Chapter 3

Asset/liability management as a corporate finance function

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The term 'asset/liability management' is most closely associated with banks and insurance companies. In this chapter a first principles look is taken at ALM, showing that the basic concept is applicable to all firms through a framework that links risk management to capital management. It will be argued that ALM is part of a firm's corporate finance function where decisions made impact capital structure, cost of capital, and return on equity.

Besides the services they offer to retail customers, banks and insurers are wholesalers of capital to institutions. It is natural to think of banks as corporate capital intermediaries through their corporate finance and trading businesses. In the last 25 years, with the development of the derivatives markets, it is also common to think of major commercial and investment banks as risk management intermediaries, offering hedging instruments for a diverse set of market risks (eg, interest rates, foreign exchange, credit, equity prices, and commodities) to corporations. Insurers are often only thought of as risk management intermediaries and not as capital providers. However, the very act of insuring risks of corporations is one of managing capital and therefore an integral part of corporate finance. After all, if a firm did not buy insurance, it would need to keep more equity (and perhaps some debt) on hand to cover its risks. Insurance acts as a substitute for equity.

The corporate finance function usually has responsibility for managing the firm's capital resources with an eye to achieving the lowest cost of capital. In this context, capital usually refers to equity, debt and other forms of paid-up capital. Increasingly, risk management and the use of insurance and hedging are being recognized as additional capital resources.

ALM, risk management, and capital management

The key proposition that ties corporate finance to risk management is that risk management and capital management are two sides of the same coin. As a starting point, consider the liability funder's problem that one encounters in insurance ALM. Liability funding refers to the process of selecting and managing asset portfolios to offset liabilities undertaken by institutions. The goal of the liability funder is to ensure that there are sufficient assets available over time to pay off the liabilities as they become due.[1]

A number of strategies have emerged to address this ALM problem, and the approach used by most of them can be summarized as follows. First, get an understanding of the nature

of the liabilities. This requires an analysis of how the liabilities develop over time and under a variety of scenarios. If the liabilities are sufficiently 'well-behaved', they can be represented by a function possessing the statistical characteristics of the underlying risks. Alternatively (or in addition), the behavior of the liabilities over time can be simulated over a set of defined scenarios. Secondly, conduct a similar analysis of the assets available to fund the liabilities. Finally, employ the selected ALM strategy to ensure that sufficient assets are utilized to ensure (within some tolerance) that the liabilities are funded.

The risk in ALM is that the assets are insufficient to meet the liabilities. This risk of underfunding is overcome by having an appropriate asset (or capital management) strategy. In this sense, risk management is capital management.

Later on in the chapter this ALM discussion is used as a basis for considering the more general case of a corporation. The corporation has a business plan that it wishes to implement. It needs to raise sufficient capital to fund that business plan and to ensure the continued viability of the firm over time. This is, in essence, the same problem as the liability funder. In this context, we can define capital management and risk management as follows.

- Capital management delivers the optimal capital resources that are sufficient to support the needs of a firm and, in particular, to cover the risk exposures that the firm faces.
- Risk management (including ALM) ensures that the firm's operational and financial exposures are controlled or structured in such a way that they are supportable by its capital resources.

These definitions appear to be mirror images of each other – one appears to imply the other. If so, the relationship between risk and capital management is a natural consequence. If the management of one is the management of the other, then the theories and practice of both must ultimately come together.

Foundations of ALM

At the very foundation of ALM is the notion that there exists some set of liabilities that need to be funded by assets. The structure of the asset portfolio is therefore driven by the structure of the liabilities. Both assets and liabilities are exposed to forces that influence their individual performances, but it is the collective performance of the portfolio of assets to cover the liabilities that is the primary management objective.

ALM has been practiced in varying degrees by liability funders. U.S. insurance companies had the luxury of managing their assets and liabilities separately until the late 1970s when the life insurance industry recognized that it had evolved from being primarily a protection provider to an investment provider as well. Pension fund managers do have the nature of the underlying liabilities as a stated objective but tend to use benchmarks that have little to do with the liabilities, such as stock and bond performance indices. Mutual fund managers have investment goals established by their prospectuses, but do not consider themselves to be liability funders.

We saw in Chapter 1 that banks also utilize ALM principles in a variety of areas. Consider managing the risk on a trading desk. A trader prices and hedges a trading position using the principle of replication. Replication is a technique used to reconstruct the characteristics of one financial instrument (call this the liability to be funded) by using a combination of other financial instruments (consider this the funding portfolio).

Non-financial corporations do not see themselves as liability funders – although they have financial obligations they must meet – so they are not visible at all in this area.

In the absence of an explicit liability to fund, what should the asset management strategy be? This is the mutual fund manager's situation, for example. The investors in the fund have certain objectives in terms of income generation and the return of their principal and in terms of the risk and reward trade-offs that they are willing to make. Even though there may not be an explicit statement about the 'benefits' payable over time to a mutual fund investor, there in an implicit one that is framed in terms of the fund objectives. It is therefore reasonable to expect that an asset management strategy that works for a mutual fund manager should work for an insurance company or pension fund manager, because they all have liability targets to meet. The converse should also hold true.

