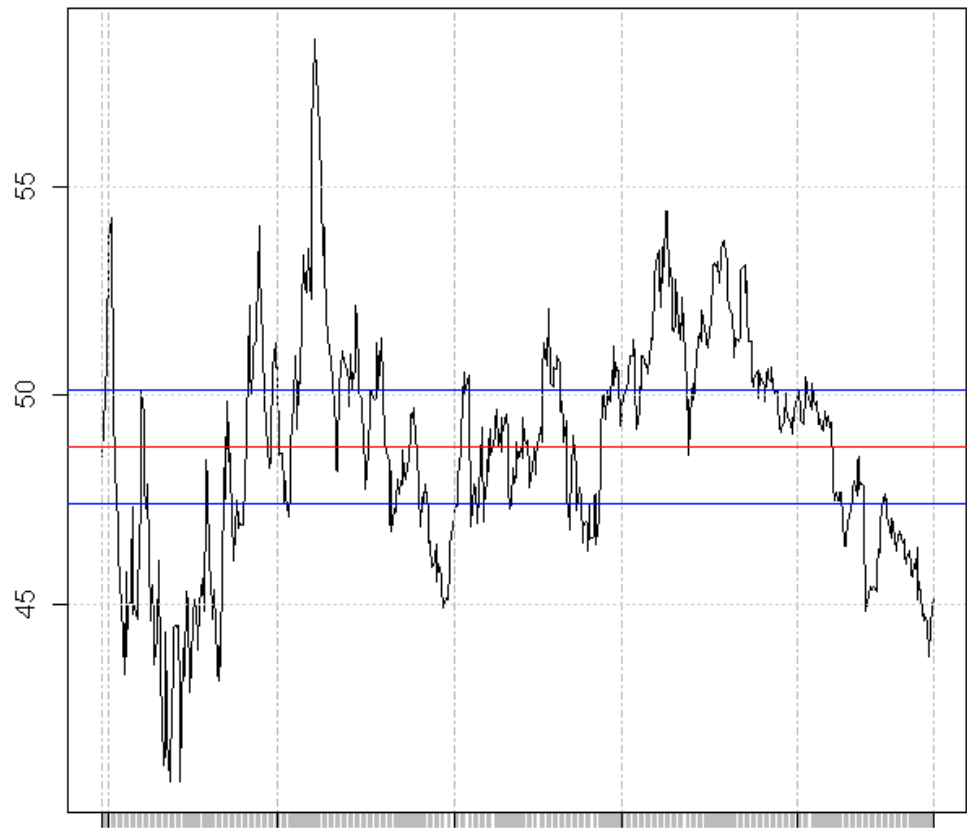# R与现代金融分析
五个示例

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示例1：

- R与金融时间序列建模

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示例1：R与金融时间序列建模

- 1.1 波动率模型
  - Garch族
    - Garch、eGARCH、gjrGARCH、apARCH
    - iGARCH、TGARCH、AVGARCH等
  - 多元Garch族
    - BEKK等
  - SV模型
- R都能搞定么？
- 是的。
- rgarch包,mgarchBEKK包,SV包。

示例1：R与金融时间序列建模

- 1.2 rarch包
  - 指定模型类型
  - ugarchspec()
  - 下面的代码复杂么？不要害怕!

  ugarchspec(variance.model = list(model = "sGARCH",
  garchOrder = c(1, 1), submodel = NULL, external.regressors
  = NULL, variance.targeting = FALSE), mean.model =
  list(armaOrder = c(1, 1), include.mean = TRUE,
  garchInMean = FALSE, inMeanType = 1, arfima = FALSE,
  external.regressors = NULL), distribution.model = "norm",
  start.pars = list(), fixed.pars = list(), ...)

