MEMORANDUM FOR	Banking Steering Group
FROM	Susan Guthrie
DATE	30 October 2018
SUBJECT	**Risk Appetite framework used to set capital requirements**
FOR YOUR	Decision

We recommend BSG:

a) **Note** The decision about how much capital to require of banks is made under conditions of uncertainty.

b) **Note** When making fundamentally important decisions under uncertainty it seems reasonable to aim to be absolutely clear about what it is we are trying to achieve and how we intend to approach the task.

c) We propose communicating our policy goal and our analytical approach using a risk appetite framework. We believe the framework we propose offers several benefits:

- It enables us to be explicit about our policy goal, contributing to transparency
- It is consistent with, and based on, the capital policy literature
- It enables us to incorporate the widest range of factors in our analysis
- It lends itself to practical application
- It is consistent with our obligations under the RBNZ Act.

d) **Agree** That FP should seek FSO's agreement to the proposed risk appetite framework which is to be used when making and communcating decisions about bank capital requirements.

Introduction

1. So far in the Capital Review we have considered what qualifies as capital and how bank assets (and other exposures), that may potentially generate bank losses, are identified, aggregated and assigned a capital charge. We are now at the point of deciding how much capital to require of New Zealand banks.

2. While globally regulators have invested considerable resources in collecting and analysing data about historical losses and bank risk, the future is an unknown. At best we can analyse the past and apply lessons learned there, but there is no guarantee future shocks will resemble those of the past. Nothing in the historical record, for example, can instruct us about how economies and their banking systems will fare under escalating climate change. Hence the decision about how much capital to require of banks is made under conditions of considerable uncertainty.

3. We believe that when making fundamentally important decisions under conditions of uncertainty it is important to be as transparent as possible – to be absolutely clear about what it is we are trying to achieve and how we will decide what to do.

4. We propose communicating our policy goal and our approach to setting capital requirements using a risk appetite framework.

The risk appetite framework

5. We propose to use a framework to determine capital settings that incorporates a specific policy goal, a two-step decision-making process and sensitivity analysis. How we respond to uncertainty and thus risk plays a central part in our proposed framework.

6. We propose defining our policy goal as:

   - Capping the probability of a crisis at 1% or less[1]; and
   - exploiting available opportunities, if any, to increase both stability and output beyond this level.

7. This policy goal lends itself to a simple graphic representation:
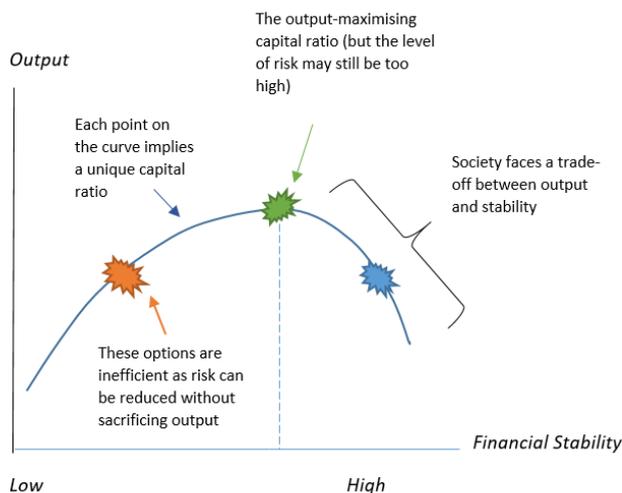
8. Each point on the graph corresponds to a unique level of capital. Points located towards the right correspond to higher levels of capital and more financial stability. 'Output' refers to the present value of future output, calculated using a risk-neutral discount rate.

9. This graph illustrates that there are levels of capital that are "inefficient" because they do not exploit opportunities that deliver more stability and more output, both of which we assume to be valued by society.[2] The orange marker on the graph indicates an inefficient capital level.

10. There is a level of capital that maximises the net present value of future output (green marker). However this capital level may not deliver enough stability.

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[1] We could use 0.5% here as an alternative, as this aligns with insurance solvency practice.

[2] By 'output' we mean the present value of future output.

11. In some cases, where there is a high degree of aversion to financial instability, it makes no sense to aim to maximise output – to do so would leave too much risk in the system. In this case it is preferable to have a higher level of capital, requiring some output to be forfeited in order to achieve the financial stability goal (indicated by the blue marker). The trade-off between stability and output that is present at some capital levels is analogous to the trade-off present in insurance – more risk-averse individuals willingly pay more in insurance premiums than others even though they face similar risks.

12. Our proposed policy goal lends itself to a two-step decision-making process:

   - Step 1: determine what level of capital delivers the level of stability required.
   - Step 2: determine whether, at the level of capital implied in Step 1, opportunities remain to increase both output and stability further.

