16.   Risk Management, Governance and Economic Capital Allocation

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16.1 Introduction

Banks have become ever more complex large organizations facing a wide range of risks, and requiring sophisticated risk management techniques and processes. Risk management involves a number of important steps. These include: the identification of risks and their sources; assessment of the severity of the risk (the exposure); management of the risk. Specialist sections of the bank will be engaged in each of these steps, and the bank will have a set of policies specifying exposure limits consistent with the bank's risk appetite, and responsibility for management of the various risks.

How the bank manages the overall level of risk and limits the risk taken on by various parts of the bank will vary between banks, but a common modern practice is via the determination of a desired

level capital to absorb risk, and the allocation among business units of that capital. The term "Economic Capital" is generally used in this context, and refers to the amount of equity (or other forms of loss absorbing capital) available to absorb unexpected losses. (Expected losses are incorporated into provisions for losses made in the bank accounts and deducted from the balance sheet figure for capital). By allocating that overall economic capital to various business lines the bank can provide incentives and constraints. High profit activities can be allocated higher economic capital to encourage their expansion, and all business units need to ensure that the risk taken on implies a "use" of economic capital consistent with their allocation. At the aggregate level, if economic capital use exceeds that currently available, the bank will need to raise more capital from the market, or cut back on some of the activities generating that usage.

16.2 Identification of risks and their sources

It is conventional to divide risk faced by banks into a number of major categories, which do not include the general types of risk or uncertainty, such as strategic risk, political risk, competitor risk, which affect all types of businesses. It is worth noting, however, that among those other types of risks, banks (and other financial institutions) might argue that they are subject to much greater *regulatory risk* (changes in regulation which affect the profitability of various activities) than many other industries. (One example of that type of risk is that of *legacy products* where, for example, insurers may be required to change the form of new products sold, but are unable to change conditions of older products which run-off slowly and involve higher operational costs as the amount outstanding declines and fixed costs increase in significance).

Banks face risks which can be classified into categories of:

- Credit (counterparty) risk – which arises from loans granted, failure of counterparties in derivative transactions to meet obligations, guarantees provided etc.

- Market (trading) risk – which arises from the activities of treasury trading desks in foreign exchange, interest rate, and derivatives markets etc.

- Liquidity risk – which is the risk of being unable to meet contractual payment obligations and arises because of differences in maturity of assets and liabilities. Sometimes this is divided into funding liquidity risk (related to ability to raise funds from deposit or debt markets) and asset liquidity risk (related to ability to sell assets into a liquid market without adversely affecting the price received).

- Balance sheet (interest rate) risk – which arises from the difference in interest rate resetting characteristics of deposits and loans and other items on the balance sheet. Typically,

deposits will have a shorter duration than loans, such that banks have an expected profit from "riding the yield curve" but are exposed to risk of loss if the yield curve slope turns negative.

- Operational risk – which is the risk of direct or indirect losses resulting from human factors, external events, and inadequate or failed internal processes and systems.

All of these types of risk are (now) the subject of regulatory standards promulgated by the Basel Committee. Those standards generally provide for either reliance on (accredited) internal risk models and management practices of (sophisticated) large banks or compliance with template approaches provided by regulators. Of course, even in that latter case, banks may adopt different approaches to risk management, as long as those also imply risk levels which are compliant with the regulatory standards. A (now somewhat dated) overview of Canadian Bank risk management practices is given in this Bank of Canada (2012) article.

There are many more risks that banks and regulators concern themselves with including:

- Capital risk – which is the risk of having inadequate capital to meet regulatory standards, ratings agency standards, internally determined minimum requirements, or to pursue profitable business opportunities

- Business risk – which relates to changes in the economy which render existing business models unprofitable, and to the possibility that strategic decisions regarding changes in product offerings, markets entered, etc., lead to significant losses.

- Insurance risk – many banking conglomerates will be involved in insurance activities with the resulting possibility that claims made will exceed those allowed for.

- Legal risk – which reflects exposure to changes in the law affecting the future profitability of various business activities. (Exposure to legal claims arising from failures in existing activities are generally classified under operational risk).

- Tax risk – particularly for institutions operating across international boundaries, where many activities may be largely driven by opportunities to arbitrage differences in national tax systems, there is a risk of tax changes rendering these activities unprofitable.

- Regulatory risk – the risk that changes in government policy and regulation may impact adversely on the profitability of the bank.

Burns et al (JRMFI, 2020) also identify industry concerns with cybersecurity risk, regulatory risk, model risk, systemic risk, fintech risk, and macro/monetary policy risk as important. Regulators also rank cybersecurity risk high.

ANZ Bank (as an example) in its Principal Risk and Uncertainties Report 2020 lists 29 different types of risk as shown in Table 1. Some of these are somewhat specific to current circumstances or emerging issues such as covid-19, real estate market conditions, and replacement of benchmark interest rates. In past years, other examples would have included the risks associated with the replacement of national European currencies by the Euro, or the Y2K computer concerns. And while the risks arising from Brexit for the bank's restructuring of European operations is not explicitly listed, it is one item considered under heading 2. Likewise, "fintech" is not explicitly listed but is a major consideration under heading 3 of competition. But most of the areas listed are ongoing issues. Notably, failures of the banks risk management systems to appropriately manage existing risk or identify new risks is included.

- **TABLE 1: ANZ LISTING OF RISKS**

1	**The COVID-19 pandemic**
2	**Changes in political and general business and economic conditions,**
3	**Competition in the markets in which the Group operates**
4	**Weakening of the real estate markets**
5	**Sovereign risk events may destabilise global financial markets**
6	**Market risk events**
7	**Changes in exchange rates**
8	**The regulation, reform and replacement of benchmark rates**
9	**Acquisitions and/or divestments**
10	**Credit risk**
11	**Challenges in managing the Group's capital base**
12	**The Group's credit ratings could change**
13	**Liquidity and funding risk events**
14	**Changes in the valuation of some of the Group's assets and liabilities**
15	**Changes to accounting policies**
16	**Regulatory changes or a failure to comply with laws, regulations or policies**
17	**Litigation and contingent liabilities**
18	**Significant fines and sanctions in the event of breaches of law or regulation (AML/CTF)**

19	Changes in monetary policies
20	Increasing compliance costs, penalties, scrutiny, with respect to global tax reporting regimes
21	Unexpected changes to the Group's licence to operate
22	Operational risk events
23	Reputational risk events including operational failures and regulatory compliance failures
24	Conduct-related risk events or behaviours
25	Disruption of information technology systems or failure of new technology systems
26	Information security including cyber-attacks
27	Impact of future climate and geological events, and diseases
28	The risk management framework may fail to manage existing risks or detect new and emerging risks
29	Lending to customers that could be directly or indirectly impacted by climate risk

16.3 Assessment of the severity of the risk

Banks have developed a wide range of sophisticated techniques for measuring the severity of various types of risk. Many of these techniques use modern finance theory and thus are difficult for non-specialists to fully understand. This applies both in the undertaking of business activities which generate risk, as well as in the centralized processes of aggregating and understanding risk positions.

