

...and the
Impact on Actuaries

Stephen Mildenhall

June 11, 1998



Overview

- ▶ Financial services is a knowledge based industry
 - ▶ Products are easy to duplicate
 - ▶ Fast product cycle
 - ▶ People are an important asset
- ▶ Education and responsive management are the only sustainable competitive advantage
- ▶ Actuaries must continually to learn new things



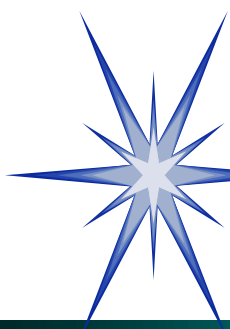
Banks and Insurance Companies

- ▶ Actuaries must understand differences between banks and insurance companies
 - ▶ Sources of risk
 - ▶ Pricing risk
 - ▶ Bearing risk
- ▶ Knowledge important to help understand how new products could work
- ▶ Wall Street analysts will do their homework



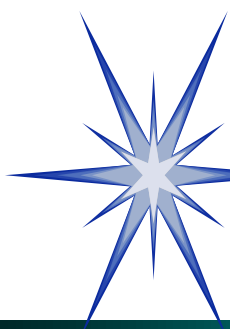
Sources of Risk

- ▶ Sources of Risk for Banks
 - ▶ Interest rate risk
 - ▶ Credit risk
- ▶ Sources of Risk for P/C Insurers
 - ▶ Predominantly underwriting risk
 - ▶ Pricing
 - ▶ Reserving
 - ▶ Process, parameter



Example

- ▶ Airplane lease residual value
 - ▶ Bank loan to purchase
 - ▶ Amortize depreciation for 10 years
 - ▶ Balloon payment after 10 years financed by sale of plane
 - ▶ Bank unwilling/unable to assume re-sale value risk at end of lease period
 - ▶ Asset side risk, not liability side



Example

- ▶ Airplane lease residual value
 - ▶ Insurance company offered residual value insurance
 - ▶ Single up-front premium plus profit sharing on sale of plane
- ▶ Insurance company able and willing to quantify, price and bear risk rejected by bank
- ▶ In future, will this deal require a bank and an insurer?



Pricing Risk

- ▶ How markets price risky financial instruments
 - ▶ CAPM, beta arguments
 - ▶ Diversifiable vs. systematic risk
 - ▶ Risk adjusted present value
 - ▶ Options pricing methods
 - ▶ Hedging
 - ▶ No arbitrage
 - ▶ Synthetics and comparables
 - ▶ Law of one price



Pricing Risk

- ▶ How insurers price risk
 - ▶ Load expected losses for profit
 - ▶ Mystical not methodological
 - ▶ Market pricing does reflect a measure of diversifiability
 - ▶ Cat insurance is expensive because it cannot be diversified
 - ▶ No dominant theory



Bearing and Managing Risk

- ▶ How banks bear risk
 - ▶ They don't---they get rid of it
 - ▶ Hedging, ALM, to reduce risk to minimum
- ▶ How P/C insurers bear risk
 - ▶ Move risk around using reinsurance
 - ▶ Ultimately, trust in law of large numbers
 - ▶ Securitization can get risk out of P/C system
- ▶ Overnight VAR vs. overnight EQ exposure



Two Key Questions

- ▶ Do asset pricing theories transfer to insurance and securitized products?
- ▶ Do hedge-based risk bearing and derivative pricing techniques transfer to insurance related products?

If you say MPT quickly it sounds like *Empty*?



Asset Pricing Theories

- ▶ “Securitization as new asset class”
- ▶ “Zero beta asset”
- ▶ What is the return on a zero beta asset?
 - ▶ Risk free rate
- ▶ Why are securitized products priced above the risk free rate?



Incidentally...