13. Sensitivity analysis is implied in each step.

14. We consider the policy goal and decision-making process to constitute a 'risk appetite framework' because our risk appetite plays a central role in both the policy goal and the decision-making process.

15. We are not suggesting this framework be applied outside the context of bank capital policy setting.

Pros and cons of the risk appetite framework

16. We can see few potential disadvantages in using our proposed framework. We are using the same assumptions about capital, output and stability as the optimal capital literature and, like the optimal capital literature, we aim to exploit all opportunities that lead to both higher output and stability (i.e. eliminate inefficiency). We are simply representing these relationships in a way that is easier for non-specialists to understand.

17. We believe the framework we propose offers several benefits:

   - It enables us to be explicit about our policy goal, contributing to transparency
   - It is consistent with, and based on, the capital policy literature
   - It enables us to incorporate the widest range of factors in our analysis
   - It lends itself to practical application
   - It is consistent with our obligations under the RBNZ Act.

18. Each of these benefits is briefly explained below.

Transparency

19. The optimal capital literature typically explains the policy problem in terms of equating marginal benefit and marginal cost, where the 'benefit' of capital is the reduced probability of crisis and the higher output likely in the event there is a crisis. In this literature the 'cost' of capital is the output that is foregone due to higher lending rates. These are not easy concepts for non-specialist audiences to grasp.

20. By relating output and stability directly, as we do in the framework (and graphically in the illustration), the concept of 'efficiency' – which lies at the heart of optimal capital analysis – can be easily introduced.

21. It is important that there is a common understanding of 'efficiency' in the context of capital policy because this is an area where there is the potential for unproductive debates, generated by differences in interpretation. The banks may argue that higher capital increases their costs and makes them 'less efficient' but, in fact, it is the impact of capital on output (and not just the output impacted by higher lending rates) which lies at the heart of "efficiency" in the context of capital policy.

22. By relating output and stability directly, as we do in the risk-appetite framework, we also make it clear that, where risk aversion is high, achieving a satisfactory degree of stability may require forfeiting some output (i.e. going beyond the output-maximising capital level).[3]

The underpinning assumptions are consistent with, and based on, the capital policy literature

23. There are several key assumptions made in the capital policy literature. These assumptions appear to be commonly accepted at a theoretical level, but empirical estimates of the key relationships can vary.

24. These assumptions, and the relationship between the risk appetite framework and the optimal capital literature, are outlined in more detail in the Appendix.

25. Suffice it to say, that the expected output impacts of bank capital pull in two directions. On the one hand, an increase in capital has a positive payoff in terms of future output (the discounted value of future output not lost in a crisis). On the other hand, an increase in capital may have a negative impact on lending which reduces output below trend during business-as-usual periods. This complex relationship between capital and output lies at the heart of the optimal capital literature.

26. Combining both output benefits and costs associated with a given level of capital produces a non-linear relationship between output (relative to trend) and capital (Figure 1). [4] Given the probability of a crisis is a function of capital, so too is the probability of stability (defined for our purposes as 1 less the probability of a crisis). Using the common factor of capital, there is therefore a relationship between output and stability, which illustrates the options available to society (Figure 2). [5] The illustration we propose is based on the relationship shown in Figure 2.

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[3] It is not always easy to see to what degree risk aversion has impacted on regulator policy settings. However, in their "Plan to end too-big-to-fail", the Federal Reserve of Minneapolis was explicit about their proposed policy goal for systemic banks: "Each year a banks remains systemically important, an additional equity capital requirement of 5 percent of risk-weighted assets will be added to its Step 1 capital charge of 23.5 percent [up to 38%]. The 38 percent charge is the point at which the 100-year probability of a crisis falls below 10 percent. At this point the expected benefits still exceed the expected costs, but not by a very large amount." The authors clarified in a footnote that the benefits and costs they referred to were not the marginal benefits and costs, but total benefits and costs (they had estimated the marginal benefit of equity capital to equal the marginal cost for non-systemic banks to be 23.5% of RWA or equivalent to a 15% leverage ratio).

[4] The aggregate output associated with a given level of capital is the weighted average output level, with the weights being the probability of a crisis P (for a given level of capital), and 1 less P, and the corresponding output levels those arising if there is a crisis, or no crisis.

