Using R for Evaluating Trading Strategies

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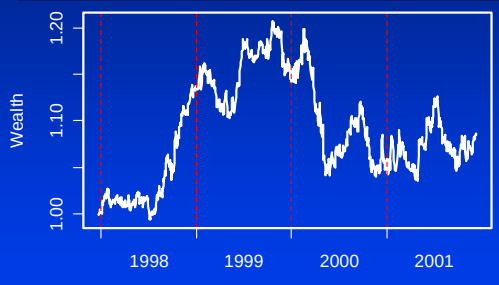
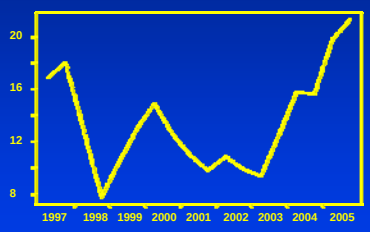
Summary

- R is a good thing
- Random portfolios are useful
- More information at http://www.burns-stat.com

Backtest Results



Emerging Market Fund



Testing Investment Portfolios

- Test if result is better than a guess
- Computers exist
- Implies a random permutation test

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A Permutation Test

- An amount of money in each asset (typically including a lot of zeros)
- Permute the amounts among the assets
- Takes at most 6 lines of R

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There's a Problem

- Portfolios are not a haphazard collection of assets
- The permuted portfolios are not realistic
- In particular volatility is too large

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Typical Constraints

- Non-negative weights (no short selling)
- weights less than some limit
- weights within some limit of benchmark weights
- Country constraints (linear)
- Industry constraints (linear)
- Liquidity constraints

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Practical Constraints

- Limit turnover
- Limit number of assets traded
- Limit number of assets in portfolio
- Threshold constraints

Random Portfolios

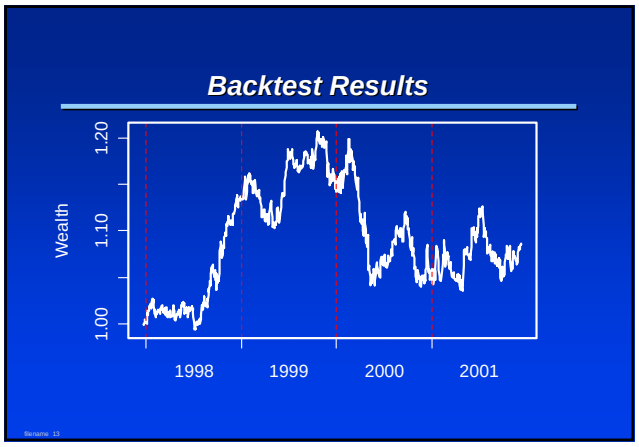
- Sample from the set of portfolios that obey all constraints
- This is non-trivial
- Uses a genetic algorithm typically

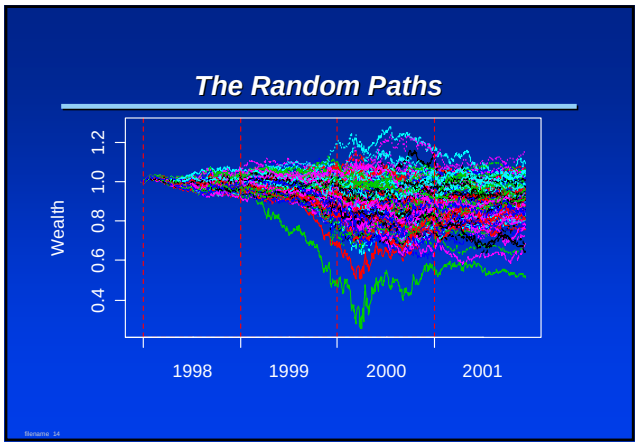
So Why is R Still Important?

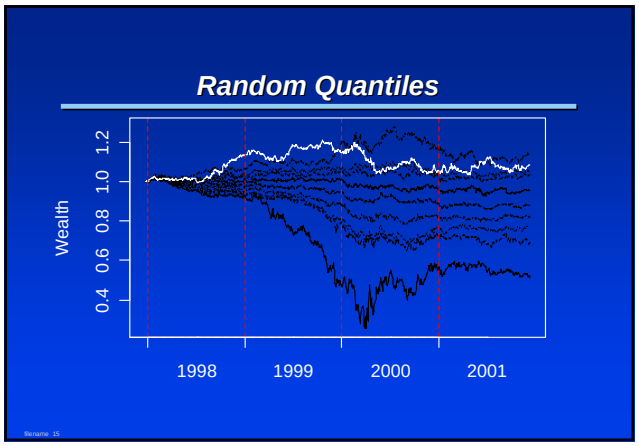
- Now have a whole pile of portfolios
- Want to step through time in backtests
- Want to graph results

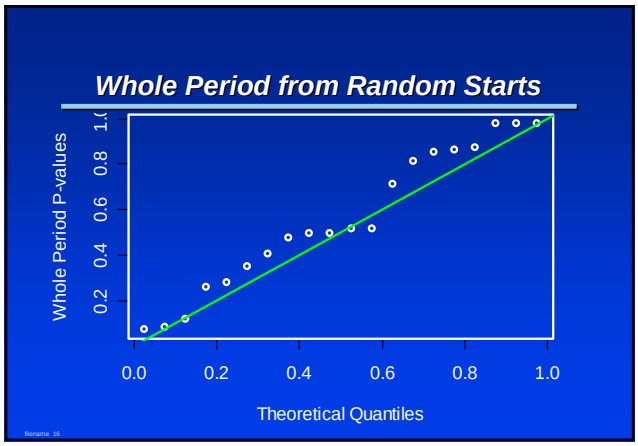
A Valid "Permutation" Test

- Generate a random sample of portfolios that satisfy given constraints
- Compare actual result to distribution from random portfolios


Backtest Results
Wealth
1.00
1.10
1.20
1998
1999
2000
2001


The Random Paths
Wealth
0.4
0.6
0.8
1.0
1.2
1998
1999
2000
2001


Random Quantiles
Wealth
0.4
0.6
0.8
1.0
1.2
1998
1999
2000
2001


Whole Period from Random Starts
Whole Period P-values
0.2
0.4
0.6
0.8
0.0
0.2
0.4
0.6
0.8
1.0
Theoretical Quantiles

10-day Non-overlapping p-values