

Capital and Value of Risk Transfer

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Abstract Classical capital market theory gives little room for corporate insurance and reinsurance. Refinements to that theory are showing that there is a cost to bearing firm-specific risk, and a value to controlling such risk. This appears to be particularly the case for insurers. As part of an ongoing study of the market-value impact of insurer financial strength, we survey some of the literature in this area.

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It is well known that economic capital requirements and reinsurance are closely related. Capital and reinsurance are essentially substitutes, chiefly secured in order to back up insurers' promises to their customers. Less well known, however, is whether insurer financial stability actually generates value, and, if so, how much. Knowing the value of financial stability is crucial for determining the valuation consequences of a change in economic capital held or reinsurance ceded.

This paper is a brief survey of studies of capital market responses to changes in insurer capital and perceived financial volatility. Despite predictions of pure financial theory, the results support the common view that company value is enhanced by having strong finances. However they also suggest that there is a limit beyond which further financial strength is too costly to achieve.

Before getting into the details of the studies, some background financial theory is covered.

What financial theory says about risk aversion

Two paradigms of risk analysis dominated 20th century thinking about risk. For the individual, utility theory served as the basis, while for corporations beta – derived from portfolio theory – was key.

Utility theory provides a mathematical way to express individuals' preference for certainty over uncertainty. The utility to you of an amount of money represents how much you would like to have it. A million dollars is worth something, and two million is even better, but if you are risk averse, it's not twice as good. So if you win a lottery for a million, and can flip a fair coin for either two million or zero, you would keep the million. Utility theory gets to this conclusion because the expected utility of taking the chance is less than the utility of one million certain, as the utility of having two million is less than twice the utility of having one million.

This logic is compelling, but it doesn't apply to corporations. In classical financial theory, corpo-

rations do not have their own preferences toward risk, relying instead on shareholder value to communicate what they should like or dislike. If shareholders invested all their wealth in only a single company, then market value would exactly reflect shareholders' dislike of any and all risk. However, since shareowners can diversify their holdings across many companies, they care only about the component of company risk that is pervasive across their portfolio – systematic risk. Any risk due to idiosyncratic fluctuation of cashflow is diversified away, and so shareholders and market value are indifferent to it. So the extent to which a corporation's cashflows move with the overall market becomes a risk measure – indeed *the* risk measure – and this is what is measured by beta.

Problems with the historical view - summary

The corporate story is clearly problematic. Companies buy insurance to protect against losses, such as damage to facilities and lawsuits. They don't seem to buy it for beta. Either the whole corporate sector's attitude toward risk is tremendously naïve, as some academics believe even today, or the theory has problems. In the late 20th century a number of such problems came to light, and now a different picture is emerging.

One line of attack on the classical view was to find material flaws in the assumptions of the original theory. One of these was that tapping capital markets and returning funds to them could be done at the same price. A company could pay out all its profits because if it ever needed funds it could raise them again at the same cost. After going public, companies rarely go back to the capital markets for more equity, and usually then only when distressed in some way. Retained earnings effectively come at a better price than new capital. This leads to the conclusion that companies with more growth opportunities will value retained capital more and will benefit from protecting it through risk management, even at a cost to current earnings. Several analytic and empirical studies discussed below have supported this idea.

Another approach was to look at ways that risk reduction could actually enhance earnings. If it costs something to reduce risk, but higher earnings result, then risk management adds to value. This is not inconsistent with the premises of financial theory, but is not contemplated in beta.

Taxation is one example – stable average earnings can be taxed at a lower average cost than wildly fluctuating earnings that average the same. The costs of financial distress are another. There are two kinds of things that happen if a firm falls into distress. The first relates to costs and the second to funding.