[5] Because other policies impact on output and stability, there is potentially an endless number of possible stability-output combinations available. However, if we assume all other policies are set optimally (i.e.
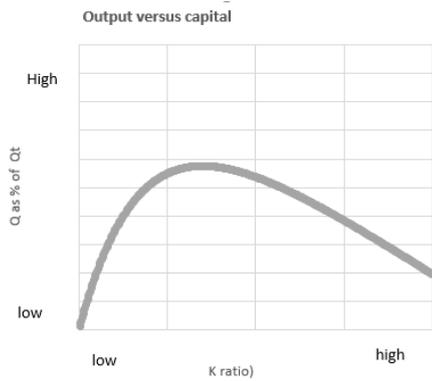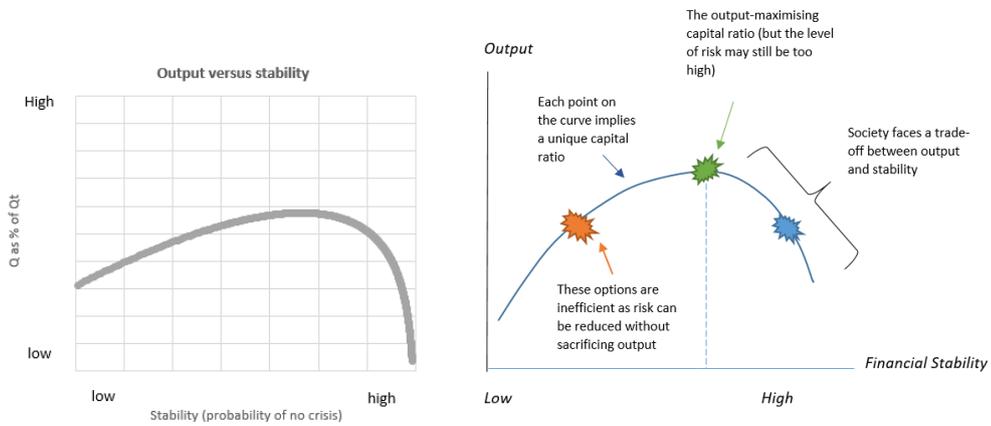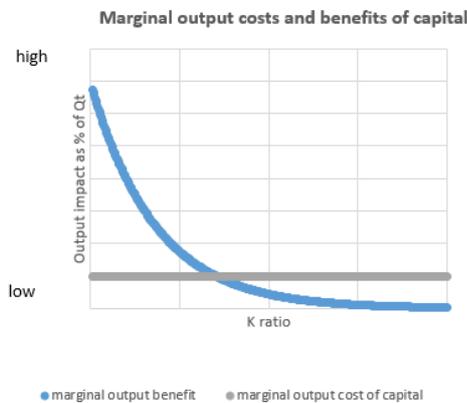
Figure 1

Output versus capital

High

Q as % of Qt

low

low   high

K ratio)

Figure 2

Output versus stability

High

Q as % of Qt

low

low   high

Stability (probability of no crisis)

Output

The output-maximising capital ratio (but the level of risk may still be too high)

Each point on the curve implies a unique capital ratio

Society faces a trade-off between output and stability

These options are inefficient as risk can be reduced without sacrificing output

Financial Stability

Low   *High*

27. The more typical representation of the policy problem in the optimal capital literature is to focus on output maximisation, which means equating the marginal output benefit and the marginal output cost (refer Figure 3). The typical approach obscures the fact that achieving high levels of stability may require forfeiting some output, and our preference is for this trade-off to be clearly visible when we discuss the policy problem.

Figure 3

Marginal output costs and benefits of capital

high

Output impact as % of Qt

low

K ratio

● marginal output benefit   ● marginal output cost of capital

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these other policies are set such that there are no opportunities to increase output with no loss of stability) the output-stability combinations available to the prudential regulator via capital policy can be represented by a single function (this function is mapped as a curve in the figure).

The risk-appetite framework allows us to incorporate many factors

28. The two-step decision-making process enables us to incorporate two strands of research in our analysis. One strand relates to estimating the capital needed to ensure bank, or banking system, solvency (or at least, non-failure), while the other strand attempts to identify the level of capital that maximises the net benefit of capital (the 'optimal capital' literature).

The risk appetite framework lends itself to practical application

29. There are various tools and/or research studies that we can draw on in terms of determining the capital level needed to deliver banking system solvency. None are without problems, but having a range of tools available is of help when making decisions under uncertainty. One tool is the capital equation that underpins Basel III's requirements of IRB banks. This equation, which adopts a value-at-risk approach, is used by IRB banks to determine the capital needed to cover unexpected losses at the asset class level. While far from perfect, this equaion does provide one way to think about and analyse the unexpected losses that might emerge across the economy as a whole.

30. Other tools include equations of best-fit that relate the probability of bank failure to bank capital. These equations have been estimated by other regulators using, in some but not all cases, historical returns from banks operating in many jurisdictions.