In some areas, it is often argued that excessive reliance upon such statistical models rather than experience of bank officers has led to difficulties. For example, reliance solely upon credit scoring techniques without personal interviews by loans officers has been seen as a recent failing.

A more general problem is the one of reporting risk positions in a manner which is understandable to senior management who are ultimately responsible for setting the bank's *risk appetite*. The risk appetite is generally defined as being some level of risk which the bank is willing to accept in its search for profits. At the aggregate level, many banks operate with risk appetites in the order of a 1 in 500 chance that the bank may fail over a one year horizon. At the business unit (or lower) level acceptable VaR levels (or other forms of constraints) will be set by reference to levels of profitability expected from that activity, and typically converted into trading (or position limits).

A common popular technique for aggregating and reporting risk is Value at Risk (VaR) which estimates a size of loss for which there is a specified probability of exceeding. The difficulties with

VaR include its reliance on assumed correlations between asset returns (which may change in times of stress) plus the uncertainty about how large the losses in excess of the VaR figure may be.

16.4 Management of risk

Modern financial markets provide a wide array of methods of changing the risk position of the bank. Derivative markets can be used to alter the risk arising from operating activities, by transferring that risk (at a price) to third parties. If for example, the estimated VaR is too high for a particular activity, such as positions arising from foreign exchange trading, the bank's traders can alter the risk position by transactions in spot, forward, swap, or options markets.

Effective overall management of risk is one of the most difficult problems facing large banks. Senior management have ultimate responsibility for the bank's risk taking, but need to delegate some responsibility to more specialized staff, who in turn oversee the bank personnel whose activities generate risk while in search of profit. Providing appropriate remuneration structures for such personnel which aligns their incentives with those of the bank is one challenging problem. Ensuring that new (or altered) products are not introduced by business units without adequate assessment of the risk involved is also an important part of risk management control processes.

Most banks will adopt some form of risk management structure which involves the following levels of responsibility, delegation, and reporting. Generally, Boards will set the overall risk appetite of the bank and determine the general policies under which the risk position of the bank is to be managed. A Chief Risk Officer (CRO) is now a common position, reporting to the CEO and CFO, with responsibility for overseeing the risk position of the bank.

One complication in risk management is that banks typically are divided into a range of business units for operational efficiency, and most types of risk arise from activities of these diverse business units. Banks may be structured along, customer, product, or geographic lines, or some combination of all of those features. Thus, for example, there may be business units for consumer banking for each region in which the bank operates. Credit risk, interest rate risk, operational risk, liquidity risk etc., will all arise in each of these business units. Thus, there is likely to be a head of credit risk for the bank, whose group will be responsible for aggregating information about and managing credit risk from all business units (and reporting to the CRO). At the same time, the head of each business unit, requires information about the overall level of risks taken by the unit, and ultimately, the units performance will be assessed by reference to profitability relative to the risks taken on.

Risk Management Structures and "Three lines of defence" – Australian Banks

A common structure for the governance of risk management in banks is the "Three lines of defence" model. The first line is the ownership of, and accountability for risk by the Business Unit which originates the risk. The second line is to have functionally independent oversight of risks via specific committees who report to senior management and the Board. The third line is to have independent assurance (such as via compliance, internal and external audit) that the risk reporting and management systems are operating in accordance with bank policies.

The risk management structures for NAB and Westpac are shown in the following diagrams.
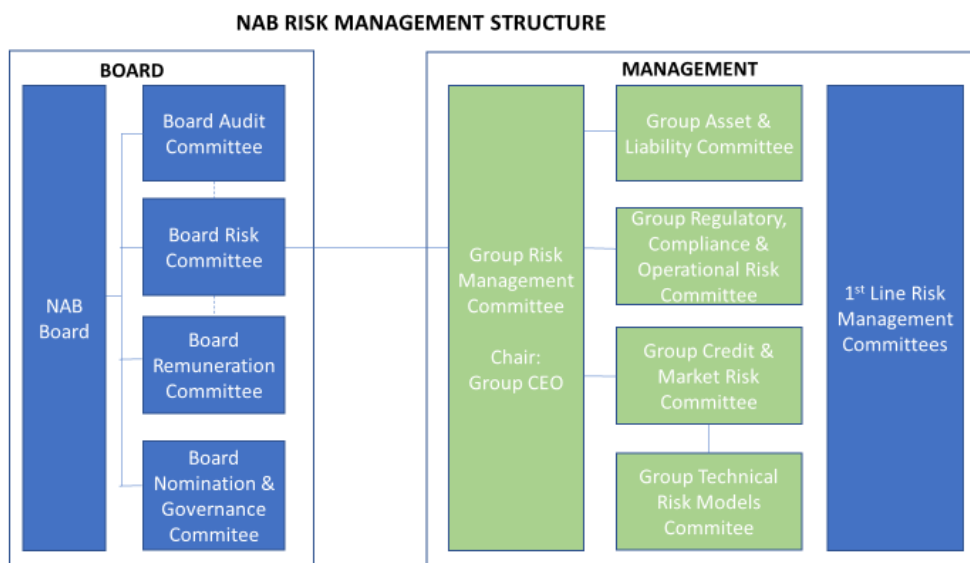
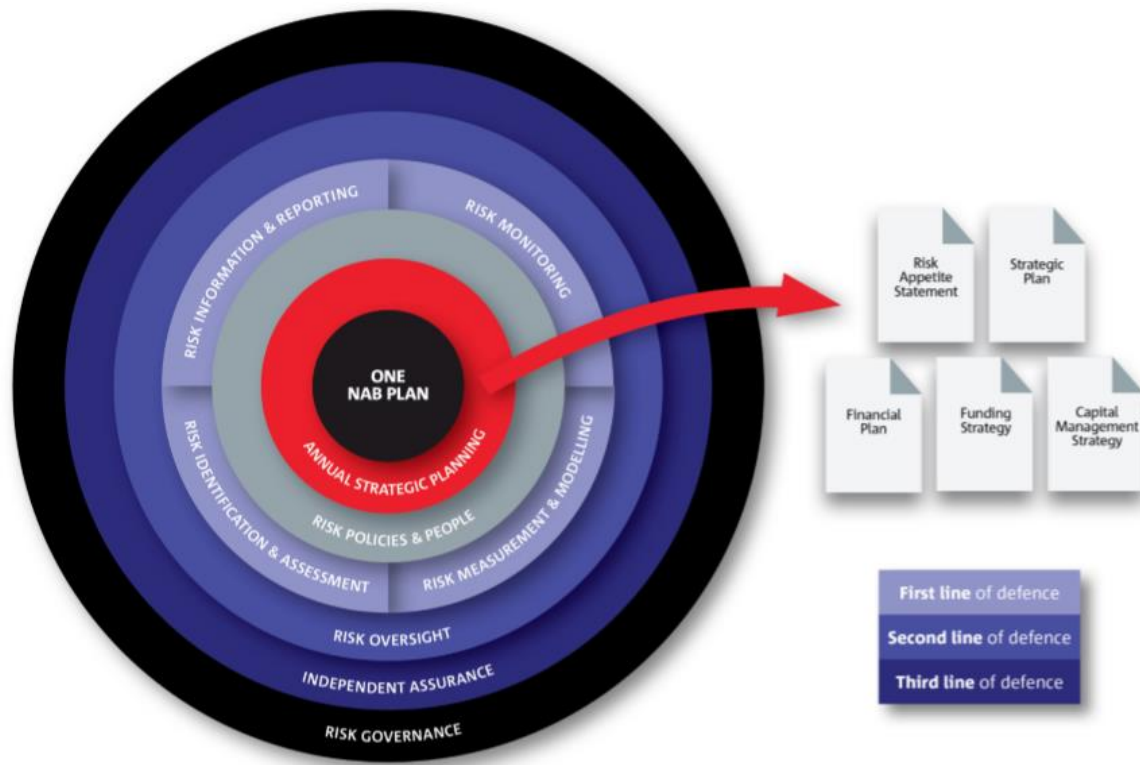**FIGURE 1: NAB RISK MANAGEMENT STRUCTURE 2017**

