mac. At the time, there was concern over the GSEs' solvency and there were proposals to increase their capital requirements. However, Fannie managed to head off this pressure by means of an audacious coup: it commissioned former Fed chairman Paul Volcker to examine the matter, and he concluded that Fannie was safe. Fannie's chief executive could then claim that their business was safer than banking:

There are no unpleasant surprises because of the nature of our business. We don't have any see-through buildings, any Third World countries or any strip shopping malls. We just have those mortgages.⁷⁶

One might even say that they were as safe as houses ...

At face value, the new standard was admirably conservative: the stress scenario envisaged a decade long 'nuclear winter' scenario of prolonged stress to mortgage defaults and interest rates. The required level of capital was then set as the amount that would allow them to remain solvent plus an extra 30% for good measure. The risks involved were complicated, however, and it took nearly a decade to build the stress models. To reinforce confidence in its financial strength, Fannie Mae commissioned a team of distinguished

⁷⁶ Quote from J. R. Hagerly, "How Joseph Stiglitz misread the risks at Fannie Mae," Wall Street Journal, October 1 2012.

economists led by Joseph Stiglitz to carry out their own analysis, and the Stiglitz team reported in 2002 that the risk of Fannie failing over the scenario decade was “effectively zero”.⁷⁷ Both GSEs then proceeded to embark on a binge of aggressive risk-taking – most notably, loading up on toxic subprime – and effectively failed six years later when the government took them into conservatorships to avert their impending collapse. The stress tests had been a spectacular failure.

So what went wrong? Part of the problem was that the capital requirements were very light: for example, Freddie’s risk-based capital requirement was below 200 basis points for the entire period 2003-2007 when it was rapidly building up its subprime exposure, but part of the problem was that the new system allowed the GSEs to game the system by loading up on risks that the models did not adequately capture. The models also ignored the major risks involved: they ignored the venture into subprime, ignored the impact of executive compensation packages that encouraged excessive risk-taking and allowed the GSEs to game the risk models to keep the risk numbers down. The GSEs were also gaming their own government-sponsored status: they would tell Congress not to worry because the government was not on the hook, then tell Wall Street not to worry because the government *was* on the hook. There was all the political meddling as well.⁷⁸ Or, to quote the book *Alchemists of Loss*, Fannie and Freddie

... leveraged more than would have been possible without the government’s quasi-guarantee, used taxpayers’ money to lobby like crazy to ensure they were

77 J. Stiglitz, J. M. Orszag and P. R. Orszag, “Implications of the new Fannie Mae and Freddie Mac risk-based capital standard,” Fannie Mae Papers, 1, No. 2, March 2002, pp. 2-3.

78 For more on this, see, e.g., G. Morgenson and J. A. Rosner, *Reckless Endangerment: How Outsized Ambition, Greed, and Corruption Created the Worst Financial Crisis of our Lifetime* New York: St. Martin’s Griffin, 2012.

not properly regulated and collapsed thankfully into the arms of the taxpayer as soon as the consequences of their own ineptitude became clear. It is indeed astonishing to consider how they managed to turn the soundest product in financial markets, the home mortgage, into a speculative casino, causing collateral damage of many times their own losses.⁷⁹

And all of which was missed by the stress tests.

6.2 THE FEDERAL RESERVE'S STRESS TESTS

The Federal Reserve began stress-testing the banks in 2009. The initial exercise – the Supervisory Capital Assessment Program – was a fairly light one involving the 19 biggest bank holding companies. This was followed by the more extensive Comprehensive Capital Assessment and Review (CCAR) in 2011. The CCAR is a highly aggressive and enormous undertaking in which the Fed requires banks to demonstrate the adequacy of their own risk models to the Fed's models. The CCAR then became an annual cycle, with each annual exercise more extensive and more demanding than the previous one; in 2013, the CCAR was supplemented by the regulatory stress tests mandated by the Dodd-Frank Act, the so-called DFAST tests; and in 2014, US banks were subject to even more stress tests to be carried out under Basel III.

⁷⁹ K. Dowd and M. Hutchinson, *Alchemists of Loss: How Modern Finance and Government Intervention Crashed the Financial System*, Chichester: Wiley, 2010, p. 190.

These stress tests were subject to the usual criticisms that they were excessively reliant on the Fed's preferred scenarios which were not particularly stressful, were blind to major risks credibly identified by independent observers, e.g., a Eurozone collapse, which was ignored till the 2012 CCAR, the risk of a rise in interest rates, ignored till the 2014 CCAR, or the enormous risks created by counterparty defaults or off-balance-sheet activities, which have still not been addressed. The Fed's stress tests were conditioned by political factors (e.g., the Fed's optimistic party line on real estate, its reluctance to face up to the ongoing weakness of the big zombies: Citi, Bank of America, etc.).

The Fed's stress tests also involved the occasional mistake – and some were howlers too:

- Regions Financial easily passed the 2012 CCAR, despite being GAAP-insolvent and therefore subject to the Prompt Corrective Action statutes that *mandated* that it should be taken into receivership. The Fed illegally passed its capital plan instead. Apparently the Fed hadn't read the bank's annual report properly.⁸⁰
- Bank of America passed the 2014 CCAR and had its capital distribution plan passed by the Fed, only to admit a little later that it had overestimated its capital by about \$4 billion. It turned out that it had been repeating the same mistake since 2009, and neither it nor the Fed had picked up the error till BAC 'fessed up. As the *Wall Street Journal* drily noted, "Despite numerous federal regulators in its offices, and a huge apparatus of compliance employees and risk controls, neither Bank of America nor its overseers

80 For more on this episode, see J. Weil, "Class dunce passes Fed's stress test without a sweat," Bloomberg, March 15, 2012.

- caught the mistake until last week” and even then it only came to light when a conscientious BAC employee happened to notice it.⁸¹
- In December 2015, it was revealed that the Fed’s own internal reviews found deficiencies in the Fed’s system for validating its own models, i.e., the ones it was using to verify the models used by the banks. These failings including relying too heavily on key personnel and inadequate procedures and policies about the validation process: these are problems symptomatic of institutions with inadequate risk systems. The review concluded the Fed would have reprimanded a bank for such lapses, its own inspector general noting that “Similar findings identified at institutions supervised by the Federal Reserve have typically been characterized as matters requiring immediate attention...”⁸²

One wonders what else might be lurking.

Critics pointed out that there were alternative approaches that are much simpler, less costly, less intrusive, more transparent and more accurate than the Fed’s stress tests. These included traditional financial analysis, in which one starts with loss assumptions, examine capital, earnings and liquidity and then determine the institution’s loss absorbing capacity without the need for any macroeconomic scenarios or risk modelling at all. As Chris Whalen pointed out, one reason why the stress tests are

a bad joke is the continued insistence by the Fed on using three macroeconomic scenarios to define the test process. [KD: These are the baseline, adverse and

81 C. Rexrode, D. Fitzpatrick and R. Tracy, “Bank of America suspends buyback, dividend increase,” Wall Street Journal, April 28 2014.

82 R. Tracy, “Fed finds fault with its own stress tests,” Wall Street Journal, December 6, 2015.

extremely adverse scenarios, but only the latter really matters.] Anyone even vaguely familiar with financial analysis understands that you don't need an economic narrative or an economist for that matter to stress test a financial institution. You start with loss assumptions, examine capital, earnings and liquidity, and then assess the loss absorption potential of a given institution.

The participating banks have noted in public comments on the DFA stress tests that the Fed and other agencies "do not have a strong record of identifying emerging risks in the past, and that the scenario variables were not sufficiently plausible to be useful as a risk management tool." These comments are well founded and illustrate the silly nature of this exercise. The fact that the Fed has required bank management to spend time on this idiocy while closing year-end financial statements is just another piece of evidence that nobody at the Fed is living in the real world.

