BANK OF ENGLAND

Speech

Stress tests: a policymaker's perspective

Speech given by

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Simultaneous, transparent bank stress tests are one of the most important innovations and reforms to come out of the global financial crisis. They are designed to deal with a serious issue that plagued the economies of the late 20th and early 21st centuries—the tendency for banking systems to make recessions worse by tightening credit availability when adverse shocks hit the economy. Stress tests inform supervisory judgments about whether banks have enough capital to continue to intermediate and lend even as GDP falls and losses mount.

The tests are done concurrently on banking institutions using the same scenario, facilitating systemic judgments and cross-bank comparisons; they are forward looking, testing bank portfolios against risks that might occur in the future; and they are transparent, affecting the judgments of market participants as well as bank management and regulators.

In addition, post-crisis stress testing integrated economics and supervision in a way that hadn't been done before, marrying the modelling expertise and macroeconomic perspective of economists with the deep knowledge of individual banks and banking of supervisors. When the Federal Reserve undertook the first such test in the depths of the financial crisis in early 2009—the Supervisory Capital Assessment Program-- we put an economist and a supervisor jointly in charge. Seeing these two people and their teams working so well together—and the two of them joined at the hip in their nightly visits to my office to report roadblocks and progress—gave me hope that we could make this experiment work. This conference further develops that critical working partnership.

In the UK the stress tests are jointly run by the Financial Policy Committee (FPC) which has a macroprudential mandate and is tilted toward economists, and the Prudential Regulation Committee (PRC), which has microprudential responsibilities and is dominated by supervisors and people with experience in individual firms. I am an external member of the FPC. Stress tests play a major role in the deliberations of the FPC in meeting our legislative mandates to identify risks to financial stability and take steps to build resilience to those risks.[1] Building the scenario each year requires us and our PRC colleagues to identify risks and assess how they have evolved. Stress test results show whether the banking system has enough capital to withstand the crystallization of the risks embodied in the scenario and other risks as well.

Goals for stress tests

I thought it might be useful for you, a roomful of researchers, to hear what I, a macroprudential policy maker, want from the banking system stress tests. First is guidance for the setting of the countercyclical capital buffer (CCyB) rate. The CCyB was conceived and designed to counter the pro-cyclical tendencies of risk-based capital models to call for less capital when times are good and loans are performing, and more capital after adverse shocks hit. Indeed, since the better the good times the greater the potential set back in

[1] The Bank of England runs two types of stress tests: the Annual Cyclical Scenario and a Biennial Exploratory Scenario. The stress test referred to in this talk is the Annual Cyclical Scenario (ACS).

bad times, the CCyB should increase capital on the upswing in business and financial cycles. A well-designed stress test, built on scenarios geared to those economic and financial cycles, will help us make sure enough capital is accumulated on the upside that it can safely be released to absorb losses and support lending after a shock hits. The stress tests should also support that release of the CCyB—they should show that as risks crystallize and losses are absorbed, less capital will be needed for potential future losses.

I'm going to spend most of my talk addressing the issue of aligning the stress test results with the appropriate CCyB as cycles evolve. But I will also address another goal I have for stress tests, which is to improve market discipline on bank risk taking and banks' abilities to understand and manage their risks. Key to that is the transparency of the stress tests. Finally, I'll take advantage of this opportunity to highlight some areas for you to focus on that I believe policymakers would find useful. Several of these are being addressed at this conference.

Stress tests and raising the CCyB

The FPC recently raised the resting place for its standard times CCyB to the region of 2 percent. An important motivation for this decision was a review of the 2004-07 period that raised questions about whether stress test results and Committee judgment would have prompted us to raise the CCyB high enough and fast enough to avoid the severe credit tightening and tax payer support that occurred when bank viability was threatened in the Global financial Crisis (GFC) of 2008.

Bank staff estimated that a CCyB in the range of 3 -1/2 to 5 percent would have been required before the GFC.[2] Their analysis suggests that would have given the banking system enough capital to absorb the losses that followed and leave viable banks that would be able to continue accessing markets and making loans on reasonable terms to creditworthy UK households and businesses. This estimate of required capital is based on several metrics, including what an adjusted BIS buffer guide would have indicated in 2007, and on the losses actually incurred in the crisis.[3] Interestingly, using very different methodology focused on the capital that was raised from public and private sources, Aikman et al (2018) come up with a similar estimate for the CCyB that would have been required to keep the US banking system adequately capitalized in the GFC.[4]

Would the stress test have guided the FPC to such a result starting at a one percent standard times resting place? The answer is probably not.

