

IAA Risk Book

Chapter 12 - Capital – A Regulatory Management Tool

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1. Executive Summary

The overriding purpose of capital requirements for an insurer is to support the sustainability of the business and fulfilment of its obligations. The comparison of actual capital levels with risk-sensitive capital requirements can act as an appropriate signal or trigger for needed management and supervisory actions.

This chapter addresses the key considerations used in the establishment of capital requirements and links them to other tools, actions and authorities available to supervisors¹ and to management. It is a basic introduction to the design and use of an international insurance capital standard and an aid to understand capital regimes across regulatory jurisdictions such as in supervisory colleges and for investors.

To be effective across all financial entities, actions or triggers need to reflect the actual risk profiles of the specific financial entity in a realistic manner². When using simplified or factor-based minimums set by supervisors, the limitations and objectives of this approach need to be well understood.

A risk-sensitive capital requirement represents a valuable tool to help a company understand and manage actual capital in relation to desired capital and for a supervisor to assess the soundness of the company's actual capital. Such a requirement should effectively address the following fundamental questions:

1. What is capital? This includes the purpose of required capital (reflecting the context in which it will be used and the sources of the firm's capital, whether internal/external or current and future).
2. What level(s) of capital should be held? While in most cases general purpose financial statements focus on value as a going concern, the level of required/desired capital needs to be a function of the underlying risks, the financial statement basis, the time horizon of the risk management/recovery framework (if any) used and the larger context of the supervisory and capital market structure.

¹ Firms in the financial services industry are typically considered to be relatively heavily regulated, i.e. subject to rules on how they must structure their balance sheets and business behaviors if they are to be allowed to continue to operate in a specific field. These rules are set by regulators and monitored by supervisors (although colloquially either term is often applied to either role. There is no universally applied terminology to differentiate between these two activities though we have tended to use supervisor throughout this chapter.

² This is of particular importance as concepts like debt, capital, liquidity and resolution have very different meanings and significance depending on the regulatory and business model environment.

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3. What method(s) can be used to determine the level of required capital? An appropriate level of required capital can be based on factors, historical averages, stress tests, standardized models and/or external/internal capital models. This level will be a function of the desired risk tolerance/appetite, recovery/resolution objectives and available management and supervisory options/tools.
4. What actions are available to the Board/management³ and/or the supervisor if current capital falls short of the level desired by management or required by a supervisor? What are the methods that can be used to access existing capital or obtain additional capital when needed, or to reduce risk exposures?
5. What actions are needed to ensure that sufficient capital is available at differing times and types of stress whether the stress is a one-time shock or a long term bleed? Should quality limits be placed on assets and their location, and if so, can these limits be prescribed without unduly affecting business management?

These five questions highlight the key issues that need to be addressed to ensure that desired capital and required capital are of use to the applicable stakeholder. In any case, it is important for this information to be prepared in a consistent manner to be responsive to the risks of the insurer.

The information in financial reports (including reported and required capital) must address what in some cases are divergent needs of key stakeholders (including shareholders, rating agencies, supervisors, and policyholders). As a result, the quantification of reported capital amounts may be better addressed through the use of a specific-purpose, but still comprehensive, set of financial statements that can enable stakeholders to better assess the current financial strength and soundness of an entity or a group.

Capital level reporting represents only one type of information needed by an insurer's stakeholders to assess its financial sustainability. Its relevance is constrained by the underlying business model of the insurer, the group structure, and the accounting framework applied.

This chapter also includes five appendices that highlight, in some depth, related topics that need to be considered in order to appropriately and consistently apply and coordinate meaningful elements of capital measures for different business models. These considerations may differ for short- and long-duration insurance contracts and for groups versus legal entities⁴. Not addressed here are specifics on coordinating the needed interdependencies for a robust solvency framework

³ The term management used hereafter is meant to include both board and senior management.

⁴ For example, in evaluating capital for an insurance group, it is important to understand the scope of the insurance group includes any non-insurance entities within the group or operating as holding companies for the group. This includes whether non-insurance entities are seen as additional resources to the group or as potential risks to the insurance operations. Supervisors tend to focus on the capital needed to provide for the risks to policyholders faced by the group and its insurance entities. Non-insurance holding companies may hold capital to address other stakeholders' interests such as protecting the interests of the capital providers and other direct stakeholders of the holding company. Similar issues may exist with regard to non-insurance entities within the insurance group.

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that exist between other key Risk Book chapters like Resolution of Insolvencies, Stress Testing and Risk & Uncertainty. They will be explored at a later time. The important specifics that are covered in the appendices to this chapter include:

1. Key Elements That Affect the Meaning and Usefulness of Capital – Detail beyond that provided in the main body of this chapter
2. Building Blocks of Financial & Intellectual Capital
3. Capital Issues for Certain Life (Long-Duration) Business
4. Comparability of Property & Casualty (Short-Duration) Capital
5. Solvency II & U.S. Classifications of Capital

2. What is Capital?

I. Definition & Purpose of Requirements

An insurer's reported capital is a combination of paid-in capital (e.g., through common equity and preferred share offerings), accumulated retained earnings, and in a regulatory context may include subordinated debt⁵. An important question is whether holding company debt and surplus notes are part of capital. For holding company debt, what is the level of consolidation used in financial statements? The conceptual issue is whether the holding company is a fundamental part of the insurance operations, serves as the head of the insurance group or as a resource of the insurance operations. See Appendix 5 for a fuller treatment of this topic. Unlike a manufacturer whose working capital takes the form of physical assets such as machinery and inventory and holds very little risk capital, the insurer's capital is primarily risk capital that is invested principally in financial assets.

Reported equity is, by definition, the excess of assets over liabilities. But, the amount of reported capital will differ depending on the financial statement framework (i.e., the definition of assets and liabilities⁶) and its objectives⁷. The significance and relevance of the amount of reported capital will depend on the business model of the insurer, the nature of that capital, and the objectives (and regulatory environment) of the user of the statements. The extent to which financial statements convey the underlying adequacy of an insurer's capital is dependent on the methods used to value its underlying assets and liabilities.

⁵ Note that reported capital contrasts with the financial economic view, which favors the market valuation of the firm's equity (via share prices) over the equity reported in an accounting statement. For a further discussion of this issue, see Appendix 2.

⁶ Although equity is a form of capital, there are other forms. Subordinated debt is a usually accounted for as a liability but is capable of being classified as a lesser quality (Tier 2) of capital. See Appendix 5 for a further discussion of this topic.

⁷ See Chapter 14 of this Risk Book for a further overview of this topic.

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To this end, actuaries often prefer a more holistic approach, known as a “total balance sheet” approach. This requires that assets, liabilities and capital cannot be viewed individually – any capital evaluation needs to comprehensively assess the combined effect of all these valuations. One way to evaluate capital levels is to base the desired amount of capital as a function of the underlying economic values of the assets and liabilities, and all the risks to which they are exposed. In this context, although reported assets or liabilities may be calculated on bases that are more or less conservative, the assessment of capital must appropriately consider the basis applied to both the assets and the liabilities to understand what is meant by the level of reported and/or targeted capital. While it is desirable to have all elements of the balance sheet valued consistently, some amount of valuation inconsistency can be addressed by the capital framework as long as it is identifiable, capable of assessment and has a manageable effect on capital requirements. Other methods to assess/estimate capital sufficiency such as through cash flow testing can also be useful.

Each type of financial statement is designed with certain objectives in mind. Insurer stakeholders will use the financial statement that best addresses their own purposes or needs. The use of a different lens, presumably for another purpose (e.g., regulatory versus public reporting), will yield a different reported amount of capital on which to assess capital adequacy.⁸ This in turn may impact the regulatory decision regarding the desired “required” levels of capital. These various definitions and purposes of capital measures may be used to indicate:

- Financial strength – used by investors, rating agencies etc. to assess relative strength among insurers, often at capital levels well above minimum regulatory requirements. Both the management of a company and its supervisors share the objective that the firm be able to fulfill its obligations (benefits, claims and expenses). Given that certainty is not possible, the real issue is what levels of relative assurance (whether expressed in terms of VaR, T-VaR or other quantitative and/or qualitative measures) are desired by the company and/or the supervisor⁹.
- Degree of a solvency buffer – to assess whether an insurer has a sufficient level of available capital to meet policyholder obligations with a high level of confidence over a pre-determined risk shock horizon. Liabilities are inherently uncertain because of the nature of the insurance business – i.e., the assumptions underlying the provisions being promised cannot be “known” (only estimated) in advance. Historically, liability requirements were set in many accounting paradigms at a level to provide for reasonable/plausible deviations due to uncertain assumptions. Capital requirements were then set to address very unlikely, but possible outcomes.

Since outcomes are uncertain, capital is required to increase the probability that the company will be able to fulfill its obligations, including the payment of future benefits

⁸ Some classes of assets (capitalized software, over-concentrations, various forms of debt, internal investments, etc.) may be routinely disallowed for supervisory purposes.

⁹ A secondary concern in some jurisdictions is that increasing capital requirements will also result in higher premium rates or a lessening of the coverage offered.

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and claims. This enhances policyholder security. Two ways of thinking about choices made to assess capital are that the capital determination needs to consider the possible deviations between (1) the current estimates of assets and liabilities on the current balance sheet and (2) their continued uncertainty and volatility over future time horizons¹⁰. Whatever measurement method and target are selected, the calculations can never be as precise as implied by a specific number determined as an x% or y% confidence level. For this reason, an important consideration is whether the measure used can correctly identify companies that are at an unacceptably high-risk of not being able to meet their future obligations and so enable supervisors to intervene before that becomes a reality. This differs from merely wanting to rank the relative strength across insurers.

- Amount of funds available for future growth, limited liquidity needs and/or fluctuations in earnings. While under normal circumstances an increase in capital can be obtained when needed, the ease of access to additional capital under stressed situations is an important consideration.
- A source of future shareholder dividends and (in the case of surplus capital held on behalf of with-profits or participating policyholders) a source of support for future bonuses (i.e., policyholder dividends/bonuses). Both management and supervisors of insurers distinguish between balance sheet capital which reflects the excess value of assets over liabilities¹¹ and “required capital”. Required capital is the minimum amount of admissible regulatory capital that has to be held to offset and safeguard against significant adverse events, including the potential inadequacy of currently reported liabilities and possible worse-than-expected experience on policy liabilities. The excess of reported capital over a required capital floor is usually referred to as “distributable capital” or surplus. If companies keep what is seen by its shareholders as “excess capital” on their balance sheet, that company will often be pressured to invest/use it for an enhanced risk return or return it to its shareholders.

Determining the adequacy of the insurer’s capital is a primary responsibility of the insurer. It is the insurer that prices and underwrites/selects the specific risks it will cover, typically based on specific models for those risks. However, as a safeguard, supervisors often define standardized (perhaps stress-level or factor-based) capital requirements as a basis from which to trigger important intervention and control measures. Thus, smaller insurers may evaluate capital relative to only supervisory or rating agency requirements/demands, but larger insurers may have the resources to consider a variety of perspectives, some of which may require more complex

¹⁰ A further question to explore is whether a more helpful measure of capital resiliency could be how to determine capital for these two methods separately instead of combining all risks into one aggregate number.

¹¹ As mentioned previously, this also needs to consider whether holding company debt/surplus notes are considered capital or a liability. For example, for a gone concern objective, a surplus note would not be repaid. But, for a going concern objective, it would typically be expected that the assessment consider it will be repaid.