As to costs, if a firm falls into financial distress, a fair amount of value can be wasted on lawsuits, regulation, and on the bankruptcy process itself. Estimates are that approximately 2% of pre-distress value can be lost due to these direct or ‘frictional’ costs.¹ More important than frictional costs, however, are the distress costs of employees spending their energy floating their resumes, suppliers cutting back on their dependence, and even customers contemplating their use of the product. Management may also have no choice but to focus on the immediate issues of distress, taking time and energy away from pursuing strategic value. These broader costs of financial distress are estimated to be an order of magnitude greater than the frictional costs.² Indeed, these broader costs start to impact the firm well before insolvency. Even the mere prospect of insolvency or financial weakness may trigger employees, suppliers and customers to begin looking elsewhere.

Second, distress unambiguously impacts funding. Once in distress, firms find it hard to raise outside funds, and virtually impossible to raise external equity capital. After all, why would an investor provide equity capital to a firm in distress, thereby “throwing good money after bad.” All too often, the funds would go directly to pay creditors, instead of funding new growth to support the equity value. As a result, distressed firms cannot sell new equity for anything near its fair market value. For all practical purposes, external finance becomes so expensive that firms cannot afford to use it when it is most needed.

¹ For studies on the direct or explicit costs of bankruptcy see: J. B. Warner, “Bankruptcy costs: some evidence,” *Journal of Finance*, 26, May 1977, 337-348; L.A. Weiss, “Bankruptcy resolution: direct costs and violation of priority of claims,” *Journal of Financial Economics*, 27, October 1990, 285-314; and E. I. Altman, “A further investigation of the bankruptcy cost question,” *Journal of Finance*, 39, September 1984, 1067-1089.

² See G. Andrade and S. N. Kaplan, “How costly is financial (not economic) distress? Evidence from highly leveraged situations,” *Journal of Finance*, 53, October 1998, 1443-1493.

These two features of distress – higher costs and reduced financing opportunities -- make it a kind of death spiral from which exit is very difficult. As a result, the prospect of distress, even the distant prospect of distress, is built into every day securities values. Risk management can thereby raise every-day value, primarily by reducing the probability of distress or near-distress states.

The costs of distress are not the only feature of practical concern missed by focusing exclusively on beta for corporations. For insurance companies, policyholders might be considered to be extremely sensitive to the prospect of financial distress. After all, the only thing a customer “buys” from an insurer is the firm’s future financial payments should he experience a loss. These payments are readily threatened if there is a prospect of future financial distress. Other companies experience these issues, though often to a lesser extent. As supply chain management becomes more critical, risk managers are increasingly looking at the risks to their suppliers. Would you buy a car from a company that might not be there to supply parts? As a result, demand for a company’s product may be strongly negatively affected by corporate exposure to risk, even if there is no beta involved.

Even the individual side of the story – utility theory – has its problems. While utility makes sense in the abstract, psychological studies of risk attitudes have found it incomplete. For one thing, typically risk adverse people are often willing to make bets at less than even odds when the cost is small and the potential payout is significant. As the advertisement for the New York state lottery goes, “Hey – you never know.” More critically here, risk aversion for large losses is more extreme than most utility functions would project. Known as the “certainty effect,” the desire to remove the last vestiges of a major risk tend to be great. Psychological studies have found, for instance, that when the risk is life altering, like losing your home, putting in a risk of insurer failure of as little as 0.1% is of concern. As discussed in greater detail below, homeowners seem to want a premium credit of 1% – 2% to accept such as risk, which is 10 to 20 times the expected value of their risk. Because of these customer attitudes toward risk, insurers may be even more vulnerable to financial instability and possibility of financial distress than firms in general.

So the corporate and individual models both have weaknesses. Utility theory is not exactly right

for individual risk attitudes, especially in getting to the value of the last bit of uncertainty. This clearly has implications for the value of insurer financial strength. Beta theory is not complete either. Besides not being the sole determinate of market risk – a feature not discussed here – beta ignores costly corporate risk that is specific to the individual company.

