The Cost of Risk: A COTOR-VALCON[1] Discussion

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This note is a summary of a COTOR-VALCON discussion on the relationship between an insurer's risk and cost of capital. The focus is two fold: on the applicability of the capital asset pricing model (CAPM), and on the effects of financial frictions.

Keywords. CAPM; cost of capital; financial frictions; shareholder value; financial economics.

1. INTRODUCTION

A central concern of insurance company management is knowing whether, and how, they are creating value for shareholders. This leads to finance questions like, "What is our cost of capital?" and "What rate of profit distinguishes a division or line of business that creates value from one that does not?" The actuarial profession has spent over a century quantifying profit and loss in this inherently tricky business, what with its randomness, uncertainty, and delayed revelation of ultimate reality. But grappling with the relationship between the balance sheet and the stock ticker is a relatively recent challenge for actuaries.

In 2006, members of the COTOR-VALCON discussion group held a four month long on-line exchange of ideas concerning these issues. This note is a summary of some of that discussion. Section 2 introduces the basic elements: cost of capital, the capital asset pricing model (CAPM), and financial frictions. Section 3 explores CAPM more deeply, examining whether non-market risk might be priced in the capital markets. Section 4 addresses the sources and role of financial frictions. Section 5 summarizes the "emerging view" of the nature of shareholder value in the insurance firm.

2. IT ALL STARTED WITH THAT SWISS RE PAPER

"The Economics of Insurance: How Insurers Create Value for Shareholders" (Hancock, et al. 2001) was received warmly by most of the group. "Good meat and potatoes stuff" and "I'm 100% on-board" were some of the initial reactions. The essence of that article is the statement:

> ...an insurer's opportunity cost of capital is the return that shareholders could otherwise achieve by investing their risk capital directly themselves plus additional compensation

[1] Committee On the Theory Of Risk – VALuation of CONtingent liabilities

for various frictional costs that are specific to insurers.

But what does this mean?

Insurance companies are often compared to closed-end mutual funds (investment trusts) because their assets are primarily financial assets. The performance of a mutual fund is transparent: it is the sum of the performance of its investments, less a small amount of overhead expense. More specifically, insurers are compared to *levered* mutual funds. The issuance of policies creates a cash flow into the investments for a period of time before claims take cash back out, and this is analogous to the issuance of bonds. In the case of a levered fund, the analysis of performance is quite straightforward because all of its assets and liabilities have market values – and returns – that can be observed every trading day. That mix of assets and liabilities leads to a specific hurdle rate of return on equity that the firm is expected to make. That hurdle rate depends on, among other things, the systematic risk of returns, i.e. their correlation with the returns of the capital markets as a whole. Measuring systematic risk by a stock's "beta" is the basis of the Capital Asset Pricing Model (CAPM). More complex versions of CAPM, using higher moments (asymmetry and "fat tails"), or more than one priced factor, have also been developed.

If an investment trust's returns persistently fell short of the hurdle rate, say through poor stock-picking or mismanagement of expenses, then the market capitalization of the firm (the sum of its share values on the market) could be lower than its book value (the value of assets minus value of liabilities) and shareholders would rightly feel that they could have done better investing directly in the assets themselves. On the other hand, if returns are persistently higher, then market cap could be higher than book value – a situation where the difference, called *franchise value*, is positive. Possessing franchise value justifies the existence of the firm; the shareholders do *not* think that they could have done better by themselves.

Getting back to the quote from Hancock et al., that hurdle rate of return on equity, the "return that shareholders could otherwise achieve," is known as the *base cost of capital*.

But insurers are not levered investment trusts. Their liabilities are not (all) bonds. Their business is issuing insurance policies. This brings a few complications to the analysis.

First, insurance policies are not traded on an exchange, so do not have a market value. The problem of valuation of insurance liabilities is and has been a major concern of actuaries for a long, long time. In more recent decades, however, the increasing sophistication of financial markets has created pressure for *market consistent*, or so-called *fair* valuation of liabilities.

The second complication is what Hancock et al. refer to as *frictions*. This is a term used in finance theory (which of course borrowed it from physics). The idea can be traced back to the famous Modigliani-Miller (1963) Irrelevance Theorems that state that under the following conditions, neither capital structure, dividend policy, nor profit volatility (and by implication risk management) matter to the value of a firm (Ng and Varnell 2003):

- Financial markets are arbitrage-free
- Taxes are neutral (i.e. the same tax rate applies to all profits and losses)
- There are no transaction costs
- There are no distress costs (costs incurred when the firm goes bankrupt or is threatened with bankruptcy)
- There are no agency costs (costs incurred due to the fact that management and ownership of the firm are separated)
- Changes in financial structure or dividend policy do not convey new information about future profits.