Another reason that the Fed stress tests are not to be taken seriously by investors is the dependence upon risk modelling, a requirement that is designed to provide employment to economists, lawyers and risk managers.⁸³

It is also important to appreciate the scale of the compliance costs involved in the Fed's stress tests. To quote Whalen and Scott:

83 C. Whalen, "Stress test dummies: It's all about interest rate risk, right?" Zero Hedge, March 24, 2014.

banks are required to perform an exhaustive self-analysis of financial and operational risks that most closely resembles a full-blown audit. Management and the board of directors are required to comprehensively identify all risks to the enterprise, then model hundreds of variables in response to the subjective criteria provided by the Fed. The banks are required to design their own internal economic scenarios and then stress credit, operational and idiosyncratic risks. Keep in mind that for many banks, there are more people working on DFAST and CCAR than are part of the core credit team. ...

The Fed refuses to provide banks with the most basic information about the DFAST and CCAR evaluation process, but expects each institution and its board of directors to spend between two to three months each year engaged in an economic modelling and financial self-evaluation process. ...

The Fed has created a process that is prohibitively expensive for banks, produces little in the way of useful information for investors, and has almost no value in terms of public policy.⁸⁴

This process is to be carried out with virtually no co-operation from the Fed about its evaluation process or its own in-house models. The final output then stretches to many thousands of pages and includes information on capital levels, loss projections on different types of

84 C. Whalen and J. Scott, "For Bond Investors, the Bank Stress Test Process is Beside the Point," Kroll Bond Rating Agency, U.S. Financial Institutes FI Research, March 9, 2015.

asset, and much else besides, down to an extraordinary level of detail. Once the report is submitted, a bank can expect to undergo a severe interrogation from Fed officials, who will evaluate the bank's results using their own models, which will almost always produce more severe results. Throughout the process, the bank has always to anticipate the Fed's reaction and it has no choice but to manage to what it perceives the Fed's model to be.

Yet Governor Tarullo – the father of the stress tests – lectures the banks against managing to the Fed's stress test models despite the fact that the Fed punishes them if they do anything else, as if to suggest that they shouldn't regard the stress tests as just a compliance exercise.

Good to have your input there, Dan, but I am reminded of primary school: the good nuns would lecture us on the need to be honest at all times and then belt us when we had the temerity to speak the truth at the wrong time. The simple truth is that bank managers' obligations are to their shareholders first and foremost and compliance with the Fed's stress test *is* just a compliance exercise, like paying your taxes, where you are only obliged to pay what you are obliged to pay and not a cent more. Otherwise managers are not putting their shareholders' interests first and in that case their shareholders should fire them. This is known as the Capitalist System.

In researching my Cato Institute policy analysis *Math Gone Mad* on the Fed's stress tests, in December 2013 I interviewed the senior management of one big and highly respected US bank: they were privately scathing about the Fed's stress tests, but were afraid to speak out publicly lest the Fed punish them for doing so. This bank had weathered the crisis very well. Unlike many, it used very little risk modeling: it had little need of models as it chose not to take excessive risks. The risk models it then submitted to the Fed under the risk

supervisory process used its own loss experience, which was much lower than the industry average.

Supervisors however rejected their models and demanded that the bank use more sophisticated models and the industry loan loss experience instead of its own. Thus, in the interests of promoting good risk management and discouraging excessive risk-taking, the Federal Reserve forced a well-run bank to adopt highly expensive risk management technology that it neither wanted nor needed, imposed higher regulatory capital requirements that were not justified by the risks the bank wanted to take, which then pressured the bank to take extra risks that it *didn't* want to take in order to recoup its higher costs!

And the Fed compelled the bank to take TARP funding that it didn't need and had no use for, but acceptance of which pushed all the banks into the same coral where the bad guys couldn't be distinguished from the good guys.

The damage went further, too. Much of the bank's normal business activity was stopped by a hugely expensive need to feed the models demanded by the Fed:

- There was a massive disruption caused by the need to upgrade the bank's models to satisfy the Fed. The bank had to stop investing in technological innovation because its IT people were overwhelmed with regulatory reporting, despite the bank having hired more than a thousand IT modelers over little more than a year. The model upgrade process swallowed up a huge amount of management time.
- The CCAR 2014 alone involved 57 separate models and over 10,000 pages of regulatory documents to be submitted to the Fed.

- The bank could not pursue further acquisitions because its systems were overwhelmed and it was not able to determine the regulatory risk in potential purchases.
- Risk management meetings went from quarterly to monthly, and the meetings themselves became marathons. On one day in December 2013, the Risk Management Committee met at 8:00 am and members were expected to have pre-digested a package of 627 pages. This meeting was immediately followed by a Board meeting that went on to 6:00 pm and Board members were expected to have pre-digested a separate package of 621 pages. In short: a 10-hour meeting and 1,248 pages of documents to go through in less than 30 seconds a page. At least 90% of the discussion was on regulatory matters.

Even worse, the regulatory process warped the bank's core business model, pushing the bank from an old-fashioned decentralized-judgment-plus-incentives business model that had worked well towards a much inferior one dominated by models, and the fact that the models were approved by the Fed made them difficult to challenge. The models then came to warp the bank's entire decision-making process right down to the level of individual lending decisions: good loans that would easily have been approved before were often now rejected by the models, and the bank was not even allowed to explain why.

Another problem is that repeated stress tests make stress losses become more predictable over time. A recent study by Paul Glasserman and Gowtham Tangirala (2015) suggests that they are now strikingly predictable and that this predictability would seem to be an artefact of the stress testing process rather than an accurate reflection of the risks actually taken. To quote:

Despite the complexity of this process, using results made public across various stress tests we find that

projected losses by bank and loan category are fairly predictable and are becoming increasingly so. ...

That stress losses would become predictable from one year to the next should not be surprising. If a bank's portfolio and the Federal Reserve's scenarios remain reasonably consistent over time, so should the bank's stress test results. In its first year of participation in the stress tests, a bank needs to make major investments in staff and information technology; over time, the process matures and becomes more routine. Indeed, consulting firms and software vendors have made a business of trying to simplify and standardize the stress testing process for banks to make it more routine.

One might note here that the banks all seem to use the same consultants to get them through the stress test process, and these consultants are often former Fed officials who used to conduct the stress tests themselves. To continue:

The models used by the Federal Reserve to define scenarios and project losses have also been refined and should change less over time. Banks have incentives to avoid investments that will attract high capital requirements through the stress tests. ... they also face incentives to align their internal risk assessments with the Federal Reserve's. All of these factors contribute to making outcomes more predictable over time.

But whereas the results of stress tests may be predictable, the results of actual shocks to the financial system

are not, and herein lies the concern. The process of maturation that makes stress test results more predictable may also make the stress tests less effective.⁸⁵

And then a little later:

The patterns [in projected loss rates] appear to be an *artifact of the stress testing process rather than an accurate reflection of potential bank losses*. ... (My italics)

The main concern with a routinized stress test is the danger that it will lead banks to optimize their choices for a particular supervisory hurdle and implicitly create new, harder to detect risks in doing so.⁸⁶

6.3 ICELANDIC AND EUROPEAN STRESS TESTING EXPERIENCES

The Icelandic and European experiences are also interesting. These are remarkable in particular for the banking stresses that the stress tests completely failed to detect in advance, including no less than *four* cases where whole national banking systems – not just individual banks – suddenly collapsed shortly after having been signed off as sound by regulatory stress tests.

The first of these was Iceland. By the end of 2007, the assets of the three biggest Icelandic banks – Glitnir, Kaupthing and Landsbanki

⁸⁵ P. Glasserman and G. Tangirala, “Are the Federal Reserve’s stress test results predictable?” Office of Financial Research Working Paper 15-02, March 3, 2015, p. 2.

⁸⁶ Op. cit., pp. 12, 19.

- had grown to almost 900% of GDP. By this point, there were concerns about the banks' dependence on wholesale markets and CDS spreads were suggesting that the banks were vulnerable. However, in 2008 a variety of stress tests by the IMF, the Icelandic central bank and the Icelandic financial regulator suggested that the system was resilient. The Icelandic financial sector then collapsed in October that year.

There were also the stress tests conducted by the Committee of European Banking Supervisors (CEBS) and later by the European Banking Authority (EBA) and the European Central Bank (ECB).