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measurements. For example, larger insurers generally try to develop their own internal view of capital adequacy. In theory, such an insurer considers the economic value of its assets and liabilities on a consistent basis as part of its internal analysis, such as through an economic capital model. Many insurers use pragmatic approximations that make use of values in their financial statements (which may or may not use consistent valuation bases and/or include explicit or implicit conservatism) as a base from which to assess the adequacy of their capital.

It can be important to demonstrate capital adequacy, not just in the near term but also over the life of the insurer's policyholder obligations and business plan. These different time periods are sometimes referred to as current financial position assessments in contrast with future financial condition assessments. There are important differences between these two perspectives on capital. The latter is typically focused on how to best manage and maintain the entity as a "going concern". The former may be focused on a "gone concern" (or runoff) perspective to ensure all benefits and claims can be paid if the company is closed for new business.

II. Time Horizon of Liquidity, Required Capital & Instruments Eligible to Meet Those Needs

Historically, insurance capital requirements have been "telescoped" into a current date requirement for all future shocks, whether they may be due in days, years or decades. Unlike banking, there has not been (with some notable exceptions) a specific regulatory requirement for liquidity¹². The exploration of (and possible future specific requirements for) insurer liquidity requirements contrasts with required capital, which requires a more nuanced recognition of the investment time horizon needed for various types of risk capital and the potential timing of insurance demands for cash. In addition to liquidity concerns, possible concerns relating to time horizons with regard to risk capital requirements include as considerations (a) the number of years of new/renewal business, (b) the number of years of low interest rates or high inflation, (c) the number of years of mortality improvement assumed, and (d) the number of years of exposure to natural disasters.

For example, in the case of life insurers (and other long-term insurance commitments), adversity may arise from one or more factors with distinct implications for the needed type of capital.

They include:

1. Situations of increased surrenders, where assets supporting liabilities may not be sufficiently liquid to provide funding for a few weeks or months. Only recently have some firms begun to separately test for liquidity risk as distinct from their risks for longer term capital needs;

¹² U.S. NAIC IRIS ratios for P&C companies do assess liquidity. (IRIS ratio 9 is adjusted liabilities divided by liquid assets.) Hence, while there may not be a liquidity regulatory requirement, there is ongoing supervisory monitoring of this risk. In addition, Solvency 2 includes a liquidity test.

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2. Use of capital to address (and recover from) rare insurance events like the Spanish flu epidemic or an unusual combination of events (whether insurance, operational and/or economic related over periods of months or several years); and
3. Financing the present value of cash flows due to the impact of adverse development in long-duration options and guarantees (which can exceed 30 years beyond the present date).

For property/casualty insurers (and other short-term insurance commitments), such adversity may arise from one or more factors, including:

1. Medium-term needs due to the underwriting cycle, operational risks, a paradigm shift in the business model or competitive environment, and mass tort or other slowly developing or emerging issues (that may include unexpected legal rulings).
2. Short-term needs typically from catastrophes, weather, or other event-driven items. Even here, these are typically medium-term cash needs (as payouts usually occur as property is rebuilt over time, not at the time of the incident)¹³. However, establishing liabilities for the incurred, but not yet paid, claims will reduce the next period's reported capital with the possible need to then access additional capital.

And finally, both types of insurers may have to maintain sufficient short-term liquidity or funding for obligations due to:

1. Required posting of collateral triggered by external events or changes in ratings of firms;
2. Securities lending activities; and
3. The repayment of debt to a bond holder and/or parent company. This is typically subject to regulatory approval if solvency levels are not above minimum requirements¹⁴.

The above distinctions in time horizons are rarely reflected in current insurance capital requirements¹⁵. Although liquidity can be a distinct feature in Enterprise Risk Management (ERM) frameworks where it may be a significant issue, the distinctions are also sometimes

¹³ An example of this from one P&C company shows that the average payment lag for their events ranged from 3 months to 12 months, with the bigger and more concentrated events having longer average time until final payment periods. Commercial lines also have average payment dates about 3 months or longer than personal lines. These are also averages for large tropical windstorms – major earthquakes tend to have longer average payment dates (due in part to more delayed discovery of damage). These are average payment dates – some payments take place several years after the event for the largest events, generally for commercial property lines. Hence, while some payments do occur before construction is complete, payments do not occur in full the instant the event happens. The quickest payments are for emergency living expenses, with construction costs strung out over the period of construction in many cases.

¹⁴ This issue can be significant for firms (either life or non-life) that invest in more illiquid assets in the search for yield, invest in financial instruments to hedge or reinsure risks which lead to large capital requirements.

¹⁵ One exception was a decision by OSFI (Canada) in late 2008 to modify required capital for long-duration options embedded in segregated funds/variable annuities.

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addressed in other regulatory requirements such as restrictions on the use of certain asset classes or their admissibility as capital. This chapter further discusses the fine-tuning and interaction of liquidity risks, the time horizon of the liability risk exposures, the financial capital allowed to be used to address them and the management and regulatory options needed for their interactions. This includes the means to replenish capital and the type of instruments actually held to address the capital needs of the organization based on the above exposures. (See Appendix 5 for how this is dealt with in the EU and the US)

3. Levels of Capital

There are several balance sheet elements subject to risk and uncertainty which are reported on and need to be monitored, reflective of different stakeholder objectives:

1. Liabilities. They use a baseline of the expected obligations and the uncertainty of their estimate. This may be determined as a single conservatively-set liability or a calculation of a best estimate plus an explicit reflection of a risk-based or conservatively prescribed margin. Alternatively, this may be done by focusing only on expected cash flows for the liability with any risk and uncertainty in the liability considered in the other element (i.e., capital).
2. Required Capital. This is held to reasonably ensure that obligations can be fulfilled (even in unusual and/or stressed circumstances). Open to clarification is the time horizon for which this needs to be calculated. For example, it could also be used to address recapitalization to cover future risk events based on today's market parameters. Capital provides a buffer against tail risks – risks that have a low probability of occurrence. Some of these (e.g., severe weather events, pandemics) can manifest themselves catastrophically over relatively short periods of time with little effect in later periods. Other tail events may manifest themselves through a material change in a key assumption in the insurer's business¹⁶. While these two examples of tail risk are not exhaustive of all possibilities, they can be helpful to visualize the implications of a time horizon for a capital requirement. Additional considerations include:
 - a. Risk horizon of one year. It is frequently chosen by insurance supervisors for setting capital requirements, as this time period is felt to coincide with the length of time it might take for all parties (insurer and supervisor) to identify and deal with a solvency-threatening situation. The capital requirement must therefore consider tail risks that present themselves as material economic losses within the risk horizon of one year, regardless of when the adverse cashflows are expected to

¹⁶ Examples include mortality or disability/recovery rates, policyholder behavior assumptions, claim development or asset yields, to name a few significant ones.

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occur.¹⁷ How does this include impacts of the risk after one year? Whether or not the troubled insurer's business is to be transferred to another insurer, the entity would need sufficient assets to provide for the post-shock assumptions, some of which (as noted above) may have suffered continuing impairment due to the tail event. Broadly, this is achieved by modelling changes in assumptions whose impact goes well beyond the end of the current period¹⁸. To the extent that further impairment of an assumption is likely, it should be reflected in revised current reported numbers or be smoothed/graded in over time.

- b. A market-based credit risk capital charge for a thirty-year obligation. In the event of an immediate market crisis, should the application of capital to cover today's credit risk event(s) be accompanied by an immediate need to require additional capital (in case there is another major crisis that lasts over the remaining 30 year period of the obligations)? Or, should the capital charge only reflect perceived changes in the long-run default rates and their volatility? In the former case, it means that capital is actually never used; it must continue to be replenished.

Typically, the determination of a required capital level involves determining a level at which the legal authority to run a company may be transferred from management to a supervisor. As such, there is a need to have an objective basis for its determination, often more focused on the runoff value needed for an orderly resolution¹⁹. An important specification to be addressed is whether there is a single goal of the process – i.e., is the liquidation meant to only run off existing obligations or is it to attract another investor to take over the ongoing operations (and distribution networks of a legal entity)? Or (in the case of a group), is the goal to sell the group as a whole or to just sell certain segments of the group?

3. Internal target capital is held by management above a supervisory standard to avoid supervisory intervention and to enhance public trust in the promises made in inforce and future products/sales. Desired public trust is often reflected in and managed by focusing on and addressing rating agency requirements. This includes assessing management's ability to continue to add value (i.e., a going concern objective).
4. Additional free/excess capital is available for new business, acquisitions or distribution to shareholders.

¹⁷ Unfortunately, future economic losses can only be estimated, and the size of the estimated loss will vary as the market changes. Thus, an important consideration is to look past the economics to the underlying extent the asset and liability cash flows diverge.

¹⁸ It may not be reasonable or practical to expect one risk measure (i.e., capital requirement based on a one year time horizon) to capture all the nuances of risk. Other tools can and should be used to enhance the understanding of the longer-term impacts of various risk scenarios and their associated uncertainties on an insurer's solvency. These tools include stress/scenario testing and ORSA, among others. The capital requirement alone is not the optimal solution to certain types of risk, where requirements for mitigation systems (e.g., cyber security or effective management of policy options) may be a more effective regulatory requirement.

¹⁹ It is often referred to as the "liquidation value".

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These four levels to assess liability risk and uncertainty are not necessarily additive, with additional nuances for capital at a group versus a subsidiary level, since where the capital is held and the ease of raising additional capital (whether internal to a group or in the external market) are important factors. Capital expected to be used to cover possible increases in current liabilities can also be used to pay higher than expected future benefits or claims instead of being used to support an expansion of new business or an acquisition. In addition, regulatory focus on a required capital target will focus on the ability to pay benefits or claims and, possibly (in certain jurisdictions), to provide enough of a margin for a risk premium sufficient to allow another company to take over the obligations while assuming the assets backing the liabilities and capital.²⁰ This will typically be a lower aggregate required capital amount than what management would focus on in order to maintain and/or increase a rating or to ensure desired growth.

The sole purpose of some regulatory capital requirements is to identify insurance legal entities that are poorly capitalized and at risk of failure. As such, those systems have not been designed to evaluate groups, rank companies or assess how much capital is “redundant” - relying on other supervisory metrics or tools for those tasks. This allows for a greater relative acceptance of imprecision in the use of calibration, factors and methods where approximations and/or simplifications may be used.

Typically, different capital levels are used as triggers or guideposts for appropriate regulatory actions and may also be used to initiate management actions. Their calibration and calculation depend on the methods used to calculate the value of assets and liabilities, as well as the agreed upon risk tolerance of the regulatory body²¹. Thus, the following (shown from highest to lowest capital level) illustrates the wide diversity of required capital purposes, goals and definitions for capital adequacy and what capital might signify.

1. Shareholder Perspective - Sufficient²² assets to continue operations as a going concern and to maintain (or enhance) the insurer’s internal capital target. Typically, such a target would meet or exceed any supervisory expectation and desired rating by a rating agency and would be managed along with other shareholder objectives.
2. Supervisory Scrutiny Trigger - assets relative to liabilities and ongoing business operations are sufficient to continue operations, but accompanied by specified minimum levels, that if breached, invite/require supervisory scrutiny.²³ Typically,

²⁰ This is often addressed through requiring a Margin Over Current Estimates (MOCE) or a risk adjustment. Issues associated with this topic will be addressed more fully in a separate IAA project.

²¹ The efforts at international financial reform and standards include discussions on the risk tolerance of supervisors based on size of regulated entity and type of business.