FIGURE 2 NAB RISK MANAGEMENT

FIGURE 3: WESTPAC RISK MANAGEMENT (SOURCE: WESTPAC)

ANZ Bank provides a useful depictions of responsibilities of the different lines of defence show in Figure 4.

	Responsible area	Key responsibilities
First line of defence	Business / Enablement	• Primary accountability for the understanding of key risks and related control environment. • Undertake day-to-day management of risks, related decision-making and reporting. • Promote a strong risk culture of adhering to thresholds, managing risk exposure and making sustainable risk decisions. • Ensure operational risk information is up-to-date and reflective of the true operational risk position.
Second line of defence	Divisional Risk	• Provide independent oversight and guidance to enable consistent application of the operational risk measurement and management framework (ORMMF). • Coordinate, oversight and report on material operational risks and change initiatives. • Contribute to the identification of systemic issues and risk collation across the Division.
	Group Risk	• Independent function responsible for overarching risk oversight across the bank. • Set Group operational risk appetite statements. • Develop and maintain relevant policies and procedures to support consistent execution and continuing appropriateness of ORMMF. • Monitor and report compliance with ORMMF, consider and approve any exception requests. • Source external loss data. • Lead scenario analysis and operational risk capital calculation process. • Central point of contact with regulators. • Provide global insight and commentary on consolidated bank wide view and identify group wide exposures and trends.
Third line of defence	Internal Audit	• Provide independent and objective assurance to management and ANZ Board regarding compliance with policy and regulatory requirements. • Perform objective assessments across all geographies, Divisions, Lines of Business and processes. • Ensure independent review of the adequacy of the ORMMF is undertaken.

FIGURE 4: THREE LINES OF DEFENCE ALLOCATION OF RESPONSIBILITIES (SOURCE ANZ P68)

Risk Culture

Risk management structures and organisational arrangements ("risk architecture") can be seen as necessary conditions for effective risk management, but they are not sufficient. As APRA notes "it is the behavioural norms and practices of individuals and groups that shape an entity's ability to identify, understand, openly discuss, escalate and act on its current and emerging risks". These "risk behaviours" include, as well as an alignment of risk raking with the entity's purpose and values, such things as leadership (role models), communication and escalation channels, willingness to accept challenges to suitability of decisions being considered, development of risk management skills and processes. These two components of "risk architecture" and "risk behaviours" combine to generate what APRA describes as *Risk Culture*.

In November 2022 APRA released the results of its survey of risk culture in banking institutions, which surveyed a large range of employees, including those with no managerial responsibilities. The survey sought views on 10 dimensions of risk culture. This is part of APRA's focus on "transforming

governance, risk culture, remuneration and accountability (GCRA)" in Australian banks. While the results indicated that progress had been made in improving risk management, it also indicated that employees still believed that there remained improvements to be made.

16.5 Risk Management – Regulatory Requirements

APRA requires banks to have an approved risk management structure and process in place under Prudential Standard CPS 220 Risk Management, including: an appropriate risk management framework; board-approved "risk appetite"; board approved strategy, board-approved business plan; adequate resources for compliance; notification to APRA of breaches.

In the APRA Prudential Inquiry into CBA criticisms were made of inadequate articulation of policies, staff training and guidance, and processes for handling exceptions to policies, and also of lack of clear separation required in the three lines of defence model. Also criticised was the need for 1st line Chief Risk Officers to have appropriate independence from the business unit executives to ensure that risk reporting to the 2nd line is not inhibited. In April 2018 CBA entered into an enforceable undertaking (EU) to address the deficiencies identified in the Inquiry regarding risk governance, accountability and remuneration, operational risk and compliance function shortcomings, dealings with customers, and need for cultural change.

