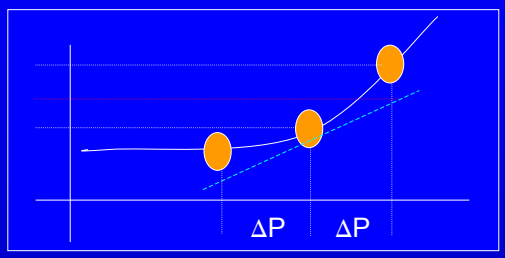
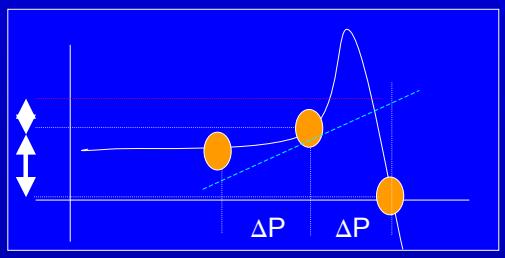
Arbitrage Research and Trading

Direct Vs Empirical Sensitivities

- Note that Greeks etc are valid only at one point and represent an "extrapolation"
- while, empirical sensitivities are based on "shifts"
- The discrepancy can be large for complex portfolios





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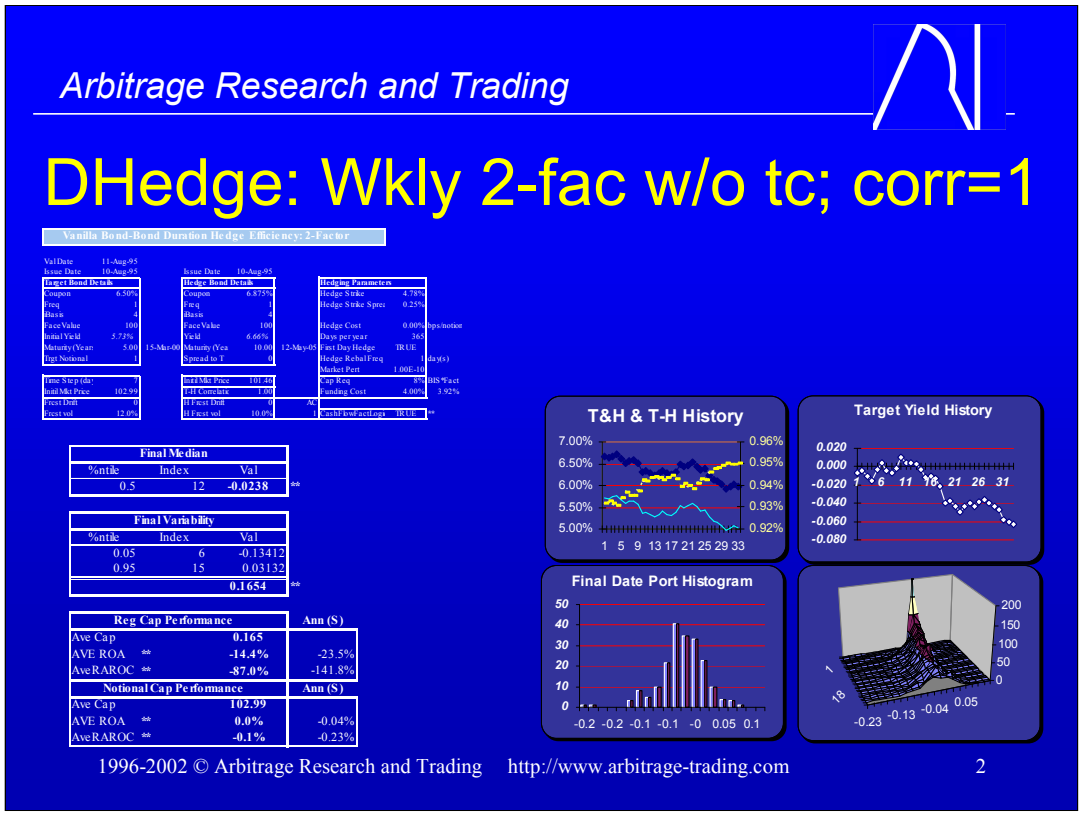
This slide is one of many from the section on options risk management. It illustrates two of the common approaches to calculating position risk. In the first method the dashed blue line "predicts" the position P&L based on delta only. This leads to an estimation error since the position has gamma (curvature), when compared to the explicit revaluation of the position as shown by the orange circles. If the "prediction distance", the size of the change of P that is used for the prediction, is sufficiently small, then the estimation error is probably acceptable, and there may not be a need to revalue the entire portfolio for many different underlying values.

