

PORTFOLIO “INSURANCE”

Presented By:

JOHN O'BRIEN

Director, Master in Financial Engineering (MFE)
and Adjunct Professor

University of California, Haas School of Business
obrien@haas.berkeley.edu

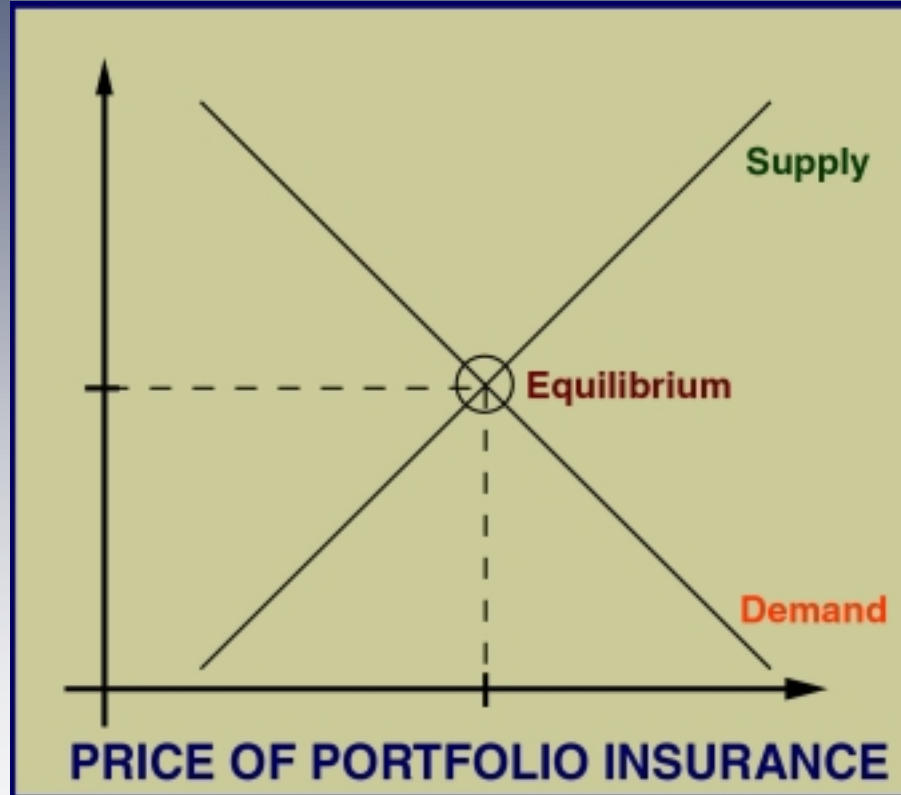


Portfolio “Insurance”

- Traditional insurance is based on the principles of diversification and actuarial science.
- Portfolio “insurance” is based only on the principal of risk transfer. One person’s protection is another person’s liability.
- For the market for portfolio “insurance” to clear: money protected must equal money at risk.
- The **cost** of portfolio “insurance” is the mechanism to equilibrate its demand with supply.



Supply/Demand Curve for Portfolio “Insurance”



Basic Portfolio “Insurance” – Stock plus Put Option

- An investor with 100 to invest could invest it all in a portfolio of stock, bearing all the risk and reaping all the reward.
- Alternatively, the investor could buy a Put Option at a cost of “ p ”, and invest the remainder, $(100 - p)$.