The first of these was conducted by the CEBS in 2009 with results reported in October that year. The results suggested that none of the 22 large banks covered would see their Tier 1 capital/RWA ratios fall below the minimum threshold of 6%. The accompanying press release proudly talked of how the exercise demonstrated the "resilience" of the European banking system after recent unfortunate difficulties. Critics suspected that the stress scenario was merely too weak to pick up any problems. Subsequent events were to prove them right.

The second exercise was conducted by the CEBS in 2010. This exercise covered the 91 biggest European banks and the results reported in July showed that only seven banks failed to meet the 6% minimum capital level; even then their combined shortfall was a mere €3.5 billion, about 0.15% of Eurozone GDP. Skeptics noted that this figure was a fraction of the estimates of independent analysts and pointed out that the stress test largely ignored the biggest risk of all: the risk of sovereign defaults. This risk was apparently left out because the EU were committed to ensuring that such defaults never happened, a classic case of policy make-believe undermining the credibility of the exercise before it had even started.

Shortly afterwards, a report by the *Wall Street Journal* revealed that the results failed to disclose banks' full holdings of government debt despite the CEBS's promise to provide a comprehensive picture of those holdings. Reducing banks' reported holdings of government debt was clearly unhelpful to perceptions of the test's credibility, it reported an analyst as saying, but "was clearly helpful for the thing [regulators] were trying to achieve: convincing you that there's not a problem."⁸⁷

Four months later, it was revealed that the Irish banks – which had passed the stress test with flying colours – were in need of massive support to stay afloat and the Irish government was unable to cover their wholesale financing requirements. The eventual cost of the Irish bailout package came to €85 billion. The 2010 stress tests were now totally discredited.

About the same time, a new round of stress tests was announced: these were to be carried out the next year by the new European Banking Authority. The EBA promised that lessons had been learned etc. and the new stress tests were to be more rigorous than their discredited predecessors. "Thank you for confirming the prior stress test, the one which found that not one Irish bank was impaired, was a bunch of bullshit," Tyler Durden graciously observed. The EBA was however wondering whether to keep the results secret. "You can't make this up: Europe plans fresh round of 'secret' stress tests to 'restore confidence,'" he noted.⁸⁸ However, the EBA soon had second thoughts and the results were published.

⁸⁷ D. Enrich, "Europe's bank stress tests minimized debt risk," *Wall Street Journal*, September 7 2010.

⁸⁸ T. Durden, "You can't make this up: Europe plans fresh round of 'secret' stress tests to 'restore confidence,'" *Zero Hedge*, November 30 2010.

In retrospect, it would have done better to have stuck with its first instincts. The new tests used a slightly stronger capital definition (5% core Tier 1 instead of 6% Tier 1) and a slightly smaller but stronger sample of 90 banks. The EBA now had a much greater awareness of the sovereign debt problem and its implications for European banks *and* it had a pressing need to prove itself.

So what did it do? It came out with an aggregate shortfall of €2.5 billion – even less than it had been the year before!

Three months later, the big Franco-Belgian bank Dexia failed: Dexia had aced the stress test with a post-stress core Tier 1 capital ratio of 10.4%, more than twice that of the 8 banks that failed the test. Its actual leverage ratio, however, was far lower – 1.0% by one estimate – but its low leverage ratio hadn't set off any bells among the regulators.⁸⁹

Meanwhile, in a frantic effort to shore up whatever credibility it imagined it still had, the EBA hurriedly redid its sums and eventually revised its aggregate shortfall to €114.7 billion, over 45 times its best estimate of a few months earlier. Even this figure, however, was well below the estimates of up to €450 billion that others were getting.⁹⁰

Then, the following May, 2012, the big Spanish bank Bankia failed: Bankia had also passed the stress test. It too had had an unimpressive leverage ratio of 2.8%.⁹¹

89 N. Anderson and J. Chappell, "European Banks – Capital: misunderstood, misused and misplaced." Berenberg Equity Research 12 June 2013, p. 33.

90 Op. cit., pp. 50-52.

91 Loc. cit.

Amongst the banks that did well in the 2011 stress test were the Cypriot banks: the whole Cypriot banking system then collapsed out of the blue in March 2013. None of the agencies monitoring Cyprus – the EU, the EBA, the IMF, the BIS, etc. even had Cyprus on any kind of watch list.

The next major EU stress tests were conducted by the ECB in 2014 as part of its new mandate as Europe’s super-regulator. A key driver behind the establishment of the Eurozone banking union and the Single Supervisory Mechanism to govern it was the argument that national regulators were prone to capture and therefore that an independent and more demanding regulator was required: the ECB.

The ECB promised that *its* stress tests really would be credible and it would not repeat the mistakes of the earlier fiascos. The ECB stress test was also to be buttressed by an Asset Quality Review (AQR) to provide assurance that the new stress test would be based on sound data given the glaring data problems that had plagued earlier stress tests. The new tests were also to have a stronger pass standard in the adverse scenario, an 8% CET1 ratio – the standard minimum of 4.5%, plus a 2.5% CCyB and a 1% G-SIB requirement – which was a much higher pass standard than the 4.5% used by the Bank of England in its headline CET1 ratio stress tests.⁹² Unfortunately, the 8% ratio soon attracted a lot of negative lobbying from interested parties – the banks and their national supervisors, who had been captured by them – and the pass standard was eventually knocked down to an easier-to-pass 5.5%.

The 2014 stress test covered 130 Eurozone banks accounting for almost 82% of Eurozone bank assets. “This unique and

⁹² S. Riecher and J. Black, “ECB capital definition tougher in stress test than in review,” Bloomberg, October 23, 2013.

rigorous exercise is a major milestone in the preparation for the Single Supervisory Mechanism, which will become fully operational in November,” said ECB Vice-President Vítor Constâncio when the results were announced on October 26 2014:

This unprecedented in-depth review of the largest banks’ positions will boost public confidence in the banking sector. By identifying problems and risks, it will help repair balance sheets and make the banks more resilient and robust. This should facilitate more lending in Europe, which will help economic growth.⁹³

It didn’t.

25 banks were failed with a combined shortfall of €25 billion as of end-2013 and a mere €9.5 billion by the time the results were published.⁹⁴ None of the biggest banks failed, and the banks that did fail were concentrated mainly in the southern fringe. For its part, the Asset Quality Review produced asset quality adjustments of an additional €48 billion. The severity of the test is apparent from the fact that the combined shortfall plus quality adjustment amounted to only about 0.3% of total bank assets – a number small enough to be rounding error. The ECB conveniently interpreted this number as indicating that earlier data-quality problems had now been solved, but most outsiders took a more obvious interpretation – that the exercise was so weak as to be pointless.

93 “ECB’s in-depth review shows banks need to take further action,” ECB Press Release, October 26 2014.

94 There was also a new set of stress tests carried out by the EBA over a slightly different sample, but I gloss over this exercise because their approach and results were not much different from the ECB’s.

A chorus of independent experts dismissed the results on publication.⁹⁵

One source of problems was the adverse scenario, which was notable for its mildness. This adverse scenario was little more than a continuation of past Eurozone experience: it assumed bond yield rises that are much smaller than the spikes we saw in recent years, omitted the possibility of a sovereign default, assumed a fall in real GDP activity of 0.7% over 2014 (actual GDP fell 0.8%). Incredibly, it also assumed that unemployment in Cyprus and Greece would *fall* in the stress. In addition, it assumed that inflation would drop to a low of 1% in 2014, but by the time the stress test results were released inflation had fallen to 0.3% and much of southern Europe was actually experiencing deflation.

Why does this latter point matter? Well, it matters in part because including deflation would have increased bank shortfalls and led to (potentially many) more bank failures and it matters in part because independent observers had been warning about deflation for some time. But the main reason it matters is because the credibility of the ECB was on the line. When challenged at the press conference on why the ECB had not modelled the possibility of deflation, Mr. Constancio's response was admirably frank: "The scenario of deflation is not there because indeed we don't consider that deflation is going to happen," he said. The ECB had failed to anticipate what already happening right under its nose.

