

Video 1: Welcome to the course

- Is investing a monkey-business?



<http://www.theglobeandmail.com/report-on-business/rob-magazine/three-reasons-a-monkey-is-a-better-investor-than-you/article14021500/>

- Professor of finance
- Advisor to investment companies
 - Expertise in portfolio management
 - Focus on risk management.

- Simple tricks to avoid large losses:
 - Carefully selected diversified portfolios;
 - Backtesting and online monitoring of performance
- Learn this by doing at Datacamp!

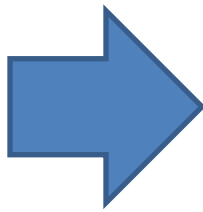
- Ch. 1 Portfolio weights and returns
- Ch. 2 Portfolio performance evaluations
- Ch. 3 Drivers of performance
- Ch. 4 Portfolio optimization

Video 2: The portfolio weights

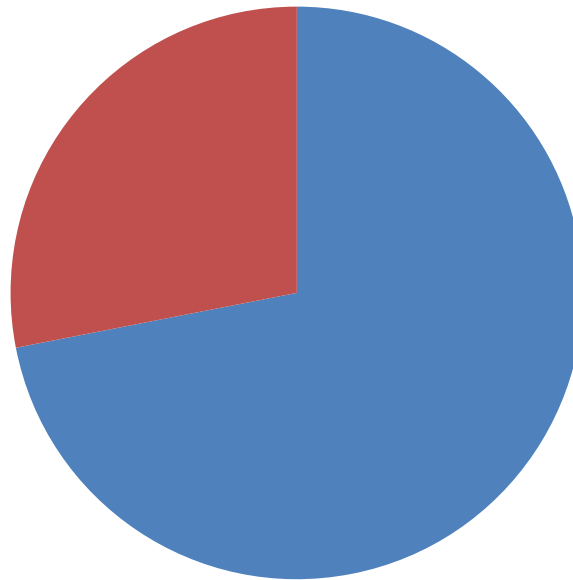
- Two similar companies: Invest in either of them based on tossing a coin?