Because capital structure, dividend policy, volatility, and risk management manifestly *do* affect the value of the firm, it must be because one or more of these requirements is not met. The failure of these conditions are known as *financial frictions*. Since failure brings negative contributions to firm value, those contributions are known as *frictional costs*.

Repeating the Hancock et al. quote in full, with added emphasis, "…an insurer's opportunity cost of capital is the return that shareholders could otherwise achieve by investing their risk capital directly themselves *plus additional compensation for various frictional costs that are specific to insurers*." In pseudomathematical shorthand, we might say: COST = CAPM + FRICTION.

Thus we see two areas where deeper understanding is needed in order to determine the cost of capital of an insurance firm. One is the valuation of liabilities consistent with financial economics; the other is the valuation of the impact of frictions, or, loosely, the estimation of frictional costs.

3. CAPM: IS NONSYSTEMATIC RISK PRICED IN THE MARKET?

Since its introduction in the 1960s, the Capital Asset Pricing Model (CAPM) has been a staple of market valuation. The insurance industry has been reluctant to use it, however. One problem is that its distributional assumptions are inconsistent with the "heavy tails" encountered in some lines of insurance. Fama and French (1992) report another problem with CAPM: other factors besides

covariance are priced. In particular, larger companies, and companies with high market-to-book ratios, tend to have lower returns. Chung, Johnson and Schill (2006), following the work of Hung, Shackleton, and Xu (2004), find that the Fama-French phenomenon can be explained away if enough higher co-moments (up to 10) are included in a CAPM-style formula. Levy and Roll (2008) suggest that estimation methods may be to blame for the apparent inadequacies of CAPM. Despite these complexities, the unaugmented CAPM explains enough to be the bedrock stock pricing formula even today.

If insurance liabilities behaved like stocks and bonds, if they were traded in fluid markets or could be hedged by securities that were so traded, then their "market consistent" valuation would not be controversial. But they don't and they aren't and they can't, so it is. The discussion group analyzed several "thought experiments" and traded several papers that hinted at the breadth of this controversy. A few are recounted here.

3.1 Hole In One Insurance

The Hole-In-One Insurance example has been around for a while. (And there actually are companies that provide such insurance!) But its value as a thought experiment lies in its simplicity. The discussant who introduced the topic described it this way:

> Let's say that I have set up my own "Lloyds Syndicate" to provide hole-in-one insurance. The local golf course is my only policyholder, and pays me $50 of premium for the following coverage: If anyone hits a hole-in-one during the year, I pay that person $1,000 (but that's the aggregate policy limit, and thus the maximum loss). If nobody hits one, I pay nothing. The coverage period is from 1/1 to 12/31 (we golf year-round in Texas!). I estimate that the probability of a hole-in-one during the year is 5% (this is a tough course). I also contribute $1,000 of capital "funds" to my Lloyds Syndicate. The premium + capital (total of $1,050) is invested in a one-year bank CD at 3%. There are no underwriting or loss adjusment expenses. There is no IBNR, so I can easily determine my annual ROE on the following 1/1. There is a 95% chance that my return on the $1,000 investment will be 8.15%, and a 5% chance that it will be -91.85%. Thus, my expected return is 3.15%. Is this a good deal for me?

According to the canon of financial economics, it is a good deal. There are no sources of friction

and the random outcome is independent of the financial markets.[2] But would you accept this sort of deal? Most people would not. The risk is substantial, and even though it is not "systematic," i.e., correlated with the financial markets, most people would want a higher return than the additional 0.15% over the risk-free rate for bearing this risk. According to financial economics, non-systematic (also known as "idiosyncratic") risk, because it is diversifiable, should have a price of zero in the financial markets. Does this mean financial economics is wrong? Or is there something else going on?

3.2 Corporate Bond Spreads

A good place to look for real-world departures from theory is the phenomenon of corporate bond spreads. Here you have the relatively "pure" world of interest rate risk, copiously represented by risk-free, that is to say, credit-risk-free, government bonds, plus the risk of default on the part of the issuing corporation. Spreads between corporate bond yields and the corresponding government yields measure the market's pricing of the default risk; typically it is several times the actuarial value. Does correlation with the market (i.e., CAPM beta and all that) explain these spreads?

Amato & Remolona (2003) address this puzzle and conclude that the problem lies in the inability to properly diversify credit risk. That is, the CAPM principle does not apply because its assumptions cannot be met.