Following the Westpac AUSTRAC prosecution and a subsequent review of Westpac's risk governance, concerns over progress in rectifying problems led APRA in December 2020, to require Westpac to enter an EU to correct risk governance deficiencies under a plan to be monitored and assessed by an independent evaluator (The Promontory Group). The root problems were seen to be

"• An immature and reactive risk culture;
• Organisational construct that creates complexity;
• A three lines of defence model that is not well understood or embedded;
• A shortfall in risk management capacity and capability; and
• Challenges in execution and 'staying the course'." Promontory Report

More detail can be found in the Promontory Report

Trading Desk Limits

An important component of risk management is the setting of limits on activities or positions taken by bank employees to whom authority has been delegated to do so. The bank will need to express those limits in some way which is easy to calculate and verify, and which relates the limits to the potential risk and reward of those activities. A method for setting of limits on positions taken by traders (on interest rate or FX desks for example) which generate market risks provides a simple example. Of course, since trading desks can involve a large number of individual traders, it is also necessary to link limits of the individual traders with limits on the desk overall in some way.

The principles involved have been spelt out by international standard setters.

A trading desk must have a clear risk management structure.

(a) Risk management responsibilities: the bank must identify key groups and personnel responsible for overseeing the risk-taking activities at the trading desk.

(b) A trading desk must clearly define trading limits based on the business strategy of the trading desk and these limits must be reviewed at least annually by senior management at the bank. In setting limits, the trading desk must have: (i) well defined trading limits or directional exposures at the trading desk level that are based on the appropriate market risk metric (eg sensitivity of credit spread risk and/or jump-to-default for a credit trading desk), or just overall notional limits; and (ii) well-defined trader mandates.

(c) A trading desk must produce, at least weekly, appropriate risk management reports.

FIGURE 5: BCBS MINIMUM CAPITAL REQUIREMENTS FOR MARKET RISK

The BCBS document provides much detail on how to implement the setting of desk and individual trader limits across a range of market risks. The Appendix provides a simple example to illustrate.

16.6 Economic Capital

"Economic capital can be defined as the methods or practices that allow banks to consistently assess risk and attribute capital to cover the economic effects of risk-taking activities." Basel Committee

"Banks allocate capital to their business lines to assess those lines' relative performance, which informs their strategic decisions. Capital allocation, together with Fund Transfer Pricing (FTP), are two important internal processes used by banks to support business optimisation decisions." Bank of England Quarterly Bulletin (2018)

At an aggregate level, one might be tempted to interpret economic capital as an optimal capital level, as in corporate finance where an optimal capital structure maximises the value of the firm (or equivalently minimises its weighted average cost of capital). While that might turn out to be the case (although unlikely), that is not how economic capital is interpreted in banking. Rather it is the level of equity capital required to be consistent with the "risk appetite" of the bank's board and management. Typically this is expressed as ensuring that there is sufficient capital such that the probability of failure of the bank in the next year is below some very small probability (such as a 1 in 1000 chance).

Thus, economic capital is focused on risks, and its calculated value will be one input, along with regulatory requirements, into a bank's determination of its desired (optimal), and thus its actual, level of capital. The actual capital level will need to be at least as large as its economic capital to be compatible with the bank's risk appetite. Actual capital also needs to exceed minimum regulatory requirements which, since the introduction of Basel 3, typically exceed bank estimates of economic capital. And because of its focus on the ability of the bank to survive adverse shocks, some adjustments will be made to conventional accounting figures to strip out assets which would not

have value in a time of crisis. For example, some figure for goodwill may be included as an asset in the bank's accounts but that intangible asset may be worth zero in a time of distress.

The economic capital concept is more relevant for the internal processes of the bank. The overall risk of the bank arises from its various activities, and assessing, managing, and pricing for those risks is fundamental to bank performance. As described by the Basel Committee:

> "Economic capital provides banks with a common currency for measuring, monitoring, and controlling: (i) different risk types; and (ii) the risks of different business units."
>
> Basel Committee

By determining, and notionally allocating, economic capital to the various activities, the bank can determine whether the expected profit from that activity is sufficient to compensate for the risk involved. The allocation will affect pricing of the activity since the required return on economic capital will be incorporated into pricing decisions. Relative performance of business units and their activities can be compared via performance measures based on economic capital.

Economic Capital and Loss Distributions

The losses determining economic capital can arise from a range of risks. Most commonly identified (and reflected in regulation) in banking are: credit risk, liquidity risk, market risk, and operational risk. (Business and strategic risk are not generally considered in the same framework, but could be relevant in, for example, determining the economic capital relevant for expansion into a new market where success is questionable and the investment of funds required could be lost).

While economic capital can be calculated for the different risks associated with an activity, the most common and important calculation is for the credit risk associated with loans.

There is for a portfolio of loans a probability of loss distribution such as shown in Figure 6 (where zero loss would involve full repayment of all loans). Only the losses are relevant, since the loan contract has no "upside" of payments beyond those agreed contractually to the bank. The bank will, based on past experience (or other methods), have some estimate of the "expected losses" on that portfolio (for example that on average 0.8% of contractual repayments of principal and interest will not be recovered). This will be incorporated into the determination of interest rates charged on loans, such that over time the profits made on successful loans are expected to offset the losses on unsuccessful loans and achieve the required return on the portfolio.
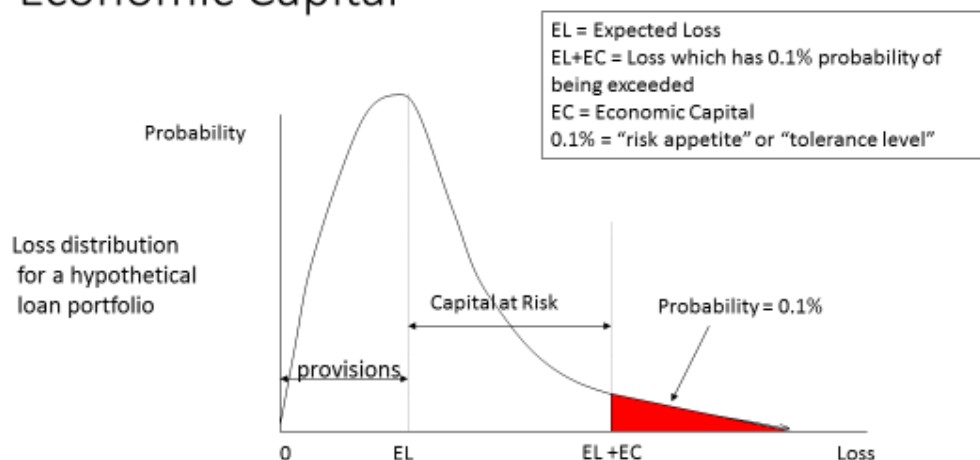
FIGURE 6: LOSS DISTRIBUTION AND ECONOMIC CAPITAL

Of course, actual losses will rarely equal expected losses. While provisions should allow for expected loss, there needs to be adequate capital available to absorb losses beyond that amount for the protection of depositors and other creditors of the bank. *Economic Capital* is the term used for the level of equity, in excess of provisions/expected losses which is available to perform this role. It has commonly been defined as that amount of capital which would be sufficient to absorb losses on the specified portfolio (position) for some proportion (such as 99.9 per cent) of possible outcomes over a specified horizon. That is a Value at Risk (VaR) approach which does not take account of the extent of the shortfall of capital to losses which might occur in the 0.1 per cent of outcomes.