示例1：R与金融时间序列建模

- 1.2 rarch包
  - 拟合模型
  - ugarchfit()
  - 这个很简单，要特别注意solver和fit.control

  ugarchfit(spec, data, out.sample = 0, solver = "solnp", solver.control = list(), fit.control = list(stationarity = 1, fixed.se = 0, scale = 0), …)

示例1：R与金融时间序列建模

- 1.2 rgarch包
  - 提取模型结果：as.data.frame(,which=…)
  - 模型预测： ugarchforecast()
  - 滚动分析：ugarchroll()
  - Bootstrap: ugarchboot()
  - 模拟：ugarchsim()
  - 还有，VaR和CVaR……

示例2：

- R与金融风险度量

示例2：R与金融风险度量

- 2.1 在险价值（Valut at Risk）
  - 定义：$x_p = inf\{x|F(x) \geq p\} \rightarrow VaR = x_p$
  - $F(x)$：资产价值变化量ΔV的累积分布函数→核心
  - inf：满足{}内条件的最小实数
  - 算法：
    - 历史模拟法
    - 蒙特卡罗模拟法
    - 方差-协方差法

示例2：R与金融风险度量

– R包：PerformanceAnalytics

– R代码：

```
>library(PerformanceAnalytics)
>VaR(test, clean="boudt", portfolio_method="component",weights=weights)
$MVaR
        [,1]
[1,] 0.02147515


$contribution
Convertible.Arbitrage      CTA.Global Distressed.Securities      Emerging.Markets
     0.0026391217          0.0000237569       0.0068367477          0.0119755210


$pct_contrib_MVaR
Convertible.Arbitrage      CTA.Global Distressed.Securities     Emerging.Markets
     0.122891904          0.001106251       0.318356266        0.557645580
```

示例2：R与金融风险度量

- ## 2.2 条件在险价值（Conditional Valut at Risk）
  - 定义: $CVaR = E(VaR \geq VaR_p)$
  - R代码:

> ES(test, clean="boudt", portfolio_method="component",weights=weights)
$MES
        [,1]
[1,] 0.03415114

$contribution
Convertible.Arbitrage   CTA.Global Distressed.Securities   Emerging.Markets
      0.006950150   -0.004918395   0.013451737   0.018667645

$pct_contrib_MES
Convertible.Arbitrage   CTA.Global Distressed.Securities   Emerging.Markets
      0.2035115   -0.1440185   0.3938884   0.5466185

示例3：

- R与技术分析

示例3：R与技术分析

- 3.1 计算技术分析指标
  - 包：TTR
  - ADX(): 平均趋向指标
  - OBV(): 平衡交易量指标
  - CMF (): Chaikin资金流量指标
  - RSI(): 相对强弱指标
  - Bbands(): 布林线
  - 等等...但是，有什么用呢？

示例3：R与技术分析

- 3.2 用平衡交易量指标获利
  - 理论基础：市场价格的变化必须有成交量的配合。
  - 算法：以某日为基期，逐日累计每日总成交量，若隔日指数或股票上涨，则基期OBV加上本日成交量为本日OBV。隔日指数或股票下跌，则基期OBV减去本日成交量为本日OBV。
  - 交易策略：
    - 买进@t 日：$OBV_{t-1} < OBVMA_{t-1}^n; OBV_t > OBVMA_t^n$
    - 卖出@t 日：$OBV_{t-1} > OBVMA_{t-1}^n; OBV_t < OBVMA_t^n$

示例3：R与技术分析

- R代码：

```
getSymbols("^SSEC")
obv=OBV(Cl(SSEC), Vo(SSEC))
obvma=SMA(obv, n=10)
Mm=merge(Cl(SSEC),obv,obvma,signal)
for(i in 25:dim(Mm)[1]){
if(Mm[i-1,2]<Mm[i-1,3]&&Mm[i,2]>Mm[i,3]){
Mm[i,4]=-1
}
if(Mm[i-1,2]>Mm[i-1,3]&&Mm[i,2]<Mm[i,3]){
Mm[i,4 ]= 1
}
}
```

示例3：R与技术分析

– 部分结果(理论研究，谨慎模仿)：

SSEC.Close	obv	obvma	obv.1	signal
2007-02-08	2737.73	503000	454020	-1
2007-02-09	2730.39	422200	436700	1
2007-02-12	2807.17	501200	416080	-1
2007-03-05	2785.31	832600	839380	1
2007-03-06	2840.18	909600	872320	-1
2007-06-04	3670.40	5338200	5376800	1
2007-06-05	3767.10	5495400	5412220	-1
2007-06-25	3941.08	6350000	6403640	1
2007-06-26	3973.37	6443800	6427760	-1
2007-06-28	3914.20	6441200	6465700	1
2007-07-03	3899.72	6499000	6453820	-1