If the only difference, from the ALM standpoint, between an insurer, mutual fund, pension fund, or other entity is the degree of specificity with which the liabilities are defined, then it should be possible to develop a general ALM framework that allows for this difference. Unfortunately, it is not as simple as that. Not only is the degree of specificity an issue, but the manner in which liabilities themselves are described. For instance, does one use the book or market value of a liability,[2] and how would one compute either one?

For the life insurance industry, the groundbreaking idea in ALM was developed by Redington (1952). The essence of his approach, immunization, still carries through in several of the methods developed since. Immunization strategies aim to manage the asset portfolio so that the liabilities will always be met when due. There are three conditions necessary for immunization. The first is that the present value of the assets equals the present value of the liabilities. In practice, this condition is met by equating the market values of the assets and liabilities. The second condition is that the duration of the assets equals the duration of the liabilities (where the duration measure is defined in terms of the rate of change of price with respect to the change in interest rates). This makes the immediate price sensitivity to interest rate changes the same for the assets and the liabilities. The third condition states that the convexity of the assets should be greater than the convexity of the liabilities. When this condition is satisfied, a fall in interest rates will result in the asset values increasing by more than the increase in liability values, and a rise in interest rates will result in asset values falling by less than the fall in the value of liabilities.

The classification of ALM methods by van der Meer and Smink (1993) shows just how influential Redington's approach has been since it features as the core of seven of the nine dynamic ALM methods. Exhibit 3.1 summarizes the grouping they use. The static methods are the most basic, being relatively simple and easy to use but providing only a one-dimensional perspective on assets and liabilities. They classified all methods based on immunization principles as dynamic value-based ones. There are only two dynamic return-based methods. The first, spread management, seeks to maintain a targeted yield spread between asset and liability portfolios, where both portfolios have yields related to the term structure of interest rates. The second is required rate of return (RRO), which is a multi-scenario, multi-horizon optimization ALM framework.[3] It describes the liabilities in terms of required returns on available assets at each scenario-horizon date and finds the optimal asset portfolio that generates sufficient returns to exceed those return targets.

Exhibit 3.1 can also serve as an appropriate description of the ALM methods used by banks to manage the risk exposures of their businesses and those of their clients. For instance, immunization is a close cousin of bond portfolio optimization strategies that emerged in the

Exhibit 3.1

Classification of ALM methods

Classification		*Method*
Static		Cash flow calendar
		Gap analysis
		Portfolio segmentation
		Cash flow matching
Dynamic	Value-driven	Standard (Redington) immunization
		Model conditioned immunization – single factor
		Model conditioned immunization – multi-factor
		Key rate immunization
		Contingent immunization
		Portfolio insurance
		Constant proportion portfolio insurance
Dynamic	Return-driven	Spread management
		Required rate of return (RRO)

Source: Van der Meer and Smink (1993).

1970s. The principles therein are fundamentally the same as in financial risk management. Essentially, those methods compare the instantaneous price sensitivities of assets and liabilities to some underlying parameter, for example interest rates.

Risk and capital in liability funding

The use of ALM tools and techniques does not guarantee that liabilities will always be funded. There is, therefore, a strong connection between a liability, its funding asset portfolio and the firm's capital resources. Although this is well understood, it is worth taking a brief look at this relationship.

A liability arises when a firm makes a promise to deliver some future stream of cash outflows. These outflows arise from contracts (or other financial arrangements) made by the firm. Consider two such contracts issued by an insurance company.

1. A universal life insurance policy. The policyholder can choose to pay a varying premium over the life of the policy and has the ability to withdraw part or all of the cash value built up at any time. The full death benefit is payable when the policyholder dies, which can happen at any time after the policy is issued. The premiums paid in by the policyholder earn interest at a rate set periodically by the insurance company. In this case, both the timing and the amount of the cash flows are not fixed or known with any certainty.
2. A fixed annuity where the timing and amount of cash flows are fixed and known in advance (for example payout on a worker's compensation claim or on a lottery).

It is clear that the insurance policy has more cash flow uncertainty embedded in it than the fixed annuity. Whichever ALM method is used for the insurance policy, there is a risk that the insurance company may run short of funds in some scenario at some time in the future. The whole

exercise that insurers (and banks) go through to demonstrate capital adequacy is to minimize this risk. The insurer could choose to fund the liability with more assets than indicated by the particular ALM method used. This additional amount increases the insurer's cost of funding the liability. If this cost is passed on to the policyholder, the insurer's premiums are higher and the insurer may not be competitive. If the cost is retained by the insurer, then it has to be met through the firm's own capital resources, thereby increasing the firm's cost of capital.

In the case of the fixed annuity, since the cash flows are known with certainty, the insurer can defease the liability by constructing a default-free set of matching cash flows using U.S. government zero-coupon bonds with the same payment dates.[4] For practical purposes, the annuity liability is perfectly offset by the dedicated funding asset portfolio. This is a luxury that the insurance policy example above does not have.