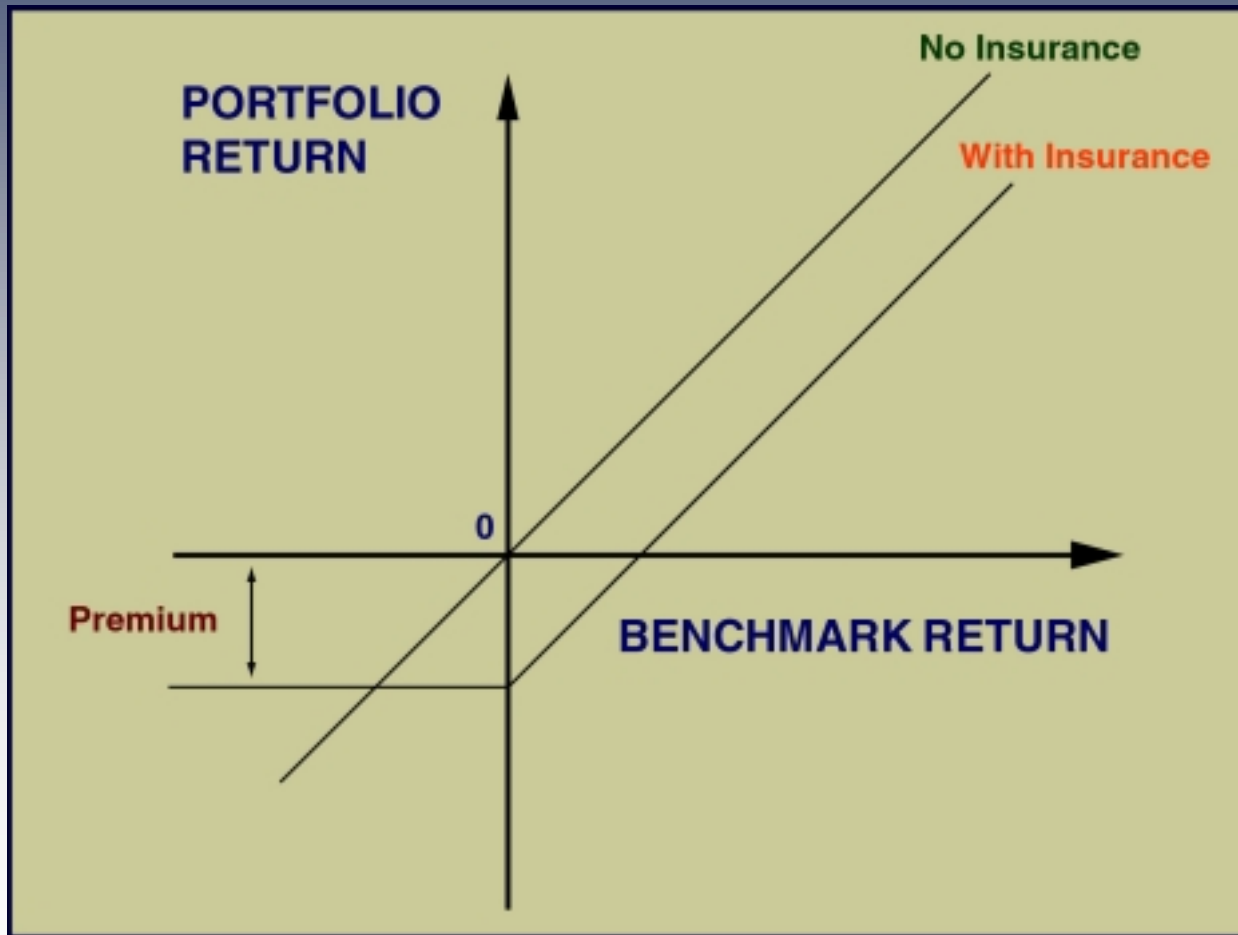


Basic Portfolio “Insurance” – Stock plus Put Option (2)

- The protected investor will gain only a fraction, $(100 - p)/100$, of future stock gains, but would be protected from loss beyond the protection level provided by the Put Option (see graph on next slide).
- Question: If the stock declines such that the protected investor should receive 25, from where does the 25 come?



Graph Illustrating Portfolio “Insurance”



Option's Markets are “Zero Sum”

- The protected investor in our example received 25 from his Put Option – the option seller lost 25 (but kept his premium, “p”)
- Our example makes clear that every gain is exactly offset by a corresponding loss.
- Fundamental identity in every Option and Future's market: buyers gain (loss) equals seller's loss (gain).
- All option and future's markets are **zero sum**.



Hedging a Put Option

- The seller of a Put Option is at risk when the stock declines. To hedge this exposure, the seller must take a short position in the stock, and adjust that short position, in order to make a profit equal to his payout if the stock closes below the protected level.
- The seller must carry out this short-stock management program without losing more than the premium he received, p .



Hedging a Put Option (2)

- Properly interpreted, and within the bounds of its assumptions, the Black/Scholes/Merton option pricing formulae prescribes exactly how to carry out the necessary short-stock management.



Leland O'Brien Rubinstein's (LOR) Dynamic Hedging

- In 1980 LOR introduced the strategy of dynamic hedging to replicate the payoff from any position in stock plus option.
- Dynamic hedging requires taking positions only in the stock in question and cash. The fraction of stock in the stock plus cash position is known as the “delta” of the position. The appropriate initial delta, and the appropriate subsequent delta adjustments, is derived from the Black/Scholes/Merton formulae.



Leland O'Brien Rubinstein's (LOR) Dynamic Hedging (2)

- The implication of dynamic hedging is that investors can think of options and dynamic stock strategies interchangeably.