95 See, e.g., P. Legrain, "Yet another eurozone whitewash," October 26, 2014; R. I. Meijer, "Europe redefines stress," *The Automatic Earth*, October 26, 2014; F. Coppola, "European stress tests: not stressful enough," October 28, 2014; M. Goldstein, "The 2014 EU-wide bank stress test lacks credibility," *Vox EU*, November 18, 2014; and Y. Onaran, "European banks see afflicted by \$82 billion capital gap," *Bloomberg*, December 2, 2014. See also the further references below.

If I understand this aright, the ECB was trying to restore its credibility by ignoring an adverse scenario that was *already a reality* on the grounds that it didn't think it would happen. One might add that the deflation scenario that the ECB overlooked was one that it had created itself.

Try satirising that.

Another problem was that the ECB was projecting implausibly low loan losses. As James Ferguson pointed out,

How can you knock 700bps off GDP [relative to the baseline], contract the economy by over 200bps and yet expect NPLs to be just 250bps higher and loan losses just 100bps worse off? In Japan, an extended period of very low real growth became self-perpetuating and has so far generated cumulative loan losses of 2,200bps.

There appears to be a significant dis-connect between the adverse macro assumptions and how these are then translated into micro-economic loan loss assumptions. By the time it gets to the impact on the banks, the adverse macro scenario has become pretty much a baseline loan-loss assumption and there is no adverse (i.e. accelerated) loan loss scenario to observe. It is clearly at this juncture that the banks have pulled the wool over the ECB researchers' eyes.⁹⁶

96 J. Ferguson, "ECB reputation risk skyrockets," The Macro Strategy Partnership, October 27 2014.

Other analyses by independent analysts also came to very different conclusions to the ECB. A study by Acharya and Steffen produced results suggesting that a 40% stock market fall could lead to an aggregate capital shortfall of €450 billion, and a second study by the same authors suggested that a global shock as severe as 2008-2009 could produce shortfalls of almost €770 billion.⁹⁷ Their results suggest that the biggest risks, by far, are in the French and German banking systems, for which the latter study estimated shortfalls of €285 billion and €199 billion respectively, the first figure being equivalent to about 14% of French GDP. The main reason for the discrepancy between their results and the ECB's is that they use leverage ratios rather than the CET1/RWA ratios used by the ECB. They also find that these two measures tend to be negatively correlated, a finding that stems from French and German banks having a greater proportion of zero- and low-RWA assets in their portfolios. In fact, their average RWAs are very low – 26% and 23% respectively – compared to the already low Eurozone average of 33%. The French and German banks therefore only appear to be strong because of their superior expertise in gaming the risk weights. This might sound familiar?

I emphasise that these studies (and others like them, which get similar order-of-magnitude results) are greatly superior because they use standardized, easily replicable low-cost approaches, emphasise leverage ratio metrics over RWA-based metrics, and are credible because

97 V. V. Acharya and S. Steffen "Benchmarking the European Central Bank's Asset Quality Review and Stress Test – a tale of two leverage ratios," Vox EU, November 21 2014; and V. V. Acharya and S. Steffen, "Falling short of expectation – stress testing the Eurozone banking system," CEPS Policy Brief No. 315, 15 January 2014.

they are independent of the political influences that compromise central bank stress tests.⁹⁸

It is interesting to examine some of the big French and German banks a little more closely, and remember that all these easily passed the ECB's stress test. Consider the following from Jakob Vestergaard:

The three big French banks – Credit Agricole, BNP Paribas and Soc Gen – would easily have failed an undemanding 3% leverage ratio test and would produce enormous shortfalls (of about 3-4% of GDP each) under a severe (7%) leverage ratio test. They also had very low RWA/TA ratios that suggest that most of their risks were invisible to the ECB stress test.⁹⁹

Deutsche Bank had a CET1/total assets ratio of 1.81% at the end of 2014 in the adverse scenario and would have produced a shortfall of €91.8 billion or 3.35% of German GDP under a 7% leverage ratio test. Its RWA/TA ratio at the end of 2013 was a puny 16.5%.

The problems with Deutsche have been known about for years. The Fed has been nagging Deutsche for a long time to get its house in order, to little apparent effect.¹⁰⁰ Then in June 2013, FDIC Vice Chairman Tom Hoenig lambasted the bank in a *Reuters* interview:

98 See, e.g., J. Vestergaard and M. Retana, "Behind smoke and mirrors: on the alleged recapitalization of Europe's banks," Danish Institute for International Studies Report 2013:10, Copenhagen: Danish Institute for International Studies, and Konrad E. Urban, "European banks: Not fixed yet," UKIP Parliamentary Resource Unit, December 2015.

99 Numbers quoted from the tables in J. Vestergaard, "European banking misery: pretending rather than mending does no favours to lending," GEC Watch, November 4, 2014, and "Unpacking Europe's banking stress-tests: German and French banks at the brink of insolvency," GEC Watch, November 20, 2014.

100 Op. cit.

“Its horrible, I mean they’re horribly undercapitalized. They have no margin of error.”¹⁰¹ Echoing Hoenig, Tyler Durden called Deutsche the “most systematically important, and undercapitalized, bank in the world”.¹⁰² The concern is that if Deutsche were to fail, it would trigger a financial crisis far worse than Lehman and bring down the entire European financial system. A little over a year later, the Federal Reserve was warning that Deutsche was suffering from a litany of serious problems in its US arm that amounted to a “systemic breakdown” in its risk reporting and presumably indicated something amiss about the state of its operations worldwide.¹⁰³ Deutsche’s operational and risk management failings then led it to fail the next CCAR in March 2015.

It would therefore appear that that the stress tests had been driven and hence compromised by the desire not to offend powerful governments – especially France and Germany – who had their own reasons to want test results suggesting that the problems lay on the fringes of the Eurozone, and not right at its heart. That same message would have also suited the empire-builders at the ECB to reinforce the case for giving them even more power. In any case, it would have suited no-one for the ECB to suggest that some of Europe’s Too-Big-to-Fail banks were on the verge of failure, as that would have put the spotlight on them to come up with a solution to this most delicate of problems. And so the

suspicion lingers that undertaking the comprehensive assessment on the basis of risk-weighted assets

101 E. Stevenson and D. Miedema, “Exclusive: Deutsche Bank ‘horribly undercapitalized’ - U.S. regulator.” Reuters June 14, 2013.

102 T. Durden, “Deutsche Bank ‘is horribly undercapitalized ... It’s ridiculous’ says former Fed President Hoenig.” Zero Hedge, June 15, 2013.

103 D. Enrich, J. Strasbourg and E. Henning, “Deutsche Bank suffers from a litany of reporting problems, regulators said,” Wall Street Journal, July 22, 2014.

and an only mildly adverse stress scenario were not ‘mistakes’, after all. More likely, it reflects substantial political pressures. It would have required courage and genuine independence for the ECB to identify several German and French banks as severely undercapitalized just days before it assumes bank supervisory responsibilities for all major Eurozone banks. If anyone believed that there was still such a thing as an ‘Independent’ ECB, they better think again.¹⁰⁴

In short, the ECB had been captured and its 2014 stress tests were no more credible than its predecessors’ had been.

Now fast forward to early 2016 to see how our problem child is progressing. In its 2015 *Annual Report*, Deutsche reported a Tier 1 leverage ratio of 3.5%. The corresponding CET1 leverage ratio is 3.16%. Both these leverage ratios are based on a leverage exposure denominator of €1,395 billion which is lower than the total assets (€1,629 billion). Remember too that the leverage exposure is supposed to take account of the off-balance sheet positions that the total assets measure misses! If we recalculate the CET1 leverage ratio with total assets in the denominator then the leverage ratio comes out at 2.71%. This leverage ratio is a book value estimate, however, and the contemporaneous price-to-book ratio was about 50%. The corresponding market-value leverage ratio was therefore 1.35%. Since then, the shares of the major European banks – especially those of Deutsche – have taken a hammering and the latest available (writing as of April 6 2016) price-to-book ratio for Deutsche is 32.5%. Applying this price-to-book ratio to the last available book value estimate then gives us a current market-value leverage ratio of 0.88%.