²² An informal acceptable definition of “sufficient” is that with a high level of certainty, the future cash flows/benefit obligations can be paid at (or perhaps very close to) full value

²³ Scrutiny is warranted not only when a certain level is reached based on the insurer specifics (i.e., not just a broad average ratio applied across the industry) but also when an insurer’s ratio shows a noticeable unexplained drop in the recent period that is out of synch with the market or a risk adjusted benchmark.

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management and shareholders are strongly incentivized to hold capital in excess of this early warning trigger level.

3. Supervisor's Level of Mandatory Direct Intervention/Control – typically based on the ability to provide for the technical provisions and a supervisory minimum amount of required capital. This reflects the supervisory risk appetite to avoid failure of firms to meet their obligations, whether as a legal entity or as a group.

The following are examples of historically used measures of “degree of sufficiency” for capital and balance sheet resources. They differ based on the accounting/capital framework and on the supervisor’s philosophy and the resolution tools that accompany the framework. They all have value in some situations and they each have unique limitations which need to be addressed via the larger supervisory governance framework:

Regulatory Benchmarks:

1. 99% TVAR over a 1-year risk horizon (OSFI);
2. 99.5% VAR over a 1-year risk horizon (Solvency 2);
3. Cover 2-3 standard deviations over a 5-year period (some aspects of the NAIC):

Management Benchmarks

1. No more than 5% chance of a loss greater than 10% of surplus in any one year;
2. Probability of ruin (or business model failure) less than or equal to 5%;
3. Whatever capital it takes to get an “acceptable” rating from one or more rating agencies;
4. Whatever capital it takes to satisfy the regulatory regime such as the Bermuda Monetary Authority, OSFI, or Solvency II;
5. Whatever specified level of capital is required to avoid increased regulatory scrutiny (a higher standard than regulatory intervention); or to reduce the probability of regulatory scrutiny to a low level (further margin);
6. Operating requirements specified by management over a short-term period, during which fluctuations in material external and internal variables are within a desired range;
7. Specific operational goals under extreme stresses as proposed by management or supervisors; and
8. Assets greater than or equal to liabilities after extreme, improbable events (e.g., through stress testing).

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Additional questions or considerations that influence what capital requirement is measured/assessed include:

1. Is the debt issued by a non-insurance holding company treated as a liability or as capital that has been contributed by a parent with no legal requirement for the subsidiary to repay? (See Appendix 5 for further details.)
2. Is the required capital level meant to ignore or give credit to diversification (whether within an entity or a group)?
3. The important legal and operational differences between required capital at a legal entity level and at a group level where fungibility and the trade-off between the value of increased diversification and increased systemic importance will come into play.
4. If adjustable insurance products (e.g., participating with bonuses or dividends or loss sensitive non-life products) pose reduced risk to the insurer, how should this be reflected in the determination of technical provisions or capital requirements in comparison with similarly designed, but fully guaranteed, products? For adjustable business with mitigation features, valuation assumptions for technical provisions (especially for discounting) need to be consistent with the basis used to project future policyholder premiums and benefits. To do otherwise produces nonsensical results.

When bonuses (policyholder dividends) are, or may be likely to be reduced, to zero or close to zero, the technical provisions must be sufficient to provide at least the guaranteed benefits, which may imply use of a discounting basis appropriate to guaranteed benefits, with little allowance for adjustability. Equally, capital requirements for adjustable products with mitigation features, while they should usually be less than those for similar fully guaranteed products, may need to reflect real world constraints on the full usefulness of their adjustability. Those constraints might include, for example, the need for regulatory approvals in some cases for premium adjustability; and/or competitive pressures from other insurers which might inhibit drastic action in (say) reducing bonuses or dividends. The ability of insurers to reduce benefits, or increase charges, may also need to take into account relevant conduct of business legislation, and the current views of conduct of business supervisors, which may mean that there are constraints compared to what was envisaged when the product was sold. (See Appendix 3 for a further discussion of these products).

5. Should liabilities be valued on a guaranteed basis using risk-free discount rates, or on a real world/fair value basis based on portfolio yields for products with bonuses or dividends?

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How each question is answered will then determine the most effective qualitative assessments and processes needed to complement and mitigate the strengths and weaknesses of the chosen framework.²⁴

4. Methods to Calculate Required Capital

Once the objective(s) and basis for capital are agreed on, the needed criteria and parameters for setting a required/desired capital level (whether for supervisors or management) can then be determined using the following considerations.

1. The point in time at which capital adequacy is measured. Typically, this is at the financial statement valuation/reporting date, but it may include a projection of possible capital needs at future points in time.
2. The time horizon over which capital adequacy is measured.
3. The specific entity, subsidiary(-ies), branches, non-financial entities and conglomerate for which capital adequacy will be measured.
4. The criteria by which capital adequacy and “available” capital will be determined. The definitions used for the baseline liabilities (and assets) in the balance sheet will affect the corresponding basis and meaning of the required capital. There can be important differences for reflecting the level of risk and/or types of uncertainty in the liabilities and assets held by the company. For example,
 - a. IFRS and U.S. GAAP – Historically these general purpose financial reporting standards have been income statement focused, to reflect a company’s revenues and expenses within a reporting period and to allow performance comparisons to be made with other companies and industries. Depending on the accounting standard used, liabilities for long-duration contracts may be book-value based, market-value based or based on account or surrender values. An adjustment for risk may be included in the value of insurance liabilities. Assets are typically valued at fair or market value (unless designated as Held to Maturity, for example). There may be greater or lesser inconsistencies between the valuation of assets and liabilities as a result of the options within the various systems. The

²⁴ In concept, companies and supervisors want to have similar conceptual levels of provisions and capital.

Where this begins to diverge rests on several risk-related topics, such as:

- Available capital (i.e., different components not viewed as having the same strength in times of crisis, such as deferred tax assets);
- Risk diversification (i.e., supervisors may take a range of views on the appropriate treatment of diversification either within risk or across risk categories);
- Capital fungibility (e.g., across companies, geographies, and currencies); and
- Whether margins over current margins (or risk margins) are considered liabilities or part of available capital.

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impact of these options needs to be addressed if the baseline is to be made consistent between entities and groups.

- b. Market value balance sheet – The focus is on the balance sheet where equity is defined as the result of reflecting current market values of assets, liabilities and guarantees. Here, the consistency of valuation is relevant for participating/discretionary value products and for benefits not exposed to liquidity calls. Insurance liability values typically include a risk margin for the cost of holding capital due to the possibility for adverse experience and the uncertainty associated with the liability estimate. There may be some circularity here, as the “cost” of capital that may be included in the measurement of the liability will be a function of the chosen capital target. (This issue is typically addressed through the use of a few simplifying assumptions). The concept of a risk margin can be theoretically similar to that of a MOCE, but its application in an income statement may be to reliably report its release into income as opposed to a true measure of the transfer value.
- c. US statutory – Typically for life insurance, both assets and liabilities have been valued on a book value basis. However, to the extent that cash flow testing leads to larger liabilities, the liabilities have been based on best estimate assumptions with additional conservatism built in to hold more assets to back the liabilities. Recently introduced Principle Based Reserves for life insurance incorporate liabilities based on best estimate assumptions with additional conservatism in all cases. General insurance claim liabilities are valued on a best estimate, undiscounted, basis, implicitly reflecting a risk margin (which may range from immaterial to significant depending on the length of the discounting) to the extent the time value of money effect exists.

Each framework has its own unique (and overlapping) areas of greater and more material impact. For example, historically, liabilities for life/annuity products have been estimated by means of factors reflecting conservatism (in policy assumptions and interest rates) based on past aggregate industry experience (with actuarial experts determining if and when more is needed). Or the liabilities may be based on risk-specific internal models²⁵. These liabilities may then be reported as book values, account values or market values, with varying levels of discount rates.

- 5. The capital calculation itself. Typically, required and/or target capital is based on a measurement of the potential adverse deviation in assets and liabilities in stressed conditions and future underwriting experience (in the case of non-life business).

This is typically carried out by modelling, designed to test the adequacy of capital in terms of the chosen target level of sufficiency. Alternatively, the calculation may be

²⁵ These models will be exposed to varying degrees of model risk based on the soundness (or lack thereof) of the modeling process.

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based on a simplified formula intended to produce amounts that more broadly correspond to simple measures of risk. However, the parameters of such formula-based systems are usually calibrated by reference to results of more complex modelling work on an industry-wide basis.

In all but the simplest formula-based approaches, calculation techniques for testing capital adequacy involve assessment of the impact of a range of stresses on the entity concerned. This assessment usually includes a range of stochastic components. Simulation techniques are often used, especially in cases where options exist in either the liabilities or the assets or for low frequency/high severity risks such as catastrophe exposures. These calculations can involve modeling the impact of significant adverse deviations in many of the assumptions on which current estimates of the assets and liabilities are based, and can take into account observed risk distributions and correlations between risks, as well as secondary impacts such as taxation.

The deviation of the net asset position of the entity resulting from the adverse stresses is a measure of how much loss the entity would incur in materially adverse, but plausible, conditions, and hence gives some measure of what level of capital would satisfy the chosen sufficiency criteria, within the specified time horizon.

6. Assessment of the level of aggregation used in capital requirements. For example, can one or more subsidiaries individually fail a capital adequacy test, while the overall group passes? Or can the overall group fail when each subsidiary passes?²⁶ And, how can/should differing local regulatory regime capital requirements aggregate at a group level?
7. If required, determination of where the additional required group capital should be held and under what circumstances it could be available to be used by other entities within the group.²⁷

²⁶ For example, in 2008 AIG failed at a legal, non-insurance, entity level, but likely had adequate group capital. Also, at what level should the aggregation occur for the “group”, since a conglomerate may well have little need to do this at the ultimate holding company/ownership level? More discussion of this topic occurs in Chapter 8 of the Risk Book (on Groups) and in Chapter 11 (on Resolution of Insolvencies).

²⁷ See chapter 8 on Groups and Chapter 11 on Resolution of Insolvencies for further considerations.

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5. Actions Linked to Lack of Achievement of Required Levels

B. Regulatory Powers

The following regulatory powers are often linked to situations in which certain levels of supervisory target and/or required capital are not achieved. They are described more fully in Chapter 11 - Resolution of Insolvencies:

1. Require management to develop an action plan that includes actions to increase capital and/or de-risk the firm (e.g., by selling assets or lines of business, by raising external capital or buying a catastrophe reinsurance policy);
2. Require additional reporting and supervision;
3. Limit or discontinue sales and approve revised products and/or pricing targets;
4. Eliminate/reduce dividends to shareholders;
5. Modify required levels of capital or classifications of capital ;
6. Liquidate/runoff (resolution) the insurance company and its obligations. This is usually seen as the last step in an escalating series of supervisory actions as capital weakens. This may include or be preceded by a temporary suspension of benefits and/or an adjustment of the amount of benefits to be paid;
7. Identify and negotiate a change of management for the company with the possible aim of taking over the management and administration of the failed insurance block or company; and
8. Transfer the assets and liabilities to a compensation or policyholder guarantee scheme.

The intervention level required by insurance supervisors for each of its multiple regulatory options is a function of the level of capital that must be held by the insurer. These levels reflect the additional risk elements/factors related to the risks of the insurer's assets and liabilities and ongoing operations. Typically, this is meant to ensure that in most scenarios (the level of uncertainty of which will depend on the risk tolerance or supervisor's preference), there will be sufficient funds to meet all applicable obligations considered essential by the supervisor and/or resolution authority²⁸. One possible result is that shareholders are left with no funds after all policyholder obligations are met. Another possible objective could be to ensure the continued survival of the firm on an ongoing basis to help ensure a competitive market; with or without a transfer of business to another insurer.