In recent years, there has been greater use of the Expected Shortfall (ES) concept for such a calculation which incorporates the size of loss not covered by available capital. Both measures require an assumption about the probability distribution of future outcomes, generally estimated by reference to past experience, which can be prone to error. (In particular, in considering a portfolio, the correlation between the components is important to the overall outcome. In the GFC, VaR measures based on historical correlations were found to be misleading because correlations shifted towards unity in the crisis).

Loan loss provisioning and Economic Capital

When a lender makes a loan it will generally associate with that loan an *Expected Loss* amount reflecting the non-zero probability that full repayment won't occur. There is also the *unexpected loss* reflecting the fact that the probability of default (PD) and loss given default (LGD) differ from the expected values assumed by the bank.

The expected loss associated with the portfolio of loans is reflected in the pricing of the loans (as was shown in the risk-adjusted loan interest rate determination described in Chapter 10). Moreover, a bank will aim to make provisions associated with that expected loss. Unfortunately, this gets us into the murky world of bank accounting principles and practices. [1] Rodgers (2015, Section 2 and Appendix A) provides a brief overview of Australian bank practices up to that time. Traditionally, loans were entered using historical cost accounting as an asset with a value equal to the amount lent (less principal repayments to date) and loss provisions were only allowed to be created when there was some evidence that full repayment would not occur. This could take the form of either *specific provisions* associated with a particular loan likely to default, or *general provisions* associated with a portfolio of loans where it was believed that some would default (even though the identity of which ones was not known). An increase in provisions at any date, such as due to an economic downturn, would be treated as an expense in the income statement for that period. General provisions would be determined based on historical loss experience

Concerns about the backward-looking nature (incurred loss) of loss provisioning has ultimately led to a new accounting standard (IFRS9) for use in provisioning by banks (See Chapter 4.6). The Basel committee has been instrumental in this, because loss provisions are deducted in calculating eligible bank capital for regulatory purposes. If provisions are inadequate given knowledge about likely losses, then regulatory capital will overstate the amount available to act as a buffer to absorb (both expected and unexpected) losses.[2] The G20 leaders had also called for changes in 2009.

The estimation of economic capital can be done at the level of risks associated with a particular portfolio such as default losses on housing loans (such as depicted in Figure 6) or for valuation changes on a trading book of equities or fixed interest securities. In the latter case, the distribution would show both gains and losses (and be approximately symmetric). Again, however, in calculating economic capital, it would only be the loss tail of the distribution which is relevant.

16.7 Aggregate Economic Capital and Actual Capital

At the aggregate level, a bank's desired economic capital will be determined by the bank's board as the amount sufficient to absorb losses in most circumstances reflecting what is often termed the "risk appetite". Often this has been calculated using a Value at Risk approach at some degree of confidence such as 99.9 per cent for a one year horizon. If believable, that suggests that the bank would be likely to fail once in 1,000 years as a result of losses exceeding available capital. In practice,

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[1] BCBS (2015) provides relevant information on bank accounting and how that interacts with bank regulation to affect bank behaviour.

[2] See BCBS (2015)

because balance sheet capital is the residual of assets less other liabilities, inadequacies in accounting can make such estimates unreliable, while (on the other hand) a bank noting accumulating loan or other losses might (if able) undertake new equity raisings to counteract that trend.

At the aggregate level for the bank, the actual amount of capital can be compared with the economic capital required to meet the bank's "risk appetite". (Note that actual capital as recorded in the balance sheet will reflect provisions made for expected losses via, in Australia, the net loans and advances figure shown as an asset equalling the gross figure minus provisions). Flannery (JMCB, 2014) considers how well book capital based on expected losses reflects market assessments of the bank's strength. He calculates the implied PD for a sample of US Bank Holding Companies over the period 1986-2011 using the Merton model and market data on BHC equity prices. He finds that in about 2/3 of bank-year observations, the implied PD was greater than the Basel regulatory standard of 0.1% and over 0.5% in half of the observations. He notes that book capital is not a good guide to market willingness to refinance banks with maturity mismatches, such that the market value of equity capital warrants consideration in regulation. This, he argues, supports his proposal for contingent capital ("bail-in") bonds with market value triggers to recapitalise troubled banks.

While reference to a "loss appetite" is the way in which economic capital is generally defined in practice, Elizalde and Repullo (2007, p88) argue that it "should be derived from an underlying objective function such as the maximization of the value of the bank.... as the capital level that bank shareholders would choose in absence of capital regulation". In their modelling[3] it is determined by trading off greater use of more costly equity financing with the risk of losing franchise value due to a "run" and closure of the bank. They find that economic and regulatory capital do not depend on the same underlying variables – with the the latter being based on a prescribed confidence level regarding failure but the former dependent on the intermediation margin and cost of capital. A higher cost of capital reduces economic capital, but the intermediation margin effect depends on the level of competition. A higher margin increases the franchise value (increasing economic capital) but generates profits which serve as a buffer against possible losses (reducing economic capital). The net effect is positive in competitive markets but negative otherwise. While increases in PD and LGD increase regulatory capital, their effect on economic capital is not always positive.

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[3] They assume a bank with a single class of loans, with less than perfectly correlated outcomes, but all with the same PD and LGD, and derive default rates using the single-risk-factor model which underpins the Basel IRB calculations of capital requirements.

Elizade and Repullo find that the lower is the cost of capital, the more likely it is that economic capital exceeds regulatory capital, while actual capital will generally exceed regulatory capital (if that is larger than economic capital) to provide a buffer against unexpected losses leading to breaching the regulatory requirement. The size of such a buffer will depend upon the severity of regulatory actions if a breach occurs. Using deposit insurance coverage as a (negative) indicator of market discipline, they find that more market discipline generally has minimal effects on increasing economic and actual capital.