31. In terms of the second strand of research, there are numerous optimal capital studies we can refer to. A summary of the literature was provided to FSO in September 2016.[6] As well, we have a rudimentary optimising model developed in FP several years ago, which we can utilise.

32. The results from the two strands of analysis often depart quite radically from each other. It is thus inevitable that one strand of research will receive priority over the other. Our proposed risk appetite framework is a response to that challenge. We propose to first establish a level of capital below which we won't go, based on our risk appetite, and then look to see whether there are opportunities to increase output and stability from this minimum capital level.

33. We propose to undertake sensitivity analysis at each step.

Relationship between the risk appetite framework and our legislative mandate

34. The RBNZ Act requires us to "maintain the soundness and efficiency" of the financial system. "Soundness" and "efficiency" have a reasonably clear meaning in everyday language – if it was applied to the family car it would mean it doesn't break down and filling the tank fits easily within the weekly budget. However in order to translate the principle enunciated in the legislation into minimum capital requirements, we need something more tangible to work with. We need an interpretation of "soundness and efficiency" that, when applied in the context of bank capital, has a clear meaning.

35. The interpretation also needs to be sufficiently tangible to serve as a benchmark against which we can be held to account for our capital policy decisions.

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[6] Refer documentum 6665392.

36. We believe a reasonable interpretation of 'soundness' in the context of capital setting is to cap the probability of a crisis at 1% (or 0.5% if we wish to mirror approaches taken in insurance solvency modelling).

37. We believe a reasonable interpretation of "efficiency" in the context of capital setting is to exploit available opportunities, if any, to increase both stability and output by increasing capital beyond the level estimated to be sufficient to achieve the targetted level of stability.

Recommendations

38. We seek the Committee's agreement to present the proposed risk appetite framework, to be used when making and communcating decisions about bank capital requirements, to FSO.

APPENDIX

1. There are several key assumptions made in the optimal capital literature. These assumptions appear to be commonly accepted at a theoretical level, but empirical estimates of the key relationships can vary.

2. The first assumption is that capital is capable of averting a crisis, with the more capital that is held, the less likely a crisis. The second assumption is that the more capital is held, the lower are the associated output losses in the event a crisis occurs. Hence it is assumed that the more capital available to a bank, or banking sector, the less likely it is that society will suffer large, abrupt disruptions to output. These two relationships are illustrated in Figures 1 and 2, using the typically assumed functional forms.

Figures 1 and 2
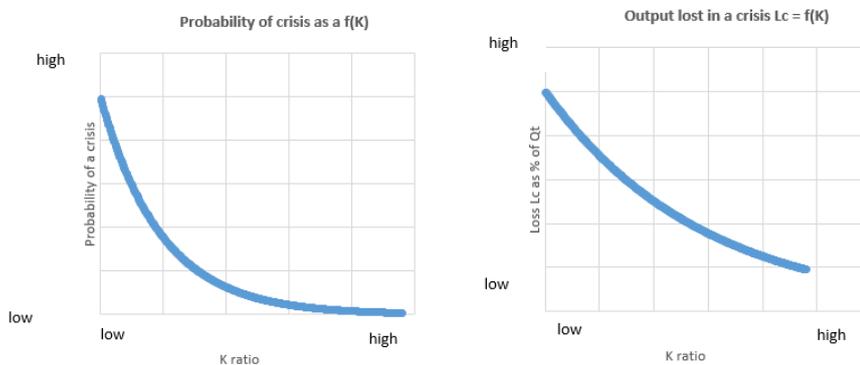
3. Assumption 3 addresses the impact of bank capital on lending rates and hence business-as-usual output. This assumption is subject to much greater debate in the literature. Bank capital is believed to impact on lending rates, because lending rates are expected to reflect the average cost to banks of acquiring long term funding - both equity (i.e. "capital") and long term debt. Lending rates are, in turn, expected to impact on lending and output.

4. The more equity that is held (relative to long term debt) the higher (potentially) a bank's average cost of funding and therefore lending rates. However the average cost of funding will only increase, when the ratio of equity to debt increases, if neither the return on equity required by shareholders nor borrowing costs fall significantly in response to the bank's greater ability to absorb losses. Theory suggests that, as the ratio of equity to debt increases, the return on equity required by shareholders will indeed fall, and this is supported up to a point by empirical evidence. Whether or not the average cost of funding for a bank is likely to increase with an increase in the ratio of equity to debt funding is a hotly debated topic in the literature and among regulators.

5. The relationship between the average cost of funding and the ratio of equity to total funding is illustrated in Figure 3.