104 J. Vestergaard, “European banking misery: pretending rather than mending does no favours to lending,” GEC Watch, November 4, 2014.

One might add that this leverage ratio analysis leaves out the uncertainties associated with asset valuations. In particular, Deutsche's Level 3 ('mark to myth') assets were €31.5 billion or 72% of its CET1 capital. Its Level 2 ('mark to model') assets were higher still: €709.1 billion or over 1,600% of its CET1 capital. Any errors in these valuations could then make a notable dent to the bank's capital position.

There is also the off-balance-sheet stuff. Its 2015 Annual Report reveals that the notional value of Deutsche's OTC derivatives book was €41.9 trillion, which was almost 74 times greater than its €567 billion in deposits, about 4 times greater than Eurozone GDP and overt 13 times greater than German GDP: Deutsche is a gigantic hedge fund with a comparatively small bank attached. Of course, this €41.9 trillion is a gross figure and the net figure is much smaller – only €18.3 billion or 0.04% of the gross figure. My best guess (for reasons given earlier when discussing the Barclays example on p. 14) is that Deutsche's true derivatives exposure is much bigger than the net figure and only a small fraction of the gross figure, but the truth is that no-one really knows for sure.

Moving on to the 2015 stress tests, the star in this show was, inevitably, Greece. Let me paraphrase Tyler Durden and add-in a few observations of my own.¹⁰⁵ In the 2014 tests, the four big Greek banks – Alpha Bank, Eurobank, National Bank of Greece and Piraeus Bank – had entered Schrödinger bailout territory: they had both passed and failed the stress test at the same time. Based on a static projection, 3 had failed, but based on a dynamic projection that took into account assumed management actions, only one failed and that by the smallest of shortfalls, just under €17.5 million, small change. The ECB were a little churlish not to have let it pass.

105 Tyler Durden, "Greek bad debt rises above 50% for the first time, ECB admits," Zero Hedge, October 31 2015.

Leaving aside that the ECB's adverse scenario was (again) on the mild side, its scenario ignored the increasingly bad tempered bare-knuckle fight going on between the Greek government and the Troika – and especially, the German government – over whether, and if so, on what terms, Greece would get yet another bailout. Indeed, the outcome of this argument was the only adverse scenario that mattered. The adverse scenario they should have modelled would therefore have been the worst of (a) Greece not getting a bailout and (b) Greece getting a bailout on terms that the Germans could live with. Either outcome would have been much more severe than the adverse scenario used by the ECB and would have produced the result that subsequently transpired, i.e., that the entire Greek financial system would go into cardiac arrest. Such an outcome was entirely predictable to anyone outside the ECB.

Put it this way: you are doing a stress test on the financial resilience of a Wild West saloon. When you turn up, there is a brawl well under way: furniture is being smashed, the windows put out and the booze bottles at the bar are being destroyed, i.e., the assets are being trashed. The only thing you are not sure about is which side will win. So what do you do? You ignore all that and project what would happen if there was a mild downturn in the local economy and the saloon was still in one piece.

By June 2015, the Greek government had imposed capital controls to avert the collapse of its banking system, and by July, it was being reported that 51% of their just over €210 billion loan portfolio was non-performing. Fast forward to the results of the 2015 ECB stress tests in October 2015: the banks were revealed to have capital shortfalls of €14.4 billion. There was no commentary on how, over the span of one year, the same banks that were deemed stable and dynamically not needing any bailouts, now needed to raise an additional €14.4 billion, nor of how they were supposed to provision for €107 billions in

NPLs. Instead, the ECB party line was that this shortfall was comfortably below the €25 billion set aside by the ESM for Greek bank capitalisations, i.e., this was good news because the shortfall was less than expected.

And so the 2015 ECB stress tests bore the same relationship to reality as their predecessors: none.

More insight into the NPL issue was provided by the EBA in its AQR report published on November 25 2015.¹⁰⁶ The EBA did not carry out any stress test this year but focussed on asset quality instead. This exercise covered 105 banking groups from 21 EU countries plus Norway. The total assets involved were about €30 trillion or 67% of EU bank assets. The report highlighted major concerns about NPLs but its commentary gives little idea how big this problem really is. Consider that the average ratio of NPLs to total loans across the included banks is 6%. The average leverage ratio is 4.9%, so the core capital is less than the NPLs. In fact, a standard indicator of bank health is the ratio of NPLs to core capital, the so-called Texas Ratio. A Texas Ratio rising upwards towards 1 is a red flag, and by these numbers, the *average* Texas Ratio across the *whole* EU with Norway thrown in is $6\%/4.9\% = 1.22$.¹⁰⁷ But even this latter number does not convey the full scale of the problem:

106 European Banking Authority, Report – 2015 EU-wide transparency exercise, November 25 2015.

107 For examples, see, e.g., V. V. Acharya and S. Steffen, “Benchmarking the European Central Bank’s Asset Quality Review and Stress Test – A Tale of Two Leverage Ratios,” mimeo November 2014; and S. Steffen, “Capital shortfalls in SSM banks: how much progress has been made?” Paper prepared for the EU Parliament, October 2015.

- The ratio of provisions to NPLs is 43%, so 57% of NPLs have not been provisioned. This provisioning gap does not take account of any Greek provisioning gap either.
- NPLs are underestimated by banks resorting to accounting gimmicks and tricks like refinancing bad assets to hide non-performance, a case in point being Spain, where banks have hidden mortgage losses by refinancing large numbers of non-performing mortgage loans.
- A sizeable amount of NPLs have been “hived off, so as to make them disappear into the memory holes of various ‘bad bank’ structures”, as Bruno de Landevoisin elegantly put it: he cites the example of Spain’s ‘bad bank’ SAREB, which took on €50 billion in bad assets from Spanish banks. These losses haven’t disappeared; they have merely been shuffled around.¹⁰⁸
- Non-performing exposures to sovereigns are close to zero, so any sovereign risk exposure problems are in addition to the non-performing issues.
- The EBA’s numbers suggest that the biggest banks are in good shape, so any problems with, e.g., Deutsche, are in addition too.

I emphasise that all these numbers but those in the last bullet point come from the EBA’s own report – or should I say, from the revised version of its report: the original was retracted when the EBA noticed that some of the numbers in their spreadsheets had been entered incorrectly. Given the history of this subject and the inability of EBA staff to handle the intricacies of Excel, it would take a hopelessly incorrigible optimist to be sure that the massive data problems that have plagued EU banks have been fixed.

108 B. de Landevoisin, “Europe’s banks are still drowning in bad loans,” *The Acting Man*, November 27, 2015.

Addendum: When I first wrote those words some months ago, I had a nagging feeling that the true situation might be worse than I had described: I could not be sure that I wasn't missing something and in this game the news is always one-way, i.e., bad.

So it turns out. My friend James Ferguson - founder of the MacroStrategy Partnership based in London - knows more about European banking than anyone I know. As we went to press, he wrote to me to tell me that the true picture is indeed worse than I had set out. To summarise his argument:

The ECB and EBA have pulled a fast one on everybody who doesn't maintain a spreadsheet of European banks. To whit, if I may paraphrase:

Of banks with €30 trillion in total assets (67% of EU bank assets) NPLs are €1 trillion, which is 6% of total loans and more than core capital of 4.9%.

As far as I am aware, total euro area bank assets are around €32 trillion.

He then goes through numbers that I omit here, before concluding that

... proper, risky, term illiquid loans to non-bank private sector borrowers who may default only add up to €9.5 trillion of euro area borrowers and a further €1 trillion non-euro borrowers. Therefore truthfully speaking, if €1 trillion loans are NPLs, this constitutes 9.5% of the €10.5 trillion of total loans, not 6% (which I presume the ECB cites instead because a) although misleading, it's not technically improper to refer to

the payment system as loans and deposits and more importantly b) it doesn't sound so bad as a percentage).

In short, properly considered, NPLs are 9.5% of total loans, not 6% as reported by the EBA, and the EBA were spinning a line.

