2002 European Day Seminars

Monday, October 14th
St Martins Lane Hotel
45 St Martins Lane
London CW2N 4HX

Wednesday, October 16th
The Grand Amsterdam
Oudezijds Voorburgwal 197
1021 EX Amsterdam
The Netherlands

Agenda

- Subtleties of Risk Management for Long/Short Portfolios
  Northfield Information Services
- Risk Modeling of Convertible Bonds
  Northfield Information Services
- Real Estate – How to include it in a mixed-asset portfolio
  Charles Ward, University of Reading
- Equity Style as Described by the Cross-Sectional Volatility of Stock Returns
  Northfield Information Services
- Just Because We Can Doesn't Mean We Should: the Fallacy of High Frequency Performance Attribution
  Northfield Information Services

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Subtleties of Risk Management for Long/Short Portfolios

Dan diBartolomeo

Northfield Information Services, Inc.

2002, European Seminar Series

14-October-2002, London

16-October-2002, Amsterdam

Major Points

- Hypothesis: Hedge funds and long/short portfolios have particular characteristics that makes risk management both more important and more difficult than traditional portfolios
- A lot of portfolio activity is based on anticipation of, or response to “news”
- Numerous quantitative methods already exist to address most of these issues

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Here a Few Differences

- Leverage
- Short Positions
- High Frequency Trading
- Illiquid Positions
- Taxable Investors
- Non-linear Factor Behavior
- Multiple Asset Class Multiple Countries

Leverage Effects

- Traditional investor utility function of Levy and Markowitz assumes:
  - single period model with known parameters
  - investor is trying to maximize the expected value of wealth at the end of time
  - Bankruptcy risk is not an issue
  - Parametric assumptions
- Derived as a two term Taylor series expansion of log wealth utility
- For leverage accounts, “bankruptcy” risk is real, whether by investors withdrawing or removal of prime broker facility

Leverage Effects II

- VAR is inadequate, addresses only the risk of bankruptcy today
- Wilcox (2001) demonstrates that higher order terms matter much more for levered investors
  - Proposes to redefine utility as maximizing growth of discretionary capital (above the a floor on wealth)
- Kritzman and Rich (2001) propose a measure of "first passage" risk.
  - Analytically treat the problem like a knock-out option Risk is the probability of hitting the floor. You don't get up again

Short Positions: Kritzman Again

- Multiple period compound returns have a lognormal distribution. With long only positions the skew is in the investors favor
  - – Ten percent per period for 2 periods = 21% gain
  - – Negative 10% per period for 2 periods = 19% loss
- With short positions, the skew is reversed
  - – The 21% gain is now a 21% loss
  - – The 19% loss is now a 19% gain
- As a short position goes bad, it becomes a larger portion of the portfolio

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High Frequency Trading

- Higher frequency stock returns are “wilder” than longer term returns
  - Distributions have kurtosis
  - Returns are mean reverting (Lo & MacKinlay
- Strategies are often driven by anticipation of, or rapid response to “news”
  - Totally unanticipated versus partially anticipated events
- If returns have serial properties (are not IID) then simple scaling of volatility from one periodicity to another is improper

Problems of Illiquid Securities

- Many hedge funds own illiquid securities without dealing with the associated risks
  - Remember David Askin? LTCM?
- Suggestion: Estimate cost of liquidating the entire portfolio in T periods. Use as a metric for liquidity risk
  - Lo and Bertsimas (1998) estimate for equities
  - Research also relates to optimal execution sequencing
  - SmartExecution.com

Hedge Funds Often Have Taxable Investors

- The problem of unrealized capital gains
  - Finding the balance between deferring gains to reduce current tax liability and locking up the portfolio with lots of unrealized gains it will be hard to trade out of
  - Formulating policy of fair distribution of tax responsibility between past and current investors
  - diBartolomeo (2001)
- After tax returns have a truncated dispersion relative to pre-tax returns
  - How do we set volatility risk policies with a mixed investor base

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Non-Linear Factor Behaviors

- Second order factor returns are common
  - diBartolomeo and Warrick (2001)
- With long only portfolios, second order factor returns still impact the portfolio but to a reduced degree
- For long/short portfolios, second order effects cancel and the portfolio has no return process in operation
  - Consider a momentum strategy.
  - High momentum does well, negative momentum does well, the middle does poorly. Nothing happens.
  - Consider the reverse. Still nothing happens

Anticipated Versus Unanticipated Events

- Abraham and Taylor, “Pricing Currency Options with Scheduled and Unscheduled Announcement Effects on Volatility”, Managerial and Decision Science 1993
- Kwag, Shrieves and Wansley, “Partially Anticipated Events: An Application to Dividend Announcements”, University of Tennessee Working Paper, March 2000
- Ederington and Lee, “Creation and Resolution of Market Uncertainty: The Importance of Information Releases, Journal of Financial and Quantitative Analysis, 1996
- Vast majority of news events are anticipated

GARCH Models & Variations

- Chowdury, “Stock Return Volatility and World War II: Evidence from GARCH and GARCH-X Models”, International Journal of Finance and Economics, 1997
- Chong, Ahmad and Abdullah, “Performance of GARCH Models in Forecasting Stock Market Volatility”, Journal of Forecasting, 1999
- BARRA risk models
- RiskMetrics risk services

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Implied Volatility

- Ederington and Guan, “Is Implied Volatility and Informationally Efficient and Effective Predictor Future Volatility”, University of Oklahoma Working Paper, January 1998
- Shu, Vasconellos and Kish, “The Information Content of Implied Volatility: An International Investigation of Index Options”, Lehigh University Working Paper, April 2001
- Malz, “Do Implied Volatilities Provide Early Warning of Market Stress?”, *Risk metrics*Working Paper, February 2000

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Malz's Point

- Scenario #1, asset with price of $1 today. Two future states each with 50% probability, $.90 or $1.10. Implied volatility is 10% per period

- Scenario #2, asset with price of $1 today. Three future states: $.90 (p = .45), $1.10 (p=.45) and $.50 (p =.1). Implied volatility is 17.75%, a 78% increase

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Other Interesting Literature

- Corrado & Su, "Implied Volatility Skews and Stock Returns, Skewness and Kurtosis Implied by Stock Option Prices", European Journal of Finance 1997
- Baturek, Chowdury and Mac, "Implied Volatility Versus GARCH", Managerial Finance 1995
- Jiltsov, "Implied State Price Densities: Predictive Power, Stability and Information Content", London Business School Working Paper, September 1999
- Ederington and Guan, "Measuring Implied Volatility: Is an Average Better?", University of Oklahoma Working Paper, August 2000

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Implied Volatility Dominates GARCH

- Events that are anticipated in time have distinct time series patterns of trading activity. Hull Trading study on earnings announcement days
  - In anticipation of events, volume and volatility dry up. People wait for the news
  - GARCH models follow the volatility trend and reduce expected volatility going into the event
  - Event day is volatile (factor of 9 intra-day) and GARCH vastly increases volatility estimate for the day after the event, but its too late, the game is over
  - Implied volatility gets it right> Option traders aren't dumb
- Bill Gates gets hit by a bus
  - Remember Jiltsov

The Short Term Model

- Take 250 trading days of returns for US stocks
- Correct for serial correlation and heteroskedaticity
- Estimate blind factors using iterated factor analysis
- Use implied volatility to adjust factor and specific variances
  - This a tricky bit, requiring cross-sectional regressions with constrained coefficients
- Implied volatility data on individual stocks is suspect due to thin trading

Model Nuances

- Conditional mean variance estimation
- Adjust factor and security specific variances for serial correlation, see Parkinson (1980)
- Make factor and security specific variances consistent with observed extreme values

Volatility Estimates on an Airline Portfolio

- 42 stocks, capitalization weighted

9/10, 9/17,11/30	Some Key Dates
589, 2755, 1145	Factor Variance
98, 161, 177	Specific Variance
26, 54, 35	Total Risk

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Driven by Noise?