The severity of the stress test scenarios is based on the FPC's risk tolerance. We have judged that the UK banking system should be resilient to shocks that pushed key economic and financial variables into the

[2] Bank of England (2019b). This is in addition to the baseline standard-times capital stack, including a Capital Conservation Buffer of 2.5% of risk-weighted assets.
[3] The Basel buffer guide assumes that countries cap the CCyB rate at 2.5%. The adjusted version removes this cap.
[4] Aikman, D., Bridges, J., Kashyap, A. & Siegert, C. (2019)

neighbourhood of the first percentile of their historic distributions, a 1 in 100 adverse event, and so they are very severe. When risks are around a standard level—that is near the middle of their distributions—that implies a scenario that in a number of dimensions—for example the rise in UK unemployment, fall in UK residential real estate prices, drop in global GDP—is more severe that the GFC.

The scenarios get more severe as risks rise and less severe as they fall. This is accomplished in two ways. First, key economic variables are shocked to the same 1 percent level as the business cycle evolves. For example, the scenario-based rise in the unemployment rate increases as the rate itself declines in an expansion. A similar pattern is applied to other cyclical variables like house prices relative to income and GDP relative to trend.

But the FPC also assesses the state of the financial cycle to judge whether the shock to these business cycle variables is likely to be larger or smaller than a straight reading might imply. For example, unusually high levels of household or corporate leverage, or bank reliance on short-term funding, would tend to exacerbate a shock. In 2019, we judged that high credit growth and rising leverage in the Chinese economy along with elevated borrowing by US businesses implied that downside risks were unusually large, so we increased the size and duration of the global recession in our 2019 scenario. Critically, this type of risk assessment is not mechanical, but requires policy maker judgment based on a variety of indicators.

Bank staff estimated a hypothetical, severely adverse scenario that could have been employed in 2007 using the process I just outlined. They started with the level of the key variables at the end of 2006 and shocked them to around the one percent risk tolerance of the Committee. They then adjusted the stressed levels to approximate how the FPC might have responded in a world where the risk environment had become elevated. The scenario they generated included a drop in UK GDP about one percentage point larger than in the GFC. Applying this scenario to 2017 balance sheets yielded an implied CCyB of 3-3/4 percent—in the range of capital buffers estimated to be sufficient to withstand the GFC. It is worth recognizing that post-crisis reforms, like central clearing and better margining for derivatives and limits on household indebtedness likely have substantially dampened some of the loss amplifiers at work in the GFC, and those reforms along with the more proactive provisioning under IFRS9 imply that the same elevated risk environment might not map to the same severity of stress, capital losses and implied CCyB today.

As this example suggests, the translation of the more severe scenario into sufficiently greater capital is by no means automatic; in the simulation, a scenario with a more severe shock than the GFC produced a stress capital near the lower end of the range of estimates of the capital required for banks to keep lending through the GFC. Indeed, a larger shock need not translate into greater stress capital losses at all because that also depends on what's happening to banks' portfolios. Indeed, Nellie Liang and I looked at US stress test capital losses and saw little change in the stress test capital buffer for G-SIBs through 2018 and a material falling off

in 2019, despite more stressful scenarios.[5] Apparently, underlying improvements in the quality of their portfolios, in part as troubled legacy loans were worked off, overwhelmed the effect of more severe scenarios. But in my examination of UK stress test results, I did find that stress test capital loses had risen each year, largely reflecting the increasingly severe global shock we applied.[6] Still, going forward, the FPC will need to pay close attention to the relationship of stress test severity and the implied hit to capital.

As the FPC considered the 3-1/2 to 5 pc CCyB that would have been required prior to the crisis, we could see that it would be difficult to get there again, if necessary, from a 1 percent starting point in standard times. The development of financial risks in the 2000s was highly nonlinear, with risks rising very sharply in the few years just before the crisis. Even as late as 2004, only about 40 percent of a set of core indicators we reference were in a zone that suggested elevated risks. Moreover, because changes in the CCyB have a one-year implementation period, we would have needed to set a CCyB north of 3% by end 2006.

That would have been especially difficult in the face of the FPC's stated intention to raise the CCyB gradually. That's because large changes—requirements to raise a good deal of capital in a short time-- can have an outsized effect on the cost of capital; meeting capital needs by slowing distributions is probably less expensive and disruptive. In addition, the stress test process itself takes considerable time; we settle the scenario and publish it by the end of Q1; the results come in by the end of Q3 and are published in Q4, with any increase in the CCyB effective in Q4 one year later.