The above actions focus on what supervisors can do if capital falls short of targets. In addition, the following preventative measures can be used by supervisors to assess ahead of time an insurer's ability to maintain adequate capital in times of stress:

²⁸ While each jurisdiction's insolvency/bankruptcy laws vary, a likely order of priority might be: (1) Policyholder guarantees, (2) Margins for an assuming company while paying off the future claims, (3) Policyholder dividends or non-guaranteed elements, (4) Creditors, and (5) Shareholders)

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1. Define the types of capital instruments (and their tiering) allowed in the determination of “available capital resources”
2. Review relevant insurer materials (e.g. ORSA and other materials) used by management
3. Supervisor initiated stress tests, either on the industry or on specific insurers
4. Supervisory direction to insurer(s) to maintain higher capital levels due to risks not adequately captured in current capital requirements

C. Management Actions/Powers

For its part, management will want to use the following actions to avoid triggering the regulatory powers and actions listed above:

1. Target how much capital is desired above regulatory required capital for it to remain an ongoing operation (not just a runoff operation) and to be in a financial position to attract or qualify for additional capital;
2. Manage the available options to raise capital or reduce capital requirements (e.g., from its parent, the capital markets, sale or reinsurance of existing blocks of business and by control of new premiums/sales);
3. Assess which lines of business provide the optimal amount of profitable (or less risky) return on their invested capital;
4. Manage each individual line of business product and asset levers in a changing risk environment;
5. Understand how volatile are the risk measures for capital charges in dynamic economic environments; and
6. Determine the level of sustainable shareholder dividends and policyholder variable bonuses or dividends that can be declared without impairing the desired level of retained capital.

Management typically targets a level of capital to avoid regulatory intervention or to meet a rating agency target. However, management also has a responsibility to communicate to shareholders how they will receive a reasonable return on their invested funds through the emergence of profits on profitable policies sold by the company.

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APPENDIX 1

Key Elements that Affect the Meaning and Usefulness of Capital

Capital is one of several essential tools used to help ensure, to the extent possible, sustainability and it needs to be considered in that context. Capital is not the answer to every risk management situation.

Key elements and considerations that go into a sound program of capital management include the following:

1. Solvency measurement reflecting a policyholder perspective should reflect real economic risks²⁹. Only risks that affect the insurer's ability to meet its policy obligations should be provided through required capital, e.g., where assets are held to provide cash flows arising from long-term illiquid liabilities, these assets are typically not subject to forced sales; therefore, while spread risk may not be economically relevant, asset default risk is. Reflection of risks that are relevant to the particular insurer's business model contributes to efficient regulation in a macroeconomic sense and also provides adequate risk management incentives. This topic is extensively covered in the IAA Blue Book (2004).
2. What is the risk appetite of the supervisor and/or management? For management this means to have a clear view of their risk appetite for such factors as business failure, risk type, regulatory intervention, and loss of franchise value (See Chapter 4 on Operational Risk for more details). This may be specified in terms of the measure of adequacy to be used, the timeframe, and a basis for the stressed risk parameters that drive the calculation. For the supervisor this includes the question of whether its objectives for intervention include a going- or gone-concern solution and the combination of quantitative and qualitative requirements used to support that intervention objective.
3. Distinguish inadequacy of required capital from cash insolvency. A failure to satisfy a regulatory required capital target represents an early warning marker for more intensive oversight or action. It would very rarely indicate that the company is insolvent on a cash/liquidity basis. Rather, it means that additional capital may be needed, now or at a future date, for the possibility that assets currently held for future risk(s) are not ultimately sufficient to meet policyholder obligations.

²⁹ One complicating factor with systemic implications beyond the risks to the entity is the ability for a solo entity to upstream cash to repay debt that was originally down streamed may be a risk to its parent and the larger economy. This question needs to be addressed for its possible implications for financial stability, not in terms of policyholder protections.

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4. Address the pro-cyclical nature of market based capital requirements. Market based capital for financial risks mirrors the riskiness of the market and thus is pro-cyclical, indicating that, in times of stress, more capital will be needed, particularly if the major risk faced is financial risk. This need therefore tends to arise when capital is more expensive (or more difficult) to obtain. If liquidity risk is of minor importance, this indicates that some countercyclical or smoothing approaches might be valuable. One driver of this pro-cyclicality is credit spread changes impacting market values. For illiquid liabilities with longer horizons, a more appropriate charge for credit risk represents a prudent level of default costs, since ultimate asset values, absent a forced liquidation, are not impacted by credit spread changes over the life of assets.
5. Understand the uncertainty of capital estimates. As mentioned earlier, the use of models can often provide more relevant and reliable measures of exposed risks than historical averages or factors. This is because models provide insightful approximations to the range of plausible values around the estimate, as well as the drivers of the range. This includes unlikely, but still possible, results; and it is based on estimates of future risk and volatility rather than past experience. This information is often more important than current best estimates. For well-defined and stable distributions of risk, there has been a progression in risk assessment over the last decade from the use of VaR to TVaR (to understand the likelihood and significance of the tail risk beyond the cut-off point). A caution is that in the tail, the distributions and correlations are often less defined and stable. Hence, for solvency purposes, there is an increased need undergo specific scenario analysis of the tails to isolate and assess the key drivers of that result. Thus, setting legally binding capital intervention levels works well for more easily determined capital charges, while stress/scenario testing (see Chapter 20) and the use of catastrophe models (see Chapter 5) may be more appropriate for tail events with uncertain probabilities. Stress test results could then be linked to either product limitations or resolution/recovery options. This concept is also touched on in Chapter 17 Risk & Uncertainty.
6. Recognize that well-designed capital requirements lead to better risk management practices. For example, market value based capital measures encourage the use of effective hedges. Operational risk capital charges based on historical events alone may lead to pro-cyclical charges, typically misaligned with the actual risk exposures and practices of a company (See the Operational Risk chapter 4 for more insight on this).
7. Coordinate treatment of Deferred Tax Assets (DTAs) with the rest of the solvency and tax framework being applied

Are DTAs a dependable asset in the case of a troubled company? Maybe. Some of these DTAs arise from the use of discounted claim liabilities for tax purposes. In some jurisdictions there are statutes that claim these DTAs do not expire or can be converted to cash after a certain number of years, although it is not known whether these are reliably tested in a troubled insurer situation. Some jurisdictions have what is known

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as tax carrybacks that allow a previous payer of tax to recover previously paid amounts in the event of taxable loss the following year. Tax carrybacks would appear to be potentially available even in a troubled company situation. It is less clear whether DTAs that rely on future taxable income are a viable asset for a future troubled company. In summary, it may be appropriate to allow reflection of DTAs in the calculation of capital to the extent they can be converted to cash in the future despite unfavourable results. DTAs that require future earnings to be recoverable as cash could be disallowed as part of capital unless they could be recovered in a runoff scenario. . Similarly there may be restrictions on assuming recovery of DTAs against profits from future new business or profits in another group company.

8. Distinguish group vs. legal entity capital. What are the important considerations and differences between required capital for a legal entity and required capital for a group which may cross several regulatory jurisdictions and may contain more than insurance entities? The early development of required capital looked for objective measures to facilitate a legal right to transfer management of a company from the shareholders to the supervisor. However, entities have grown in complexity and in diversity across countries. This has several implications, including:
 - a. Capital calculated at a group level will not usually capture the extent that capital may not be fungible across the organization when it is held in different jurisdictions around the world, instead of at a parental level. Regulatory actions may have also an impact on its fungibility.
 - b. A consideration for this issue is the location of the DTAs within the group and the extent to which the group files consolidated tax returns. Where a consolidated group tax return exists for a jurisdiction, tax treaties may exist among group members such those with a stand-alone tax liability would pay part of that tax liability to other group members with negative tax liability. This would make DTAs for those group members more likely to be recovered. In contrast, a DTA might exist in a jurisdiction within the group that does not contain other group members with probably future tax liabilities; hence the group may have a more difficult time recognizing the tax liability. In short, the recoverability of a DTA may be a function of its fungibility across jurisdictions/entities based on its location by jurisdiction within a group.
 - c. There may be a potential for raising capital through the sale of specific subsidiary entities while still retaining the viability of the parent (as was done at AIG in 2009 by selling off subsidiaries in Asia).
 - d. The ability to legally transfer ownership of the entire group across regulatory jurisdictions may be difficult to achieve at a group level.
 - e. The possible required use of more individualized risk models may be of greatest benefit to supervisory colleges which oversee the diverse entities of a group so

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they could more proactively assess and manage fungibility in stressed environments and then apply the appropriate set of regulatory powers to various stress events to the group.

9. Reflect Business Model Considerations

- a. Capital Backing General Insurance. Setting capital requirements for short-term insurance liabilities has additional considerations to be aware of, which are discussed in more detail in Appendix 4.
- b. Capital Backing Participating Life Insurance Products and Products with Non-Guaranteed Elements. These considerations are discussed in more detail in Appendix 3.
- c. Capital Backing Insurance vs. Banking.

Conceptually, capital requirements for banks seek similar outcomes to those for insurers, i.e., some high likelihood that promises made to customers will be honoured. However, there are differences in practice reflecting the different business models adopted. Historically, bank capital may have been viewed as a first line of defence against liquidity risk. But nowadays the tendency is to rely on specific additional liquidity requirements / buffers, e.g., the Liquidity Coverage Ratio and the Net Stable Funding Ratio, that are designed to ensure that banks have sufficient liquid assets available to meet all but very onerous liquidity stresses.

Some features of regulatory capital requirements for banks are conceptually like those applicable to insurers. For example, both often include some scope for firms to develop internal regulatory capital models rather than merely using standardised formulae, although the exact terms used differ. Both also include, as part of their Pillar 2 requirements, an onus on firms to explore their own intrinsic capital needs in the context of the risks that they face (typically called ORSA (Own Risk & Solvency Assessment) in an insurance context and ICAAP (Internal Capital Adequacy Process) in a banking context, although there are some jurisdictions where such assessments are called ICAAP for both types of business).

In contrast, there are some features where capital requirements typically differ, often reflecting the different business models involved. These include:

- i. Greater international banking convergence due to the work of the Basel Committee on Banking Supervision (BCBS);

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- ii. Terminology and computations for banks that focus on ‘risk weighted’ assets, a concept which was originally introduced by BCBS to reflect some inherent differences in the risk characteristics of different types of assets³⁰;
- iii. Different valuation approaches used within the same bank for parts of the bank that are run using different ‘business models’ - e.g., held-to-maturity loans in the bank’s ‘banking’ book are typically valued using amortised cost methodologies (the theory being that such methodologies are more consistent with the way in which the liabilities associated with these books are also valued) versus securities held in available-for-sale or trading books typically valued at mark-to-market (or mark-to-model). Where risks are not perceived to be effectively captured by such approaches, supervisors often mandate that firms carry out additional disciplines such as stress testing and reverse stress testing and other forward-looking assessments of assets and liabilities under both expected and stressed circumstances (sometimes, for larger firms, with summaries of the results then made public).
- iv. A more developed linkage between capital requirements and resolution planning including an additional ‘Total Loss Absorbing Capacity’ (TLAC) requirement for larger international banks;
- v. Greater sophistication in some areas such as derivatives where banks are typically more active than insurers³¹;
- vi. Greater adoption of macroprudential elements (i.e., elements specifically targeting the stability of the whole financial system rather than the robustness of individual firms) reflecting the typical view that financial crises are more usually associated with banking than with insurance and given the lender of last resort role typically played by a country’s central bank;
- vii. For banks, the loan portfolio contains maturity transformation risk which means the assets are long and illiquid in comparison to the demand deposit liabilities. Capital is coupled with the central banking system as a resource for additional cash borrowing. Thus, capital needs to be invested in assets not subject to market/credit risk vulnerabilities that will impair its liquidity and/or value in a moment of crisis. In addition, default capital

³⁰ Note that the Basel framework that focuses on “risk weighted assets” does not readily address risks that don’t come from assets. Risks arising from liabilities or contingencies not on the balance sheet have to be converted to a “risk weighted asset” equivalent, which can be an awkward exercise.