	31 August	30 September
P&C Insurance	13.04	16.87
Manufacturing	20.88	19.38
Foods	11.56	11.31

Dealing with Multiple Asset Types in Multiple Markets

- Approach 1: use separate models of separate markets and combine with a grand covariance matrix
  - We see this as problematic
  - Has some advantages
- Parsimonious model of EE
  - The "atomic" security approach
  - inspired by Arrow and Debreu

Conclusions

- Hedge funds and long/short portfolio have some properties that make risk management both more necessary and more complex
- Techniques exist to handle most of the risk and liquidity related problems exist
- An increasing body of literature supports analytical use of implied volatility in forecasting changes in market risk and their magnitude
- Integrating implied volatility into asset management models is practical but not trivial

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A Unified Model of Equity Risk, Credit Risk & Convertibility Using Dual Binomial Trees”

Nick Wade
Northfield Information Services
2002, European Seminar Series
14-October-2002, London
16-October-2002, Amsterdam

Structure

We need to answer the following questions

- ❑ What is a convertible bond?
- ❑ How can we sensibly price it in a consistent fashion?
- ❑ How can we decompose it into "atomic" risks?
- ❑ How does this fit into our "Everything Everywhere" model?

What is a convertible bond?

Literature Review I

- Frankle, A. W. and C. A. Hawkins. "Beta Coefficients For Convertible Bonds," Journal of Finance, 1975, v30(1), 207-210.
- Ingersoll, Jonathan E., Jr. "A Contingent-Claims Valuation Of Convertible Securities," Journal of Financial Economics, 1977, v4(3), 289-321.
- Brennan, Michael J. and Eduardo S. Schwartz. "Analyzing Convertible Bonds," Journal of Financial and Quantitative Analysis, 1980, v15(4), 907-929
- Beatty, Randolph P. "Estimation Of Convertible Security Systematic Risk: The Marginal Effect Of Time, Price, Premium Over Bond Value, And Conversion Value/Call Price," Advances in Financial Planning and Forecasting, 1987, v2(1), 135-154.

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Literature Review II

- Beatty, Randolph P., Cheng L. Lee and K. C. Chen. "On The Nonstationarity Of Convertible Bond Betas: Theory And Evidence," Quarterly Review of Economics and Business, 1988, v28(3), 15-27.
- Altman, Edward I. "The Convertible Debt Market: Are Returns Worth The Risk?," Financial Analyst Journal, 1989, v45(4), 23-31.
- Brooks, Robert and Bill Attinger. "Using Duration And Convexity In The Analysis Of Callable Convertible Bonds," Financial Analyst Journal, 1992, v48(4), 74-77.
- Ferguson, Robert, Robert E. Butman, Hans L. Erickson and Steven Rossiello. "An Intuitive Procedure To Approximate Convertible Bond Hedge Ratios And Durations," Journal of Portfolio Management, 1995, v22(1), 103-111.

Literature Review III

- Sparaggis, Takis D. "Factor And Spread Analysis Of The Convertible Securities Market," Financial Analyst Journal, 1995, v51(5), 68-73.
- Carayannopoulos, Peter. "Valuing Convertible Bonds Under Assumption Of Stochastic Interest Rates: An Empirical Investigation," Quarterly Journal of Business and Economics, 1996, v35(3,Summer), 17-31.
- Datta, Sudip and Mai Iskandar-Datta. "New Evidence On The Valuation Effects Of Convertible Bond Calls," Journal of Financial and Quantitative Analysis, 1996, v31(2,Jun), 295-307.
- Ho, Thomas S. Y. and David M. Pfeffer. "Convertible Bonds: Model, Value Attribution, And Analytics," Financial Analyst Journal, 1996, v52(5,Sep-Oct), 35-44.
- Tsiveriotis, Kostas and Chris Fernandes. "Valuing Convertible Bonds With Credit Risk," Journal of Fixed Income, 1998, v8(2,Sep), 95-102.

Literature Review IV

- Ma, Ronald and Cecilia Lambert. "In Praise Of Occam's Razor: A Critique Of The Decomposition Approach In IAS 32 To Accounting For Convertible Debt," Accounting and Business Research, 1998, v28(2,Spring), 145-153.
- Sarkar, Sudipto. "Duration And Convexity Of Zero-Coupon Convertible Bonds," Journal of Economics and Business, 1999, v51(2,Mar/Apr), 175-192.
- Epstein, David, Richard Haber and Paul Wilmott. "Pricing And Hedging Convertible Bonds Under Non-Probabilistic Interest Rates," Journal of Derivatives, 2000, v7(4,Summer), 31-40.
- Kariya, Takeaki and Hiroshi Tsuda. "CB - Time Dependent Markov Model For Pricing Convertible Bonds," Asian-Pacific Financial Markets, 2000, v7(3,Sep), 239-259.
- Mayers, David. "Convertible Bonds: Matching Financial And Real Options," Journal of Applied Corporate Finance, 2000, v13(1,Spring), 8-21.

What Are Convertible Bonds?

Simple yet Complex!

A bond that may be converted at some time in the future at the bond holders' discretion into N shares of stock X at a price P.

Key Common Features:

- call schedule
- put schedule
- sinking fund or other redemption features
- convertible into issuing (or another) companies stock
  - may be convertible at any time
  - may be convertible at a fixed price or a time-dependent price

A Bond plus a Warrant plus Embedded Options?

How Can We Price A Convertible Bond?

Break it into pieces and price those…

- Choose an approach for bonds with embedded options
- Choose a *consistent* approach for stock options
- Add the pieces together

Important: the equity model must be consistent with the bond model

Risks of Convertible Bonds

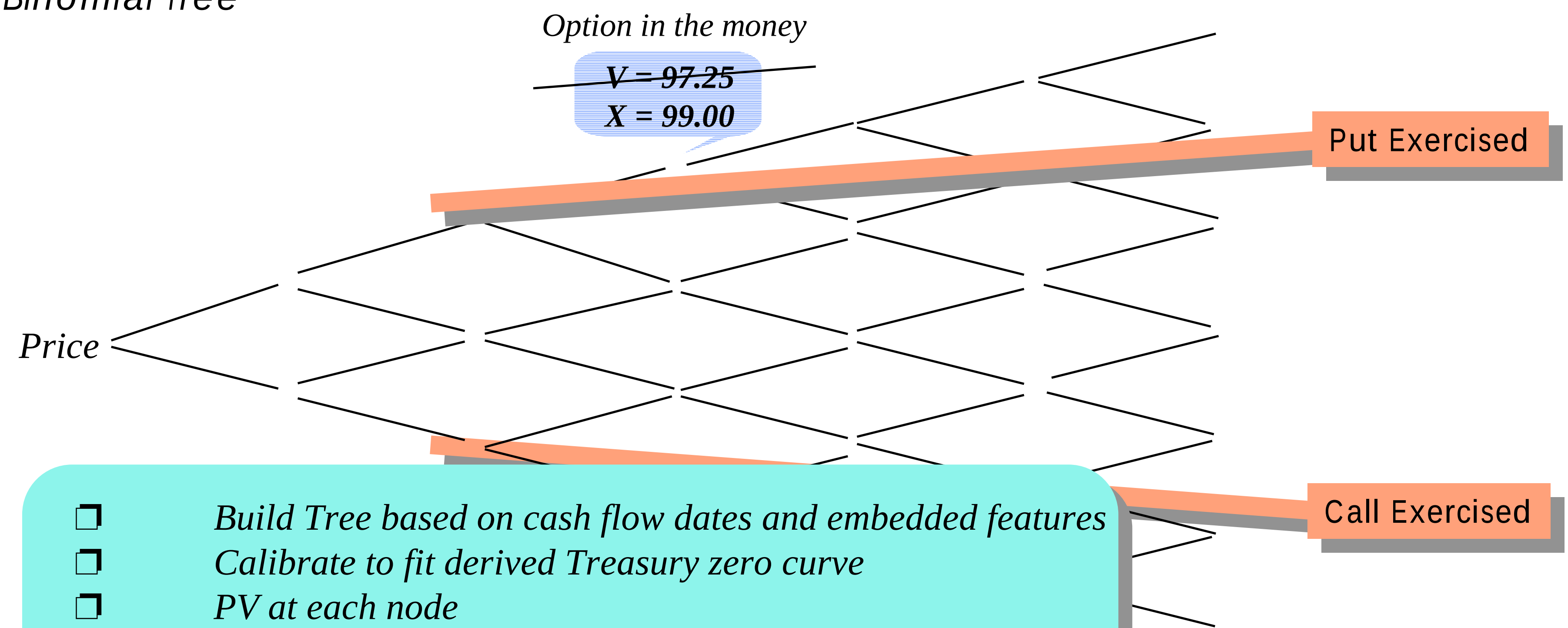
Break it into pieces and think about "atomic" risks...