However this does not say that corporations are people after all – it does not suggest that utility functions will work for company risk management. Beta is still a risk that has to be addressed – it is just not the only risk. Company value from risk management depends on specific issues, like the costs of distress in a particular industry and how close distress might be, and what needs there might be for future capital. In essence these all boil down to assessing the improved profit opportunities that come from risk management, which is quite different from saying that firms prefer certainty to uncertainty just like individuals do. A particularly strong motivator when the company is selling insurance is the risk concerns of its customers, especially the certainty effect for personal lines customers.

Problems with the historical view - empirical findings

The general issues in the previous section have been studied in more detail. Works that bear on these issues include studies of individual attitudes toward risk, corporate risk management, and insurance market impacts.

Individual attitudes towards risk

The cracks in the utility theory that concern us begin with Richard Zeckhauser's Russian roulette example. Suppose a revolver has a completely full chamber of six bullets. How much would you pay -- before pulling the trigger -- to remove one bullet? How much, by comparison, would you pay to remove a single bullet if that bullet was the only one in an otherwise empty chamber? Zeckhauser both introspected and interviewed others on this question.³ He emerged with the view that, contrary to what is predicted by Utility Theory, most individuals would pay more to remove the last bullet than merely to reduce the probability of death from 1 to 5/6. This example

³ Richard Zeckhauser himself did not formally write up this example. However, see Kahneman and Tversky (1979) for the behaviorist view of the roulette game.

helped Kahneman and Tversky develop a central idea in their famous Prospect Theory, one that they call the “certainty effect.” Individuals value certainty, and will pay more to reduce uncertainty the lower is the probability of a bad outcome.

The psychological study that builds on this most directly is “Probabilistic Insurance” by Wakker, Thaler, and Tversky, which was published in 1997 in the *Journal of Risk and Uncertainty*. It tests people’s reactions to insurance policies that are subject to a fairly small probability of default, using methods that get people to reveal their risk attitudes. The finding is that a reduction in premium of over 20 times the expected value of default is needed for people to feel this is equivalent to a no-default cover. The authors show that utility theory has difficulty explaining this, but that an alternative form of risk analysis called prospect theory fits.

A growing number of studies support prospect theory in general. A paper that discusses implications for insurance companies, including the resulting need for strong financials, is “The Loss Of The Certainty Effect” by Stewart & Stewart, in *Risk Management and Insurance Review*, 2001.

Corporate Risk Management

The finding that retained earnings is a more economical source of capital than is external financing, derived by Froot and others (as in Froot, Scharfstein, and Stein, 1993, “Risk Management: Coordinating Investment and Financing Policies,” *Journal of Finance* 48, 1629-1658), implies that, all else equal, firms with greater capital needs will gain more from risk management. Testing this requires a publicly available proxy for risk management activities. Engaging in hedging transactions is often used for this, since even though it is typically only a small part of most companies’ risk management activities it is an available statistic. Firms with greater capital needs are generally those with better growth prospects, which might be indicated by a higher market-to-book ratio or by higher research and development expenditures. Higher liquidity constraints would also indicate potential capital needs. Several studies have found differences in the use of hedging among firms in the directions predicted. These include:

- Geczy, C., B.A. Minton, and C. Schrand, “Why Firms Use Currency Derivatives,” *Journal of Finance* Vol. 52, 1997, pp. 1323-1354.
- Nance, Smith, and Smithson., “On the Determinants of Corporate Hedging,” *Journal of*

Finance, Vol. 48, 1993, pp. 267-284.

- He and Ng, “The Foreign Exchange Exposure of Japanese Multinational Corporations,” *Journal of Finance*, Vol. 53, 1998, pp. 733-753.
- Dolde, “Hedging, Leverage, and Primitive Risk,” *Journal of Financial Engineering*, Vol. 4, 1995, pp. 187-216.

These studies are part of a growing body of support for the existence of value in risk management that relates to external financing costs. However not every study has found such effects.