He then offers a helpful perspective on NPLs. To paraphrase:

Recent crises, even the less bad ones, reveal that with the benefit of hindsight, NPLs on average reach somewhere in the neighbourhood of 25%. So, NPLs of only €1 trillion suggest that total NPLs are still being under-reported. E.g., US mortgage NPLs eventually exceeded 22% and consumer credit NPLs were far worse. Peak real economy loans were around €12.25 trillion and assuming a 25% NPL rate, that implies €3 trillion of NPLs. Loan losses to date at the largest banks have averaged almost 6%, which implies we might be less than half way through, which in turn suggests NPLs are more likely to be €1.5-2 trillion than the €1 trillion reported - and hence bank loan growth of near zero.

We can be fairly confident, then, that the true situation is fairly dire. European banks will be mired in bad loans for a long time, and the worst is yet to come.

At best, it's going to be a long, long lost decade for European banks - and for the European economy.

Chapter Seven: The 13 Fatal Flaws in the Stress Tests

This Chapter sets out the 13 fatal flaws in the Bank of England's stress tests. The conclusion is that the stress tests are useless as indicators of the dangers facing the banking system, and that the practice of central bank stress testing is worse than useless because of the false risk comfort that it provides and because of the additional hidden damage and systemic risk that it creates.

7.1 INTRODUCTION

This chapter summarises the fatal flaws in the Bank of England's stress tests – 13 by my count.

Let's get our meanings clear. We are talking here not just about any old flaws but about *fatal* flaws, any *one* of which *on its own* would be enough to discredit the entire exercise.

Here they are:

7.2 THE FATAL FLAWS IN THE STRESS TESTS

Fatal Flaw #1: The stress tests consider only one adverse stress scenario

A stress test is a guess about what might happen and the world is an uncertain place. Consequently, if you choose to rely on such guesswork, then it would be unwise to rely on a single adverse scenario: no one scenario can possibly give you confidence that the banking system is safe in the face of all the other scenarios that you didn't consider.

Moreover, the chances of any particular scenario coming to pass are small, so it is highly likely that you will get an outcome quite different to one that you envisaged: whatever you think might happen, something else generally does.

Fatal Flaw #2: The Bank's stress scenario is insufficiently stressful

Not only did the Bank of England rely on a single adverse scenario in each of its 2014 and 2015 stress test exercises, but its chosen scenarios were only mildly stressful. They cannot therefore give any reassurance about the ability of UK banks to withstand the severe stress scenarios that we should be concerned about.

Instead of attempting to argue that the Bank's stress scenarios are severe when a plausible case can be made to the contrary, it is better to follow the sensible advice of the then-French Finance Minister Christine Lagarde when this issue arose with the stress tests of the French banks in 2010:

If someone suspects you have an illness, it's all very well to say no, no, no I'm very healthy, but it's even better if you say ok, fine, take my blood and make sure that I'm healthy.

There is nothing more damaging than rumours, suspicion, doubts and uncertainty. What's best for markets, operators and investors, is the reality of numbers, figures, percentages as long as they are accurate and honest.¹⁰⁹

Fatal Flaw #3: The Bank of England lacks the forecasting record to produce credible stress scenarios

We can only have confidence in the Bank's 'forward-looking' stress projections of adverse scenarios if we can have confidence in the Bank's past forecasting record, but that record is positively dire.

Fatal Flaw #4: Headline stress tests are undermined by their reliance on useless risk weights

The Bank's headline stress tests – those based on the ratio of CET1 capital to Risk Weighted Assets (RWAs) – are undermined by the useless RWA measure. A low RWA does not mean that the bank

109 B. Hall, R. Atkins, G. Wiesmann and V. Mallett, "EU edges towards disclosing bank 'stress tests,'" *Financial Times*, June 17 2010.

concerned has low risks; instead, it means that it is taking a lot of risks that are invisible to the risk measurement system.

Fatal flaw #5: Stress tests are undermined by their reliance on useless risk models

The stress tests are undermined directly by their dependence on the Bank of England's and the banks' own risk models and indirectly by their reliance on the Basel capital adequacy regime, which itself depends on risk models that have proven themselves to be useless. The main reason why is because the models are used for risk management purposes. However, risk takers have an incentive to game model-based risk control systems and no model can take account of the ways in which it might be gamed. The risk models are therefore subject to a version of Goodhart's Law by which any risk model will break down when used for risk control purposes.

Fatal flaw #6: Stress tests are undermined by poor measures of capital and leverage exposures and by inadequate data

The stress tests are undermined by core capital measures that overstate core capital and by leverage exposure measures that understate total risk exposure. They are also undermined by their reliance on inadequate data: the accounting numbers used have well-documented inadequacies (leading to dodgy valuations, false capital, inflated profits, etc.) and there are major data problems inside the banks themselves.

Fatal flaw #7: The pass standards used in the Bank of England's stress tests are way too low

The pass standards used in the Bank of England's stress tests are way too low. They are also not compliant with the higher minimum

requirements coming through in the United States or the much higher minimum capital standards recommended by many experts.

Fatal Flaw #8: Conclusions from stress tests are not robust to reasonable choices of pass standard

The Bank's stress test exercises carried out with higher and more reasonable pass standards would have contradicted the Bank's conclusions and indicated that the UK banking system was actually very weak.

Fatal Flaw #9: The credibility of the stress tests is undermined by a variety of compelling factors

The credibility of the stress tests is undermined by the conflict between the two main objectives of the exercises, namely, to determine the financial strength of the banking system and to promote confidence in the banking system.

The credibility of the stress tests is undermined by a blind spot at the heart of any stress testing programme: we cannot expect any central bank to anticipate the main risks facing the banking system, i.e., those it creates itself.

The credibility of the Bank's stress tests is undermined by the pressures from the industry and from the government under which it must operate, and both of these parties have a vested interest in the 'banking system is sound' narrative.

The credibility of the exercise is undermined by the central bank's own self-interest. If the central bank were to conclude that the banking system was unsound, then it couldn't ever admit that in public: to do so would undermine public confidence and concede that its own

policies towards the banks had been a failure. As a consequence, the stress tests can only be expected to come to one conclusion – that the banking system is sound – regardless of what the Bank of England might really believe.

Fatal Flaw #10: Repeated stress testing becomes an increasingly irrelevant compliance exercise

Evidence from the United States – the Federal Reserve has been conducting stress tests since 2009 – indicates that repeated stress testing is producing ever more predictable results. This finding suggests that the banks have learned how to play the stress testing game in order to pass the tests with the minimum cost and inconvenience.

There is now a flourishing cottage industry by which the banks hire experts to get them through the tests. The experts involved are former Federal Reserve officials who used to conduct the tests themselves, and who are much better remunerated as poachers than they used to be as gamekeepers.

In the meantime, everyone involved is so focused on the regulatory risk metrics that they have lost sight of the risks the banks are actually taking.

Fatal Flaw #11: Stress testing creates new systemic risks that are invisible to everyone's risk management systems

Stress testing creates new systemic risks because it exposes the entire banking system to the weaknesses in the models approved by the central bank and because it promotes standardisation across the industry when systemic stability requires diversity. In doing so, stress testing creates new systemic risks that are invisible to the risk management systems of both the banks and the central bank.

Fatal Flaw #12: Stress testing has a disastrous track record

Regulatory and central bank stress testing has an appalling track record. The relentless message was that the system is sound and policymakers were often lulled into a false sense of security. Again and again, individual institutions (Fannie Mae and Freddie Mac in the United States, Dexia Bank in Europe, etc.) and even entire national banking systems (Iceland, Ireland, Cyprus, Greece) were signed off as safe by stress tests only to collapse unexpectedly afterwards.

Nor is there a *single* case where regulatory stress testing was ever proven to be of any use afterwards, i.e., by warning of an impending build-up so appropriate remedial action was then taken that allowed the banks concerned to weather the subsequent stress event. Instead, stress testing has repeatedly offered false risk comfort by blinding those involved to the real dangers they were facing,

Fatal Flaw #13: Stress testing is not necessary and there are better ways to assess bank capital-adequacy anyway

Lastly, there is no need for stress tests in the first place: there are better ways to assess bank capital adequacy. As we shall see in the next chapter, the simplest and best is to use the latest available data to estimate *current* leverage ratios and then compare those ratios to reasonable pass standards.