- ❑ Interest Rate Risk
- ❑ Credit Risk (default risk)
- ❑ Equity Risk
- ❑ Embedded Options
- ❑ Currency Risk

We must consider *all* the risks associated with the convertible

Interest Rate Risk: How Do We Price a Bond?

Binomial Tree



- *Build Tree based on cash flow dates and embedded features*
- *Calibrate to fit derived Treasury zero curve*
- *PV at each node*
- *If PV>Option strike, assume exercised => Value = Strike*
- *Continue back down tree*
- *PV at time 0 (now)*

Tree accommodates Calls, Puts and Sinking Funds

How Could We Price a Stock Option or Warrant?

It must be fast, useable in production environment, and consistent with bond pricing model

Black-Scholes	-	easy to use, but assumes interest rates are constant!
Finite Difference Methods	-	hard to set up constraints, intractable in production system
Binomial Tree	**-**	**easy and fast to use but not very accurate?**
Trinomial Tree	-	much slower and more difficult but better accuracy?

Choose the Right Model – *consistent* with Bond Pricing Model

How to Connect Them and Price Convert in One Go?

Is there an easy way?

Standard Practitioner Choice as Proposed by Many Textbooks:

- ❑ Black-Scholes for stock option part of convertible
  (ignores inconvenient BS assumptions about constant interest rates)

Other Academic or Textbook Answers:

- ❑ Finite Difference Methods to Solve PDE directly
  (difficult to run as large-scale production process)
- ❑ Binomial tree for stock prices, determine at each node whether instrument is stock or bond. Use risk-free rate (fixed) to discount stock, use risky rate (fixed) to discount bond.*
  (ignores term-structure of interest rates entirely)

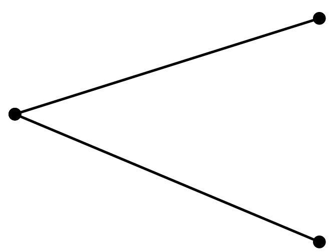
** Suggested by Goldman Sachs: "Valuing Convertible Bonds as Derivatives," Quantitative Strategy Research Notes, November 1994*

No easy way unless you make horrible assumptions

Binomial Tree Approach – More Detail

Could We Adapt This Approach?

Use a binomial tree for stock prices, determine at each node whether instrument is stock or bond. Use risk-free rate (fixed) to discount stock, use risky rate (fixed) to discount bond.



At this node the convert value > bond value
The bond is converted. Since it is now an equity we should discount it at the risk-free rate.

At this node the convert value < bond value
The bond is not converted. Since it is still a risky bond we should discount it at the risky rate.

*The value at the target node is reached by discounting the value at the two future nodes by the **average** of the risky and risk-free rates.*

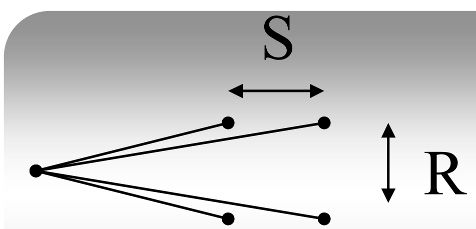
*With this approach the **same** two rates (one risky, one risk-free) are used throughout the tree.*

Can we adapt this to include stochastic interest rates?

Our Approach

Two trees – two stochastic processes

- We use ***two combined*** trees at the same time.
- The interest rate tree allows us to model the short-rate diffusion
- The stock price tree allows us to model the stock price diffusion
- We discount value back at each node based on the average rate
  - if it's still a bond at some node we should use risky rate
  - if it's an equity at some node we should use risk-free rate
- Given what we determine it to be at each future node we can discount the value back to the preceding level.



*Each node branches into **four** new nodes*

Diffusion processes for both stock and interest rates

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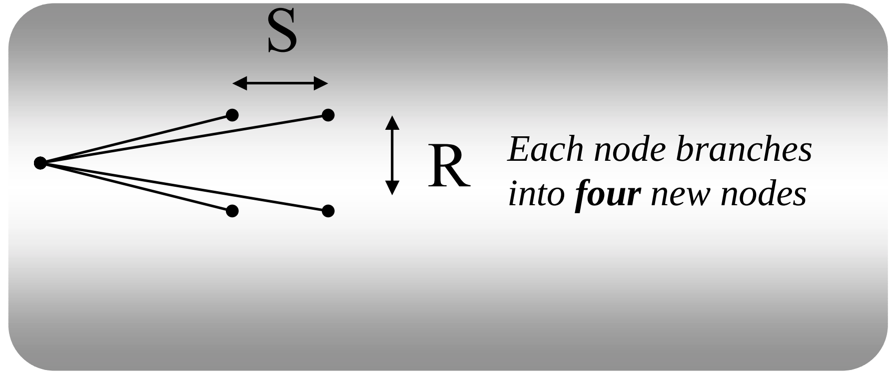
Branching and Dividends

Other Features of the Stock Diffusion Tree

- Most stocks pay dividends
- What about volatility?
- What about accuracy?



- Branching for stock tree **includes** dividends based on constant annual dividend rate of q

  $u = \exp\{ (r-q-\sigma^2/2)\Delta t + \sigma \sqrt{(\Delta t)} \}$

  $d = \exp\{ (r-q-\sigma^2/2)\Delta t - \sigma \sqrt{(\Delta t)} \}$

- Stock tree branching based on volatility – can be either **one** volatility or a **term-structure** of volatility. (Ours is one for now…)

- Add many extra nodes at the short end to ensure accuracy – 50 additional levels added over first five years.

Diffusion processes for both stock and interest rates

Valuation

An attempt at clarity…

For each of Four Nodes Branching from Target Node:

- Compare Value V_N with convert value
- Compare (if not converted) with Call / Put strike
- If called, compare *again* with convert value (so-called "forced" convert)
- Final result: a new value V_N^*, and a status (Bond or Equity)
- Final final result: a discount rate D_N:
  - appropriate *risky* rate if Bond
  - or appropriate *risk free* rate if Equity

Use the Average Rate (average of D_1 to D_4) to discount V_1^* to V_4^* back to Target Node