We concluded that by starting from a one percent CCyB in standard times, we risked falling behind the curve should risks rise to elevated levels. A resting place in the region of 2 percent greatly increases the odds on getting to the right level at the right time, but it by no means guarantees it. If the Committee had begun to recognize the emerging high-risk environment in 2004, it would have needed to require a series of material increases in the CCyB to get it within the range I discussed earlier by end 2007. One can envision considerable resistance to sizable increases in capital requirements when loan losses are low and the financial environment looks benign. Stress tests could be very helpful in that regard if there were ways of helping scenarios and implied capital evolve more quickly as the risk environment moved from standard to material to elevated. My challenge to you is to find ways that the stress tests can better take account of the nonlinearities in the cycle and lags in the process to help policymakers raise their CCyBs soon enough and high enough when the risk environment is rising.

Stress tests and releasing the CCyB

Those nonlinearities and lags could pose an even greater challenge to stress testing after risks crystallize and the FPC decides to release the buffer. The reason to raise the buffer is to increase the amount of capital

[5] Kohn, D. & Liang, N. (2019)
[6] Kohn, D. (2019)

that can be safely released in a downturn to support continued lending.[7] The FPC has emphasized that buffers are there to be used after a shock. The CCyB is a particularly attractive buffer in that regard since banks will be able to utilize capital released by a cut in the CCyB without incurring distribution restrictions. Concerns about those restrictions, say as banks run into the capital conservation buffer, might make them reluctant to lend so that they can hold down the denominator of their capital requirements.

Stress tests will support the release of the CCyB as risks crystallize because the scenario will become less severe: the unemployment rate will rise less following an increase; house prices will fall less after they already decrease; risk environments will be less threatening going forward when some of those risks have already materialized. But there are reasons to question whether the scenarios will keep up with developments; and even if they do if they will fully support the release of the capital buffer.

An examination of this issue for the US that Nellie Liang and I undertook raised some questions about how this might work out in the U.S. for the most important banks—the GSIBs.[8] The issue we surfaced for the US was that in the second year of a recession, concerns about breeching regulatory minimums in the stress test might induce these banks to cut lending to avoid substantially curtailing dividends—exactly the outcome the tests were designed to avoid.

The scenario might lag downside shocks because downward adjustments in financial markets tend to be especially sharp when sentiment turns; think about dot.com equities from the 1990s to the 2000s, or house prices a decade ago. And as I already detailed, scenario design and stress testing take time. The situation could have changed dramatically by the time the results were public.

Moreover, our actual experience with the capital consequences of changing scenarios in stress tests is limited on the upside and non-existent after shocks hit. We don't know how much the stress test implied capital buffer would be reduced as scenarios adapted after risks crystallized. Recall that Nellie and I found that scenario severity and implied capital losses have not been closely related in the US stress tests.

Some CCyB releases may be pre-emptive, as was the FPC's after the Brexit referendum. In that circumstance the risks did not materialize and the FPC began to raise the CCyB in line with its original, pre-referendum, intention a year after it had reduced it, backed by stress test results.

But one can also imagine situations in which the FPC cuts the CCyB in anticipation of, or in the early stages of, an actual recession and "risk-off" financial cycle. In those early stages the macroprudential authorities may appropriately take an aggressive "risk management" approach to buffer setting when threats to financial

[7] Alongside the FPC's action to raise the CCyB in standard risk environments, the PRC is considering whether it can reduce its pillar 2A requirements in light of the higher buffers and other developments, such as forward-looking reserving under IFRS 9. Together these would raise required capital slightly in standard risk environments and tilt the capital stack more decisively toward buffers. See the Bank of England's December 2019 *Financial Stability Report* for more information.
[8] Kohn, D. & Liang, N. (2019)

stability begin to materialize—seeing risks and costs of future credit tightening as greater than the costs of an unnecessary release of the CCyB that could be reversed. These are circumstances in which the scenario and implied capital might not fully validate the lower CCyB.

The consequences of these circumstances might be the FPC publishing a stress test that, for example, implied say a one percent CCyB when the committee had determined that zero was more appropriate. Explaining an inconsistency between the stress tests and the CCyB in these circumstances is a communications issue. For example, the FPC could say that the scenario hadn't caught up to the reality of the situation as seen by the FPC; and the FPC was being pre-emptive to avoid really bad outcomes that would result if a cutback in lending amplified recessionary tendencies.