Of these fatal flaws, flaws #1, #2, #3, #4, #5, #6, #8, #9, #10, #11 and #12 each serve to produce false risk comfort – they bias the stress tests to indicate that the banking system is healthy in circumstances where it might not be.

Flaws #10 and #11 indicate that stress testing can also be very damaging – and in unseen ways too.

The conclusion is that the Bank of England's stress tests are useless as indicators of the dangers facing the banking system, but that the practice of central bank stress testing is worse than useless because of the false risk comfort it provides and because of the additional hidden systemic risks that it creates.

Chapter Eight: An Alternative to Stress Testing

This chapter proposes an alternative to the Bank of England stress tests: an open competition to assess banks' capital adequacy or state of financial health. My entry to that competition would use the latest and most conservative leverage ratio data and compare those leverage ratios against reasonable pass standards without any attempt to carry out any actual stress scenario analysis. A little work on such an exercise shows that the UK banking system is massively under-capitalised – a conclusion that the Bank of England's highly sophisticated 'rocket science' stress tests managed to entirely miss.

8.1 INTRODUCTION

In previous chapters I went through the Bank of England's stress tests and pointed out a number of fatal flaws with these exercises.

You might ask: how would you go about stress testing yourself?

I wouldn't.

Stress testing is not just fatally flawed, but also satisfies the dictionary definition of superstition: it reflects an irrational belief in useless ritual implements, the stress test models, maintained despite all evidence that those ritual implements don't actually work. The stress testers should therefore be laughed out of court and the practice of central bank stress testing should be abandoned as a failed experiment.

To paraphrase Gillian Tett and Benjamin Disraeli, one might say that the stress tests are a predictable act of public theatre in which the Governor of the Bank of England stands in for the Chancellor of the Exchequer:¹¹⁰

Just at the moment when unutterable gloom overspreads the population, when nothing but despair and consternation prevail, the Chancellor of the Exchequer - I beg pardon, the Archbishop of Tarento - announces the liquefaction of the blood of St Januarius, as the Chancellor of the Exchequer announced that a wholesome state ... had returned [with the temporary suspension of the Bank Charter Act]: the people resume their gaiety and cheerfulness; the panic and the pressure disappear; everybody returns to music and macaroni as in London everybody returned to business, and in both cases the

110 G. Tett, "Stress tests for banks are a predicable act of public theatre," *Financial Times*, March 5 2015.

remedy is *equally efficacious, and equally a hoax*.¹¹¹ (My italics)

Most superstitious practices are fairly harmless except to the occasional chicken involved. Stress testing, on the other hand, is highly damaging. It undermines the policy-making process by providing false risk comfort, lulling policymakers to sleep in the face of imminent dangers that could easily be spotted without the distractions and false signals that it generates. Stress tests also damage the banking system and the economy more generally in so far as they impose poor risk management practices and create systemic risk that the risk models themselves cannot see.

Going back to basics, there is no need for stress tests in the first place. As Chris Whalen put it when discussing the Fed's stress tests:

The more complexity or subjectivity you inject into any financial analysis, Ben Graham taught us in *Securities Analysis*, the less the analysis matters. Stress testing for capital adequacy, to us, is about asking the right questions about operations, loss rates [etc.] ... It would be a simple matter for the Fed and other regulators to benchmark every bank and non-bank participating for safety and soundness using public data. Instead we go through this largely economic, that is, political exercise led by the Fed's economists every so often, producing stress tests results which marvel

111 Cited in M. Hutchinson, "St. Januarius' blood," *The Bear's Lair*, January 6, 2010.

the Big Media but [are] largely useless as a capital adequacy indicator.¹¹²

By injecting subjective economic scenarios into a test of loss absorption capacity, the Fed renders the output meaningless from a safety and soundness perspective. The various economic variables make the process so subjective and so speculative that the objective of measuring the capital adequacy of the bank is lost. Measuring the ability of a bank to absorb loss via retained earnings and capital is a straight-forward exercise that the Fed has needlessly complicated to the point of irrelevance.¹¹³

So what should the central bank do instead?

Simple: the central bank should hold an annual competition to find the best way(s) to evaluate bank capital adequacy, no stress. Open entry: anyone can enter, from the central bank's own staff to school kids doing homework projects. Entrants would be given the following task: how would you evaluate the capital adequacy of the bigger banks in the UK economy? The central bank would provide some data to all entrants, which they may or may not wish to use – that would be up to them – and there would be a modest cash prize for the winners.

Entries would be judged by a panel of experts from inside and outside the Bank. The panel would select and rank the top three entries, which would be published without any revision along with referee

112 Quoted in D. Santiago, "Diving into the FDIC's stress test scenarios," Bank Monitor Newsletter, December 9 2012.

113 C. Whalen and J. Scott, "For bonds investors, the bank stress test process is beside the point," Kroll Bond Rating Agency, March 9, 2015, pp. 2-3.

reports provided by the panel or experts consulted by the panel. The process would be entirely transparent.

You would then have a healthy public debate – let a thousand flowers bloom etc. – with all sorts of diverse entries. This diversity is exactly what we want.

Here is what my entry to the competition might look like.

I would start with some observations:

The track record of central bank and regulatory stress testing is poor.

The methodology underlying stress testing and financial risk modelling is unreliable. Despite the talk of financial ‘rocket science’, these models merely ape the outward form of rocket science, but lack any true scientific substance. The one got a man on the Moon, the other helped produce the GFC; one is tested, and the other tested to destruction. The models don’t work, simple as that.

A considerable body of research, including some by the Bank of England itself, conclusively demonstrates that the Risk-Weighted Average (RWA) measure is unreliable.

We want a simple approach that has some credibility – and one that does not rely on the central bank’s abilities to forecast the future or anticipate what might happen in the future, if only because those abilities do not exist.

I would also emphasise that it would be advantageous to use audited accounting data if only because these data have been audited. Whatever their faults, these are the best data we have and we have some sense of their limitations.

I would then note that there are a number of approaches that would be worth exploring. These include:

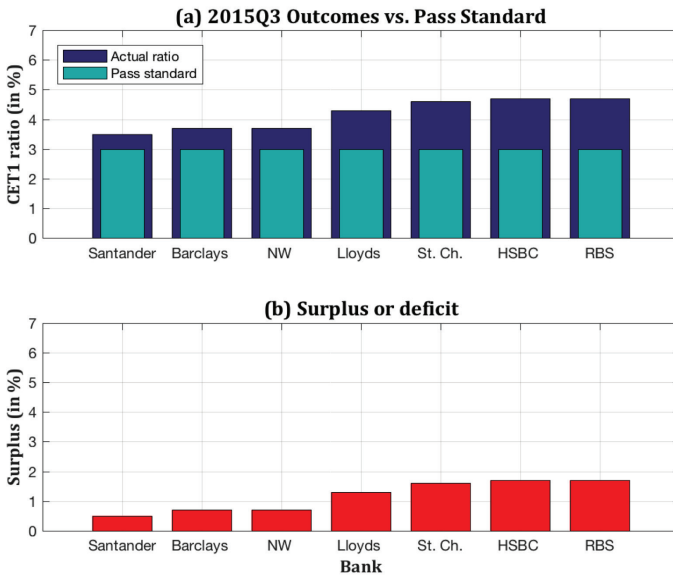
- An analysis based on banks' Texas Ratios, i.e., their ratios of Non-Performing Loans to core capital, where a high Texas Ratio indicates that a bank has problems. Typically, a Texas Ratio heading up toward 1 is a sign of impending trouble, as it suggests that the bank might struggle to cover potential losses, and a Texas Ratio over 1 is a red flag.
- There are a variety of much simpler stress tests available based on simple stress scenarios, such as those of Viral Acharya, Jacob Verstergaard and their colleagues. Such exercises are straightforward to conduct and have a reasonable track record.

My preference however would be some kind of financial analysis. The simplest such analysis would be a leverage ratio pass/fail analysis using the most conservative capital measure and the latest and best available data.