Continue Rolling Back through Tree

Semi-Final Result: Price of Instrument

Stochastic Processes and Forced Conversion features Modeled Fully

More Thinking

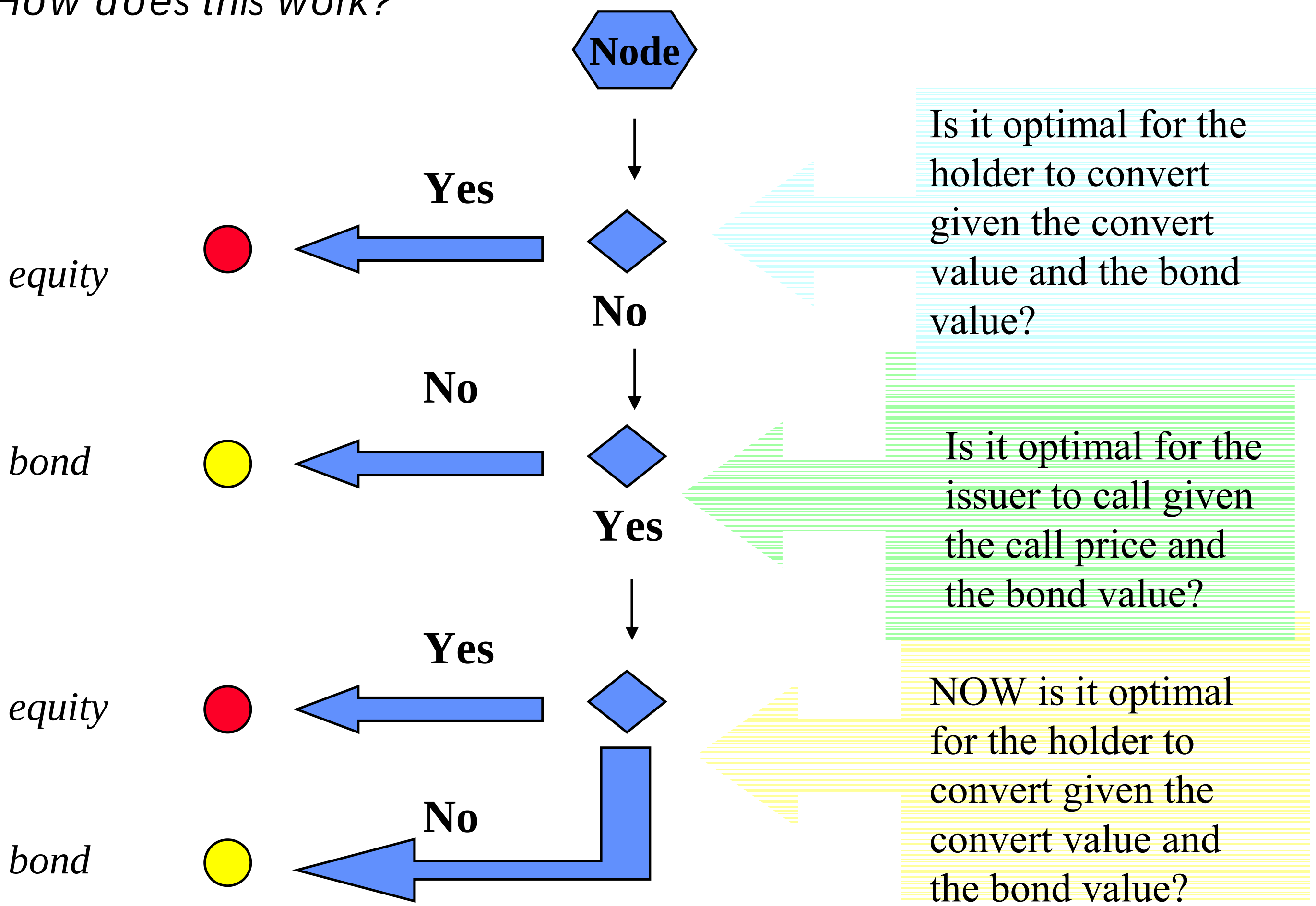
What falls through the cracks?

- Forced Conversion
- Correlation between stock return and interest rates
- Credit Risk & Equity Risk

We need to focus on these key attributes

Forced Conversion Flowchart

How does this work?



Forced Convert is Treated in a Cascade Process

Correlation Between Stock Price Process and Interest Rates

How can we rationally treat this correlation?

- *Stock prices are correlated to interest rates. So we have to compute the state price densities for evaluating the equity warrant have to be computed conditionally on the covariance matrix of the equity factors and the term structure factors. We "bend" the stock pricing tree to fit expected returns, given the term structure state*

- Margrabe, William. "The Value Of An Option To Exchange One Asset For Another," Journal of Finance, 1978, v33(1), 177-186.
- Hull, John and Alan White. "Numerical Procedures For Implementing Term Structure Models II: Two-Factor Models," Journal of Derivatives, 1994, v2(2,Winter), 37-48.
- Hull, John and Alan White. "Valuing Derivative Securities Using The Explicit Finite Difference Method," Journal of Financial and Quantitative Analysis, 1990, v25(1), 87-100.

The transformed tree explicitly captures the correlated relationship

Equity Risk - Capturing Equity Related Covariance

How can we rationally treat this source of risk?

- Idea 1: observe the fraction of the total number of nodes in the combined tree that reflect conversion into equity. We could then say that the instrument has, say, (20/100)×equity security exposure.

- (Better) Idea 2: treat the equity factor exposure *today* as the present value of the *future* equity factor exposure. This captures two effects:
  - *the time aspect of convertibility*
  - *the interest rate environment at, or path toward, convertibility*

- Using the tree pricing procedure captures the interaction of multiple option features
  -*Conversion to equity effectively reduces bond maturity*
  -*Call or put options on the bond effectively shorten the expiration date of the warrant*

A more sophisticated version of a "delta equivalent" equity risk

Risk in the “Everything Everywhere” Model

Can we model converts with the same risk factors?

❑19 Factors, plus currency covariance matrix

- *5 geographic regions*
- *6 aggregate industry-sectors*
- *Interest rates*
- *Energy cost (an inflation proxy)*
- *Investor confidence #1: large cap – small cap spread*
- *Investor confidence #2: emerging - developed spread*
- *Dividend yield: a proxy for growth / value in equities*
- *Three-Factor Model of Term Structure Movements*
- *Currencies*

Sources of Risk in Convertible Bonds can be modeled by EE Factor Set

How Can We Treat These in Our EE Risk Model?

Can we model converts with the same risk factors?

- We capture interest-rate risk by varying our three *term-structure* factors and re-pricing under term-structure changes
- We capture *credit risk* of the bond (the risky bond part of the convertible) as a duration-weighted exposure to a credit-synthetic
- We capture *embedded options* (calls, puts etc) *explicitly* in the pricing process
- We capture the *equity portion of the convert* risk using a version of a delta-neutral underlying exposure to the equity.
- We capture *currency risk* explicitly as factors in the risk model

Sources of Risk in Convertible Bonds can be modeled by EE Factor Set

Musings

What other fun things could we do?

- Use *micro-economic* factors, such as those in our Fundamental Model for equity risk, and repeat the same process linking credit risk to those.
  - (see "Credit Risk Management", Nick Wade, Newport 1999)
  [http://www.northinfo.com/papers/pdf/19990607_credit_risk.pdf]

- (following Merton) Treat the stock price at node N in our stock price tree as a *call option on the assets* of the firm, reverse out the implied expiration date of the option, and compare that to the maturity of the debt issues. Compare to industry / sector averages and make inferences about the health of the company.

- *Adjust our OAS on a per-node basis* within the tree to take into account the implied expectations about the risk of the firm given the stock price. (i.e. if the stock price is 80, our OAS should be less than if it's 50).

- Final thought that given our effort building this tree approach to what is essentially option pricing, we can do better than Black-Scholes for estimating the implied expiration date of the option on the assets of the firm.

We can neatly join many mutually-conditional effects in one model

Conclusions

Can we model converts with the same risk factors?

- We can both *price* and *evaluate the risks* of convertible bonds using a three dimension tree approach adapted from our EE risk model
- We believe this model is a substantial advance over methods that rely on seriously flawed simplifying assumptions.
- Empirical evidence is encouraging. Our model prices are in excellent agreement with reported trading prices