However, note that for positions that have complex pay-out profile, as in the second portfolio, the prediction based on delta alone can be massively wrong. This can arise not only in positions with exotic options, but also even with simple portfolios such as the ratio call spread used here. Notice that in risk management departments a 1.00% change in prices is often used. However, many instruments have strikes in increments of 0.25%, thus leading to a potentially gross error in the risk management numbers. In this situation an explicit revaluation of the portfolio is necessary (even though this may make those overnight P&L reports even longer to calculate) at some number of underlying prices.

Notice also, that a delta+gamma prediction will not help in the second case, since the gamma of the portfolio at the current market prices is positive, and so delta+gamma prediction would be even further away from the truth than a delta prediction alone.



This slide is one of very many slides in a series case studies examining actual position P&L and risk performance for various position types over their holding periods using both back testing and forward testing. Different hedging strategies and assumptions result in P&L distributions at each rebalance point for bonds, futures, swaps, vanilla option, exotic options, convertible bonds, structured products, etc.

This particular slide is form the sequence examining hedging bonds with bonds and bond futures. It illustrates that using a two-factor term-structure model, and with a rebalance strategy using duration/V01 matching the position P&L losses an average of 40 bps (which is much improved compared to traditional models). This occurs for a number of reasons as other slides in the sequence show. However, a particularly important aspect is that even with the sophistication of a two-factor model, a bond hedged with another (similar but not identical) bond is not a risk free position, but rather a directional position on the spread between the two bonds, and with the market conditions as used in this example, the spread has moved against us.

These series of case studies review many aspects of the reality of position keeping and trading under real world conditions.

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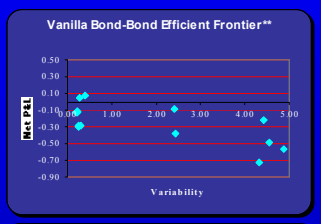
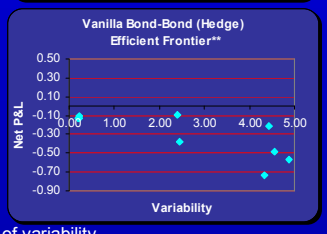
Optimal Strategies: *Efficient Frontiers*

- Create scenarios of strategies and compare P&L (or return) to variability (risk).

Case	Val	Var
NoH	1.47	12.16
Static 0-C	0.08	0.39
Static w/Cap	-0.29	0.30
Weekly 0-C	0.05	0.27
Weekly w/T&C: 1.0	-0.13	0.22
Weekly w/T&C: 1.0 (b)	-0.13	0.21
Weekly w/T&C: 1.0 (c)	-0.11	0.23
Weekly w/T&C: 0.75	-0.38	2.44
Weekly w/T&C: 0.75 (b)	-0.09	2.41
Weekly w/T&C: 0.5	-0.73	4.33
Weekly w/T&C: 0.5 (b)	-0.57	4.88
Weekly w/T&C: 1.5	-0.49	4.56
Weekly w/T&C: 1.5 (b)	-0.22	4.42
Mnthly w/T&C	-0.30	0.24
8Week w/T&C	-0.29	0.26





Note, repeat "same" scenario several times to obtain variability of variability

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With each of the position keeping analysis case studies it is possible to summarise the hedging efficiency with a kind of "efficient frontier" for trading analysis. This slide illustrates that different hedging strategies with different models and "real world" effects (e.g. transactions cost, funding issues, liquidity, etc.) can compared on a risk/return basis in that the profitability of the hedge analysis can plotted against the risk of the strategy.

Many useful results follow, such as "optimal" strategy, "optimal" rebalance frequency, and model selection based on "optimal P&L" to name a few.