There are, of course, a number of complications in analysing economic capital at the aggregate level. One is the fact that the bank will have other forms of "capital" (such as preference shares and hybrids which can absorb losses) in addition to common equity. A second is that the bank will be required to meet regulatory capital requirements. Arguably, until the introduction of Basel 3, regulatory capital was less than economic capital such that it was not a major consideration for bank capital planning. Since Basel 3, higher regulatory capital requirements have probably become a binding constraint for banks – as evidenced by the need for them to increase equity capital in response. (While banks have higher equity capital than the regulatory minimum, the difference can be interpreted as the need to have some safety margin to avoid falling below regulatory requirements and invoking regulatory action).

A third complication is that regulatory capital requirements involve subtracting some amount of assets (such as goodwill) from total assets in calculating actual capital, and this divergence between recorded balance sheet equity and eligible regulatory equity needs to be taken into account. More generally, "book" capital is used in regulatory calculations (and in economic capital calculations) and this may be distorted by accounting valuations of assets and liabilities which differ from market/realisable values. The US experience in 2008 when Bear Stearns, Lehman Brothers, Washington Mutual, Wachovia, and Merrill Lynch all failed or were acquired after previously reporting capital ratios all over 12 per cent, illustrates how investors may be unwilling to roll-over short term funding due to concerns about actual solvency.

A fourth complication arises when there are subsidiaries operating offshore which have their own regulatory capital requirements. Home jurisdiction regulators may not allow the value of the parent's equity stake in the subsidiary to count as an asset in calculating eligible capital for the parent. This has been the case in Australia for part ownership of offshore banks, and was one reason for ANZ withdrawing from a number of its overseas joint ventures.

16.8 Capital Management Policy

In determining its aggregate desired economic capital position, bank management will take into account more factors than any loss distribution estimated by its specialists. An important consideration will be the impact of its capital position on the ratings given to the bank by S&P, Moodys, or Fitch. (Moody's bank rating criteria are found here). Another will be the share market response to its capital position, as well as the regulatory capital requirements. Banks are required (under Pillar 2 of the Basel requirements) to have an Internal Capital Adequacy Assessment Process (ICAAP) which requires regular assessment of current capital position and future needs. In undertaking its ICAAP a bank will note that expected growth in activity is a fundamental determinant of required growth in capital. McKinsey provides an overview of practical approaches and issues. Such growth is given by Earnings less Dividends plus External Capital Raisings (negative for share buybacks). Notably poor past performance creates difficulties in growing capital - both from internal and external sources.

More generally, capital management policies should include

- determining the overall need for capital and other sources of funds for the business as a whole

- the allocation of financial resources within the business to new business activities

- determining whether existing activities generate an adequate return on capital employed

- pricing and costing of activities to achieve an adequate return

- ensuring that risks of capital loss are appropriately managed.

16.9 Allocating Economic Capital

For internal bank management a major challenge is the need to allocate and price equity capital among various business units and activities. By notionally allocating more of its equity to particular business units and assessing performance of the BU by reference to some measure of risk adjusted return achieved on that allocation of equity, incentives to expand particular activities can be generated. One approach could be to allocate economic capital among various activities in proportion to their contribution to required regulatory capital. This would imply an allocation based on the Risk Weighted Assets (RWA) measure arising from those activities. While relatively simple, that would leave allocation of capital in excess of the regulatory requirement still to be allocated, and major banks are also likely to prefer their own assessment of the risk associated with particular activities than simply following regulatory assessments. Nevertheless a Bank of England survey in 2018 found that RWA was an important factor in methods used by many banks in allocation of capital. One explanation for this is that the Basel 3 increases in capital requirements have meant that regulatory capital exceeds the bank's own estimate of economic capital. Complications with reliance

on RWA arise from operations in different jurisdictions and determination of the desired overall capital level to take into account other risk considerations such as identified by stress tests. This could lead to an allocation based on some average of a number of risk measures or regulatory requirements.

The expected loss associated with the portfolio of loans is reflected in the pricing of the loans (as was shown in the risk-adjusted-loan-rate determination). Having an allocation of capital to business units facilitates risk adjusted performance measurement such as by calculation of economic profit or EVA (subtracting a cost of economic capital from accounting profits) or risk adjusted rate of return (eg RAROC) relative to some required rate of return. However a fundamental problem is that economic capital calculated using concepts such as VaR is not "sub-additive" (ie the total risk should be less than the sum of individual risks due to less than perfect positive correlation).

There is also the issue of separately calculating economic capital for different types of risk, such as credit and market risk, and then aggregating by summation that may ignore interdependencies between them and lead to an incorrect level of aggregate capital. Breuer et al (JBF, 2010) argue that decomposition of risks of a position (portfolio) into separate credit risk and market risk positions (portfolios) is not necessarily possible. If it were, then (with sub-additive risk measures) the aggregated risk level would generally be less than that calculated but, if not, the aggregated level would understate the actual level, leading to a shortfall of economic capital from what is needed.[4] (As they note, in practice, matters are even more complicated by market risk and credit risk generally being calculated using different time horizons, such as 10 days and 1 year respectively). Alessandri and Drehmann (2010) address the same issue but find that the sum of economic capital for banking book credit risk and IRRBB in their model provides an upper bound to what would be derived allowing for interactions between the two risk factors.

Ita (2017) discusses approaches in 2014 of large global banks to economic capital allocation to major business segments and in his Tables 1 and 2 provide information on methods used. Each of the 7 G-SIBs for which information is available uses somewhat different methods, with regulatory capital requirements playing a significant role (including via allocation based on risk-weighted assets). Three allocate economic capital as a percentage (eg 12% based on aggregate target level) of RWA plus

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4 Their argument is based on the simple depiction of the value of a position (V) depending on two risk factors (credit and market) of (a) and (e). The typical estimation of credit risk would consider the effect of a change in a holding e constant, and vice versa for market risk. However, the change in the position value between date 0 and 1 is $V(a1, e1) - V(a0,e0)$, which only equals $[V(a1, e0) - V(a0, e0)] + [V(a0,e1) - V(a0,e0)]$ if $V(a,e) = V1(a) + V2(e)$ which is not necessarily the case. They provide some examples, such as a foreign currency loan.

deduction items (eg goodwill). Others incorporate (or use exclusively) economic capital calculations done at the business unit level using internal risk-based capital models.

