



Valuation of structured risk management products

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Abstract

This paper applies valuation theory to structured risk management products. We specialize the theoretical model to two representative products, a “double trigger” put option and a property insurance with a retention which is a function of a commodity price. The double trigger refers to the fact that the option has to satisfy two conditions in order to be in the money: the underlying equity must be below the strike price and, in addition, a specified catastrophic event must have occurred and affected the insured firm. These examples illustrate how the standard valuation theory for pricing risk in an arbitrage-free market should be applied to products engineered to manage multiple risks within the firm.

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1. Introduction

This paper builds upon the results of Cox et al. (2000) and applies the valuation machinery from financial economics to structured risk management products. In that paper, we argue that the introduction of any risk management technologies (products) that reduce market frictions associated with the allocation of risk over the economy result in a welfare improvement. We then provide details on how such products represent the reduction of certain market frictions and how these products move existing imperfect markets toward a perfect markets equilibrium. This paper assumes perfect markets and applies the resulting valuation theory to structured risk management products. This approach is in the same vein as using Black–Scholes to establish benchmark values of over-the-counter and real

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options, since the assumptions of a Black–Scholes economy do not obtain in practice (e.g., the violation of local dynamic completeness).

2. Structured risk management products

The traditional approach to risk management of a general business firm begins with identifying certain event exposures, such as catastrophe exposure or interest rate shocks. Then traditionally the risks are handled on a case-by-case basis. Some will be retained, some insured, others hedged with options or futures, and so on. Moreover, the risk management organization is typically split between traditional “insurance” exposures (e.g., property, liability, etc.) and “financial” exposures (interest rates, foreign exchange, commodity prices, etc.). In a traditional structure the chief financial officer may supervise both functions, however, they often have little functional interaction—they work independently for the most part.

Prior to the hard market of the 1980s, corporate risk managers purchased relatively standardized insurance products, typically 1-year policies. Premiums were unstable, and followed a cyclical pattern that would lag the so-called underwriting cycle. These methods did not work well. They were highlighted by epochs of severe under supply or over supply of insurance. Cummins and Outreville (1991) give an explanation for “the existence of underwriting cycles which is consistent with modern theories of financial economics and with institutional realities of insurance markets”. If insurance (or reinsurance) premiums are set in a competitive market and reflect rational expectations, then there would be no underwriting cycles. They conclude that institutional and regulatory factors intervene in insurance markets, leading to an apparent cycle. The lack of a frictionless flow of capital manifested itself in the form of cycles. The intervening factors they mention are data collection, regulatory lags, policy renewal lags, and statutory accounting. Alternative forms of risk financing may reduce the regulatory and statutory accounting factors and reduce frictions which impede the flow of capital.

The hard market of the 1980s was severe enough to cause many purchasers of traditional insurance products to self-insure. Subsequent market conditions remained soft for some time, however many firms continued to use self-insurance, perhaps in combination with traditional insurance. Firms continue to retain and manage their own risks, a situation that can be shown under the right conditions to be more efficient than purchasing traditional insurance. This trend continues, and the “self-insurers” are becoming more sophisticated in the process. Moreover, the recent hardening of direct and reinsurance markets should increase the number of “self-insurers”.

Mayers and Smith (1982) describe a rationale for the insurance purchases by corporations with diffuse ownership. Because stockholders and bondholders can diversify insurable risks in the capital markets, there is no incentive to require managers to buy insurance. For example, consider the risk of fire damage to buildings owned by a firm. Actually the firm’s stockholders own the buildings, but they can diversify the risk by buying shares in a number of firms with similar but uncorrelated risks. Mayers and Smith argue that the demand for corporate insurance derives from factors other than risk aversion. They describe the ability of the insurance contract to

- (1) allocate risk to the firm’s stakeholder with the comparative advantage in handling the risk,
- (2) lower transaction costs,
- (3) provide claims administration services,
- (4) monitor compliance of contractual provisions,
- (5) bond the firm’s real investment decisions,
- (6) lower the firm’s tax liability, and
- (7) reduce regulatory constraints on the firm.

The emerging approach to risk management is to combine “insurance” risks such as liability or weather-related and “financial” risks such as foreign exchange or commodity price risk. This is different than the traditional notions of buying insurance products each year to transfer specific risks and paying the corresponding premiums. This approach involves combining multiple risks to which the firm is exposed and engineering a long term risk management program

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