The Economic Law of “One Price”

- Defined: All assets offering the same payout in all states of the world will sell at the same price.
- Implication: Any option and its replicating strategy must have the same price.
- Said another way, the price (or cost) of an option replicating strategy is the fair price (or premium) of the option being replicated.



The Economic Law of “One Price”

(2)

- Black/Scholes/Merton indicates the fair price of an option in an idealized world; the cost of a replicating strategy indicates the cost of an option in the real world. This distinction is often overlooked – an often costly mistake.



Determinants of the Cost of a Replicating Strategy

- Pure Cost – Cost in a continuous, frictionless, constant-volatility market.
 - The actual, or opportunity, cost of moving from the initial strategy delta (say, 0.5) to the delta at expiration (either 0 or 1), plus
 - The “reversal” costs resulting from volatility-driven reversals in the strategy delta (buying high, selling low).



Determinants of the Cost of a Replicating Strategy (2)

PLUS

- Real World Costs – Costs resulting from price discontinuities, trading frictions, and volatile volatility



Real World Replicating Strategy Costs

- Stock Price Jump – Prevents maintaining the appropriate delta as the stock price moves from one level to another.
- Changing volatility, but continuous trading – Causes the number of actual reversals of stock price to differ from the anticipated number.



Real World Replicating strategy

Costs (2)

- Transaction friction (cost) – Causes more value loss per reversal than anticipated (similar impact as higher than anticipated volatility).
- Cost of capital and profit.



Real World difference between Buying and Replicating an Option

- When you buy an option the cost is certain, and, except for default risk, the payoff is certain.
- When you replicate an option either the cost or the payout is uncertain.
- This difference tends to define who buys options (mostly end-users), and who sells options and hedges his position (mostly broker / dealers / investment bankers).



Macro-market Implications of Portfolio “Insurance”

- Option’s markets provide transparency for prices, and allow price to equilibrate the demand and supply of Portfolio “Insurance”, or any option’s strategy.
- Replicating strategies are not transparent to the market. Stock transactions initiated for differing reasons are confounded in the market. Therefore, the cost of any strategy (say, Portfolio “Insurance”) is not clearly known. This uncertainty prevents a proper equilibration of demand and supply. Bad things can result.



October 1987 in the U.S. Market

- The U.S. market was generally seen to be “overvalued”.
- The Portfolio “Insurance” replicating strategy was not well understood by market participants.
- The amount of Portfolio “Insurance” in force was not well understood by market participants.
- The Index option’s market had just developed. It did not provide sufficient position limits, or liquidity, for broad institutional use.



October 1987 in the U.S. Market (2)

- Stock-index stocks/stock-index futures arbitrage was in early development and not well understood by market participants.
- Fear of broker and market-maker insolvency caused stock bids and trading capital to be reduced by market participants.
- Taken together, the above factors caused natural “value” buyers to step aside, or to demand large price discounts.



Cash-Index/Index Futures Arbitrage

- Sale (purchase) of an Index Future is more efficient than the sale (purchase) of a list of, say 500, stocks to affect an asset allocation shift. Long stock plus short futures contract equals cash.
- Properly implemented, an asset allocation shift using Index Futures would be seen as a “no-information” trade with respect to the individual stocks in the index, hence less disruptive to individual stock prices.



Cash-Index/Index Futures Arbitrage (2)

- Operationally, an Index Futures trade involves much less stock-transfer activity (and cost) than trading a large list of stocks.



Requirements for an Orderly Portfolio “Insurance” Market

- Transparency in the price and amount of Portfolio “Insurance”.
- A well developed cash-index/index futures arbitrage market.
- Appreciation of the economic benefit of Portfolio “Insurance”.



Requirements for an Orderly Portfolio “Insurance” Market (2)

- Since the above outcomes would benefit all market participants, one would expect them to develop and for Portfolio “Insurance” to become part of any robust capital market.



Interested in a Deeper Understanding of Finance?

- **Master's in Financial Engineering Program (MFE)**
 - 12 Month program leading to a Master of Financial Engineering degree from U.C. Berkeley.
 - www.haas.berkeley.edu/MFE
- **Financial Investment Technology (F.I.T.)**
 - 7 January – 1 February, 2002
 - One-month intensive course in quantitative financial economics leading to an F.I.T. Certificate.
 - www.haas.berkeley.edu/finance/FIT
- **Berkeley Program in Finance (BPF)**
 - Twice yearly, two-day seminar in contemporary issues in finance.
 - www.haas.berkeley.edu/BPF