Researchers at the Bank of England have published a report on bank capital allocation based on PRA reviews of bank practices. They describe the] overall process as the bank's strategic plan leading to capital budgeting decisions (identifying which product areas and business lines they wish to expand or contract), allocating (equity) capital accordingly, and measuring performance of business units via comparison of some profit metric against capital allocated. Most commonly, the equity capital allocation involves CET1 capital, although the regulatory measure of that figure may differ from the bank's preferred measure to use. (Regulatory measures and financial accounts measures can vary considerably). In allocating capital to business units, the relevant consideration may be the BU's RWA or contribution to a non-risk-weighted leverage measure, or contribution to stress test outcomes, or some combination of those or other metrics. The PRA review found regulatory capital considerations were the principal drivers of allocations, and that regulatory capital has, since the crisis, tended to exceed banks' own estimates of their economic capital needs.

One approach described was to calculate economic capital based on applying the bank's target CET1 ratio to the RWA of the BU and measure the BU performance by BU profit as a rate of return on allocated capital. If, in aggregate target CET1 is greater than that implied by RWA regulatory requirements, some adjustment to BU target returns will be needed to ensure overall targets are met. Some banks may set the same return hurdle rates for different BUs while others may differentiate them.

16.10   Economic capital allocation and FTP

A simple implementation of FTP leads to business units being "match-funded" generating a balance sheet for the business unit with, for example, loans to customers matched by funds lent by the FTP unit. This leaves no room for equity capital. But in aggregate, A = D + E (some part of assets is funded by equity).

One solution is to make "notional allocations" of equity capital to business units and add a "notional" return on that equity capital to the net income of the business unit. Table 2 provides a simple example in which (for ease of exposition) the FTP rate (r_{FTP}) is the same for all transactions, and the FTP unit needs to raise $10 from the wholesale market at rate r_W. The bank's equity is allocated to business units A and B based on total assets and a notional income attributed to each by applying a specified return on that equity. It would then be possible to calculate the actual return on allocated capital to compare with required return using either EVA or RAROC or some other

performance measure. Both the allocation of equity and the imputed return on equity would affect the performance measure.

TABLE 2: ECONOMIC CAPITAL AND FTP

Unit A		Unit B		FTP		Bank	
A	**L**	**A**	**L**	**A**	**L**	**A**	**L**
Loan 60	FTP 60	FTP 60	Deposit 60	A&B 100	A&B 80	Loans 100	Deposit 80
FTP 20	Deposit 20	Loan 40	FTP 40		Equity 10		Equity 10
					W'Sale 10		W'Sale 10
Notional equity	6	Notional Equity	4				
Net Income		**Net Income**		**Net Income**		**Net Income**	
$60(r_A - r_{FTP}) + 20(r_{FTP} - r_D) + 6r^*$		$40(r_A - r_{FTP}) + 60(r_{FTP} - r_D) + 4r^*$		$100\,r_{FTP} - 80\,r_{FTP} - 10r_W - 10r^*$		$100rA - 80rD - 10r_W$	

An alternative approach would be to adjust the FTP rates to allow for the allocation of equity to the business units. Suppose, for example, that a "pure" FTP rate (reflecting that this was the marginal cost of wholesale funding) was r_w, and the BU was allocated equity equivalent to 10% of its loans. If the FTP pricing involved borrowing from the FTP unit (to finance loans) being priced at $0.9r_w$ and lending deposits raised to the FTP being priced at r_w the following would occur. Unit A would have Net Income of $60(r_A - 0.9r_w) + 20 (r_w - r_D)$. Unit B would have Net Income of $40(r_A - 0.9r_w) + 60 (r_w - r_D)$. The FTP unit would have Net Income of $100(.9r_w) - 80r_w - 10r_w$ (where the last term is the cost of funds raised in the wholesale market). Aggregating, the Bank net Income would be $100rA - 80rD - 10r_W$ as required. Individual BU performance could be calculated as Net Income relative to allocated equity.

The actual process used would affect the allocation of income and performance measures derived.

CASE STUDY: WESTPAC CHANGES TO FTP and Economic Capital Allocation

In a statement to the ASX in 2012, Westpac outlined changes it had made to its FTP system and economic capital allocation process.

"The need to hold higher and better quality capital levels under Basel III has led to a divergence between the economic capital allocated to divisions and the total capital held by the Westpac Group to meet regulatory requirements. This additional capital was previously treated as a residual and held within the Group Businesses. To ensure the Group achieves an appropriate return on capital employed, the additional capital is now formally allocated to divisions, better aligning divisional capital levels to Group Tangible Equity.

The changes reflect a thorough review of risk and return characteristics across the portfolio, including the experience of the global financial crisis.

Key changes in the approach include:

· Capital allocated to divisions has been calibrated to Group Tangible Equity; and
· Certain portfolios, were regulatory capital is higher than economic capital, now receive an additional regulatory capital loading. These portfolios include: residential mortgages; commercial property lending; structured credit (including securitisation) and wealth management.

Changes in capital allocated to divisions principally impacts economic profit and net interest income as operating divisions effectively earn more on the higher capital balances while the Group Businesses earns less. This change also impacts divisional margins; revenues and tax. As part of the changes, divisional net interest margins are now calculated inclusive of the earnings on capital allocated to divisions.

Transfer pricing changes

Changes in funding and liquidity through the global financial crisis have necessitated some changes in how funding and liquidity costs are allocated to products. The prior approach was principally based on average funding costs with overlays applied to reflect the more rapid changes in marginal funding costs.

The new approach embeds a marginal cost approach into the funding cost model."

The effects of the changes are shown in the following tables of divisional results as previously derived and under the new arrangements.

Among the questions raised by this change are the following:

Which divisions gained/lost most from the changes? Why?
How would the "equity charge" be determined?
Why are franking benefits included in the adjusted cash earnings?
How can the net interest income changes and economic profit changes be reconciled?