³¹ An example of this is the Jan 2016 BCBS standard on “Minimum capital requirements for market risk”, i.e., <http://www.bis.org/bcbs/publ/d352.pdf> (effectively how under Basel banks will need to handle market risks in their trading books). Elements in this standard include greater detail on treatment of vega risk, curvature risk, instruments with exotic underlyings, etc. Though again, key differences in business models should be noted. In insurance, the predominant, almost exclusive use of derivatives is for hedging promised liabilities. They are not intended or used for trading purposes.

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charges/assessments rest almost exclusively on the nature and quality of the asset loan portfolio, tempered by broader macro-economic factors.

- viii. It may be assumed that to avoid loss of control or intervention, any insurance company assets (including lines of business and/or subsidiaries) can and will be sold (if need be) to back an unexpected change in liability payments due. Capital is then available in the event that the amount paid out in a runoff mode (over three to perhaps 30 years) exceeds the original estimates.
 - ix. For insurers, liabilities (and their accompanying assets), in most jurisdictions, are annually re-estimated through projected cash flow assessments under both expected and stressed future states to ascertain that the assets are still sufficient to meet the liabilities over time horizons that may be from a few years to thirty plus years. For banks, the traditional focus has been on stressing the balance sheet for impacts over time horizons of days and/or months.
- d. Role/purpose of debt in insurance vs. banking.
- i. Commercial banks extend credit to acquire what are often illiquid assets (loans) and then look to secure funding via a blend of deposits, and debt and equity offerings, at times supported by credit advances by central banks. Leverage, (direct) interconnectedness, liquidity and maturity transformation are key vulnerabilities. If failure occurs due to these risks, it can be rapid and has the potential to ripple quickly to others, often in a timeframe of days. For insurance business, most risk exposures and their implications take months or years to unfold (except in those rare instances where maturity transformation risk has also been taken on³²).
 - ii. In contrast, insurers secure much of the funding for their liabilities up front through premiums and then look to acquire assets that are relatively liquid and, at least partly, duration-matched. Taking on new liabilities is not a leveraging action for insurers as it is for banks, unless interest rate guarantees are onerous. Underwriting risks, liability estimation risk, early surrenders, excessive lapsation, interest rates and key regulatory/judicial disruptions are the key vulnerabilities. Resolution of a failure typically occurs over an extended period of time with little direct interconnection to other firms (except for reinsurers of the failed firm). There may be time, if needed, to typically raise/secure extra capital to cover the event that conceptually, at the end of the runoff additional assets are more likely to be needed. Thus, if bank depositors and bondholders could not lay claim to their deposits until all the

³² Two notable examples are General American, a U.S. based company in 1999 and AIG in 2008

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loans were settled (or defaulted), then required capital for banks and insurers would be more similar³³.

iii. While modern banking regulatory capital requirements are increasingly emphasising capital in the form of common equity Tier 1 (CET1) and deemphasising Tier 2 capital such as debt issuance, it is an open question whether insurance should converge to this approach, given different risks and business models. The risk to a bank in holding a certain bond, which has on-demand liabilities, is very different from the risk to an insurer with illiquid liabilities.

e. Dependency between value placed on assets and value placed on liabilities

In life/annuity contracts, the value of the liabilities is often dependent on the future performance of the assets, thus it is crucial to arrive at a consistent way of valuing/discounting/projecting the asset and liability cash flows. See Appendix 3 for a further discussion of the impact of this significant feature of many insurance liabilities.

f. Role/purpose of a Margin Over Current Estimate (MOCE):

What is a MOCE versus a risk adjustment? The use of MOCE is being considered by supervisors and shares some similarities with the accounting (IASB) introduction of a risk adjustment in IFRS 17.

The IASB risk adjustment increases the liability based on the company's viewpoint toward risk and is released over time. However, there is a question whether the treatment of MOCE should be different for supervisory purposes and should a MOCE be part of the liability, or a component of required capital.

When the failure of an insurance company results in the transfer of a set of assets along with the liabilities to another carrier, the determination of the value of assets to transfer includes not just the expected value of the liabilities but a risk margin to cover the cost of capital needed to hold the additional amount above an expected value to cover the uncertainty of the full liability until is paid. However, for many P&C liabilities such a "transfer" of the held assets and liabilities to another party is rare and problematic in many jurisdictions (and hence rarely if ever occurs in a troubled company situation), which introduces additional nuances to this topic.³⁴ The complex issues associated with MOCE will be addressed more fully in a separate IAA project.

³³Left unaddressed is to consider that banks finance their growth in assets through two sources of debt – that of their demand depositors and through issuing corporate debt (bonds). What is the priority of that debt in the event of resolution (and does corporate debt get counted as capital)? And how does this occur in the insurance context?

³⁴ In this case, there is no value or profit to be gained from just paying off the residual claims as there is no market for selling off the inforce claims.

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g. Impact on Leverage and Comparative Surplus Ratios.

Assuming that capital is uniform across time horizons and business models leads to a common misapplication of leverage and capital ratios.

- i. For example, in the US, life insurance companies may typically report a surplus of approximately 5% of total assets, non-life companies report about one third of their total assets as capital³⁵ and mortgage companies usually report about two thirds of their total assets as capital. This reflects both the lack of any prefunding needed for short-term insurance and the volatility of its short-term capital needs. In fact, in the US, one feature of the required capital charge is based on the volatility of past reported results
- ii. Translating these ratios into a view that life insurance is much more highly “leveraged” than other business models is to misunderstand the impact that volatility of capital needs has on these ratios.

³⁵ Per the 2016 *Best's Aggregates & Averages*, the year-end 2015 U.S. P&C industry surplus was 38% of assets. Removing the two largest P&C groups (Berkshire and State Farm); the value drops to 34%. Mutual companies tend to hold more capital than stock companies, perhaps due to their restricted access to capital markets.

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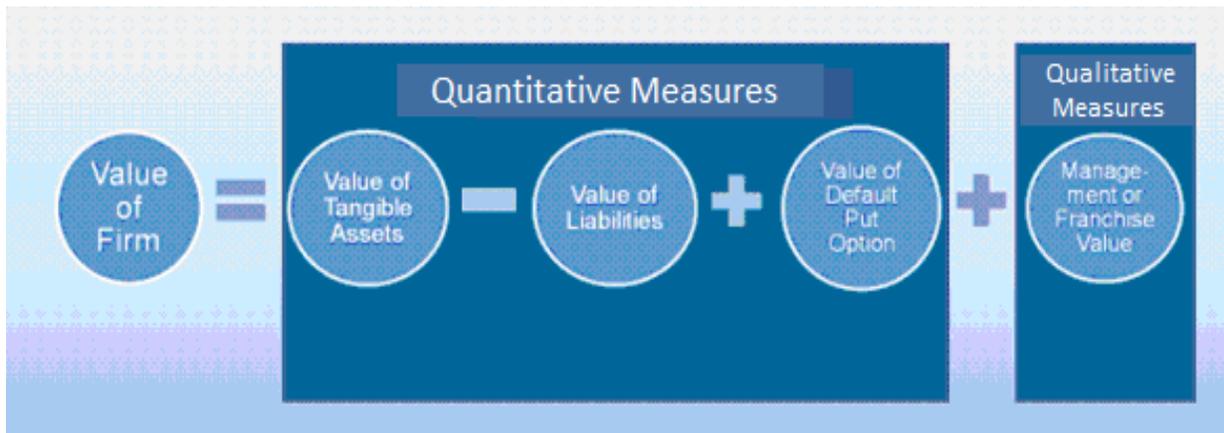
APPENDIX 2

Building Blocks of Financial & Franchise Capital

A common conceptual approach to set a minimum solvency requirement is the level of capital below which the supervisor can take control of the insurer. That level is often set such that, after significant adversity, within a reasonable time horizon (e.g., perhaps 1 year) it is expected that the entity will still have sufficient funds to (a) run off or (b) transfer or sell the business. The intention would be that the level of assets transferred would include sufficient margins, so that another entity would be willing to assume the risk of managing the business.

How do these concepts relate to the idea of a Market Value (or going concern) view of the firm?

One important conceptual development in moving some jurisdictions from a book basis to a market value basis for required capital needs was described by Babbel and Merrill in a (March 2005) paper “Real and Illusory Value Creation by Insurance Companies” in the *Journal of Risk and Finance*. The article was written to point out flaws in the historical use of more book value based accounting methods. The article dissects the value of a firm by including that in the case of bankruptcy, the owners can “put” their unfunded liabilities onto the policyholders or a government/regulatory entity and thus may be blind to risks that pose a danger to the firm. This was summarized in the following equation³⁶.



What is Franchise Value?

Typically, required regulatory capital and financial disclosures are mandated through the traditional foundation of required accounting and additional required disclosures (which may be a mix of public and confidential information). But the observed market value of the firm is also driven by the perceived qualitative processes used by the firm to manage its existing inforce business and to write [profitable] new business. And this observed market value of the firm is almost always different from the equity/market value reported on the balance sheet. The above formulation suggests a helpful reconciliation for this discrepancy. It provides a more transparent

³⁶ Value of Firm = (1) Value of Tangible/Financial Assets – (2) Value of Liabilities + (3) Value of the Management Put Option + (4) Management/Franchise Value (including frictional costs).

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understanding of the components of capital³⁷, because (1) traditional amortized cost methods of accounting ignore the value of guarantees embedded in applicable contracts and (2) organizing it in this manner illustrates how important it is to capture value-based aspects of the business. Building on this framework, by definition, the market value of the stock (i.e., value of the firm) less the value of quantitative reporting requirements (as shown above) represents the perceived value of the company's management/franchise value. The components of this franchise value incorporate the value of the company's culture and processes it uses to execute, refine and manage its business strategy. Thus, in addition to the capital of a firm, the intellectual and cultural capital of its employees, distribution channels, relationships, reputation and management are important ingredients in assessing the franchise value of the firm. All are essential for the long-run sustainability of an insurer. This franchise value is how the firm creates value through its operations of:

1. Growth (new business)
2. Operating efficiency
3. Underwriting effectiveness
4. Capital efficiency (liquidity + required capital)
5. Financial market alpha.

It is commonly held that the share price times the number of shares gives the market capitalization of a firm and represents the value of capital that could be raised by all shareholders selling their shares in a deep and liquid market to new shareholders. In 2008, the stock price of AIG was close to zero, reflecting that investors placed no value on the firm, and as a result were not willing to contribute any additional capital. The equation shown here posits the Value of the Firm (as reflected by the value of the market capitalization) as a function of the value of financial assets and liabilities and the "soft" capital attributed to processes and franchise value.

While this chapter is focused on the measurement of capital, the above equation illustrates a purpose and role of capital as it relates to the value of the firm. Although the levels of required capital can serve as triggers for appropriate regulatory and management actions, the processes (and regulatory oversight) used to manage the firm are a major driver of current and future franchise value. They ensure that capital or access to capital will allow the company to sustain its promises and existence. The quantitative reporting and disclosure typically required are determined through counting, calculation and/or modeling. But, the qualitative "measures" largely represent the realizable value of processes, relationships and reputation that are often classified as accounting intangibles.