Sources of Risk in Convertible Bonds can be modeled by EE Factor Set

Real Estate – How to include it in a mixed-asset portfolio

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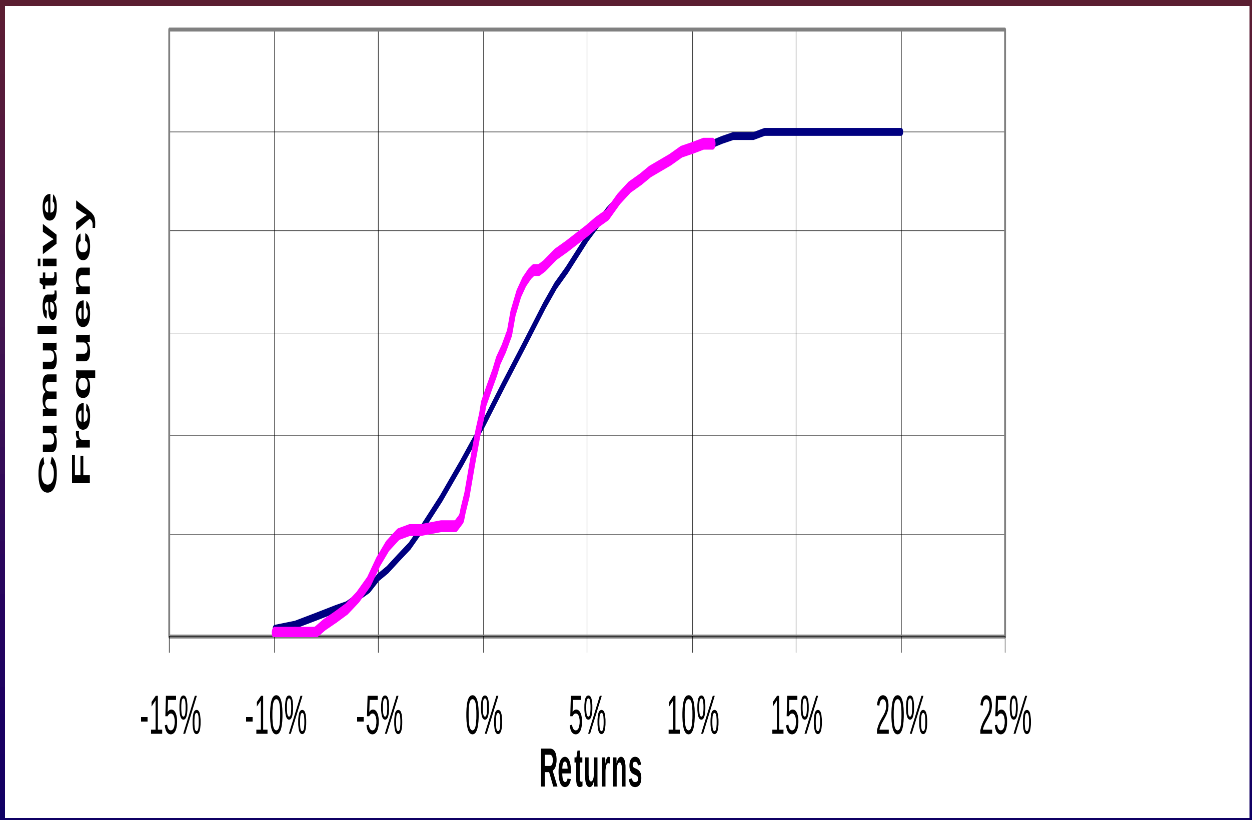
1. Real estate returns are different: solutions
   - Model the return process
   - Create new indices of returns
   - Make ad hoc adjustments to risk/return numbers

2. Developments in the real estate market
   - Instruments and derivatives

3. Futures of real estate market

The problem: Example 1
Monthly returns from Property Unit Trusts



Results

Returns depend on changes in successive valuations

Non-normal

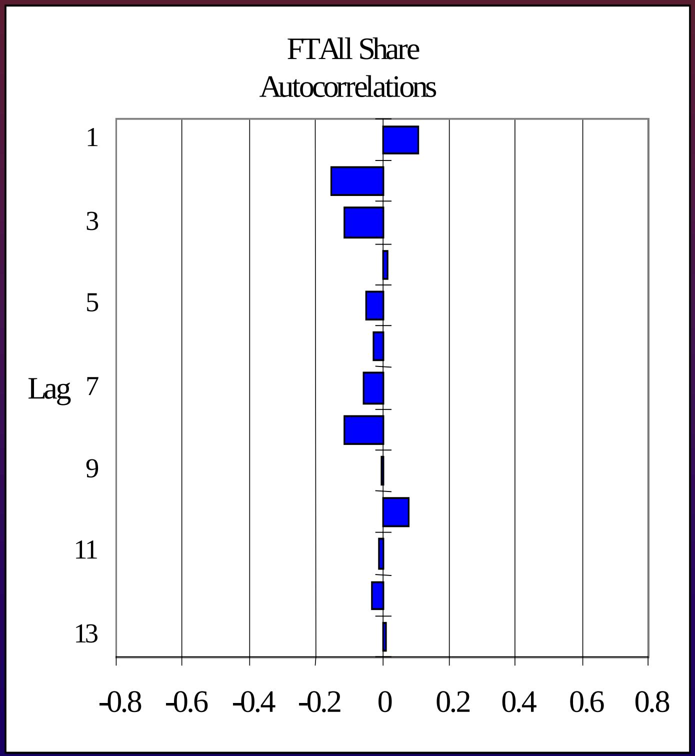
Too many zero returns

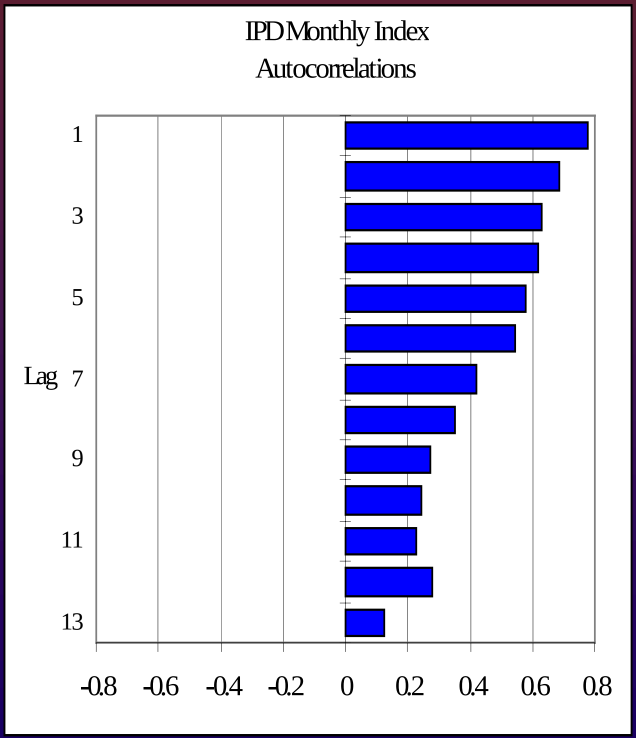
Too many small positive returns

Too few larger positive returns

Too few small negative returns

Example 2 – Auto correlation





Results

- Returns depend strongly on previous returns
- Symptomatic of persistence and momentum to a very high degree
- Estimates of risk (as measured by standard deviations) very low
- Estimates of correlations/covariances with other assets also very low (zero?)

So Property is great to have in your portfolio - right?

Not so fast Sunshine. Let’s think about where are the returns coming from…

Assume a valuer behaves like a “smoother”

$$R_t = \alpha (R_{t-1}) + (1 - \alpha) Rtrue_t$$

So we can de-smooth by reversing the model

$$Rtrue_t = (R_t - \alpha (R_{t-1}))/(1 - \alpha)$$

The Rtrue series will have the same average as the observed series but a higher standard deviation

Some estimates of smoothing factors

	α	Effect on S.Dev
Brown (monthly)	0.8	3.4
MacGregor (quarterly)	0.6	1.9
Ward (quarterly)	0.7	2.9
Ward (annually)	0.5	1.8

But these adjustments are too simple and the model is wrong

Elaboration 1: Seasonal ARIMA

$$R_t = \mu + \alpha_1(R_{t-1}) + \alpha_s(R_{t-s}) + \beta_s e_{t-s} + (1 - \alpha_1 - \alpha_s - \beta_s)e_t$$

Elaboration 2: Fractional Differencing

Provides for long-term memory effect that would also explain the property cycle

Estimates from ARIMA(1,d,0)

	AR	d	Standard Deviation Annual
R.E. Month	0.98	-0.45	13.6
R.E. Quarter	0.91	-0.32	16.8
R.E. Annual	0.53	-0.12	17.7

Problems remain: needs much data to fit the model

Property returns may not be stable in the model sense

Still assumes that the underlying model is an efficient market

Artificial indices

IPD Indices are valuation-based

(1) Perhaps a transaction-based index?

Too few transactions

No more volatile

(2) Perhaps a movers-only index?

Too few transactions

Unrepresentative

(3) Stock-Market index de-geared?

Simple and *ad hoc* adjustments

(1) Assume a de-smoothing alpha of 0.6

(2) Multiply the standard deviation of returns by 2 or 3

(3) Relate de-smoothing to market conditions

All of these approaches have non-predictive effects on correlations with other assets

So…

Lengthen Measurement intervals

StDev	IPD	FTRE	FTSE	Ratio 1/2
Monthly	0.9%	6.5%	5.0%	0.14
Quarterly	2.6%	12.2%	8.9%	0.21
6-monthly	4.9%	18.5%	11.5%	0.26
Annually	9.0%	25.0%	11.7%	0.36
2-Yearly	16.0%	31.4%	9.2%	0.51

Effect on Correlations

IPD- FTRE

Month	**-0.03**
Quarter	**0.096**
6-month	**0.202**
Annual	**0.547**
2-Year	**0.796**

Perhaps Property isn’t so hot after all?