Elton et al. (2001) also address the credit spread issue, with extensive data analysis. They conclude that correlation between default and overall stock market returns is an adequate explanation for credit spreads, so the CAPM principle does apply.

So which is it?

3.3 Who Is The Investor?

Look at the finance argument for hole-in-one insurance again. If you have a well-diversified portfolio, and you consider whether to add this "investment" to it, you will find that it will improve the risk/return characteristics of your portfolio. So why not do it?

There is a stream of research known as "behavioral finance" that explores the psychological side of risk-taking and investment. You can watch an ongoing experiment in behavioral finance weekly,

[2] And let's not quibble about the estimated 5% probability of a hole-in-one. It could be high, it could be low. All we require is that it be an unbiased estimate.

on television (Post et al. 2006). Examples of more scientific studies are (Shiv et al. 2005) and (Wakker et al. 1997). This research finds that most investors, being human, are not nearly the rational actors that economic theory builds its models upon. Perhaps more importantly, (and this is emphasized in Modigliani & Miller's 1963 paper), even though investors may be rational, they do not necessarily assume that other investors are, too – and this itself can lead to what appears to be "irrational" behavior (like bubbles).

How many rational investors does it take to make the finance argument fly? If the hole-in-one premium were higher and the expected return were, say, 6%, there would likely be many people vying for the opportunity to write it – so the premium would be bid down. Would it be bid down all the way to 3.15%?

And how long would it take? Much of financial economic theory is about equilibrium – that mythical state of affairs when everything has settled down after all those nasty random disturbances finally stop. Ask a bunch of day-traders about the relevance of CAPM, beta, and equilibrium economics and they just might tear themselves from their screens for a few seconds to laugh at you. For them, it's all about the short term, hedging and arbitrage, taking a position, and finding an edge. The eventual trends in pricing will matter to them, but not much. On the other hand, a buy-and-hold investor whose planning horizon goes out for decades will not be overly concerned with current market turbulence, but rather with the relationship between current and expected future prices.

So which perspective rules? That is hard to say. Price formation is not a function of all investors, it is a function of the so-called marginal investors – the investors at the margin, the ones who are ready to trade next. If an investor who is rational and holds a diversified portfolio knows about the hole-in-one opportunity and is in a position to act upon it, then a 3.15% expected return will be attractive and this will be the marginal investor. But what if no such investors are available? This appears to be the case for some types of investments. For example, Gabaix et al. (2007) discuss mortgage-backed securities where it seems the available marginal investors are specialists who hold overweighted (not well-diversified) portfolios. As a consequence, returns are higher than they would be according to CAPM-type arguments. This could well be happening to catastrophe insurers, too.

4. FRICTIONS AND FRICTIONAL COSTS

As one discussant put it, "There's more to financial theory than systematic covariance with a

market portfolio of all risky assets." And a lot of that "more" seems to be covered under the heading of "frictions."

Recall that the Modigliani-Miller Irrelevance Theorems apply when certain conditions are met; when they are not, we refer to the reasons they are not as "frictions." Most relevant to the discussion group were the financial frictions experienced by insurance companies.

By negating the premises of M&M, we can construct a list of potential frictions:

- Barriers in the financial markets, such as institutional restrictions on trading
- Tax asymmetry and nonlinearity
- Transaction costs
- Distress costs and counterparty credit sensitivity
- Agency effects
- Information asymmetry
- Signaling

Some of these are fairly straightforward to quantify, such as direct tax and transaction costs. Some are a bit trickier, like tax nonlinearities. Some are wholly mysterious, such as agency effects – which are fundamentally psychological phenomena.

Generally, the impact of frictions can be seen as taking place on a continuum of the amount of risk capital held. Too much risk capital, and some frictions, such as the tax cost of holding capital, dominate. Too little risk capital and another set of frictions, such as distress costs and credit sensitivity, dominate instead. The art of managing frictions involves, among other things, finding the optimal level of capital to hold.

4.1 Too Much Capital

Feldblum (2006) argues that the main frictional cost that bears on the question of fair value accounting is the tax on investment income that risk capital earns. According to financial theory (basically, going back to M&M again), whatever risk capital is invested in, its rate of return would be sufficient for investors – as long as they got it all in their returns from the insurer. But they don't (usually) because the IRS takes about 35% of it.[3] Investors need to be compensated for that tax loss, so premiums need to be higher by an amount sufficient to raise those funds. To make a level playing field in the capital markets, *policyholders* need to pay that tax on risk capital – not just once,

[3] That is, in the USA. Bermuda-based firms, on the other hand, face approximately zero tax.

but twice, because the higher profits resulting from the higher premiums are themselves taxed, before they can flow to the investors!