Other aspects of the value of hedging specific risk are also finding support. The Dolde study above reports a positive relationship between tax loss carry forwards and the use of risk management instruments, indicating that taxes provide an incentive for risk management. It also finds a significantly positive relationship between the use of risk management and leverage, as suggested by the expected frictional costs of financial distress, which would usually be higher for more leveraged firms. A similar outcome is found by the He and Ng study, as well as by Samant, “An Empirical Study of Interest Rate Swap Usage by Nonfinancial Corporate Business,” *Journal of Financial Services Research*, Vol. 10, 1996, pp. 43-57.

Thus tax effects and financial distress, in addition to capital costs, appear to influence corporate risk management behavior, shown by the findings that corporations will spend money on risk management when doing so increases profit opportunities.

Insurance specific studies

Finance researchers see the insurance industry a good field for studying corporate risk management, because the extent of reinsurance purchases is available. An initial paper from this perspective is Mayers and Smith "On the Corporate Demand for Insurance: Evidence from the Reinsurance Market," *Journal of Business*, Vol. 63 (1) 1990 pp. 19-40. They find tax effects and financial distress costs to be important drivers of reinsurance purchases. Corporate form is also important, with closely held corporations and mutuals buying more reinsurance than do widely traded stock companies. The costs of financial distress can be great for insurance companies, leading to loss of business well before solvency is threatened. Another paper that finds that avoiding financial

distress is an important motivator for insurer hedging is Cummins, Phillips and Smith “Derivatives and Corporate Risk Management: Participation and Volume Decisions in the Insurance Industry,” Federal Reserve Bank of Atlanta Working Paper 97-12, 1997. They find that reinsurance and financial hedges are to some extent replacements for each other, and identify other determinants of insurer hedging. An increase in market value from using risk management to avoid financial distress is reported by Staking and Babbel, “The Relationship between Capital Structure, Interest Rate Sensitivity, and Market Value in the Property-Liability Insurance Industry,” *The Journal of Risk and Insurance* Vol. 62 No. 4, 1995 pp. 670-718.

Several studies have found pricing and growth benefits from insurer financial strength:

Phillips, Cummins and Allen “Financial Pricing of Insurance in the Multiple-Line Insurance Company,” *The Journal of Risk and Insurance*, vol. 65 no. 4, 1998 pp. 597-636, estimate the price discount that insureds demand for accepting a higher probability of insurer default. They find the discount is about 10 times the economic value of the default probability for long-tailed lines and 20 times for short-tailed lines. This is roughly consistent with the predictions of prospect theory and the certainty effect. Cummins, Lin and Phillips have found even stronger effects in a study announced preliminarily but not yet published.

Sommer “The Impact of Firm Risk on Property-Liability Insurance Prices,” *The Journal of Risk and Insurance*, vol. 63 no. 3, 1996, pp. 501-514 finds that the profit load insureds are willing to pay decreases as the ratio of capital to assets declines, and also decreases as the volatility of that ratio increases. This reinforces the impact of strong capitalization on pricing. Part of this is a response to stability of results, suggesting that stability itself can contribute to earnings. Numerically, he finds that at the mean levels of the variables, a 1% increase in capital, with obligations held constant, leads to an almost 1% increase in pricing achieved, and a 1% decrease in the portfolio standard deviation produces more than 1/3 of a percent increase in pricing. He concludes that there is an impact of guarantee funds on insurer choices, but the uncertain and possible delay involved still place a premium on insurer financial strength.

Grace, Klein and Kleindorfer “The Demand for Homeowners Insurance with Bundled Catast-

trophe Coverages,” Wharton Project on Managing Catastrophic Risks, 2001, find indications that higher rated homeowners insurers get higher premiums, but with state variations having to do with insolvency funds.

Epermanis and Harrington “Market Discipline and Reaction to Rating Changes in U.S. Property-Liability Insurance Markets,” University of South Carolina, March 2001 find that growth rates are higher for higher rated insurers, and that the growth rate of a company moves up and down with rating changes. They found that a ratings upgrade is worth about 3% additional growth in the following two years, with a slightly stronger effect for initially lower rated insurers. A ratings downgrade costs lower rated insurers in the range of 20% loss of business over two years, but costs only about a 5% loss of business when higher rated insurers become less highly rated.