In this example, the management issue is whether cash matching is absolutely necessary or whether some other ALM strategy would be acceptable. An alternative strategy would require a smaller funding asset portfolio but would increase the insurer's risk. The insurer would have to hold capital to cover that risk, so this choice would be attractive if the all-in cost of the alternative strategy, including the cost of this additional capital, is cheaper than the cash matching strategy. The competitive pressures are the same as in the insurance policy example. The trade-off can be expressed as the cost of funding versus the cost of failing to fund the liability.

ALM for non-financial corporations

The preceding discussion described how ALM could be used by a financial firm to manage both its transaction risks (ie, meet its liabilities) and its capital costs (to cover its retained risks). Are the principles of ALM of use for non-financial corporations? Consider the most commonly faced corporate finance issue, that of determining the capital structure of the firm.

The corporate financier's problem can be stated as minimizing the cost of capital subject to ensuring that the firm has sufficient capital to meet its financial obligations. In an insurance company seeking to invest funds to cover liabilities, the problem can be stated as minimizing the cost of the asset portfolio subject to ensuring that they generate sufficient returns (funds) to meet the liabilities as they come due. The two problems share a common underlying structure, indicating that a flexible ALM approach developed for financial institutions may also apply to the corporate capital problem.

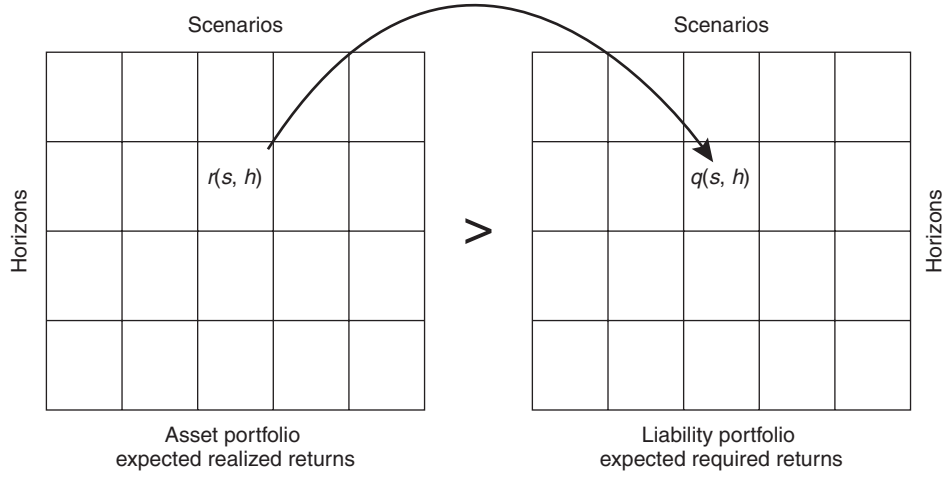
The formulation of the optimization and the underlying rationale for it are key to making the connection between risk and capital management. In particular, for the ALM approach to be applicable in both situations, it needs to be valid, even if the underlying data are sparse and do not lend themselves to a significant amount of statistical analysis.

Finance theory uses mathematical optimization as a matter of routine. There is a great divide, however, between the information requirements implied by financial risk management models and the data actually available to corporate finance practitioners. The ALM problem in financial institutions has a strong connection to risk management, and is ultimately one about ensuring corporate solvency. It therefore provides an ideal device for bridging the information divide.

ALM approaches, for instance those based on immunization, with a close connection to fixed-income portfolio construction and interest rate risk management, impose requirements on the measurement of asset and liability values that are not always available in practice. Alternative methods such as realized return optimization (RRO), introduced earlier, are major steps in overcoming some of the information limitations.

Exhibit 3.2

Realized return optimization (RRO)



Source: Author's own.

RRO starts by describing a range of scenarios that can unfold over time. Along each scenario, a number of time horizons are selected so as to capture the future characteristics of assets and liabilities. Along each scenario, at each time horizon, we determine the returns that the assets must earn in order to meet the liabilities at that date and all future dates from there on. In Exhibit 3.2 these required returns are labeled $q(s, h)$. The least cost asset portfolio must be constructed so that the portfolio return in each scenario-horizon combination, $r(s, h)$, exceeds the corresponding required return.[5]

The ability to set constraints in each cell of the target return matrix provides tremendous flexibility to build in conservatism and mitigate some of the limitations that shortage of data may cause. As an example, adding an additional margin to the required return target means that the assets have to work just that much harder in that instance.

For this type of targeting approach to make sense in a general corporate finance setting, there are three requirements.

1. Understand a firm's corporate finance objectives.
2. Focus on how risk management and ALM can increase a firm's value.
3. Articulate the risk structure of the firm.

This will facilitate linking ALM, risk management, and capital management together in a consistent framework.

Corporate finance objectives

For financial managers, there are many ways to articulate the objectives of the firm. Each of these, in essence, comes down to a quest for capital efficiency – earning the highest return possible on shareholders' funds and the firm's capital base.

In their pursuit of capital efficiency, corporate financiers are constantly asking themselves questions about their company's capital structure. There are three questions in particular.

1. *Capital adequacy.* Does the firm have enough capital to achieve its objectives?
2. *Financial leverage.* Is that capital achieving a sufficient return?
3. *Risk leverage.* Is the company adequately managing its risk?