The point made is that both the market and the supervisor apply a "qualitative" assessment of the firm to assess its resiliency and strength to continue as a going concern. To the extent that the supervisor is focused on going versus gone concern basis, this is helpful to keep in mind.

³⁷ It was also a major motivator in the last 20 years for moving away from traditional book based reporting for insurance, which ignored the value of this put option.

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The measurement of capital, as well as the company's tangible assets and liabilities, only reflects the company's financial condition at a point in time. It is the value of the franchise processes that will be used to manage future uncertainties not apparent today that will help ensure the future sustainability of the company³⁸.

While the quantitative metrics of Solvency II in Europe and similar efforts by Singapore, Bermuda, Mexico, the IAIS and others have focused on the development of more refined market metrics, the last fifteen years has also seen the development of ERM and model governance tools to manage, preserve and enhance the qualitative or value creation processes of insurance. History provides examples of firms that showed strong financial balance sheets, yet their franchise value was found to be negative while other firms with less robust balance sheets had positive franchise value that continued to enhance future balance sheets³⁹. There were mutual companies in the 70's who did not understand their ALM risk due to a book based accounting framework while AIG had poor risk oversight of an overseas subsidiary.

However, one of the fundamental reasons why insurers avoided the major financial hits of the recent financial crisis is because this risk management aspect was embedded into the culture of the regulatory and professional oversight recommended by the actuarial profession and the actuaries that support the insurance sector to manage the business model of most insurers.⁴⁰

One of the primary motivations and assumptions behind the drive to increase the transparency of the market values of an insurer's balance sheet over the last fifteen years has been the belief that it will motivate management to enhance the franchise value of the firm by better disclosure and consideration of the market risks of the firm.

What is the "Value of Liabilities (With MOCE)?"

There can be considerable uncertainty associated with the obligations involved in fulfilling insurance contracts. Anyone that undertakes insurance obligations would expect to be compensated for this responsibility, whether on an ongoing or a runoff basis. In addition, because everyone is risk averse, this aversion should be recognized in market value estimates. As

³⁸ As a further example and comparison, in a medical exam, taking measures of vital signs/indicators is important in assessing the relative degree of stress or illness. However, a proper diagnosis needs to determine how to treat the underlying processes needed for improved health.

³⁹ Two empirical papers have demonstrated that careful management increases the value of the firm. K. Staking and D. F. Babbel, "The Relation between Capital Structure, Interest Rate Sensitivity, and Market Value in the Property-Liability Insurance Industry." *Journal of Risk and Insurance*, December 1995.

K. Staking and D. F. Babbel, "Insurer Surplus Duration and Market Value Revisited." *Journal of Risk and Insurance*, March 1998.

⁴⁰ This suggests that part of the perceived "Franchise value" is also impacted by macro factors beyond the firm such as a strong professional and/or regulatory presence. In addition, traditionally, some economic theory would argue that shareholders desire higher leverage and less capital. A shallow look at a life company's balance sheet lends credence to this misperception as much of the risk margin is buried in the liabilities so it appears the firm is highly leveraged compared to other financial firms. However, it has also been shown by Babbel, Merrill and Staking that shareholders value this embedded value if the firm has a lot of "franchise value" which is captured by running the firm in a safe manner.

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a result, in assigning a value to liabilities, it is appropriate to reflect this uncertainty. In addition, if risk & uncertainty is not recorded, the timing of recognition of income may be significantly misleading. This last point has been the focus of the IASB work on this topic – how and when to recognize, via a “risk margin”, into income the amount “earned” for that period by accepting the uncertainty of the risk? Without a risk margin income will be prematurely recognized in the income statement. It is inappropriate to measure a liability for insurance contracts at the level of the present value of their expected cash flows, for the cost of bearing risk and uncertainty is always in excess of their expected value⁴¹.

However, no single method can meet the needs of all stakeholder objectives. It is therefore to be expected that a MOCE designed to reflect the economic value of risk and uncertainty in solvency calculations would not usually be identical to the risk margin used for profit reporting.

Indeed, since there is no unique best MOCE method, it will be necessary to have the MOCE method correspond to the perspective and objectives of the user, as applicable. For example:

1. For claim liabilities, methods might be focused on a level of policyholder protection or exit value deemed most consistent with the runoff of these claims, as they cannot be “assumed” by a third party.
2. In contrast, in a going concern with long-duration contracts, a cost of conducting ongoing business (e.g., using regulatory required capital if a regulatory viewpoint is taken or economic capital if a market value is applied) may be appropriate.
3. In any case, a confidence interval technique would most likely not be appropriate for coverage with an asymmetric probability distribution. In addition, each of these can be applied in different manners, e.g., the cost of capital method can use regulatory required capital or economic capital; the quantile method can use a confidence interval or conditional tail expectation (CTE) technique.

Thus, the application of a MOCE for solvency purposes has a different objective than to reflect an income release mechanism and will be addressed in a separate IAA project, intended to supplement its work on risk margins for income statement purposes.

⁴¹ Taking an alternative view, the latest FASB proposal for long-duration contracts does not desire an economic value, but desires a useful and reliable value for the users of the financial information. If a component of an economic value is not reliably estimable (as they define that term) they would say that the estimate should be made by the user of the information and not the presenter of the information.

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APPENDIX 3

Capital issues for Certain Life (Long-Duration) Business

Contributed by Stuart Wason, and David Sandberg

1. Participating (with dividends) Products

There are several complex issues associated with assessing required capital for participating individual life insurance business as sold in North America and other jurisdictions (hereafter called “par” business for simplicity). There are other types of par business such as par individual and group annuities. However, their capital related issues (unless related to higher guarantees) are of less importance and will not be further considered here. To the extent that products have some form/blend of guarantees and risk sharing then these comments would apply to them as well.⁴²

Par insurance usually requires the insured to pay higher premiums than a similarly designed non-par product in exchange for a combination of policyholder and/or terminal dividends, voting rights in the operations of the par fund and possibly ownership rights if the company is organized as a mutual insurer. Some insurers choose to design and sell par products with higher premiums and hence higher dividends than other insurers’ par products.

Par business has historically been an important individual life insurance product, especially for mutual insurers. It remains a key product for some insurers, whether mutual or stock. Some insurers have a significant amount of par liabilities on their books. Note that North American life insurers also sell other types of long-term life insurance products which include various adjustable features (e.g., non-guaranteed elements), but which are not sold as being par (e.g., non-par universal life insurance). The capital considerations associated with these non-par adjustable products are discussed later.

Dividends (known as ‘bonuses’ in many jurisdictions) are typically paid or accrued annually on par policies and represent, in theory, a return to policyholders of the gains due to actual experience of those policies in their dividend class, over the conservatism inherent in their guaranteed premiums. The manner of allocating dividends uses well known actuarial concepts such as asset shares and contribution principles.

Dividends frequently have more than one component in their determination, the largest of which can often be the excess interest component (the excess of the asset earned rate over the cash surrender value (CSV) interest rate multiplied by the CSV). Other components relate to mortality and expense savings, or other miscellaneous sources.

There are unique challenges in the setting of capital requirements posed by par products, which typically feature the presence of dividends (or the equivalent) paid to policyholders. Par business

⁴² For example, par business which includes a specific reference to participation (i.e., x% of something). Here, the prior references to a dividend would not apply, but they share some common risk characteristics.

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has a much greater ability to manage shocks and adverse experience than non-par business, due to the ability to modify these dividends. As a result, capital requirements for par business should be (and usually are) lower than a similarly designed non-par fully guaranteed product.

The supervisory requirements regarding the separation of par business (i.e., assets, liabilities, revenue and expenditures) from other insurance operations varies by jurisdiction, but the following are common in North America:

1. The accounting for par business tends to be included in the general account of the insurer (i.e., not subject to separate account or segregated fund accounting, except to the extent that the policyholder directs that dividends are to be invested in such accounts at their discretion). This contrasts with the practice in other parts of the world where explicit allocation of assets are made for this business.
2. Par surplus (not permissible for demutualized closed blocks) supports the objectives of the par block – such as policyholder reasonable expectations, but is also available in the event of insurer insolvency. Consequently, capital metrics (e.g., RBC ratios) include both par and non-par operations.

I. Issues in setting par capital requirements

One approach to setting capital requirements for par business is to 1) set the requirements as if the business was non-par and non-adjustable and 2) apply a credit to the non-par requirement based on the adjustability inherent in the dividends (i.e., in simple terms, the present value of future dividends).

For additional context, this appendix assumes that the policy liability for par business is determined using a cash flow valuation method (i.e., premiums, cash surrender benefits, death benefits, maintenance expenses and dividends) with assumptions which are current estimates and include limited margins for adverse deviation.

The two most difficult issues which serve to complicate this (presumed to be) straightforward 2-step process are:

1. Investment return congruence; and
2. Real adjustability in dividends

Before describing these issues in more depth, it is important to clarify that it is important

1. to keep clear and separate the issues relating to the fair treatment of par policyholders and capital metrics; and
2. to understand how par policies are treated in insolvency in each jurisdiction and the impact that those differences may have on the capital framework.

A. Investment return congruence

As previously mentioned and in most cases, a large (if not) majority portion of the annual dividends result from investment returns in the underlying asset portfolio which are, for

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examples, in excess of the rate of interest anticipated in the premium basis in the U.K. or the contracts cash surrender guarantees or statutory reserve in the US. Typically, the scale of dividends is reviewed on an annual basis as a result of emerging experience (including investment returns). If investment returns weaken, it would be expected that the dividend scale would be correspondingly reduced to offset such reduced returns.

Therefore, a valuation of par business (or as part of the 2-step capital calculation previously mentioned) which uses the current dividend scale as an input (i.e., as a series of cash flows to be paid out), must similarly use a discount rate assumption consistent with that scale. The use of a discount rate assumption inconsistent with the expected investment return underlying the dividend scale used in the valuation misrepresents the adjustable nature of the product. Of course, a par product for which the insurer has no intention of adjusting the dividends based on emerging experience should be valued as if it were a non-par (non-adjustable) product.

Another way in which dividend/investment congruence can be maintained and useful valuation results achieved, is through a valuation process that tests the impact of various future interest rate scenarios (either deterministic or stochastic) along with a series of dividends which vary depending on the scenario. This valuation method requires that dividends are not input into the valuation as constants, but as variables calculated by formula which take into account changing investment returns. Such a multi-scenario par valuation provides much more useful information to the valuation actuary regarding the impact of varying scenarios on the par business. In setting the capital requirement for par, the supervisor may ask the insurer to use the most adverse scenario or meet some defined degree of severity.

B. Real adjustability in dividends

In theory, the full amount of future dividends is available to absorb adverse experience. In practice, however, the adjustability of future dividends may be more limited, as one or more of the following situations may occur or apply:

1. Through past practice the insurer has not varied the dividends with emerging experience – this sets the policyholder reasonable expectation that this practice will continue in the future;
2. The change in emerging experience (say, investment return) is much larger than the dividend formula can absorb; dividends cannot fall below zero;
3. The insurer is subject to competitive pressures such that it is unwilling to pass along the full extent of adverse experience through dividend reductions⁴³; or
4. The insurer is slow to react to emerging experience by means of changes to the dividends.