Attempts to make real estate more exciting

Derivatives on individual properties

Derivatives on groups of properties

Derivatives on indices

Securitisation of property

UK Real Estate

The institutional lease

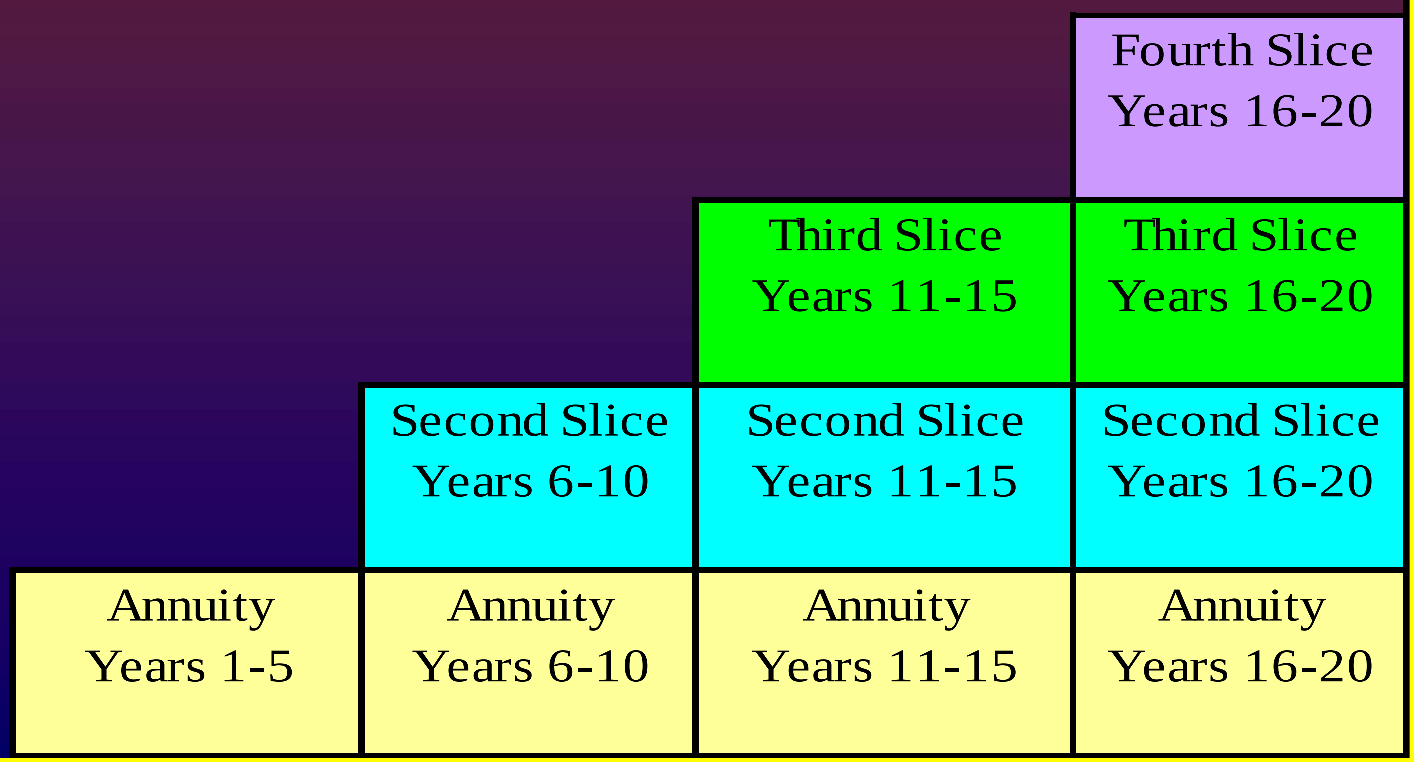
(1) 25-year lease with rent marked to ‘market’ every 5 years (but upwards-only)

(2) reluctance to grant shorter leases or up-down reviews

(3) trend to allow more ‘break clauses’

(With penalty)

Slices of income in upwards-only lease



Characteristics of Lease

Current rent effectively forms a long-term annuity/bond

Upwards-only clauses are call-options, for landlords, on market rents, with unknown exercise prices.

Break clauses are put-options (for tenants) on market rents.

Individual property derivatives

- Option pricing used in valuing upwards-only leases but not yet formally recognised
- No derivatives marketed or traded

Securitisation on individual properties
The Rotch Experience

- Rotch – private company
- Arbitrage – bought UK property lease,
- Securitised the current rental stream for length of lease
- Because of differences in cap rates, raised sufficient cash to pay for lease!

The British Land issue

£1.54bn issue, 1999, arranged MSDW

Secured on 13 Broadgate, Offices

Notes long maturity, fixed & floating

Seven tranches, £785m Aaa (Moody's)
(5.9%; LIBOR + 0.55%)

Rating generally higher than B Land's

Claimed reduced debt cost 150 bp by using proceeds to repay expensive loans

Issues regarding asset-backed securitisation

- Lower interest payment partly because of longer maturity
- Also affected security of other bonds previously issues with floating charge on British Land properties (prices weakened)
- Was there any economic benefit?
- Perhaps contributed to opening up of ABS market
- Some analysts surprised, some appalled

Derivatives on groups of properties

The Workspace experience

- Portfolio of small secondary properties
- Banks happy to offer high-rated bond issue

Creating a property proxy

- Portfolio of FTSE All Share, Gilts, Property companies + other equities

What is the model?

Co-integration model; long term form is

Property = 1.841 Equity + 2.554 Gilts - 2.34 FTA

Short term portfolio is long in FTA short in equities

Long term portfolio is long in equities short in FTA

Under-performs property

Suggests some equilibrium but weak ECM

Derivatives on Indices

The FOX experience

The Prudential initiative

PICs (1) 1994 PIFs 1996 (BZW)

The Standard Life case, PICs (2)

Futures on IPD Monthly Index

FOX
- Futures on IPD Monthly Capital / Rental
- 1991 - 1991

Thin (non-existent) trading
No marking to market
No market depth
Inference that market makers reported non-existent trades

Prudential initiative

- Prudential – largest UK institutional real estate investor
- Wished to reduce exposure to UK offices
- Offers to swap IPD UK Office returns for UK retail returns over five year period.
- Still under development

Barclays PICs PIFs

Originating from property held by Barclays Bank

1994 Sold PICs (mirroring IPD Annual returns)

1996 offered P I Futures - Forward contract 1 and 2 year ahead of IPD Capital index.

Quoted on Reuters – not a lot of movement

PICs 2 –
The Standard Life ‘Swap’

- £150m, 1999 (3 tranches of £50m)
- IPD property index
  - Income swapped for LIBOR
  - Capital sold as property index forward
  - Combined as PICs
- Sold to charities/local authority pension funds
- No secondary trading
- Little expectation of sector index trade

Conditions for successful derivative trading

Volatility of prices

Depth of market in longer-maturity assets

Breadth of market

Holistic organisational perspective of real estate

Residential Investment

The UK housing market

Lack of institutional ownership

Initiatives to encourage ownership

Trading in derivatives (spread betting?)

Conclusion on derivatives

Thin markets, shallow markets – a text book case for not establishing derivative market

Tenant pressure will force landlords to price leases more efficiently

Use of volatility-based pricing may encourage model-based pricing – (OPM)

Once approach is accepted, more trading may follow

Summary and Future questions

Will property companies survive? Will institutional direct property persist?

Effect of lease accounting standard?

Boutique investment companies/funds?

Large portfolio investors - should they dominate the market?

Actuarial / pension fund regulations?

Growth/Value/Momentum Returns as a Function of the Cross-sectional Dispersion of Stock Returns

Dan diBartolomeo

Northfield Information Services, Inc.

2002, European Seminar Series

14-October-2002, London

16-October-2002, Amsterdam

Major Points

- Current definitions for equity styles such as growth, value and momentum are problematic

- These styles can be efficiently represented as options on the cross-sectional dispersion of stock returns in a market

What Do the Terms Growth, Value and Momentum Mean?