示例3：R与技术分析

- ## 3.3 作图
  - quantmod
  - 强大的作图

示例3：R与技术分析

- 3.4 附注
  - 获取股票数据（单因子模型）
  - 获取股息数据（调整股价）
  - 获取财务数据（多因子模型）
  - 直接建立模型，很强大
  - buildModel(x, method, training.per, …)
  - method参数中的选项有:
  - lm, glm, loess, step, ppr, rpart[rpart], tree[tree], randomForest[randomForest], mars[mda], polymars[polspline], lars[lars], rq[quantreg], lqs[MASS], rlm[MASS], svm[e1071], and nnet[nnet]
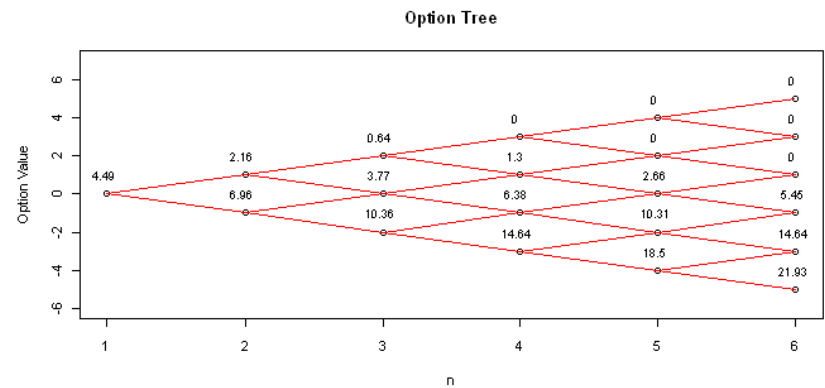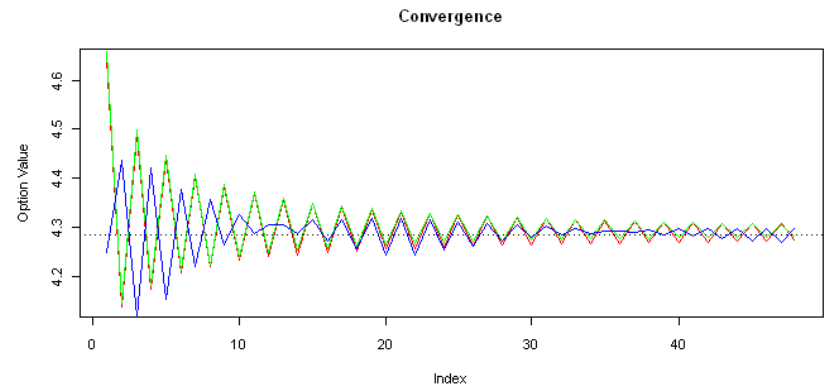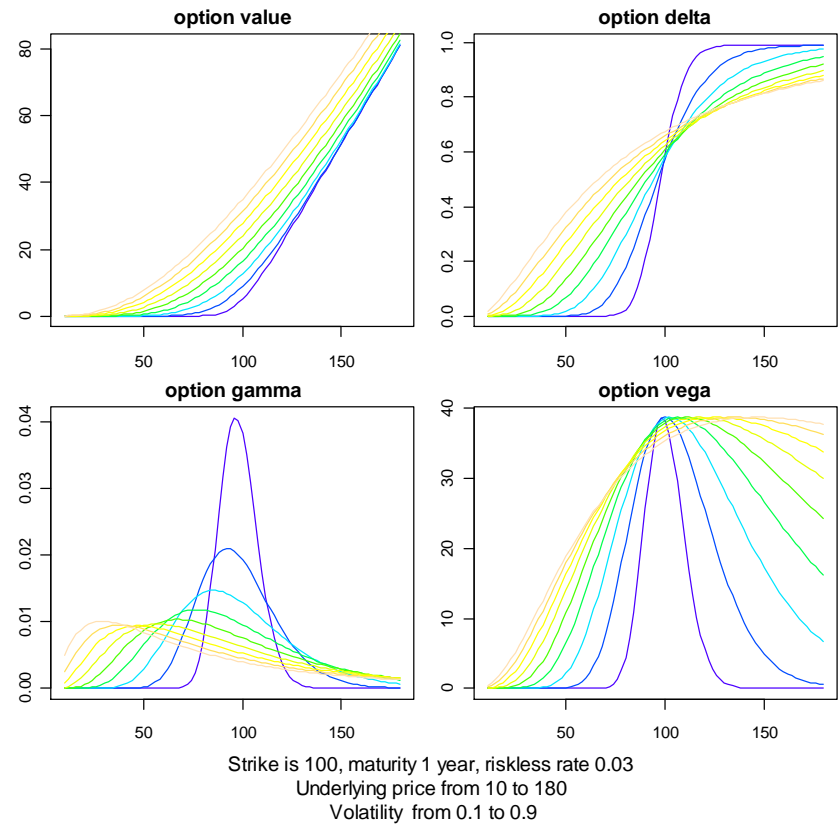
示例4：