In recognition of the preceding practical issues, supervisors may therefore wish to set an upper limit on the level of liability or capital credit (say x% of the present value of dividends) to ensure that there is some prudent, but practical floor being established for reserves and/or capital.

⁴³ This situation may not exist if the adverse experience is brought by the movement of the market as a whole.

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II. Par Products Conclusion

These issues (investment return congruence and real adjustability in the dividends) are important for (and make more complex) the setting of capital requirements for par business because,

1. Modern capital requirements usually begin with a realistic valuation of the insurance obligations as their foundation. Without proper consideration in the valuation of the congruence and adjustability issues, the determination of capital requirements for par will not be realistic
2. Appropriate capital requirements for par business should be no higher than those for comparable non-par products. In many cases the requirements can be considerably lower however the amount of credit given must recognize the real adjustability of the dividends, but no more.

2. Non-participating individual insurance products which include non-guaranteed values

There are also significant capital issues associated with non-participating individual insurance business with non-guaranteed values sold in North America (hereafter called “adjustable non-par” business for simplicity). One of the most recognizable life insurance products in this category is Universal Life. Many deferred annuity products also feature significant adjustable features.

Similar to participating products with dividends, adjustable non-par products contain features which enable the emerging experience from one or more pricing elements to be shared with the insurance consumer. Consequently, adjustable non-par products also require less required capital than a similar non-par fully guaranteed product. Similar to par, capital requirements should provide a credit for the adjustability inherent in the product design. Unlike par, adjustable non-par products are not sold as being “par” and they do not include policyholder dividends.

Adjustable non-par products typically offer weaker guarantees in order to allow modestly greater risk taking by the insurer (and shared with the policyholder), for example, through greater credit risk (via corporate bonds) or equity risk (via equity indexed options). This allows the company and the policyholder to share in a credit and equity risk premium⁴⁴. If this premium is accepted as a reality, then in the long-run, weaker guarantees will allow a higher long-term return than an initial, stronger lifetime guaranteed rate, while also requiring less capital than a fully guaranteed product. So, while their initial design is different from a par product, they both reduce the risk compared to similar products with either stronger guarantees or lower required premiums and will likely provide higher values to the policyholder.

⁴⁴ . In addition, if there are product designs such as surrender charges, then while the charges are in effect, there is a liquidity risk premium that can also be captured. But this extra yield is there whether there are guaranteed or non-guaranteed values.

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For adjustable non-par products there is an important choice that needs to be linked to the purpose of the valuation. The requirements could be set to value:

1. The guaranteed values only and discount them using risk free rates with only a liquidity spread adjustment, or
2. The expected payments discounted based on expected portfolio yields (less a prudent default cost/charge) and crediting methods. This is sometimes referred to and valued by using a real world set of stochastically generated future scenarios.

Valuation basis 1) reveals the cost to fully hedge the guaranteed payments with risk free assets available at the time of the valuation. Valuation basis 2) assesses the cost of funding the expected series of payments that are likely to be paid based on the current portfolio of assets.

3. Implications for Both Product Types

Trust by policyholders in the company to manage these discretionary elements in a long-term fair and balanced manner is essential for the company to sustain new sales. Future sales and the field force will be significantly compromised if the products are either irresponsibly priced and/or unable to be managed in a credible and sustainable manner.

Valuing guaranteed benefits at relatively risk-free discount rates is what a supervisor would need to provide for the promises in a runoff situation. Valuing the expected benefits based on current yield rates less expected default rates results in the amount of assets needed to maintain the inforce business on a going concern basis.

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APPENDIX 4

Comparability of Property & Casualty (Short-Duration Contract) Capital

Contributed by Ralph Blanchard

This appendix covers the comparability considerations for premium, catastrophe and claim Liability estimation risks.

A. Premium risk (underwriting/pricing/event)

This risk exists for all lines, so a charge for this risk is always appropriate to apply. It represents the risk from unfavourable results arising from future years earned premium. Typically, only one year's future earned premium is considered in regulatory capital requirements.

Many capital approaches use the most recent years' net written premium (NWP) as the exposure base for this risk, with factors or model-calculated charges applied to determine the capital need for this risk⁴⁵.

These risks can vary dramatically from one jurisdiction to another and even from one insurer to another and from one product to another within the same line/jurisdiction.

1. Jurisdiction Examples. One of the biggest P&C lines in nearly all jurisdictions is auto/motor insurance, particularly the liability component of that coverage. There are no policy limits for U.K. motor policies. In contrast, all U.S. auto policies have coverage limits, typically \$500,000 or less. Hence, a catastrophic at-fault injury that would result in an insured liability greater than a million Pounds Sterling in the U.K., payable over a lifetime, would typically result in a relatively quick payment of the full policy limit in the U.S. This implies materially different risk from what at first appears to be the same product but written in different jurisdictions. As another example, flood is a covered peril for the typical residential property policy in some jurisdictions, but is an excluded peril in other jurisdictions. Hence premium risk measurement may need to reflect material flood risk in some jurisdictions, but should not reflect flood risk in other jurisdictions. Hence the risk factors applying to premiums for similar sounding products in different jurisdictions should vary materially if they are to produce comparable capital requirements.
2. Insurer-by Insurer Differences. Actual experience for a given product line in a given jurisdiction can vary materially from one insurer to another. Those charged with

⁴⁵ There are implicitly (at least) three components to this risk category – pricing risk, underwriting risk and event risk. Pricing risk represents the risk from misestimating the future expected loss costs that will result, given certain characteristics of an insured. Underwriting risk results from misapplying the pricing plan or underwriting a different mix of business than that assumed in the pricing. Event risk comes from natural volatility in events from one year to another (e.g., weather volatility) - even if the underwriting matched the pricing assumptions and the pricing assumptions were accurate, natural volatility in events from one year to another could result in unfavorable experience in a future year.

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evaluating solvency or financial strength for P&C insurers generally incorporate the insurer's actual experience relative to the industry in their analysis. Publicly available data in several jurisdictions make this possible, although it may not be available in all jurisdictions. (These differences can be observed from public disclosures available in at least one jurisdiction. Some insurers have a history of re-estimations that typically result in reductions in past estimates, while others have a history of increasing past estimates, even for the same lines of business in the same jurisdiction(s). Similarly, some have a history of continued profitability for certain lines in a certain jurisdiction, while some of their competitors have a history of questionable profitability or unprofitability for the same lines in the same jurisdictions.)

3. Product Line Differences. While premium is a reasonably useful exposure and practical basis for determining the amount of required capital for most lines, special problems can occur for high level excess products that may be reported in the same "line" as lower risk first-dollar products. Similarly, some products within a certain line may be dominated by very low frequency and high severity (such as earthquake insurance within the commercial property line), in contrast to other products in that line that are high frequency/low severity (such as insurance on properties with theft and tree damage as the major hazards). If premium is used as the exposure basis for required capital for these products, then to the extent possible it would be helpful to separate high-risk products from others in the product line segmentation used. (This is just one example of product difference within a line resulting in very different underlying risks relative to premium volume.)

In summary, jurisdictional differences in the insurance risks for various products and differences in experience across insurers writing the same products in the same jurisdiction (or similar sounding products in the same jurisdiction) should be reflected in risk factors or model assumptions in order to produce comparable premium risk capital requirements. These factors/assumptions may vary considerably between insurers, products, and jurisdictions⁴⁶.

B. Catastrophe risk (property insurance)

The risk from catastrophes (cats) is a material portion of many P&C insurers' risk profile, depending on the products they write and the jurisdictions where they write them. As these events are relatively rare, measurement of their risks are not amenable to historic data capture. The only feasible way of measuring those risks are via models (Chapter 5 – Catastrophe Models contains a fuller treatment of this topic).

Rating agencies have had the most experience in evaluating these risks for P&C insurers, with many years' experience in data capture and comparative evaluation for this industry. The format of their rating questionnaires identifies many of the key issues related to obtaining relevant data

⁴⁶ Local capital requirements may provide insights on how this might be accomplished.

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for this risk exposure⁴⁷. However, even with these questionnaires, there are still many potential sources of non-comparability in the reported exposures (which typically take the form of the amount of loss for a given return period, such as 1-in-100 years). These include:⁴⁸

1. The particular vendor model used (most insurers use one of the limited number of well-known third-party vendor Cat models, such as RMS and AIR).
2. The various switches turned on or off in those model runs (e.g., “fire following” for earthquakes, and storm surges for hurricanes). The use of different switch settings by different insurers may be entirely justified, as different settings may reflect different product characteristics by insurer.
3. Data quality. The models can produce different results for different levels of granularity in input (e.g., GPS coded vs. mail code precision vs. town/city/county coding).
4. Data & Stress Testing Implications. When capturing data on these exposures, it is generally helpful to frame the data request based on existing model functionality. Data collection can be problematic if the catastrophe scenario specifications don’t match existing model functionality. The resulting data submissions will likely contain guestimates as to what the models would produce if they were able to handle the request, with higher risks of non-comparability. For example, when asking for the impact of a certain size bomb for terrorism insurance, the scenario should match those already run for other purposes.
5. Reflection of residual market pooling mechanisms (such as windstorm pools or other mechanisms to address the lack of available or affordable insurance in high-risk areas). In some jurisdictions, this risk pooling is in the form of mandatory assumed reinsurance of a share of the high-risk pool (which may be written at a rate insufficient to cover the risk over time). In other jurisdictions, this is handled via a tax or other surcharge/assessment to bail out the high-risk pool when the pool has a deficit in the pooled high-risk account.
6. Customization of the third-party vendor models. Some insurers perform this customization due to observed or perceived biases in certain vendor model’s output based on past experience, or that reflect ceded reinsurance programs that are more complicated or nuanced than the vendor model can handle.

⁴⁷ This does not necessarily imply that all rating agencies are experts in this area, but their questionnaires would be a good indication of the capabilities of existing cat models.

⁴⁸ The order of significance of the items listed below can vary dramatically based on the particular facts and circumstances. For hurricane risk for inland areas, there may be material variation by model vendor, but the variation for a coastline state may be minimal. Similarly, in markets where residual markets cover most of the high-risk cat properties the treatment of those residual market impacts might be a huge issue, but it may be largely immaterial where such residual markets are not big.

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7. Treatment of non-modeled losses. Although existing cat models generally model those items that are most amenable to modeling given the data captured, they do not model all potential exposures to loss. Non-modeled exposures can include small buildings (e.g., supply sheds) that may also be covered. This can be significant for those who specialize in insuring risks with such out-buildings and other non-modeled items, or a small issue if the covered book rarely has these.
8. Estimation of occurrence probabilities vs. annual aggregate probabilities, also known as OEP (Occurrence Exceedance Probability Curve) vs. AEP (Aggregate Exceedance Probability Curve). AEP deals with the annual aggregate losses from cats during the year, allowing for multiple events in the same year, with a 1-in-100 AEP signifying the 99% VAR level of cat losses during a year for the hazard/peril measured.
9. The types of perils measured. Modeling of hurricane and earthquake perils is common. Many insurers also model terrorism peril. Other perils may also be modeled (such as a result of winter storms, floods, non-tropical windstorms and fires), but, in general, those models have not been tested for as long and hence their tail estimates may not be as reliable⁴⁹. Most of these other perils are also more of an annual earnings variability issue than a solvency issue. Flood risks may be an exception in some jurisdictions, although the coverage of this hazard can vary drastically by jurisdiction – it is commonly excluded from most U.S. property policies. The problems with obtaining reliable tail estimates for these other perils will vary in significance from one insurer to another. For example, problems with the reliability of hail models may be a material issue for an insurer concentrated in areas where hail hazard is high, but may be immaterial for insurers not writing in such areas.
10. The ability to model the catastrophe hazard for pricing does not necessarily mean there is also an ability to reliably model the hazard for solvency purposes, for pricing usage may focus on estimating the average annual losses, not the size of rare tail event losses. In contrast, solvency usage focuses on modeling these rare tail events. By definition, it takes a long experience period to obtain a certain number of observations of rare tail events, and these observations are critical to model validation and re-parameterization of the model. Models of the rarest events tend to be the least validated.