Experienced managers are used to thinking about the first two questions, but the third has only recently come into focus for the most progressive companies. Risk in its many forms has been highlighted over the past decade, and how it is managed and financed has moved to the front of management's mind.

Of course risk management has always been central to the enterprise, as has the efficient management of capital. But the two are symbiotically related – if you did not have risk, you would not need capital. This is true whether one is considering a start-up operation or a long-running company. There will be differences in the types of risks faced by different firms and the types of capital resources that are available to each of them. Nevertheless, this underlying rationale for capital – as a response to the risks of the firm – is the same.

Traditionally, firms have dealt with risks in silos, with different forms of risk managed by different departments within the firm. For instance treasury deals with the financial markets, risk management with the insurance markets, operational risk by the business units, and so on. However recent corporate news has shown how these types of risk are intertwined and can impact upon each other. Companies can face severe consequences when oversight is inadequate and fragmented. Needless to say, the recent emphasis on corporate governance demands that management stay on top of risk issues within their organizations and lay the groundwork that will enable the firm to manage its way through unfortunate events.

In the past, the ability to efficiently collect and analyze risk data of many different kinds and from varied sources did not exist. However, technology has changed this, and we are quickly moving to a point where the best firms will have an end-to-end flow of information that will provide managers with a comprehensive and useful analysis of the variety of risks facing the firm – if they know the right questions to ask.

Increasing the value of the firm

Managers focusing on risk need to have an understanding of how managing those risks can have an impact on the value of the firm. A simplified theoretical framework provides a convenient way to think about this problem, as follows. Consider the basic formula for the value of a firm, V, expressed as the net present value of future free cash flows (net revenues less capital investments):

$$V = \sum_{t=0}^{\infty} \frac{FCF_t}{(1+k)^t}$$

where

FCF_t = Free cash flow at time t

= (Revenues – Expenses – Investments) at time t

and

k = Cost of capital for the firm

(Equation 1)

We can increase *V* by increasing the numerator, decreasing the denominator, or both. Corporate finance theories tell us what the numerator and denominator are, and how they change as capital structure changes. We can apply this same approach to risk management; in other words, do they change the numerator and denominator of the value equation and, if so, how?

A number of academic studies have emerged that look at this question. For example Tufano (1996) examined whether managers hedge in order to increase firm value, or because they are risk-averse (he found the latter); Schrand and Unal (1998) found that managers can use risk management to substitute one kind of risk for another, to the advantage of shareholders; Minton and Schrand (1999) found that cash flow volatility increases both the likelihood and the cost of external financing; Allayannis and Weston (2001) found that users of foreign currency derivatives have a consistently higher firm value than non-users; and a study by Antunovich and Laster (1999) showed that firms that can generate positive earnings consistently – perhaps engineered in part by effective risk management – can command a higher market value multiple over book value.

Notwithstanding the sometimes obscure studies of finance academics, using this simple concept of firm value indicates that the aim of risk management must be both to decrease the volatility of future cash flows, and to decrease the cost of capital by lowering the impact of risk on the firm's operations. For management, this demands attention be paid to the risk structure of the firm, and how that structure can alter these financial variables.

Risk structure

The risk structure of a firm is a way of articulating the risk exposures of the company and analyzing the potential impact of those exposures on future performance. To aid in this, the firm needs to find a way to capture and describe the complete set of risks it faces – perhaps in the form of a 'risk map', as described in Shimpi (2001).[6] A risk map articulates the firm's risk appetite in a framework that can be applied across all its operations. It serves as a catalogue of critical risks and helps to ensure that they are prioritized and that appropriate processes are in place to manage them. Importantly, a risk map can serve as the foundation for the quantification of risk the firm faces and the development of a dynamic financial model of the firm which incorporates all major risks that affect earnings.

This final aspect of the risk map is an essential link between the description of risks and the quantification and financial management of them. Some risks will have a greater propensity to quantification than others, and there is a trade-off between the completeness of a company's risk catalogue and the precision of its techniques for measuring them. Foreign exchange risk, for instance, is easily quantified and expressed in financial terms, while risks to intellectual capital or corporate reputation are more nebulously defined. Nonetheless, the risk map is the foundation of the holistic risk analysis project that is becoming an essential part of good financial management.

It provides the basis for a complete analysis of the company's capital structure which will give answers to each of the three capital management questions raised earlier in this chapter. With a comprehensive model of the firm and the risks it faces, financial management can look at the capital structure of the firm from first principles. In essence this means:

- looking at how the existing capital structure of the firm differs from that of the 'baseline firm' (ie, one completely financed by equity capital); and

- determining how the current capital structure might be changed to increase capital efficiency by drawing from all sources of capital available – including equity (for capital adequacy), debt (for financial leverage), and insurance (for risk leverage).

By looking at the risk management task in this way, we can see that the risk management objective is identical to the corporate finance objective – substituting equity with 'cheaper capital' while maintaining adequate coverage of the risk; this delivers both financial leverage as well as 'risk leverage'.

The insurative model

With this type of targeting approach in mind, consider again the corporate finance problem. The 'standard model' of corporate finance defines capital structure in terms of priorities of cash flows and value to capital providers of the firm. It is natural, therefore to think of capital as cash paid in by investors. The priorities help distinguish between different classes of investors – senior debt holders have top priority, mezzanine capital have the next, and equity holders come in last.