- R与期权

示例4：R与期权

- ## 4.1 fOptions
  - CRRBinomialTreeOption ()
  - JRBinomialTreeOption ()
  - TIANBinomialTreeOption()
  - BinomialTreeOption()
  - Binomial Tree Plot()
  - 功能强大
  - 但图形有点丑……
  - 别急！！！

Convergence

Option Tree

示例4：R与期权

- 4.2 RQuantLib
  - QuantLib本是是个开源软件
  - RQuantLib是二者的桥梁
  - example(EuropeanOptionArrays)
  - 够美观么？
  - 还有更好的！！！

Strike is 100, maturity 1 year, riskless rate 0.03
Underlying price from 10 to 180
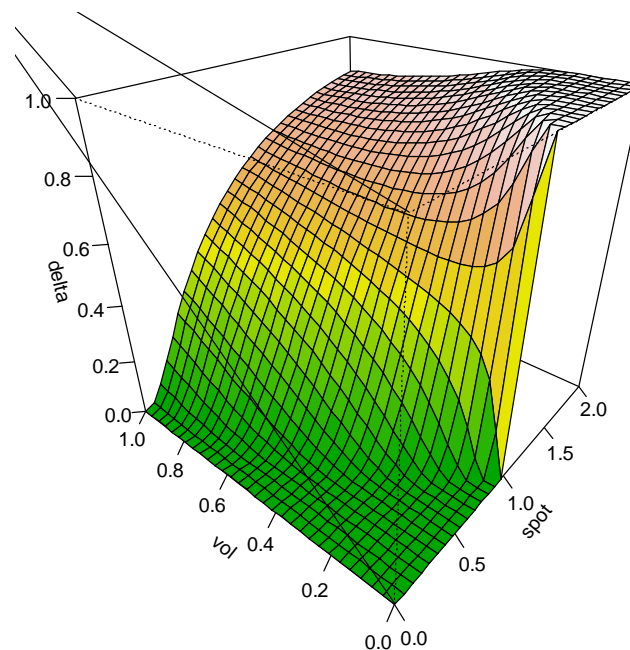Volatility from 0.1 to 0.9