But the challenge is not just about explaining an inconsistency to the public or the parliament. Two other critical target audiences for a well-reasoned explanation of why cutting capital requirements just as the economy weakens and loan losses begin to mount are the microprudential regulators and market participants.

Both may be concerned with the difficulty implied by not knowing just how serious the situation may become and concerned about how banks will fare if the slide deepens materially. Market participants need to have confidence that the viability of their bank counterparties will be protected by adequate capital even as the situation worsens so that they will continue to supply the funds the banks need to continue to lend. Communications will need to address the fact that the shock is not likely to be exactly congruent with previous stress test scenario designs.

The FPC has prepared for these circumstances in several ways. As already noted, we have stressed the system to a very severe shock—one approximated by key financial and economic variables reaching the neighbourhood of the first percentile of their historic values—a more depressed level in several dimensions than was associated with the GFC. In this way we try to build confidence in our view that banks will have enough capital in standard or elevated risk environments to remain active and viable lenders with access to market sources of financing after a wide variety of very severe shocks.

Building on that, the FPC has published analyses showing that indeed, serious situations that differ in key ways from the stress test scenarios are "encompassed" by those scenarios. That is, because banks had enough capital in the stress test, they would also have more than adequate capital even in these other adverse circumstances. For example, we have done this for disorderly Brexit and for a global trade war—and even for the two together.[9]

[9] Bank of England (2019a)

When we released the CCyB as markets adjusted after the Brexit referendum, we were able to demonstrate with the results of the previous year's stress test that banks would be resilient even to a very adverse outcome, a tail risk, which might conceivably flow from this event but hadn't been anticipated in financial markets. Judgments like this require not only a very stressful base scenario, but credible modelling of the effects of alternative adverse shocks to show they are encompassed by the base case.

I've dwelt a bit on the interaction of the stress tests and release of the CCyB because I sense that our focus, as policymakers and as researchers, has been more on detecting and building capital against rising risks than it has been managing capital requirements after the shock hits. Indeed, the Bank of England's Independent Evaluation Office has also made this point.[10] Many of the issues are similar—what role can stress tests play in helping how policymakers both raise and lower capital requirements in a countercyclical manner consistent with financial stability and preserving an adequate supply of credit. But the down slope of the economic and financial cycles can be especially precipitous and bumpy—the double black diamonds of financial cycles—and financial stability will depend on sustaining the confidence of market participants.

There are a variety of ways the stress tests might be made more supportive of CCyB release. For example the whole process might be fast tracked, or run more frequently or scenario design incorporate to some extent a prediction of the rapidly shifting risk environment. Here again we would benefit greatly from modelling and insights researchers might have on this.

Stress test transparency, market discipline and bank risk management

Earlier I noted that informing the FPC's CCyB decisions wasn't the only goal I have for stress tests. In addition, they can help shape the behaviour of private parties as they assess and manage risk —the banks and market participants supplying them funds-- in ways that are more supportive of financial stability. A key to that is the transparency of the tests. The behaviour we were trying to change in the first stress test was fear and flight from banks. Our goal was to build public confidence in the banking system by determining how much capital banks would need to be viable even if a very bad economic and financial situation got much worse, and then to force the banks to get that capital from either private or public sources.

One key to rebuilding confidence and restarting bank intermediation obviously was having a public source of capital available through TARP for those banks that had been effectively cut out of the private markets by doubts about their viability. Another was to apply very severe stresses, but also to be very open about those stresses, and how they affected the capital of individual institutions. Only in that way could the public reach the judgment that all banks were being held to very high standards for building resilience even in the midst of a severe crisis. Transparency was required for credibility.

[10] Independent Evaluation Office, Bank of England (2019)

A continuing high level of transparency has been important to the effectiveness of the stress tests after that. Transparency helps markets assess the strength of individual institutions and differentiate among them more accurately. Anticipation of market reactions to stress test results should discipline bank behaviour.

In addition, stress test submissions give the microprudential authority insight into the quality of the risk management and capital planning of individual banks, which can then be used by supervisors to require upgrades or as inputs into decisions about pillar 2 capital requirements. In the US, transparency about these management evaluations helped to pressure the banks into substantial improvements in their risk modelling, capital planning, and governance. Shortfalls relative to expectations were publicly called out and if serious enough could impinge on authorization to distribute capital. The Federal Reserve has determined to stop the public evaluations in favour of folding the results into largely non-transparent supervisory processes; expert observers of US banks have been concerned that this shift will reduce the involvement of boards of directors and slow further improvements in risk modelling and management.