All of these results support the conclusion that having a strong balance sheet, with capital strength and earnings stability, adds value to the insurer, increasing both current earnings and the value of future earnings. Specific risk is costly and worth managing, especially for insurance companies.

Toward an Integrated Post Modern View

These empirical findings, coupled together with a small collection of theoretical papers provide the basis for a revised view of corporate risk management in general, and one that applies to insurers and reinsurers in particular.⁴ The emerging view has just a small number of points at which it deviates from the classical “beta-only” view of corporate risk management, so that it’s relatively easy to summarize. These are the presence of:

1. Deadweight costs of depleting capital
2. Customers who dislike Probabilistic Insurance
3. Deadweight costs of hoarding capital

• ⁴ See Myers, S and Read, J (2001), “Capital Allocation for Insurance Companies,” *Journal of Risk and Insurance*, 68:4, Froot, K., and J. Stein, “Risk Management, Capital Budgeting and Capital Structure Policy for Financial Institutions: An Integrated Approach,” *Journal of Financial Economics*, 47, January 1998: 55-82, and Froot, K., “Risk Management, Capital Budgeting and Capital Structure Policy for Insurers and Reinsurers,” Harvard University working paper.

The deadweight costs of depleting capital arise because retained earnings appear cheaper than external funds. The mechanisms are those discussed above. First, as internal capital is depleted, financial distress becomes a more realistic possibility. This hurts the opportunity set of the firm and its valuation. Employees, management, and shareholders all consider their investments in the company and their willingness to make further investments. This willingness declines substantially the more likely is distress. External funds may be available to replenish the company coffers, but these funds become more expensive – even unavailable – as distress increases in likelihood. Firms may therefore find it difficult to finance their way out of a depleted–capital situation.

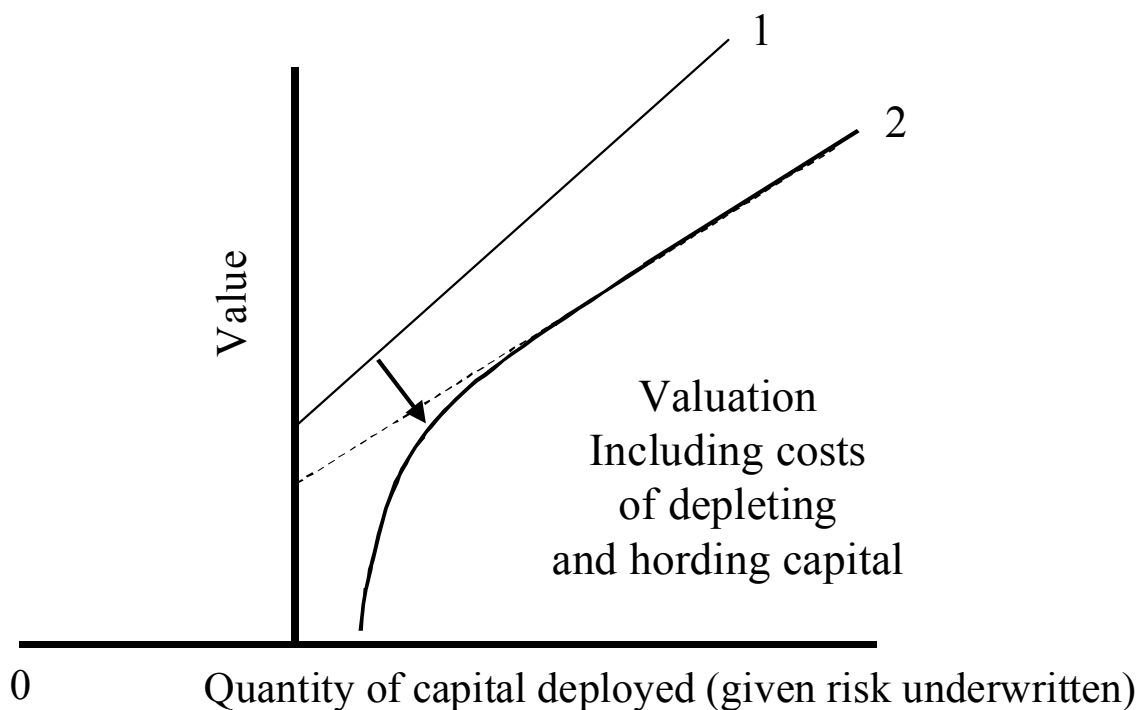
There is also an additional indirect cost for insurers and reinsurers, a kind of externality, associated with depleting capital: the impact on customers. Naturally, customers see that the insurer is riskier as its capital is depleted. Just as investors who hold the insurers bonds, policyholders face credit risk. However policyholders are different: they tend to be more sensitive than bondholders to the possibility of default. This is what we refer to above as policyholders’ dislike of probabilistic insurance. They appear even more risk averse than a diversified investor focused strictly on the possibility of loss.