示例4：R与期权

- ## 4.3 QuantLab
  - ### QuantLab更强大

pf=function(x,y) Call.BS(spot=x,vol=y)$Delta

Persp("pf(x,y)",xlim=c(0,2),ylim=c(0,1),xlab="spot",phi=30,theta=-50,ylab="vol",zlab="delta")
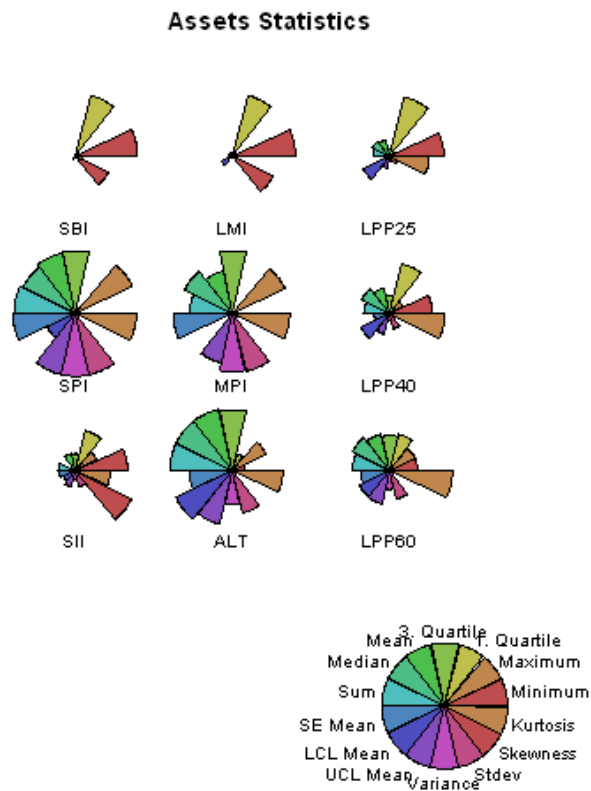
示例5：

- R与投资组合
  - fAssets
  - fPortfolio
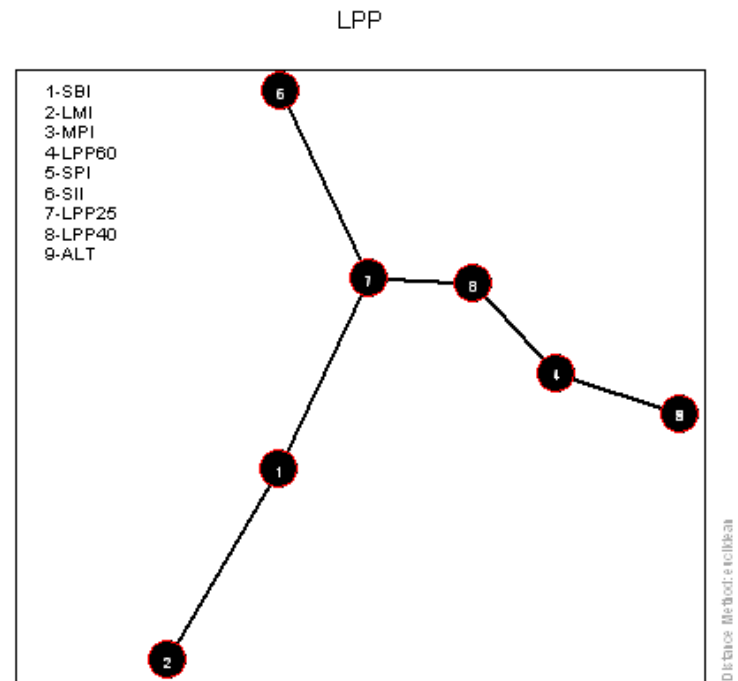 - fPortfolioSolver
  - quantstrat系列