- Would we invest in any enterprise that had an expected growth rate of zero?
- Is not any stock a good "value" if the price is greatly less than we perceive the market clearing price?
- Does a stock have good momentum if its down 10% when the market is down 20%?
- Is this whole discussion just a false syllogism? Like a comparison between "apples" and "fruit". (see Arthur Clarke.. Boston portfolio manager.. Not the science fiction writer)

Obviously We Can Impose Our Definitions on the Process

- Index publishers such as Frank Russell and Saloman Smith Barney use fundamental information such as book-to-market ratio at a moment in time to define a taxonomy
- Other research entities such as Morningstar have their own definitions
- Academic researchers such as Fama and French have formed their taxonomy based on some security or corporate characteristic

We Can Also Form Taxonomies without External Definitions

- diBartolomeo and Witkowski, FAJ, 1997
- Group all funds by what they call themselves (growth, value, income, etc.)
- Form indices of returns by group
- Use returns based style analysis to find group members loadings on the various group indices
- Reassign group members that have dominant loadings on the index from another group
- Repeat entire process until all funds appear correctly classified

Characteristic Based Data is Often Unreliable Or Problematic

- Enron, Worldcom, etc.
- Accounting standards across countries still vary widely
- Emerging markets such as the Peoples Republic of China are problematic. No penalties for false financials if its illegal at all.
- Robustness is lacking due to severe problems with outliers (Knez and Ready 1997)
- Overlaps in definitions. Can't a stock be a good value and have high growth at the same time?

Value and Volatility

- Value approaches are often referred to among hedge funds and trading desks as "convergence strategies" as they depend on the convergence between the market price and a manager's definition of the fair price of some security. The greater the noise in the market environment, the more obfuscation and impediments to the convergence process.

Momentum and Volatility

- Momentum strategies buy stocks on strength and sell on weakness. This is similar to a Constant Proportion Portfolio Insurance (Black and Perold, 1992) applied to the cross-section of stock returns.
- CPPI replicates being long a put option on the underlying asset. Option buyers are advantaged when realized volatility is greater than the volatility expected when the option was established
- If momentum strategies are comparable to being long an option, then anti-momentum strategies (value?) must be comparable to being short an option, so low volatility conditions would be most favorable

Defining Volatility as the Basis of Style

- We could just take the cross-sectional dispersion of securities in a particular market on a period by period basis
- Beta differences will cause cross-sectional dispersion in volatile (market index across time) conditions
- So lets define our dispersion measure as the cross-sectional standard deviation of residual (net of beta effect) returns
- Or think of it as the “excess standard deviation” (standard deviation of stock returns) minus (the product of the absolute value of the observed market risk premium times the cross-sectional dispersion of the beta values)
- diBartolomeo (2000) relates periods of high cross-sectional dispersion to positive serial correlation in stock returns (I.e. momentum strategies working)

Summing Up the Idea

- Value strategies should work best in periods of low excess cross-sectional dispersion of stock returns. Another way to characterize this is periods when correlations among securities is highest
- Momentum/growth strategies should work best in periods of high excess cross-sectional dispersion as they are like being long an option.
- Strongin and Petsch (2002) find value strategies work best when confined within sector (small cross-sectional dispersion), while growth strategies work best with no sector constraints (high dispersion)
- Solnik and Roulet (2000)

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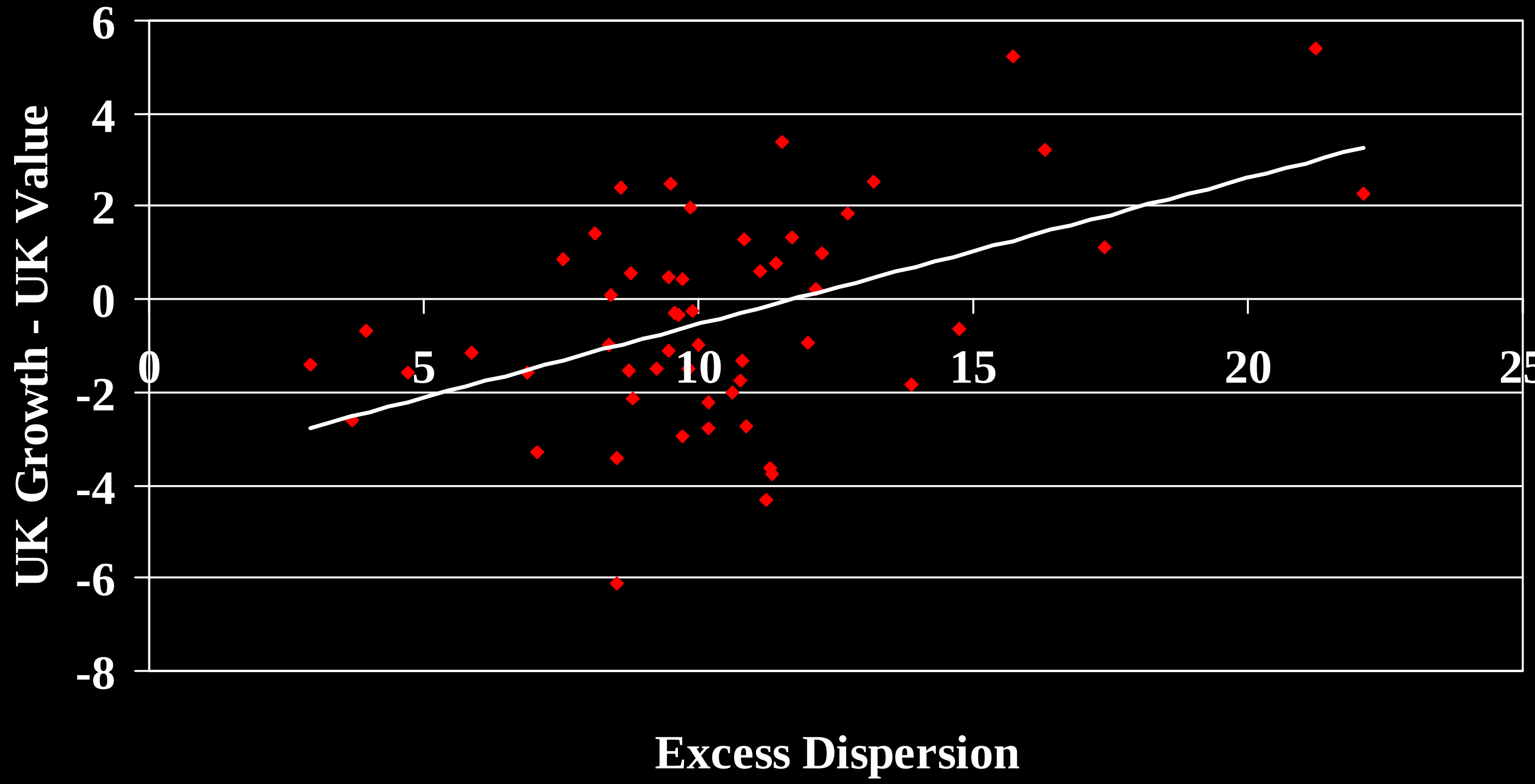
A Simple Empirical Test on UK Data

- Compute the monthly “excess” cross-sectional standard deviation of stock returns in using beta values the Northfield UK Risk model
- Compute the “Growth-Value” return spread from the Saloman Smith Barney UK Primary Market indices
- Data from January 1996 through September 2002
- Correlation coefficient of .48 with significant T statistic
- Comparable results to data for the US
- Captures the build and collapse of the late 1990s “bubble” nicely. Consistent with Derman (2002)

Monthly UK Style Returns Versus Excess Dispersion January 1998 through September 2002



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Conclusions

- Popular equity management styles such as value, growth and momentum can be viewed as bets on the future excess dispersion of the cross-section of stock returns
- Risk controls for portfolios defined as style neutral can be viewed as being neutral to future movements in the volatility level

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- Emmanuel Derman, "Perception of Time, Return and Risk During Periods of Speculation", Goldman Sachs Working Paper, 2002

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The Fallacy of High Frequency Attribution

Dan diBartolomeo

Northfield Information Services, Inc.