Third, there are not only deadweight costs depleting capital, but deadweight costs of hoarding capital as well. If there were costs only of depleting internal funds, then firms would presumably stock up on capital when they were healthy, bringing internal funds to such a high a level where they would never be threatened. Some firms do in fact show signs of this behavior. Startup technology companies, for example raise large amounts of capital in IPOs relative to their profits or revenues. They are often prefunding their expenses for a few years, and not necessarily using the funds to invest in new assets. Nevertheless, there is a limit to how much capital any firm can hope to hoard. There is probably no healthy firm in the world that could raise, say, \$100 billion of additional funds of equity capital. Such an amount wouldn’t be a problem in the classical finance world where beta is the only risk – after all, it’s only about 10 basis points of global liquid securities. In the real world, however, shareholders view managers’ discretion as a potential risk – management control over such large sums is dangerous since the funds may not be used in

shareholders' best interest. Moreover, it is much more tax efficient for shareholders to warehouse extra funds in mutual funds (where the interest income is not taxed before reaching shareholder) than in corporations (where the interest income is tax before being paid back to shareholders). These two mechanisms – agency issues and corporate taxation – drive the deadweight costs of hording capital. The result is that even the shareholder-benevolent Warren Buffett wouldn't be able to raise \$100 billion of funds for Berkshire's unrestricted use.

These three distortions mean that a lump-sum infusion of capital into a financially struggling firm will increase its capital market value by more than dollar for dollar. For firms that are in the normal range of financial strength, the increase in capital market value will be less, about dollar for dollar with the capital infusion. And for firms that hold excessive amounts of capital, further infusions will increase their value at a rate less than dollar for dollar.