The next task is to select a pass standard. I would start with the easiest possible pass standard, i.e., 3%. Of course, a 3% pass standard is way too low, but it is a good place to start and provides a ready comparison with the pass standard in the Bank's stress tests.

Applying such an analysis to the latest available data (i.e., 2015Q3) gives us the outcomes shown in Figure 19 (overleaf):

FIGURE 19: 2015Q3 CET1 LEVERAGE RATIOS AGAINST A 3% PASS STANDARD



(a) The pass standard is the bare minimum required leverage ratio under Basel III, expressed in terms of the CET1 leverage ratio - the ratio of CET1 capital to leverage exposure. (b) Outcome refers to the CET1 leverage ratio for 2015Q3. These data are obtained from Annex 1 of the Bank's stress test report (Bank of England, December 2015).

What jumps out from these results is that every single bank passes the test by remarkably narrow margins despite the fact that I have chosen the Basel III absolute minimum pass standard: the average surplus is only 132 basis points. The worst performing bank (Santander) scrapes through by just over 50 basis points and the best performing bank (RBS) has a surplus of under two hundred basis points.

One should remember too that this average CET1 leverage ratio of 4.32% is a book-value figure, and the corresponding market-based

average leverage ratio is only 3.63%.¹¹⁴¹¹⁵ One should also consider that even this series is unreliable because it depends on unreliable Level 2 and Level 3 valuations. It is also biased upwards because of the ‘sin bucket’ and the potential for earnings manipulation in the numerator, and because the denominator leaves out many of the banks’ off-balance-sheet risk exposures. One can then say with confidence that the ‘true’ leverage ratio is below 3.63%, and quite possibly well below that level.¹¹⁶

One should then compare this leverage ratio of under 3.63% against the 5% to 6% minimum required leverage ratios coming through in the United States and the 15% plus needed for a healthy banking system.

This set of results alone is enough to kick the stress tests out to touch – without even the inconvenience (not to mention the stress) of actually working through any stress scenario analysis. If the banks perform so poorly with such a low pass standard and no stress, you can

114 The 4.32% figure comes from the data presented in Chapter 2: total CET1 across the big 7 banks as of end-2015Q3 was £243.7bn (see Chapter 2 Table 1) and the corresponding total leverage exposure was £5,635.1bn (see Chapter 2 Table 2) and $243.7/5,635.1 = 4.32\%$.

115 The number 3.63% comes from multiplying 4.32% by the average price-to-book ratio of 0.84. This latter figure is to be found on the spreadsheet ‘9. Equity measures’ under the B column in the Bank’s Excel workbook ‘ccbdec15.xlsx’ which is available here (accessed 9 March 2016).

To illustrate, if we assume (as seems reasonable) that banks made full use of the ‘sin bucket’ to include softer items in their reported CET1 numbers, then the 3.63% average leverage ratio would fall to 85% of $3.63\% = 3.09\%$. And even this number would still be an over-estimate because it ignores the risk exposures that are left out of the denominator.

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imagine how well they would perform with a demanding pass standard and some real stress.

There you have it: a few minutes' work on a simple leverage ratio analysis that makes no attempt to project adverse future scenarios reveals something that the Bank of England's highly sophisticated 'rocket science' stress tests managed to entirely miss – that is, that the UK banking system is *massively* under-capitalised.

This conclusion, in turn, confirms that the stress tests are not so much useless but worse than useless because they fail to detect the most obvious weakness of the banking system, i.e., they provide false risk comfort. In this sense, the stress tests are rather like a ship's radar system, but a radar system with an innovative cloaking feature that makes the most obvious threats – such as the occasional iceberg – appear invisible. Unfortunately, making those threats invisible does not make them go away.

Chapter Nine: What Should be Done?

The previous chapters have shown that the Bank of England's stress testing programme is unreliable and counter-productive, both because of the false risk comfort it creates and because of its tendency to create additional systemic risks that the models cannot see.

So what should be done?

The first step is to recognise that the stress-testing programme is a failed experiment that should be aborted forthwith. Those who wish to assess banks' capital adequacy should then do it the old-fashioned way, by examining the banks' core capital ratio metrics and comparing them to reasonable pass standards.

The next step would be to abandon the use of any capital-ratio metrics that depend on the discredited RWA measure: RWA is a pretend number that creates fake capital. Instead, regulatory capital ratios should be based entirely on leverage ratios and real capital.

If we want to rebuild the banks' capital bases – and we should as a pressing matter, because ongoing bank weakness is *the* major drag on economic recovery – then the minimum required leverage ratios should be much, much higher than they currently are. I would incline towards 20% as a standard default and 30% for the G-SIBs. We can make these higher minimum required ratios 'bite' by a rule that prohibits banks from making distributions of dividends or bonus payments until they meet these new minimum requirements.

Then we need to fix the numerator and the denominator in the regulatory leverage ratio:

- The numerator, the capital measure, should be Tangible Common Equity.
- The denominator, the exposure measure, needs to be much more encompassing of off-balance-sheet risks than the current Basel III- leverage exposure measure.

Needless to say, the bankers would howl like hyenas as their subsidised lunch bucket was taken away, but that would tell us that we are on the right track.

These measures would do much to get the banking system recapitalised again and drive out much of the toxicity that still infects it. However, we must also acknowledge that public policy towards the banking system has failed to fix the banking system and still leaves it highly exposed to the next major shock. The Bank of England's much vaunted 'rebuilding' of the UK banking system is, in fact, nothing of the sort: the Bank papered over the cracks.

For those who don't believe this claim, recall that the best available estimate of the average leverage ratio across the UK banking system at the end of September 2015 was less than 3.63%. This figure is not

much bigger than the Basel III absolute minimum; it is also below the current 4% minimum requirement in the United States, well below the 5%/6% minima coming through over there and is close to an order of magnitude lower than expert recommendations.

There is therefore much to be done. Any genuine solution to the problems facing the banking system requires concerted action on three fronts: models, data and governance/incentives.

On the first front, policymakers need to recognise that regulatory risk modelling – stress testing or Basel risk modelling – has been a failure. Besides ending the Bank's stress test programme, they also need to get away from a capital adequacy regime that relies on models. Since the Basel system is insanelly wedded to them, the UK would need to leave Basel altogether; in any case, Basel has long since been captured by the industry it purports to regulate.

On the second front, any system of capital regulation should be based on sound accounting data. A start in this direction would be to require companies to prepare accounts using UK GAAP as it existed before the UK adopted IFRS accounting standards in 2005. However, what is really needed is a complete overhaul with a focus on reforming the widespread abuses associated with mark-to-market, mark-to-model, mark-to-myth and off-balance-sheet activities. The underlying principle of any such reform should be to ensure that published accounts give analysts enough information to come to an accurate view about the financial conditions of their banks. To achieve this outcome, there should be: (1) a requirement that banks disclose all material facts, including all liabilities and exposures, not just netted ones, and (2) an enforcement mechanism to deal with those who violate this disclosure requirement. The natural enforcement mechanism would be exposure to civil liability for those responsible for material misstatements in banks' audited accounts.

The restoration of sound accounting standards would enable bank stakeholders to come to their own informed judgments about the soundness or otherwise of their banks – without smoke and mirror gimmicks like stress tests, which confuse the issue. It is not unreasonable to expect banks' financial statements to reflect reality and we are not going to get far with banking reform until they do. Getting the basic numbers right is the bedrock of financial calculation under the capitalist system.

On the third, last and most difficult front, we need to restore strong corporate governance in banking and that requires the restoration of strong personal incentives on the part of key decision makers. Bank senior managers and their auditors need to be made personally and strictly liable for the consequences of the decisions they make: their own personal wealth should be first on the line to cover any losses. Policymakers can do their bit too by putting the weakest banks into receivership and by rolling back all the policy interventions that they have accumulated over the years. These include, most notably, the lender of last resort, deposit insurance and Too Big to Fail. These interventions have greatly increased the incentives for bankers to take excessive risks and are, in fact, the root cause of our banking instability problems. Once the incentives to take excessive risks have been removed, capital adequacy regulation could be abolished. We could then safely rely on market forces to deliver a safe and sound and free banking system.

About the author

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