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Portfolio

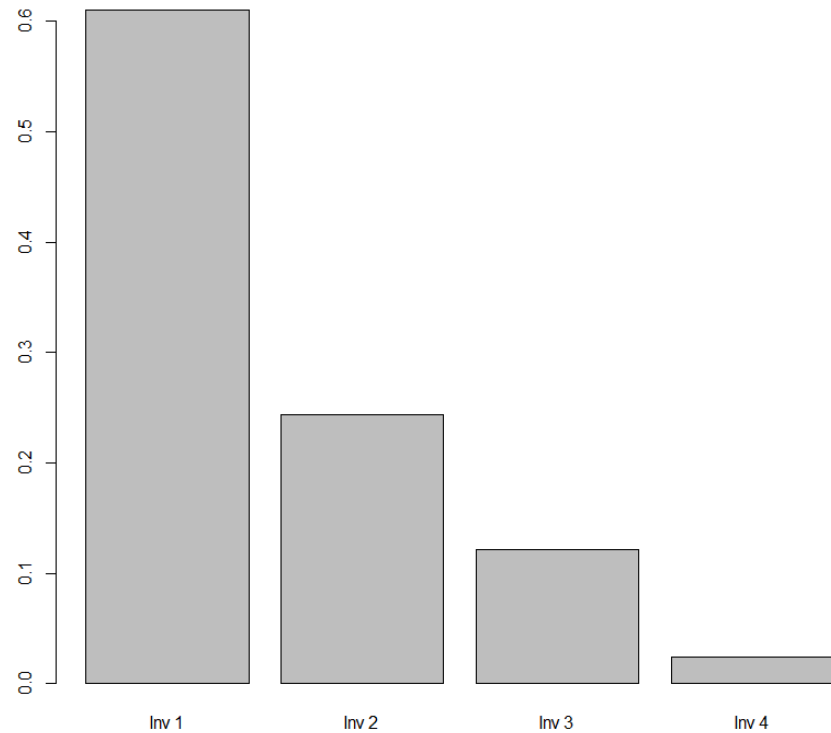


- Company 1
- Company 2

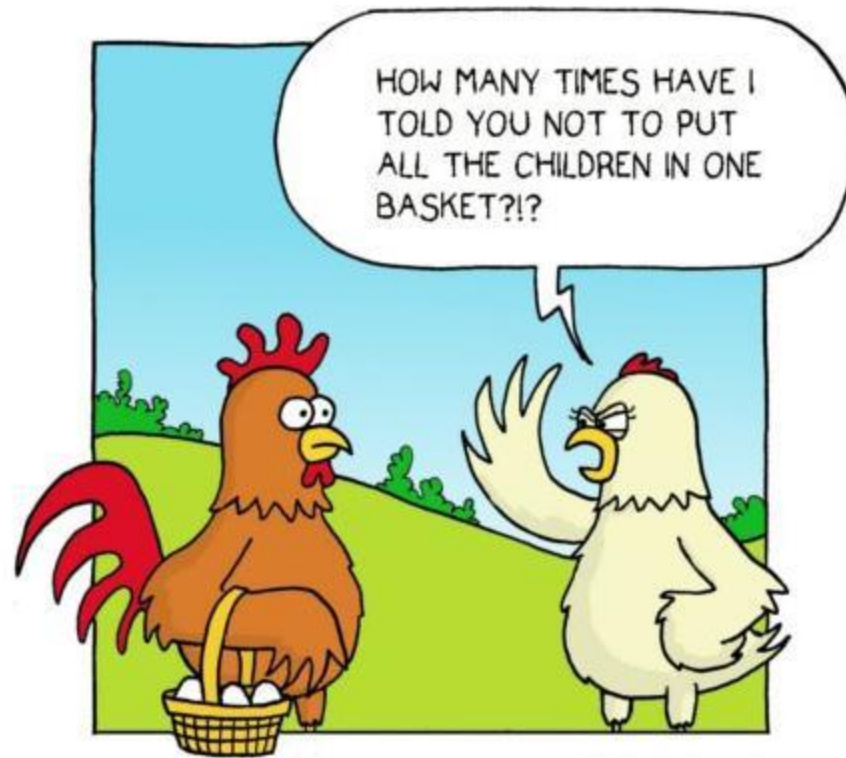
Portfolio weights

Investment	Value invested	Weight
1	V_1	$w_1 = \frac{V_1}{V_1 + \dots + V_N}$
2	V_2	$w_2 = \frac{V_2}{V_1 + \dots + V_N}$
*		
*		
*		
N	V_N	$w_N = \frac{V_N}{V_1 + \dots + V_N}$

```
values <- c(500000, 200000, 100000, 20000)
names(values) <- c("Inv 1", "Inv 2", "Inv 3", "Inv 4")
weights <- values/sum(values)
barplot(weights)
```



- Allocation strategies
 - Optimize mean and variance (chapter 4)
 - Betting on one asset;
 - Equal weighting of a diversified set of assets;
 - Market capitalization based weighting
 - ...



<http://www.falibo.com/vocabulary/idiom-dont-put-all-your-eggs-in-one/>

Video 3: The portfolio return

- Weights reveal active investment bets;
- Returns are the relative changes in value:

$$\frac{\text{final value} - \text{initial value}}{\text{initial value}}$$

Initial value	100
Final value	120

$$\left. \begin{array}{l} \text{Initial value} \\ \text{Final value} \end{array} \right\} \frac{120 - 100}{100} = 20\%$$

Asset 1	...	Asset N
InValue.Asset ₁	...	InValue.Asset _N
FinValue.Asset ₁	...	FinValue.Asset _N



$\text{InValue.Portfolio} = \text{InValue.Asset}_1 + \dots + \text{InValue.Asset}_N$
$\text{FinValue.Portfolio} = \text{FinValue.Asset}_1 + \dots + \text{FinValue.Asset}_N$



$$\text{Portfolio Return} = \frac{\text{FinValue.Portfolio} - \text{InValue.Portfolio}}{\text{InValue.Portfolio}}$$