2002, European Seminar Series

14-October-2002, London

16-October-2002, Amsterdam

Major Point
Polite Version

- Hypothesis: Moving to higher frequency attribution will detract from rather than improve our ability to understand the strengths and weakness of our investment process.   This is because our analytical statistics are based on assumptions that are only approximately true. As we increase the frequency of analysis, the quality of this approximation becomes much, much worse, invalidating the results.

Performance Attribution versus Performance Measurement

- Performance measurement is the process of computing and reporting the observed returns on a particular investment
  - Knowledge of daily holdings and trading provides more exact measurement
- Performance attribution is the process of disentangling the observed returns so as to understand the strengths and weaknesses of our investment process. Otherwise why bother?
  - This requires understanding the statistical significance of the attributed returns. Do they arise from skill or luck?

Fallacy #1: Distributional Assumptions

- The usual statistical procedures for analyzing the significance of investment return observations are parametric. There are numerous important assumptions
  - Investment returns are normally distributed
  - Returns are independently and identically distributed
  - There is no serial correlation in the observed return data
- These assumptions are simply not true, and the lack of truth gets worse as we shorten the time periods we observe

A Small Sample of Hundreds of Research Studies

- Lo, Andrew W. and A. Craig MacKinlay. "Stock Market Prices Do Not Follow Random Walks: Evidence From A Simple Specification Test," Review of Financial Studies, 1988, v1(1), 41-66.
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The Results

- Security return distributions have kurtosis. Big stuff happens more frequently than it should according to our assumptions
- Distributions are heteroskedastic. Both time series and cross sectional volatility levels vary through time.
- Returns in one period are not independent of returns in other periods. This is a necessary but sufficient assertion for active management. We cannot simultaneously assume relationships for portfolio management, and then attribute the returns achieved assuming the opposite. You can have it one way or the other, you can't have both.
- At monthly intervals, the imperfections of our assumptions are small. **With daily returns, we must consistently reject our assumptions**
- Anyone remember the difference between Type 1 and Type 2 errors?

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What's the Problem with Daily Returns

- Financial markets are driven by the arrival of information in the form of "news" (truly unanticipated) and the form of "announcements" that are anticipated with respect to time but not with respect to content.

- The time intervals it takes markets to absorb and adjust to new information ranges from minutes to days. Generally much smaller than a month, but up to and often larger than a day. That's why markets were closed for a week at September 11th.

Volatility Estimates on an Airline Portfolio

- 42 stocks, capitalization weighted
- 9/10, 9/17,11/30 Some Key Dates
- 589, 2755, 1145 Factor Variance
- 98, 161, 177 Specific Variance
- 26, 54, 35 Total Risk

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Driven by Noise?

	31 August	30 September
P&C Insurance	13.04	16.87
Manufacturing	20.88	19.38
Foods	11.56	11.31

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More Reading

- Ederington and Lee, “Creation and Resolution of Market Uncertainty: The Importance of Information Releases, Journal of Financial and Quantitative Analysis, 1996
- Kwag, Shrieves and Wansley, “Partially Anticipated Events: An Application to Dividend Announcements”, University of Tennessee Working Paper, March 2000
- Abraham and Taylor, “Pricing Currency Options with Scheduled and Unscheduled Announcement Effects on Volatility”, Managerial and Decision Science 1993

Possible Fixes

- Failures of cross-sectional distribution assumptions can be dealt through use of non-parametric statistical tests. For example use the Komolgorov-Smirnoff Type 2 test in place of T statistics
- Model the time series problems as n-dimensional multivariate GARCH problems
- Use event study methods instead of typical longitudinal statistics
- Unless you have two math PhDs, don't try this at home

But Doesn't Daily Allow You to Capture "Event-Driven" Factors?

- Some people would argue that daily attribution allows the estimation of "event-driven" factors such as earnings surprises
- Jones, Charles M., Owen Lamont and Robin L. Lumsdaine. "Macroeconomic News And Bond Market Volatility," Journal of Financial Economics, 1998, v47(3,Mar), 315-337.
  - Treasury markets have nearly no transaction costs
  - Traders can and do make daily "bets"
  - Stock market transaction costs are much higher so better information even if you get it may not be actionable

More on Event Factors

- The other problem:
  - If the event is wholly unanticipated you don't have a factor for it in your model by definition
  - If the event is partially anticipated, market participants behavior is effected on the days prior to the event
  - Most anticipated events such as government announcements, statistical releases and Fed meetings are either on a monthly schedule or ad hoc but less frequent. Corporate earnings announcements are quarterly.
- By controlling for event factors, you may get a better estimate of return to other non-event factors but trading costs are way too high to allow for daily shifting of growth/value bets

Fallacy #2: The Assumption of Independent Observations

- When we do statistical analysis one of the most basic assumptions is that different observations represent independent events

- Consider a dead portfolio manager
  - Invests his portfolio in large cap growth stocks, January 1, 1990, then dies.
  - We perform attribution at December 31, 1995.
  - How many observations of management skill do we have?

- Thanks to Evan Shulman, Santa Fe, 1994

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Fallacy #2 Continues

- In a world where transactions costs are non-zero, this is a ridiculous assumption. It is saying that we start our investment portfolios fresh everyday.
  - Maybe we can argue that what we hold now is independent of what we held a year ago (transaction costs are usually small compared to annual returns)
  - For monthly returns the assumption gets weaker
  - For daily returns its silly. Can we believe that we hold today is unrelated to what we held yesterday?
- In the real world, there are limits on turnover and possibly taxes on realization of gains. Serious path dependence! Independence assumption is clearly rejected

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Fallacy #3: Microstructure Doesn't Count

- Microstructure effects are small relative to typical monthly returns but large compared to typical daily returns
  - Bid / Asked Bounce
  - Non synchronous trading
  - Painting the tape
- Many microstructure effects are controlled by portfolio personnel and hence can be gamed

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Even More Reading

- Gosnell, Thomas F., Arthur J. Keown and John M. Pinkerton. "The Intraday Speed Of Stock Price Adjustment To Major Dividend Changes: Bid-Ask Bounce And Order Flow Imbalances," Journal of Banking and Finance, 1996, v20(2,Mar), 247-266.
- Chu, Quentin C., David K. Ding and C. S. Pyun. "Bid-Ask Bounce And Spreads In The Foreign Exchange Futures Market," Review of Quantitative Finance and Accounting, 1996, v6(1,Jan), 19-37.
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- Wood, Robert A. and Thomas H. McInish. "Bias From Nonsynchronous Trading In Tests Of The Levhari-Levi Hypothesis," Review of Economics and Statistics, 1985, v67(2), 346-351.
- Shanken, Jay. "Nonsynchronous Data And The Covariance-Factor Structure Of Returns," Journal of Finance, 1987, v42(2), 221-231.

Fallacy #4: The Cross-Product Problem is Solved

- Numerous papers have been written on how to mathematically transform interaction effects between factors in attribution to minimize value of cross-products as compared to the value of products. All are approximate methods
- As the number periods increases, these methods becoming increasingly approximate
- See the technical appendix to chapter 17, *Active Portfolio Management*, Grinold & Kahn, 2nd Edition, McGraw-Hill, New York, 1999

Fallacy #5: High Frequency Attribution is Relevant to Investors

- Investors invest to accumulate wealth. The standard expression of investor utility is the mean variance utility function
  - Levy, H. and H. M. Markowitz. "Approximating Expected Utility By A Function Of Mean And Variance," American Economic Review, 1979, v69(3), 308-317

- The Levy-Markowitz function is a single period model. The future is one long period. If we impose discrete time all the math has to be redone
  - Introduction to Mathematical Finance: Discrete Time Models. Stanley Pliska, Blackwell Publishers, Oxford UK, 1997
  - Performance measures such as alpha, Sharpe ratio, etc. all have to be redefined. Shouldn't someone tell portfolio managers, we've changed all the rules

Conclusions

- Daily performance attribution accumulates values more closely to correct measurements of performance, but at a tremendous cost in the ability to judge the statistical significance of the results
- Most of the imperfections of daily attributions result in upward biased estimates of manager skill, leading to persistent Type 1 errors. Such errors are typically much more costly in economic terms than Type 2 errors.