In the UK, risk management standards have been subject to supervisory interaction alone, but in 2019 the PRA published a high level (albeit anonymized) overview of findings about the quality of bank risk management based on an assessment of stress test submissions.[11] In addition, the PRC has considered publishing its judgments about individual institutions. If the US is any guide, such a step could accelerate banks' improvements in this important underpinning for financial stability.

Finally on transparency, in the UK the FPC has gone to pains to be transparent about the impact of management actions in the results of its stress test. As we said in our December 2019 Financial Stability Report, banks' resilience relies in part on their ability in stress to cut dividend payments, employee variable remuneration, and coupon payments on additional Tier 1 instruments. Indeed if banks had not cut their distributions sharply in the 2019 stress test, in aggregate they would not have met the capital hurdle rate we set. By reinforcing clear expectations about dividend and coupon conversion behaviour in a stress, stress tests can promote efficient pricing by the market.

A policymaker's stress test research wish list

Facing a room full of stress test researchers, I can't resist finishing by putting out my agenda for where your work might take you. I'm encouraged that quite a bit of this has been included in this conference.

Obviously from what I've discussed, a high priority would be to explore how stress tests can best inform the setting of capital buffers. A lot of information will go into our decisions on raising or lowering the CCyB. But stress test results, as utilized in the UK, are a valuable input and cross check on our actions. We have a

[11] Bank of England (2019c)

process that is sound in theory, but largely untested by substantial shifts in business or financial cycles. I'm looking forward to the session right after lunch on this topic.

As I've said, the transparency of stress test results is essential to their effectiveness in building confidence, improving market discipline, and giving banks incentives to hold adequate capital and model and mange risks well. We are often faced with decisions on how much more to publish about our own modelling and judgements as well as the results from the banks. As an economist I am usually tempted to argue that the more information markets have the better pricing should be. But market participants need the right context to interpret that information and, as we see in the context of stigma at the discount window, information can adversely affect bank incentives to behave in a stabilizing manner. I know there is some literature on the effects of stress test transparency on market discipline and bank incentives, but I wonder whether as data points are added every year across a variety of jurisdictions, this also isn't an area in which economic researchers might have more to say on the optimal degree of transparency.

Stress tests are sometimes characterized as microprudential tools with a macroprudential overlay, in that they are on a bank by bank basis with no explicit accounting for the effects of correlated positions or interconnections. In my view this characterization undervalues the macroprudential aspects of these tests. The scenarios are adjusted by the stage of the economic and financial cycle; they are drawn from a history in which correlated positions and interdependencies influenced these economic and financial cycles; the scenarios are adjusted to take account of current perceived risks, such as business leverage; and systemically important institutions are held to higher standards. Moreover, staff at the Bank of England model the effects of correlations and interconnections using the data submitted by the banks and report the results to the FPC.[12] No doubt, modelling of these feedback loops is still a work in progress and can be further improved, enhancing the macroprudential aspect of the tests. One method to explore would be running a two-stage stress test with the results of the initial submissions being used to modify the scenario to be used in the second stage. In fact we are doing this in our biennial exploratory scenario this year, which is focused on responses to a liquidity shock.

Perhaps the most profound challenge for stress testing is to extend it beyond the banking sector—the focus of session three tomorrow morning. The FPC regularly examines whether risks beyond banking need our attention or even our suggestions for extending the regulatory perimeter. And these efforts are backed up by extensive staff research and modelling. For example, in our 2018 review of non-bank leverage, we looked at risks from hedge funds, using bank staff research to identify the potential for rapid shifts in demands for liquidity.[13] The FPC is currently awaiting a joint review by the Bank and the FCA on the financial stability risks posed by liquidity mismatch in open-ended funds. And Bank staff have been at the frontier in system-wide stress simulation, some of which is now used by the FSB.[14] Still, my answer to the question of

[12] For more information see Churm, R. & Nahai-Williamson, P. (2019)
[13] Bank of England (2018)
[14] See for example Aikman *et al* (2019)

what keeps me up at night is drawn from my experience of not seeing the build-up of risks prior to the GFC, so much of which involved risky and opaque intermediation away from banks. There will be many rewards from improving our modelling of nonbank risks—including identifying tools required for financial stability and a better night's sleep for me. What greater incentives could you need?

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