⁴⁹ When the first hurricane (and earthquake) models were produced, the tail estimates for a given event in a given location from one vendor's model tended to materially differ from that produced by another vendor's model. This was partially due to differing approaches used in estimating the potential losses, and partially due to different assumptions used in the modeling for the same phenomena. Each event after the models were created allowed each vendor to update, enhance and re-parameterize their models. Hurricane and earthquake models from different vendors now generally produce comparable estimates for a given tail event in a given location, although differences remain in estimates from one vendor model to another. Hence models for those perils are now considered to be somewhat mature. In contrast, models for other perils (as of mid-2017) have yet to experience the same convergence across vendors and have yet to go through the learnings experience and re-parameterization arising from new events (when modeled results can be tested against actual claims experience).

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11. Whether mandatory reinstatement premiums are reflected. Where reinstatement of the catastrophe reinsurance limits after a covered event is part of the contract and requires the payment of additional premium to reinstate such limits, payment of that premium is generally mandatory and not an option.

Solutions. The NAIC (U.S.) has addressed some of the above issues by restricting the allowable models to the most commonly used ones in the market, but with the switches set at the same values as used for internal risk management (which assumes that internal risk management would use the best match of the switch settings to the insurer's actual products and exposures).

Usually, the more infrequent the return period under consideration, the less reliable is the estimate. In other words, estimates for values at the extreme tail are less reliable, and the farther out on the tail the less reliable the estimate. Values for 1-in-50, 1-in-100 and 1-in-200 or 250 are frequently discussed. Values much farther on the tail become increasingly speculative, although even the values mentioned earlier are largely guestimates and can contain significant uncertainty.⁵⁰

In summary:

1. The focus should be on perils that create solvency risk, not earnings risk.
2. Annual aggregate risk is also more relevant than single event occurrence risk, but on an all-major-perils combined basis rather than on a peril-by-peril basis.
3. There is no realistic alternative to the use of cat models, but there needs to be a general understanding that this is not a precise exercise.
4. The return periods chosen for a capital standard should not be too far out on the tail, reflecting the greater uncertainty the farther out on the tail one goes. 1-in-1,000 values are purely speculative. Values ranging from 1-in-50 to 1-in-250 might serve as a reasonable range for the selection of the desired return period, with the shorter return periods more advisable the greater the concern with model accuracy.
5. Concerns with model uncertainty can be alleviated somewhat by relying on models that have been vetted (either through their common use in the industry – as in the case of third party vendor models, or through their evaluation by an outside party with sufficient expertise to test the model for the given hazard and geographic area).
6. The use of various model switches can be tied to what is done for internal risk management purposes. To the extent periodic testing of this and an insurer's internal risk management is conducted, it may be deemed to be a sufficiently reliable

⁵⁰ These return period values are generally measured on a VaR basis using what are termed "loss exceedance curves". Loss exceedance curves are generated by running the cat models for multiple scenarios in a stochastic manner, then sorting the resulting values by size. If 10,000 scenarios were run, then the 1-in-50 value would be the 200th value when the results are sorted from largest to smallest. Values could be calculated on a TVaR basis, although such values would then be relying on the estimates for the tail values that are less reliable.

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approach. Annual ORSAs, supervisory colleges and periodic financial exams can be utilized for this work.

C. Claim liability estimation risk

As in premium risk, all lines need to have risk charges applied for this risk. Estimates are established for unpaid claim liabilities for events that have already happened. Depending on the product line and jurisdiction, these can be subject to significant uncertainty in both amount and timing, with potentially lifetime payment patterns. Other claim liabilities can be subject to very little uncertainty with very fast payment, depending on the product line and jurisdiction. The same issues regarding jurisdiction variability and insurer-by-insurer differences in the premium discussion above also apply here. In addition, just because a product line has a high premium risk in a given jurisdiction for a given insurer doesn't mean that it will present a high claim liability estimation risk, and vice versa. In short, jurisdictional and insurer differences from industry averages are important to reflect to obtain comparable risk measures.

Some claim liabilities are subject to inflation risk, but not all. Whether inflation is a risk to the claim liability estimate depends on whether the liability is for past or current/future economic costs⁵¹. An additional consideration regarding inflation risk is the currency applicable to the policy coverage. Insurance coverage may not be expressed in terms of the local currency, especially if that country is in a hyper-inflation environment. In those cases, the insurance coverage may be expressed in terms of a non-local currency with lower inflation risk.

Some third-party lines also have exposure to mass torts or phenomena that impact multiple policies at the same time. Whether this is a risk worth measuring may depend on the jurisdiction and market reactions⁵².

In summary:

1. Conclusions are similar to those of premium risk (item I.A above) for the jurisdictional and insurer-by-insurer variability issues.

⁵¹ Third party liability lines with low policy limits generally have less exposure to future inflation, as injured parties typically do not wait for a court or legal process to repair damaged property or seek medical treatment. Hence payments made several years after the claim event for such policies may be largely for past economic costs (plus potential "pain and suffering" awards). In contrast, liability lines with high limits or unlimited benefits (e.g., U.K. period payment obligations or U.S. workers compensation lifetime medical claims) are subject to current and future inflation, as many payments are made contemporaneously with the purchase of medical services. While claim liabilities for these lines may include an inflation assumption, it may not be possible or feasible to isolate the inflation component entirely in estimates of future estimation risk. Hence it may be more of a consideration in stress testing than in capital standards.

⁵² For example, certain U.S. mass torts caused policies from multiple years for a given insured to be triggered by the same claim or event. The market reacted by moving insureds and products with the most obvious mass tort risk to claims made policy forms, essentially limiting future mass tort risk. Similarly, the risk of multiple insureds being exposed to losses from the same event is typically addressed by means of underwriting guidelines (as well as certain reinsurance policies designed to cover such a risk). Thus, as for operational failures, once the risk has occurred it typically leads to important structural/process change which means there is less risk going forward than was there historically.

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2. Inflation does not apply to all lines and to all jurisdictions (due to contract differences); hence it may be more of a consideration in stress testing than in capital standards.
3. Regarding mass tort-type risks, estimation of the risk for future mass torts is highly speculative. Past mass torts have generally led to changes in coverage terms and underwriting so as to prevent a reoccurrence of similar mass torts, making history from past mass torts of questionable relevance for the future. As such, this risk may be better addressed through stress testing. The speculative nature may be mitigated by focusing on potential variability to the estimate for currently known mass torts, rather than the risk of future mass torts⁵³. In addition, these risks can vary significantly by country.

⁵³ The risk for future mass torts has also been reduced to some extent by the internet. The rationale for this statement is as follows:

The largest mass tort to-date has generally been asbestos. This is partially due to the lag in the general public becoming aware of the risks of asbestos. Asbestos had been in widespread usage for decades before the dangers were widely known, allowing the list of potential defendants and claimants to become very large. If instead the danger had become known or suspected a few years after the product started being used, the list of potential defendants and claimants would be far smaller. Hence the faster a potential danger is publicized the smaller the potential ultimate claim activity. The internet and the rush to file lawsuits by attorneys in certain jurisdictions leads to faster dissemination of information on a product's potential risks and hence to lower mass tort risk.

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Appendix 5

Solvency II & U.S. Classifications of Capital

Contributed by Dave Sandberg & Ralph Blanchard

1. Solvency II

This is an example of tiered capital requirements, largely consistent with banking definitions under Basel III. Instruments allowed to meet the Solvency II capital requirement are divided into three 'tiers' based on both 'permanence' and 'loss absorbency'. The permanence must be defined in the contractual terms of the instrument that may have been used to generate the insurance working capital. The rules impose limits on the amount of each tier that can be held to cover capital requirements with the aim of ensuring that the items will be available if needed to absorb any losses that might arise. This means that they need to be sufficient in amount, quality and liquidity to be available when the liabilities they are to cover arise.

Eligible items under Solvency II must be loss absorbing on both an ongoing and a winding up basis - it is also a requirement that such instruments should not include terms which could cause or accelerate the insurer's insolvency. There are also limits on the amount of Tier 1, Tier 2 and Tier 3 internal funds that can be used to cover the firm's solvency capital requirements, the SCR.

Tier 1 is the highest quality and is also divided into 'restricted' and 'unrestricted' Tier 1. Tier 1 includes ordinary share capital and retained earnings, non-cumulative preference shares and relevant subordinated liabilities. Preference shares and subordinated debt will be subject to a 'loss absorption' requirement which could involve writing off all amounts owed by the insurer. At least 80 per cent of total Tier 1 funds have to be "unrestricted Tier 1" own funds, which are made up of ordinary shares (i.e., those with full subordination) plus share premium and the equivalent paid up members contributions for mutuals. Unrestricted Tier 1 items include paid in subordinated preference shares/members contribution and paid in subordinated liabilities.

Tier 2 includes cumulative preference shares, and subordinated liabilities with a shorter-duration. Unlike Tier 1 instruments, the principal need not be written down or converted following a serious breach of the Solvency Capital Requirement. Tier 2 may therefore also include shares or long-term debts which do not comply with the Tier 1 requirements.

Tier 3 is intended to catch eligible items which do not satisfy the Tier 1 or Tier 2 requirements.

2. U.S. Capital

There is no tiering of capital for U.S. solvency purposes. The closest analogous situation is the limit placed on the amount of a particular asset that can be recognized based on the impact on statutory surplus or capital. For example, recognized goodwill arising from an acquisition is capped for statutory accounting purposes at 10% of the amount of statutory surplus adjusted to exclude goodwill, computer equipment, software and net deferred tax assets.

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Regarding debt instruments issued by an insurance company, U.S. statutory accounting would generally not recognize those as “capital” unless debt holders’ interests are subordinated to policyholders, claimants and all other classes of creditors, and payment of the debt interest and principal requires the domiciliary supervisor’s prior approval. Debt instruments that meet those criteria are called “surplus notes”.

Debt issued by a non-insurance parent company that is then contributed to a U.S. insurer is not an obligation of the insurer, and laws prevent the U.S. subsidiary insurer from being forced to pay the parent company’s debt. Hence such contributed cash would also become capital for the insurance subsidiary. This limitation on the priority of the debt is not written into the terms of the debt contract, but is written into the statutory legal requirements of the regulatory framework.

Issues Surrounding Classification of Capital

Whether U.S. subordinated debt should be recognized as Tier 1 capital was being vigorously discussed at the IAIS in 2017. A summary of views of IAIS member supervisors was shared early in 2017 by the IAIS⁵⁴. They demonstrate how important it is to consider the implications of each jurisdiction’s legal, regulatory and business model. While many jurisdictions have the same supervisor overseeing banks and insurers, regulation at a holding company level for banks whose major risk is liquidity also needs to address the needs of a business typically regulated at a legal entity level with very different, longer-term risk exposures and where laws and taxation will vary by country.

⁵⁴ Slides 5-9 from the following presentation on Capital Resources found at <https://www.iaisweb.org/page/events/stakeholder-meetings//file/64275/agenda-item-2a-capital-resources-slides-for-la-jolla-stakeholder-meeting>

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