A risk perspective of capital structure leads us down a different path, bringing us closer to the ALM setting in realized return optimization (RRO). This risk perspective provides the impetus to develop an alternative, more intuitive way to describe the relationship between shareholders and bondholders, and to include a firm's insurers (and hedgers) in the same framework. This model, known as the insurative model,[7] starts with the proposition that a firm is a collection of risky activities. The firm's capital resources bear these risks. Hence, just as in ALM, the capital structure must be set to ensure that each capital instrument takes responsibility for some part of the firm's risk so that, in aggregate, all of the firm's risks are covered. The term 'insurative' recognizes that each form of capital carries some risk of the firm and can therefore be thought of as insurance or a derivative.

The concept of a derivative perspective of securities issued by the firm is not new, although the insurance approach is very different. The idea that a firm's stock is an option on the underlying assets was suggested in the original Black and Scholes (1973) article, but it was actually developed into the notion that is familiar in finance today by Merton (1974). In this view, the nature of the claims of shareholders and bondholders is distinguished by default risk as a put option that is written (in effect, if not explicitly) by the bondholders and held by the shareholders. The position of the shareholders is like that of an investor who has an option on the assets of the firm. If the assets are worth more than they owe on the debt, they have the right to exercise their option. They would pay off the bond's face value (ie, the exercise price of the option) and take hold of the remaining value. If the face value of the debt is less than the asset value the shareholders will let their option expire worthless by defaulting on the debt. In other words, shareholders own a put option, reflecting their limited liability. If the asset values fall below the face value of the bonds, the shareholders simply turn over (put) the assets to the bondholders and walk away.

This characterization of the bondholders as the put writers – ie, effectively the insurers – is analytically accurate but not necessarily intuitively appealing. First, in the event of default, the bondholders get the firm and the underlying assets while the shareholders get nothing. That sounds like the bondholders are the ones who are protected by the shareholders. After all, when you buy insurance, the insurance company should not get your firm when a claim

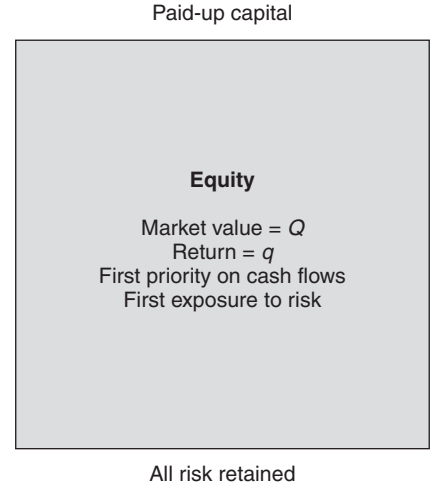
occurs, leaving you with nothing.[8] Secondly, it is not clear what insurance premium the shareholders paid to the bondholders.

The insurative model's treatment of risk and capital in the same framework creates a more appealing description of the relationship between the various capital providers. In the process it shows how the familiar equation for weighted average cost of capital (WACC) is a natural consequence of risk sharing and that a more comprehensive measure, total average cost of capital (TACC) should be used instead.[9]

First consider the standard model setting with the baseline firm that has only equity (Exhibit 3.3). The firm has underlying assets A. Assuming no debt or insurance the minimum equity (baseline capital) required for this firm is Q, which will earn a rate of q. With no excess capital, Q must equal A.

Exhibit 3.3

The baseline firm

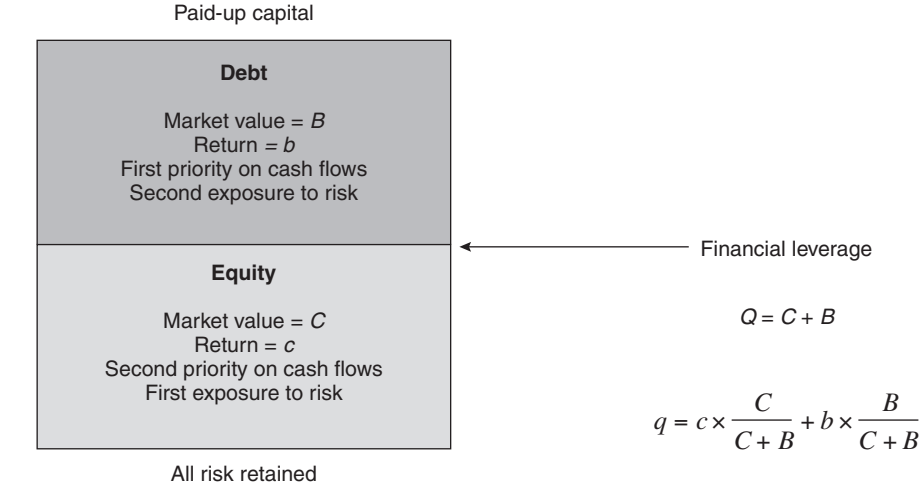


Source: Author's own.