Figure 3

Modigliani-Miller (Imperfect)
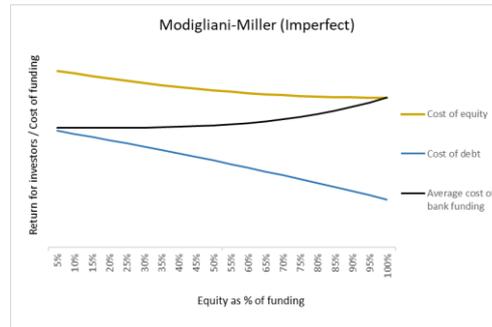
6. In the optimal capital literature the relationship between capital and business-as-usual output can be assumed to take a simple linear form, meaning the marginal cost of capital is assumed to be a constant fraction of trend output (as illustrated in Figure 4).

7. The expected output impacts of bank capital therefore pull in two directions. On the one hand, an increase in capital has a positive payoff in terms of future output (the discounted value of future output not lost in a crisis). On the other hand, an increase in capital may have a negative impact on lending which reduces output below trend during business-as-usual periods. This complex relationship between capital and output lies at the heart of the optimal capital literature. Combining both output benefits and costs associated with a given level of capital produces a non-linear relationship between output (relative to trend) and capital (Figure 5). [7]

Figures 4 and 5

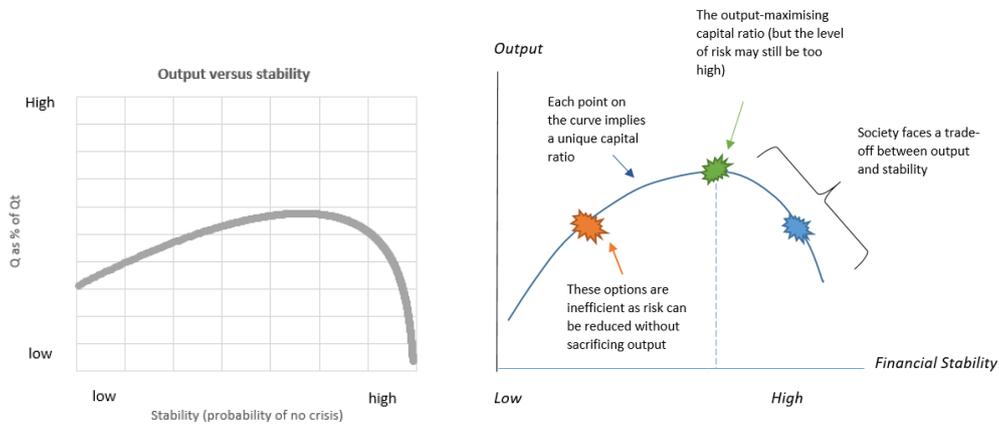Output lost due to lending rates Lr = f(K)

Output versus capital
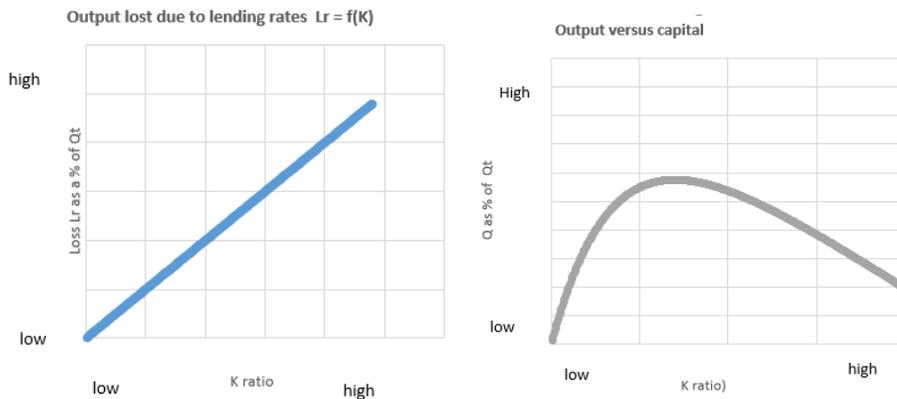
8. Given the probability of a crisis is a function of capital, so too is the probability of stability (defined for our purposes as 1 less the probability of a crisis). Using the common factor of capital, there is therefore a relationship between output and

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[7] The aggregate output associated with a given level of capital is the weighted average output level, with the weights being the probability of a crisis P (for a given level of capital) and 1 less P, and the output levels those corresponding to whether or not there is a crisis.

stability, which illustrates the options available to society (Figure 6). [8] The illustration we propose is based on the relationship shown in Figure 6.

Figure 6