Figure 1

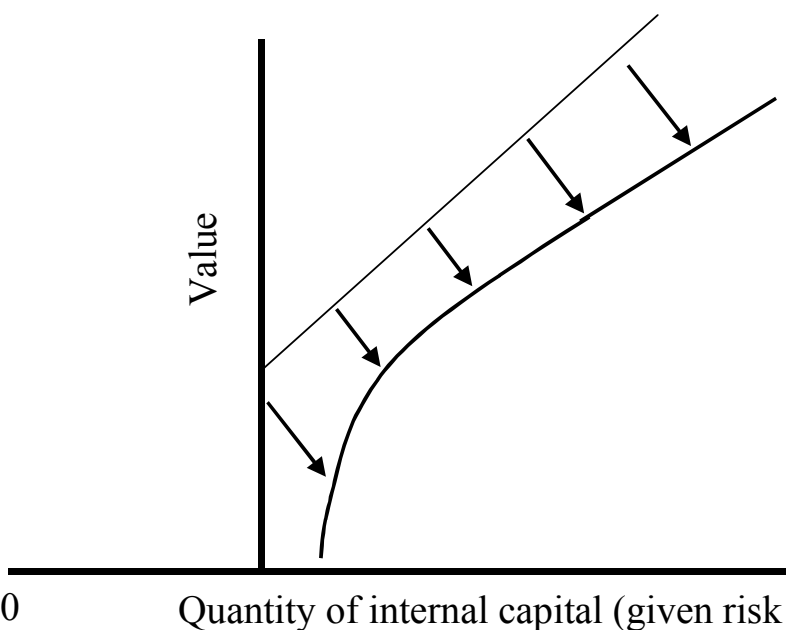


This behavior is summarized graphically in Figure 1. It shows how corporate valuation as a function of internal capital differs between the classical world in which only beta matters (line 1) versus the post-modern world in which the three deadweight costs are prevalent (line 2). The

graphical setup makes several points that are worth emphasizing about value. It also helps to motivate some of the findings discussed in the empirical literature above.

First, the amount of insurance capital deployed in the (more-realistic) post-modern view is always scarcer than under the classical view. In other words, the three sources of deadweight costs above form a drag on the capital-market value of insurance capital. This can be seen clearly in Figure 2 below.

Figure 2



Second, an additional dollar of firm capital has higher marginal value as internal capital than as external capital, so internal capital is scarce. This implies that a marginal event loss has a greater impact on undercapitalized companies. This may be magnified by competitive pressures, whereupon competitors become predators vis á vis undercapitalized firms. This effect is shown in Figure 3 below.

Third, uncertainty in performance reduces value, and does so by relatively more for less-well-capitalized firms. This kind of effect is perhaps most important for insurers and reinsurers, whose internal capital is also a source of product-market strength. Because curvature declines as capital increases, sufficiently well-capitalized companies do not suffer in value from uncertainty, unless volatility is extreme. This effect is depicted in Figure 4 below.