示例5：R与投资组合

- ## 5.1 fAssets
  - ### 基本统计量分析
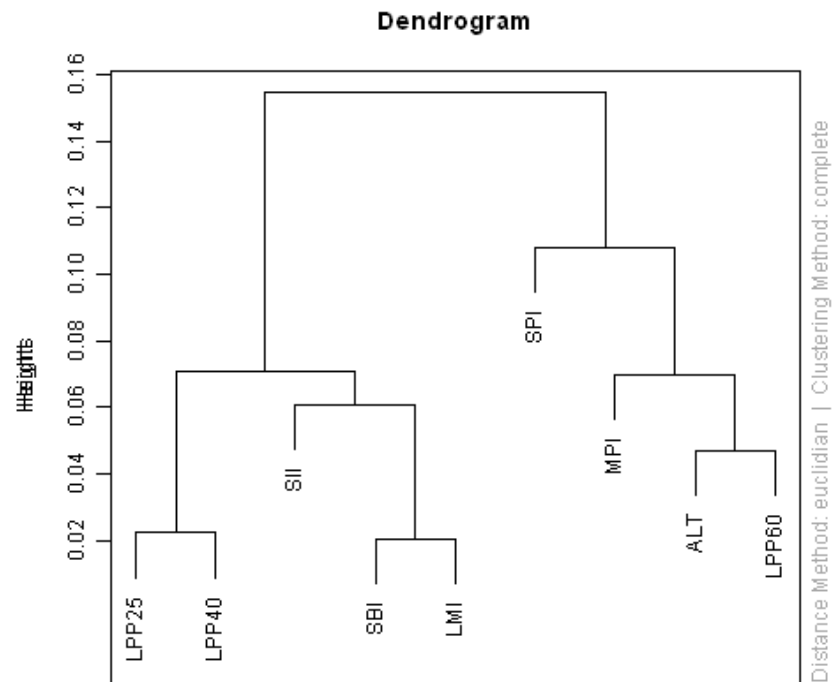 - assetsBasicStatsPlot(LPP, title = "", description = "")
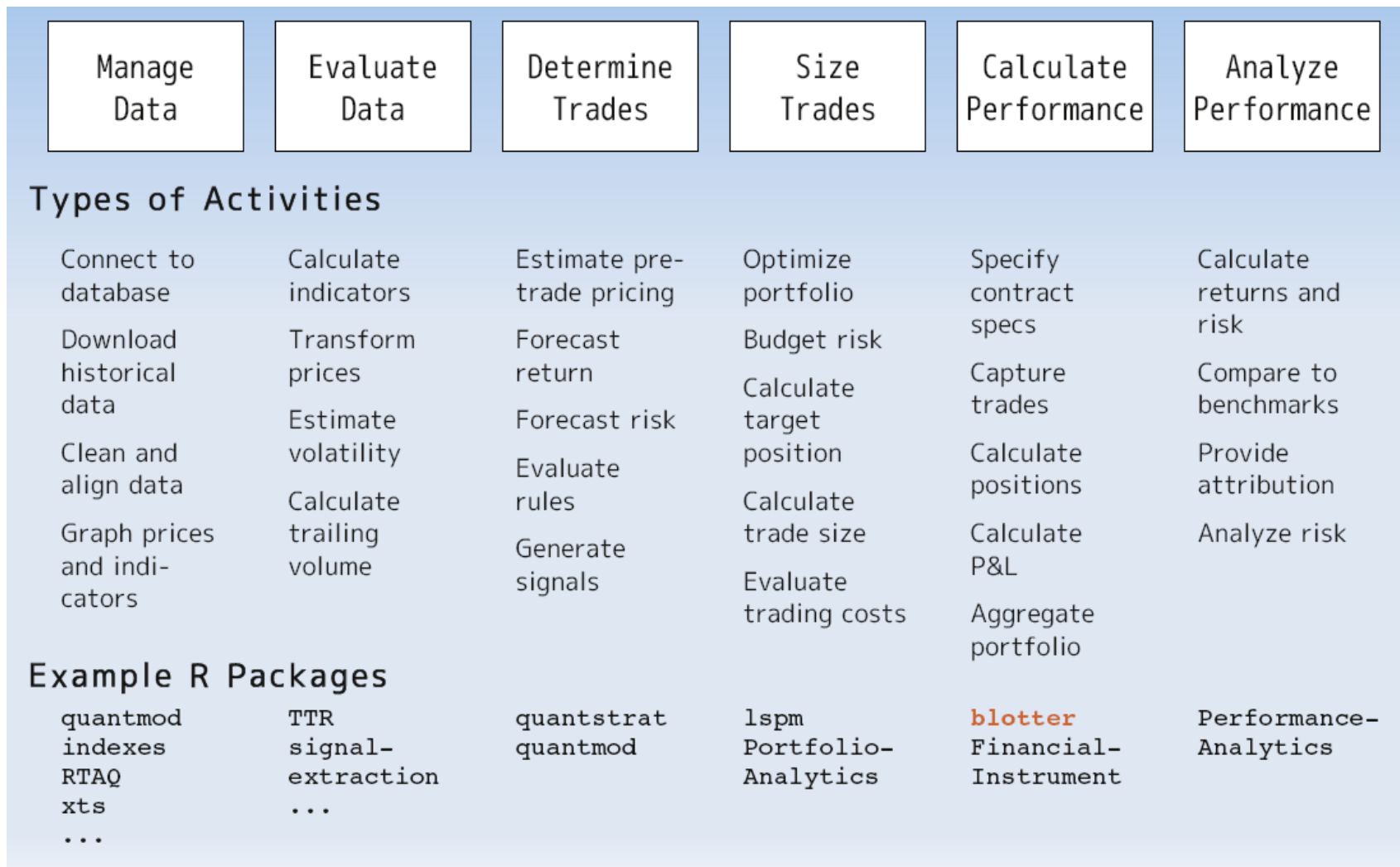
示例5：R与投资组合