- ▶ Are cat derivatives a zero beta asset?
 - ▶ In 5 months after Kobe, Nikkei lost more than 20%
 - ▶ SF 1906 EQ: DJIA lost 9% in 2 weeks on massive volume and interest rates increased from 3.5% to 5%
- ▶ Zero beta only for small cats?
 - ▶ Andrew was about 0.5% of GNP



Asset Pricing Theories

- ▶ CAPM assumes investor preferences are determined by mean and variance of the return distribution
 - ▶ Asset returns typically symmetric and close to normally distributed
 - ▶ In this case not unreasonable to assume mean and variance do specify preferences
- ▶ Assumption **not** reasonable for insurance



Asset Pricing Theories

- ▶ Insurance liabilities
 - ▶ Skewed
 - ▶ Small upside, large downside
 - ▶ Opposite of what investors want
 - ▶ CAPM fails to differentiate pricing between assets with same mean, variance, and correlation to market (beta), but different skewness
 - ▶ The market does not!
 - ▶ Accounts for current pricing



Hedging

- ▶ Hedging is a key difference between how banks and insurers bear and price risk
- ▶ Hedging means taking advantage of correlations between prices to offset risk
- ▶ Financial assets have structural correlations
 - ▶ Stock and an option on the stock
 - ▶ No arbitrage ensures correlations hold in market prices



Hedging

- ▶ Financial assets can have positive and negative correlations
 - ▶ Stock and call (positive), and put (negative)
 - ▶ Derivatives have long and short positions
- ▶ Similar phenomenon could exist for insurance
 - ▶ Policies on same exposure with different limits or attachments
 - ▶ No market trading such instruments
 - ▶ Insurable interest

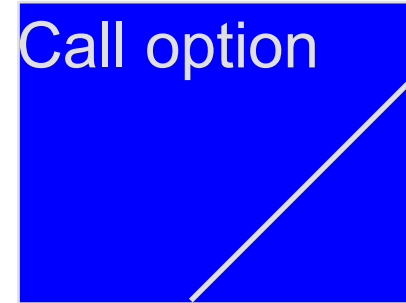


Insurance and Derivatives

- ▶ **Derivative:** instrument whose value is *derived* from the value of another instrument
 - ▶ Stock options
- ▶ **Payout of insurance policy** is derived from underlying loss amount
 - ▶ Apply deductibles, limits, coinsurance etc.

Insurance and Derivatives

- ▶ Insurance policies are like options
 - ▶ Call = XOL cover
 - ▶ Exercise - Put = Deductible
- ▶ Similarity is superficial
 - ▶ One payment vs. multiple payments
 - ▶ Known settlement date vs. unknown claim payment date(s)
 - ▶ Standardized financial options vs. unique insurance risk





Insurance and Derivatives

- ▶ Derivative pricing is based on hedging
 - ▶ Use correlation between underlying asset price and derivative price to hedge away risk
 - ▶ Black-Scholes option pricing theorem is archetypal example
- ▶ Properties of asset prices that facilitate derivative pricing
 - ▶ Long time series, Markov process, independent increments, continuous



Insurance and Derivatives

- ▶ Could this work for insurance?
- ▶ Cannot trade in underlying instrument
 - ▶ Underwriting risk unique to each policy
 - ▶ Lack of standardization, especially larger accounts
- ▶ Can still use hedging arguments to price one derivative relative to another
 - ▶ Interest rate derivatives
 - ▶ But, assumes market in derivatives



Conclusions

- ▶ CAPM needs to include skewness measure
 - ▶ Already exists in finance literature
- ▶ Not clear if OPT applies insurance risk
- ▶ OPT techniques can be applied to some insurance-like products
 - ▶ Weather derivatives
 - ▶ Will be market in derivatives

Conclusions

- ▶ Insurer/actuary expertise still needed to evaluate risk and determine premiums
- ▶ Do actuaries have an monopoly on this knowledge?
- ▶ ***NO!***
- ▶ Be happy: when you get FCAS you can start learning the interesting stuff