Figure 3

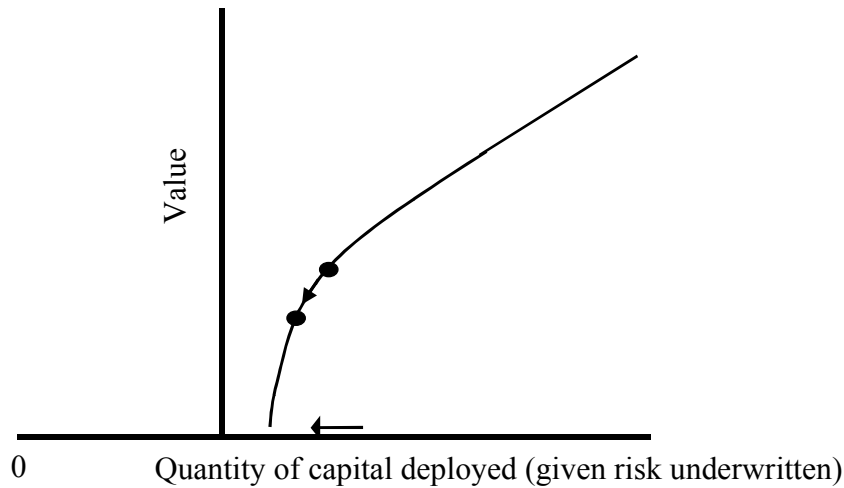
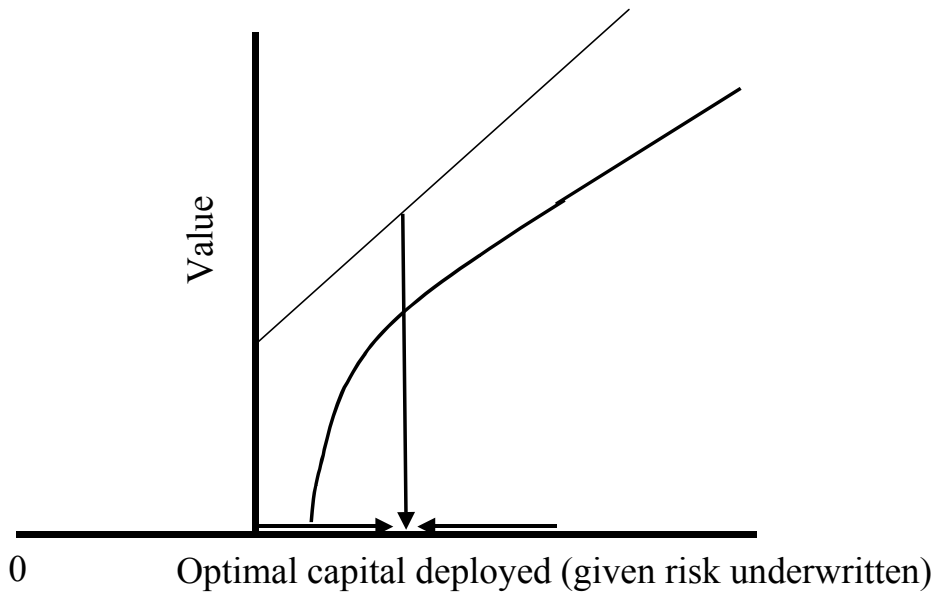
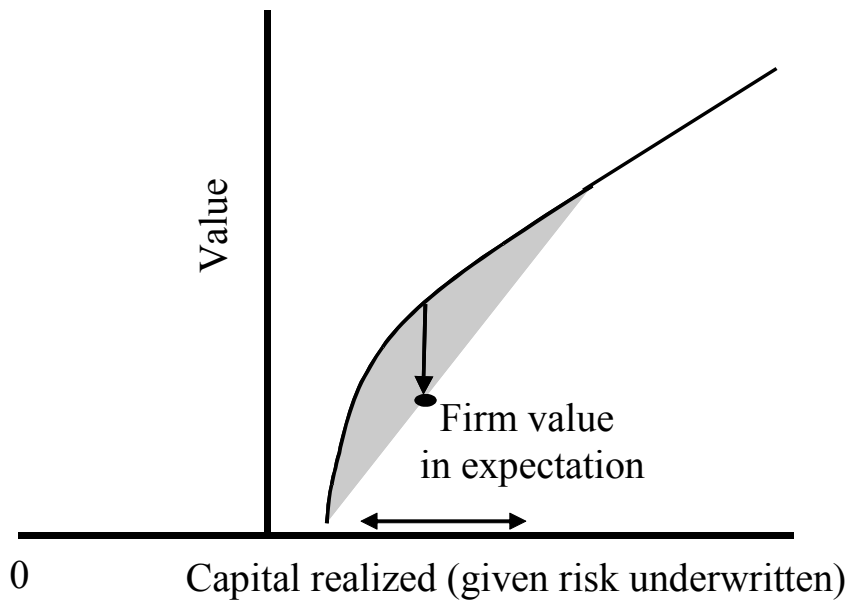


Figure 4



Fourth, the three sources of deadweight costs imply that there is an optimal amount of capital to deploy. This amount trades off the costs of depleting capital (including demand effects) against the costs of hoarding capital. Of course, under the classical view, there is no optimal amount of capital – given the risks they bear, firms can carry as much, or as little capital, as they desire. The impact on value is equal to the difference in capital held. This effect is shown in Figure 5. The optimal point occurs where the slope of the curved line just equals 1.0.

Figure 5



The post-modern view predicts that there should be empirical evidence of all four of these implications. An indeed, much of the evidence above is supportive of this view against the classical view. Beta is not a sufficient statistic for the valuation of insurance and reinsurance companies.

We still have a long way to go in fleshing out the implications of this post-modern view for financial policies at insurers and reinsurers. There are no agreed-upon estimates of slopes, levels, or curvatures in Figure 1. Getting to the optimal level of reinsurance has been regarded as a judgment trade-off between the marginal cost of the program (premium less expected recovery) and the stability gained. Going forward, while there are a few studies with slightly different findings (as noted above), there is an increasing consensus that a reasonable range of parameters for the post modern view can be ascertained. This will bring us to a more narrow range of answers to the fundamental question “What is the value of insurer financial strength?”