As Reported in Interim 2012 ASX – First Half 2012 Economic Profit

Six months to 31 March 2012 $m	Westpac Retail & Business Banking	St.George Banking Group	BT Financial Group (Australia)	AFS	Westpac Institutional Bank	New Zealand	Pacific Banking
Cash Earnings	1,049	569	294	1,912	663	257	55
Franking benefit	316	172	86	574	182	-	-
Adjusted Cash Earnings	1,365	741	380	2,486	845	257	55
Average ordinary equity	6,721	5,603	3,486	15,810	6,277	2,439	251
Equity charge	(370)	(308)	(192)	(870)	(345)	(134)	(14)
Economic profit	995	433	188	1,616	500	123	41

Restated First Half 2012 Economic Profit

Six months to 31 March 2012 $m	Westpac Retail & Business Banking	St.George Banking Group	BT Financial Group (Australia)	AFS	Westpac Institutional Bank	New Zealand	Pacific Banking
Cash Earnings	1,001	574	301	1,876	734	267	55
Franking benefit	301	173	89	563	203	-	-
Adjusted Cash Earnings	1,302	747	390	2,439	937	267	55
Average ordinary equity	7,896	5,803	2,839	16,538	7,615	2,659	266
Equity charge	(435)	(319)	(156)	(910)	(419)	(146)	(15)
Economic profit	867	428	234	1,529	518	121	40

	Half Year 2012 Original	Half Year 2012 Restated
Net interest income ($m)		
Australian Financial Services	3,938	4,270
Westpac Retail & Business Banking	2,523	2,617
St.George Banking Group	1,301	1,444
BT Financial Group	114	209
Westpac Institutional Bank	626	881
New Zealand ($A)	538	601
Pacific Banking	65	72
Group Businesses	1,056	399
Group total	6,223	6,223
New Zealand ($NZ)	698	779
Interest margin		
Australian Financial Services	2.02%	2.19%
Westpac Retail & Business Banking	2.13%	2.21%
St.George Banking Group	1.87%	2.08%
BT Financial Group	1.62%	2.97%
Westpac Institutional Bank	1.84%	2.59%
New Zealand ($A)	2.42%	2.71%
Pacific Banking	4.93%	5.46%
Group Businesses	3.08%	1.16%
New Zealand ($NZ)	2.43%	2.71%

Further reading on Economic Capital Allocation and Credit Risk

Rasna Bajaj, Andrew Binmore, rupak Dasgupta, and Quynh-Anh Vo "Banks' internal capital markets: how do banks allocate capital internally?" *Bank of England Quarterly Bulletin* 2018 Q2, https://www.bankofengland.co.uk/quarterly-bulletin/2018/2018-q2/banks-internal-capital-markets-how-do-banks-allocate-capital-internally

BCBS (2015) Guidance on credit risk and accounting for expected credit losses http://www.bis.org/bcbs/publ/d350.pdf

BCBS (2006) Sound credit risk assessment and valuation for loans http://www.bis.org/publ/bcbs126.pdf

Joint Forum (2015) Developments in credit risk management across sectors: current practices and recommendations http://www.bis.org/bcbs/publ/joint38.pdf

BCBS (2010) Vendor models for credit risk measurement and management. Observations from a review of selected models http://www.bis.org/publ/bcbs_wp17.pdf

BCBS (2010) Regulatory Consistency Assessment Programme (RCAP) Analysis of risk-weighted assets for credit risk in the banking book http://www.bis.org/publ/bcbs256.pdf

Baer, T., A. Mehta and H Samandari "The use of economic capital in performance management for banks: A perspective" *McKinsey Working Paers on Risk, Number 24, January 2011* www.mckinsey.com/~/media/.../24_The_Use_of_Economic_Capital.ashx

Basel Committee on Banking Supervision "Range of practices and issues in economic capital frameworks" March 2009 http://www.bis.org/publ/bcbs152.pdf

Appendix: Setting Trading Desk Limits: An Illustration

Dealer trading limits could be related to a VAR model (using a 99 per cent confidence interval for example). For example, the bank determines economic or regulatory capital (= K) to be assigned to a particular activity (eg trading AUD/NZD). Then it is necessary to calculate a VAR* consistent with K which is acceptable. It may be that the bank is happy for the desk to operate at a risk level where VAR* = K, such that 1 per cent of days will see a loss exceeding the capital allocated to absorb the loss. Alternatively it may set VAR* = K/m where m is some multiplication factor (eg 3) such that on 1 per cent of days the loss will exceed 1/3 of the capital allocated.
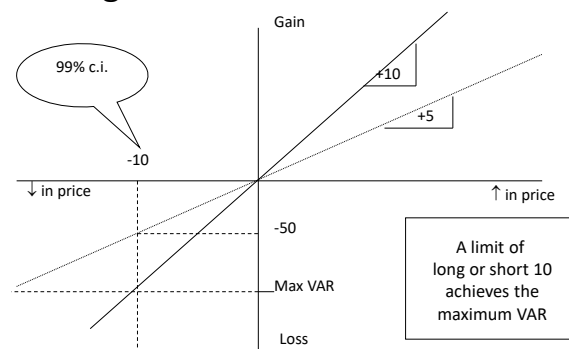
Using the fact that Δ Value of Position = (Position).(Δ Price), then given volatility of price (σ) and 99% confidence limit (2.33σ) it is possible to calculate the maximum open position as

$$Position^{max} = (K/m)/(2.33\ \sigma)$$

Determining Position Limits
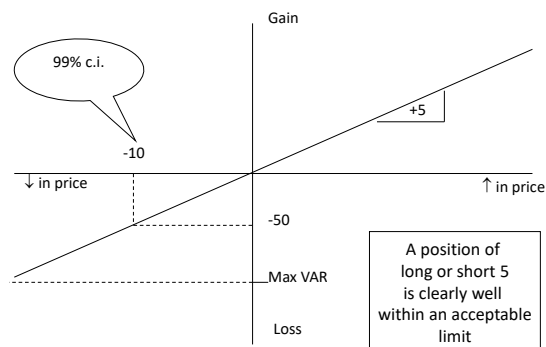
Determining Position Limits

Numerical Example

Economic (Regulatory) Capital Allocated K = $10 mill

- VAR scaling factor (m) = 4

- Maximum VAR (10 day holding period) = K/m = $2.5 mill

- Price volatility = 10% p.a.

- Vol per 10 days = $.10 \times (10/250)^{0.5}$ = .10 x0.2 = 0.02 per 10 days

- Maximum Position = $2.5 mill / (0.02x2.33) = $53.65 mill.

The approach outlined refers to trading limits for an activity such as a swaps or FRA desk.

Two issues

    (i) How to determine VAR for range of products involved in that activity – reflecting correlations across activities. Desk will have positions in swaps of different tenors etc. Sum of VARs not equal to total VAR

    (ii) How to allocate activity limits among traders

- Perhaps assume that all traders on that desk will have perfectly correlated positions (worst case scenario)?