Asset 1	Asset 2
$\text{InValue.Asset}_1 = \200	$\text{InValue.Asset}_2 = \300
$\text{FinValue.Asset}_1 = \180	$\text{FinValue.Asset}_2 = \330



$\text{InValue.Portfolio} = \$200 + \$300 = \500
$\text{FinValue.Portfolio} = \$180 + \$330 = \510



$$\text{Portfolio Return} = \frac{\text{FinValue.Portfolio} - \text{InValue.Portfolio}}{\text{InValue.Portfolio}} = \frac{510 - 500}{500} = 2\%$$

- New formula

$$\textit{Portfolio Return} = w_1R_1 + w_2R_2 + \dots w_NR_N$$

with:
$$R_i = \frac{\textit{FinValue.Asset}_i - \textit{InValue.Asset}_i}{\textit{InValue.Asset}_i}$$

$$w_i = \frac{\textit{InValue.Asset}_i}{\sum_{j=1}^N \textit{InValue.Asset}_j}$$

Asset 1	...	Asset N
$InValue.Asset_1$...	$InValue.Asset_N$
$FinValue.Asset_1$...	$FinValue.Asset_N$



Asset 1	...	Asset N
$w_1 = \frac{InValue.Asset_1}{InValue.Portfolio}$...	$w_N = \frac{InValue.AssetN}{InValue.Portfolio}$
$R_1 = \frac{FinValue.Asset_1 - InValue.Asset_1}{InValue.Asset_1}$...	$R_N = \frac{FinValue.AssetN - InValue.AssetN}{InValue.AssetN}$



$$Portfolio\ Return = w_1R_1 + w_2R_2 + \dots + w_NR_N$$

Asset 1	Asset 2
$\text{InValue.Asset}_1 = \200	$\text{InValue.Asset}_2 = \300
$\text{FinValue.Asset}_1 = \180	$\text{FinValue.Asset}_2 = \330



Asset 1	Asset 2
$w_1 = \frac{200}{500} = 40\%$	$w_2 = \frac{300}{500} = 60\%$
$R_1 = \frac{180-200}{200} = -10\%$	$R_2 = \frac{330-300}{300} = 10\%$



$$\text{Portfolio Return} = 0.4 * (-10\%) + 0.6 * (10\%) = 2\%$$

Video 4: The PerformanceAnalytics package

- Portfolio analysis requires to compute a time series of portfolio returns;
- Save time and use the functionality in the package PerformanceAnalytics to do so.

- PerformanceAnalytics is the go-to package for the analysis of portfolio returns in R
- Created by two quants from the city of Chicago:



Peter Carl



Brian Peterson

- Return.calculate to compute the asset returns
- Return.portfolio to compute the portfolio return

Return.calculate <- function (prices)

Return.calculate

In: prices



Out: returns

	AAPL	MSFT
2006-01-03	9.829465	21.07395
2006-01-04	9.858394	21.17602
2006-01-05	9.780810	21.19173
2006-01-06	10.033286	21.12891
2006-01-09	10.000411	21.08966
2006-01-10	10.632916	21.19958

head(prices)

	AAPL	MSFT
2006-01-03	NA	NA
2006-01-04	0.002943090	0.0048434670
2006-01-05	-0.007869842	0.0007415934
2006-01-06	0.025813404	-0.0029640809
2006-01-09	-0.003276594	-0.0018579752
2006-01-10	0.063247901	0.0052121756

returns <- Return.calculate(prices)
head(returns)

Return.calculate

In: prices



Out: returns

	AAPL	MSFT
2006-01-03	9.829465	21.07395
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head(prices)

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2006-01-09	-0.003276594	-0.0018579752
2006-01-10	0.063247901	0.0052121756
2006-01-11	0.037595802	0.0107407783

returns <- Return.calculate(prices)

returns <- returns[(-1),]

head(returns)

Time series of portfolio weights:

- Set initial weights and do not intervene
- Dynamic portfolio allocation: frequently specify the weights
 - The action of buying and selling assets to actively change the portfolio weights is called portfolio rebalancing.

```
Return.portfolio <- function (R, weights = NULL,  
  rebalance_on = c(NA, "years", "quarters",  
  "months", "weeks", "days"))
```