The equity holders decide to lever the firm with debt. The value of debt is B and that of equity is C, so that $B + C = Q$ (see Exhibit 3.4). The firm's risks are stratified horizontally – ie, the risks of the firm are all retained by the investors, but shared with different exposures. Equity holders demand a return of c and debt holders demand b. Since they are both investors in the firm, one can argue that they should both get the same return on the assets of the firm, q. However, since the equity holders take the first loss position, they are protecting the debt

Exhibit 3.4

Standard model of corporate finance



Source: Author's own.

holders. The equity holders are entitled to an extra return for the risk that they are taking. Similarly, the debt holders give up some of their return of q. This is summarized as follows:

- *equity:* C, gets q as investor + extra $(c - q)$ for return of c;
- *debt:* B, gets q as investor – extra $(q - b)$ for return of b.

In this setting, $b < q < c$. The extra $(c - q)$ for the equity holder looks like an insurance premium that is received for taking on more risk. The reduction $(q - b)$ for the bondholders looks like an insurance premium that they pay so that they can get priority in distribution of assets before the shareholders. For this to be internally consistent at equilibrium, the two amounts must equate. Equation 2 is the WACC equation, with q equal to the WACC.

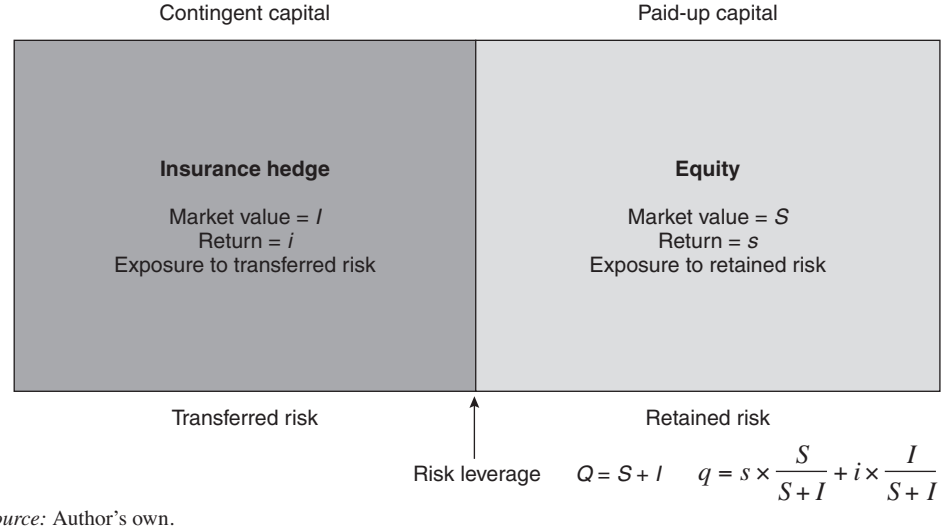
$$C \times (c - q) = B \times (q - b)$$
$$q \times (C + B) = c \times C + b \times B$$
$$q = c \times \frac{C}{C + B} + b \times \frac{B}{C + B} \qquad \text{(Equation 2)}$$

In this case, it is clear that the equity holder, as owner of the firm and therefore the underlying assets, has the right to do this. The shareholder's objective is to maximize return on equity (ROE) by leveraging. The amount of the insurance premium is derived explicitly from the relationships above.

Now consider the setting of the insurative model (Exhibit 3.5). In this case, it is risk leverage, not financial leverage that provides the shareholder with the means to increase ROE. Here, the firm's risks are stratified vertically. The retained risks are covered by the equity investors (there is no debt here) and the transferred risks are taken up by the insurers. The market value of equity in this case is S and the equity substitution value[10] of insur-

Exhibit 3.5

Insurative model without debt



Source: Author's own.

ance is I, with the two amounts adding up to Q. The return that the equity holders will get for the retained risk will be s appropriate for that risk. Similarly, the insurers will get a return of i on the transferred risk that they are covering. The shareholders will only insure if there is a positive benefit from risk leverage – that is, $i < q < s$. As before, both the shareholder and the insurer are entitled to q as participants in the risks and activities of the firm, except that the returns are modified to reflect the risk shifting between the two. This is summarized as follows:

- *equity: S*, gets q as investor + extra $(s - q)$ as gain on risk leverage for return of s;
- *insurer: I*, gets q as investor – extra $(q - i)$ as loss on risk leverage for return of i.

The extra $(q - i)$ loss on risk leverage is actually the benefit provided to the shareholder by the insurer for keeping the transferred risk. Again the two extra amounts look like insurance. Note however that although the equity holder is purchasing insurance, the relationship on returns is such that the equity holder shows an increase in return from insuring; there would be no reason to purchase insurance otherwise in this setting. In equilibrium, the two amounts paid and received must be equal. Equation 3 is the TACC equation, with no debt. In this case the WACC equation does not apply. The TACC is q.

$$
\begin{aligned}
&S \times (s - q) = I \times (q - i) \\
&q \times (S + I) = s \times S + i \times I \\
&q = s \times \frac{S}{S + I} + i \times \frac{I}{S + I}
\end{aligned}
\qquad \text{(Equation 3)}
$$