- ## 5.1 fAssets
  - assetsTreePlot(LPP)

LPP

1-SBI
2-LMI
3-MPI
4-LPP60
5-SPI
6-SII
7-LPP25
8-LPP40
9-ALT

示例5：R与投资组合

- # 5.1 fAssets
  - assetsDendrogramPlot(LPP)

Dendrogram

示例5：R与投资组合

- 5.2 一个典型的分析流程

Manage Data	Evaluate Data	Determine Trades	Size Trades	Calculate Performance	Analyze Performance

Types of Activities

Connect to database	Calculate indicators	Estimate pre-trade pricing	Optimize portfolio	Specify contract specs	Calculate returns and risk
Download historical data	Transform prices	Forecast return	Budget risk	Capture trades	Compare to benchmarks
Clean and align data	Estimate volatility	Forecast risk	Calculate target position	Calculate positions	Provide attribution
Graph prices and indi-cators	Calculate trailing volume	Evaluate rules	Calculate trade size	Calculate P&L	Analyze risk
		Generate signals	Evaluate trading costs	Aggregate portfolio	

Example R Packages

quantmod indexes RTAQ xts ...	TTR signal-extraction ...	quantstrat quantmod	lspm Portfolio-Analytics	blotter Financial-Instrument	Performance-Analytics

示例5：R与投资组合

- 5.2 一个典型的分析流程
  - 策略:
  - 买：monthly price > 10-month SMA.
  - 卖： monthly price > 10-month SMA.
  - 美国数据（避免误导大家）

示例5：R与投资组合

• 5.2 一个典型的分析流程

```
currency('USD')
symbols = c("XLF", "XLP", "XLE", "XLY", "XLV", "XLI", "XLB", "XLK", "XLU")
for(symbol in symbols){ stock(symbol, currency="USD",multiplier=1) }
getSymbols(symbols, src='yahoo', index.class=c("POSIXt","POSIXct"),from='19980101')
for(symbol in symbols) {
x<get(symbol);x<to.monthly(x,indexAt='lastof',drop.time=TRUE)
colnames(x)<gsub("x",symbol,colnames(x));assign(symbol,x)
}
initPortf('longtrend', symbols=symbols, initDate='19971231');
initAcct('longtrend', portfolios='longtrend', initDate='19971231')
initOrders(portfolio='longtrend', initDate='19971231')
s <strategy("longtrend")
s <add.indicator(strategy = s, name = "SMA", arguments = list(x =quote(Cl(mktdata)), n=10), label="SMA10")
s <add.signal(s, name="sigCrossover", arguments = list(data=quote(mktdata),
columns=c("Close","SMA"), relationship="gt"), label="Cl.gt.SMA")
s <add.signal(s,name="sigCrossover", arguments = list(data=quote(mktdata),
columns=c("Close","SMA"), relationship="lt"),label="Cl.lt.SMA")
s <add.rule(s, name='ruleSignal', arguments = list(data=quote(mktdata),
sigcol="Cl.gt.SMA", sigval=TRUE, orderqty=100, ordertype='market',
orderside=NULL, threshold=NULL), type='enter')
s <add.rule(s, name='ruleSignal', arguments = list(data=quote(mktdata),
sigcol="Cl.lt.SMA", sigval=TRUE, orderqty='all', ordertype='market',
orderside=NULL, threshold=NULL), type='exit')
out <try(applyStrategy(strategy='s' , portfolios='longtrend'))
updatePortf(Portfolio='longtrend')
```

示例5：R与投资组合

- ## 5.2 一个典型的分析流程

结语

- 最重要的是什么？
  - 独立思考
  - 用量化交易代替主观判断的核心是:
  - 以机器理性克服人性的贪婪和恐惧!