While Feldblum acknowledges "principal agent problems" as another cost of holding capital, he writes, "[T]hey are rarely large, and they are not easily measured. We ignore them in this paper." (Neither does he address the costs of holding too little capital.)

Jensen & Meckling (1976) started the whole discussion of agency costs of holding capital. They were coming from the perspective of the typical industrial firm, where capital was about funding new, positive net-present-value projects – that is, projects that will earn profits higher than the required capital market hurdle rate. A firm that holds a bunch of cash evidently doesn't know what to do with it. While the firm is holding it, in government bonds, say, it is indeed earning an appropriate rate (taxes aside). But what happens when management decides to spend it on an ill-advised acquisition or other negative NPV project? What if management plays it safe and doesn't embark on certain risky but profitable ventures that investors would approve of? What if management decides to spend the money on an upgrade to the corporate jet fleet or other perks? That capital is at risk, and investors would rather get it back than trust management to eventually invest it in good, new projects. As a result, certain costs, which mostly go under the heading of "monitoring and bonding" are incurred to avoid these outcomes. Jensen & Meckling recognize the difficulty of quantifying this sort of risk. They state (p. 346),

Before proceeding further, we point out that the issue regarding the exact shapes of the functions drawn in fig. 5 and several others discussed below [agency costs vs. financial leverage] is essentially an open question at this time. In the end the shape of these functions is a question of fact and can only be settled by empirical evidence.

4.2 Too Little Capital

Why would an insurance firm hold too much capital? To avoid the adverse effects of holding too little capital. For the industrial firm, too little capital means flirting with the possibility of bankruptcy and the costs that financial distress brings (lawyers, management distractions, raising capital) and missed opportunities for investing in positive NPV projects. For the financial firm, it also means disapproval from ratings agencies and potential action by regulatory authorities.

At heart, this reflects more than the distress and bankruptcy costs facing an industrial firm; it reflects a significant amount of counterparty credit risk, or, more specifically, customer (policyholder) risk aversion. Policyholders buy insurance to protect themselves from certain adverse

contingencies – like property damage, bodily injury, medical expense, and death – they cannot easily "diversify away." Being offered coverage with a material probability of not paying off (call it "probabilistic insurance") is not going to satisfy customers' desire for certainty in removing the risk. Wakker et al. cite survey data suggesting that people will pay much less in premiums than the actuarial cost of bearing the residual credit risk, perhaps twenty times less.

Looked at from the opposite perspective, customers are willing to pay more for the service of having certain risks transferred away from them than the actuarial value of those risks. That's what supports underwriting and claim expenses and even, sometimes, underwriting profits. Holding too little capital threatens the profitability of the insurance firm – not just probabilistically, but immediately.

5. THE EMERGING VIEW

The emerging view of the insurer's financial predicament (Harrington & Danzon 1994, Staking & Babbel 1995, Doherty 2000, Froot et al. 2004, Babbel & Merrill 2005, Epermanis & Harrington 2006, Panning 2006, Mango & Major 2007, Froot 2007, Major 2008, Yu et al. 2008) centers on its need to protect and enhance its franchise value. Recall, franchise value is defined as the difference between market capitalization and book value. If the firm earns only enough to cover its cost of capital, then (in theory) there will be no franchise value. As Babbel & Merrill (2005) explain it,

The franchise value stems from what economists call "economic quasi-rents." It is the present value of the "quasi-rents" that an insurer is expected to garner because it has scarce resources, scarce capital, charter value, licenses, a distribution network, personnel, reputation, and so forth. It includes renewal business. Franchise value is dependent on firm insolvency risk. The less insolvency risk there is, the more likely the firm is to remain solvent long enough to capture all the available economic rents arising from its renewal business, its distribution network, its reputation, and so forth.

As we saw earlier, threats to surplus can translate into threats to profitability. This means, therefore, threats to franchise value as well. Mathematically, MARKET CAP = BOOK VALUE + FRANCHISE VALUE. If franchise value is positive, but erodes when book value is too low (distress and credit frictions) or too high (tax and agency frictions), then the market value vs book value curve (which Froot et al. call the "M-Curve") will be concave, not linear. Thus, increased volatility in book value will translate into decreased expectations for future market value.

The source of that volatility does not matter; it can be systematic or idiosyncratic. Either way, it will have an impact on the value of the firm. So, a risk management program (e.g., investment hedges, reinsurance, cat bond, strategic changes to the business mix, etc.) that protects a million dollars of surplus, but appears to do so at greater than actuarial cost, may be worth engaging if it also protects a substantial amount of franchise value as well.

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