Finally, consider an expanded insurative model (Exhibit 3.6), with equity (E earning e), debt (D earning d), and insurance (H earning h). Having done the preceding steps the analysis is quite straightforward. Combining Equations 2 and 3, we get the following TACC equation:

$$
\begin{aligned}
&q = e \times \frac{E}{Q} + d \times \frac{D}{Q} + h \times \frac{H}{Q} \\
&\textit{where} \\
&Q = E + D + H
\end{aligned}
\qquad \text{(Equation 4)}
$$

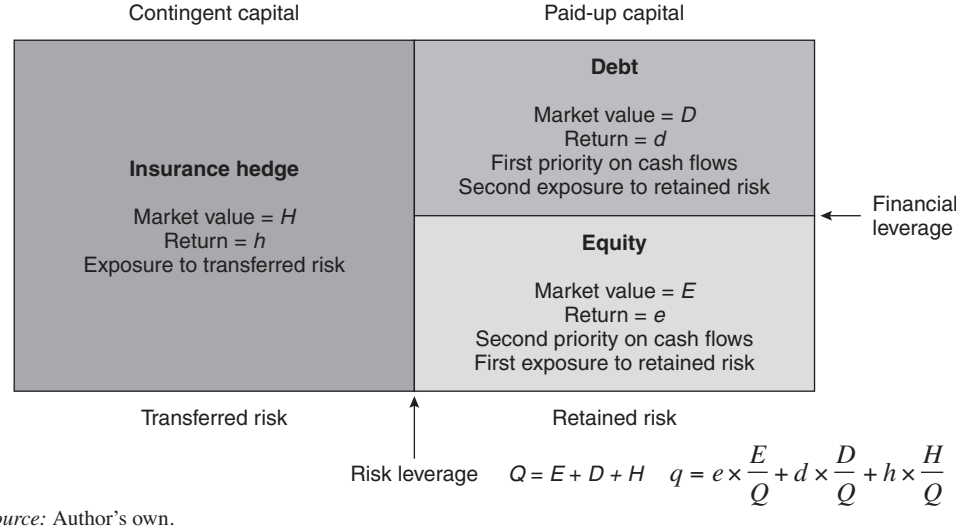
The insurative model leads to a natural discussion about risky debt being the sum of unleveraged equity investing plus an insurance policy (for which a premium is paid through the cost of debt) that gives debt holders a priority on assets. The analysis is also consistent with the idea in finance that in equilibrium, the risk-adjusted return to the equity holder must be the same, independent of leverage. The extra return to the shareholders from leverage must come from somewhere. This analysis shows that it comes from 'insuring' the bondholders.

From an ALM perspective, the capital cost minimization objective should be over all capital resources, not just the paid-up capital. Hence the focus on WACC misses the insurance and hedging component whereas TACC would be a more appropriate target.

The complete specification of the corporate capital structure problem is the familiar ALM one: minimize the firm's TACC, subject to ensuring that in all possible futures under consideration (ie every scenario and time horizon of interest), the firm's risk structure is adequately covered by its capital resources.

Exhibit 3.6

Insurative model of corporate finance



Source: Author's own.

The practitioner's challenge

In the preceding discussion we have seen that the ALM process can be viewed as having an impact on a firm's capital requirements. Just as importantly, the assessment of a firm's capital needs can be viewed as an ALM process.

This way of looking at risk management – as the other side of the capital management coin – demonstrates that there is a role for an executive whose responsibility is to collect and analyze data from across the firm that relates to risk and its management. A company's CFO gathers all the financial information from across the firm and synthesizes that into a coherent picture of the financial profile of the firm. The CFO has the measurement tools to articulate the status of the firm's finances and the execution capabilities to implement capital management strategies from the top down.

This argument shows that there is a need for the equivalent role on the risk management side of the business – the chief risk officer (CRO). Recently, financial institutions and several of the world's leading corporations have defined the role of CRO to parallel that of the CFO. In those institutions, the CRO is a very senior officer on a par with the CFO. In smaller firms, the CRO role is an additional responsibility taken on by the risk manager, treasurer or CFO, reporting either to the CFO or CEO. The CRO is expected to gather the risk information from across the firm and synthesize that into a coherent picture of the risk profile of the firm. In addition, the CRO is expected to articulate the risk appetite of the firm in order to provide guidance on business priorities to line managers.

The CRO has several significant practical challenges.

1. *What is the nature of the information that should be gathered from across the firm?* For instance, how does one define risk in such a way that it means the same thing to everyone

in the firm? Even if a consistent definition is achieved, how do the line managers measure risk consistently and deliver it in a timely manner to the CRO?

2. *What is the mechanism to gather this information?* Unlike the CFO who has well-established information systems to capture the smallest petty cash payment to the largest M&A financial flows, the CRO has, at best, a number of disjointed systems focusing either on insurance programs or hedging in the financial markets. There are many more risks, especially those that are uninsurable and therefore retained by the firm, that are not captured by any information system.
3. *What to do with the information once it is gathered?* The CFO has the luxury of aggregating the financial information in a number of formats such as the balance sheet, income statement and cash flow statement. There is no consistent framework currently available to the CRO that enables a satisfying aggregation of risk data with the ability to take actionable decisions.

A necessary first step in addressing these challenges is to recognize that the practitioner is not seeking mathematical precision. Rather, there is a desire to have a framework that allows a myriad of risks to be brought together in a consistent manner. It is not necessary for every risk to be managed in the same way. What matters most is that line managers and financial managers of a firm adopt the same framework that embraces a common view of risk.

This framework should allow each manager to express the risks that he or she faces and their consequences to the whole firm in a manner that is accessible to other managers. It should allow a bottom-up assessment of risk that results in a firm-wide risk management perspective. It should enable top management to articulate the firm's risk appetite and translate that into objectives for line managers.

ALM as a navigation tool

The financial manager's job in risk and capital management has to be described in a way that recognizes the dynamism of business. If one views risk simply as the outcome of a turn at the roulette wheel, then a financial manager can be described as a gambler who wants to keep playing for as long as possible. The gambler has an opportunity to either win or lose at each turn. Even if it is a fair wheel (ie, the odds are not stacked in favor of the casino), the gambler's ability to stay in the game over time is determined by the amount of cash he or she starts with. The cash in the gambler's pocket at the outset is key. This is how we think conventionally about capital – it is what a firm has in its corporate pockets at any given time. The more it has, the greater its ability to stay in business. The financial manager's job is to keep the corporate pockets full. There is, however, a conflict with capital efficiency. The more capital a firm has in absolute terms, the less its risk-adjusted return on that capital. At some point, it is not attractive for investors to have a low return relative to the risk they are undertaking.

An alternative approach is to consider the risk facing the firm as a combination of the forces acting on the business and the management actions in anticipation of or in reaction to those forces. This is more dynamic than the roulette wheel. An analogy that captures this is that of the aircraft pilot. The pilot has the objective to keep the plane flying for as long as possible over uncertain terrain in all kinds of weather conditions. The last thing the pilot would want to do would be to subscribe to the gambler's view and load up the plane with all the fuel that it can take in its tanks and anywhere else that it can be stored (eg, barrels in the passen-

ger and cargo compartments). Too much fuel would add weight and have a drag on the plane's efficient performance.

Instead, the pilot would develop a flight plan with a number of components. The first would be to work out how much fuel is required on take-off and how much refuelling would be available along the way. At take-off, the pilot would select the best mix of fuel grades to give a cost-efficient blend that would take the plane to the first refuelling point. Then the pilot would have to anticipate the refuelling needs over different terrain and weather conditions, bearing in mind that the pilot's reactions to those conditions will affect fuel usage. There should be 'fair-weather' refuelling resources that can fly in and fill up the plane's tanks. In 'foul weather', the pilot will need to ensure that the refuelling planes can also navigate through those bad conditions and provide the necessary fuel.

The pilot's environment represents that of the financial managers of a firm. The capital management process is analogous to the pilot's fuel plan. Managers need to decide how much capital and the type of capital they need to raise immediately and how much they may need in the future. The absolute amount of capital is based on an assessment of the future uncertainties faced by the firm. In calm financial markets, it may be sufficient to have capital resources such as bank lines of credit and commercial paper. Those facilities may not be available at all times – eg, when financial markets in general are tight or if the firm faces a particular loss. The managers should therefore also have alternative capital resources available for those situations. Likewise, the managers have the ability to manage the risk exposures faced by the firm and make each bit of capital go that much further.

Another aspect of dynamism captured in the pilot analogy is that the pilot does not simply set the autopilot at the average height of the surrounding terrain. That would guarantee a crash. The pilot tends to look into the near distance and adjust the altitude periodically to make sure the plane is flying high enough to clear all obstacles. In financial management, we have a number of examples of crashes because of heavy reliance on financial models with statistical autopilots. Most risk management models and ALM methods can lead to a false sense of comfort by relying too heavily on the stability of means and other moments of assumed statistical distributions of the data.

A good financial manager should look out the window periodically and check out the terrain.

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[1] For a full discussion, see Miller, Rajan, and Shimpi (1989a).

[2] Vanderhoof and Altman (2000) is a collection of several excellent papers on the subject of the fair value of insurance business.

[3] Although van der Meer and Smink used required rate of return, RRO actually stands for realized return optimization.

[4] If the bond payment dates do not match the annuity payment dates then an element of reinvestment risk is introduced, unless of course the defeasance is constructed assuming a reinvestment rate of zero.

[5] For more description and applications of RRO, originally developed in1987, see Miller, Rajan and Shimpi (1989b and 1989c). Also, see Shimpi (1989).

[6] See Shimpi (2001), 'Chapter 4: Risk Mapping'.

[7] For a more comprehensive discussion of the insurative model see Shimpi (2001), Chapter 3, and Shimpi (2002).

[8] Strictly speaking, of course, the equity holders get relief from having to make up the shortfall to the bondholders.

[9] Traditionally, WACC is the market value weighted cost of a firm's equity and debt costs. TACC is a measure proposed in Shimpi (2001) which extends the concept of WACC to include the cost of insurance and hedging instruments.

[10] The value of insurance here is equivalent to the value of the equity that would have to be held if insurance were not used. See Shimpi (2001) for a discussion of this concept.