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/

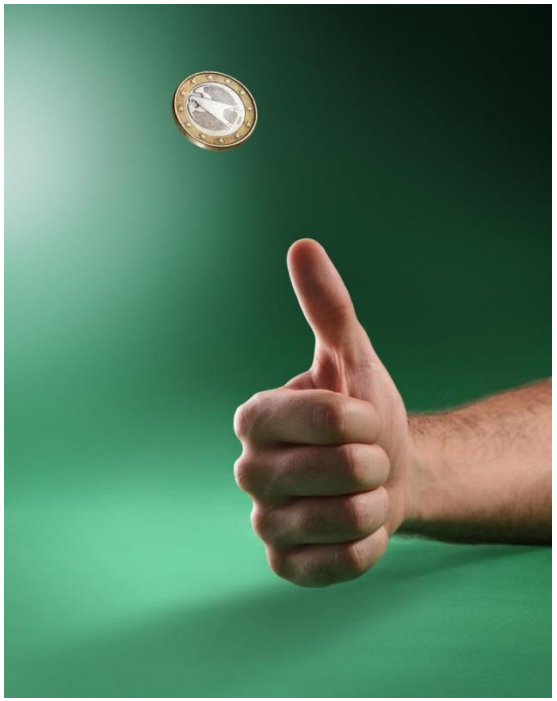
- Professor of finance
- Advisor to investment companies
  - Expertise in portfolio management
  - Focus on risk management.

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

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

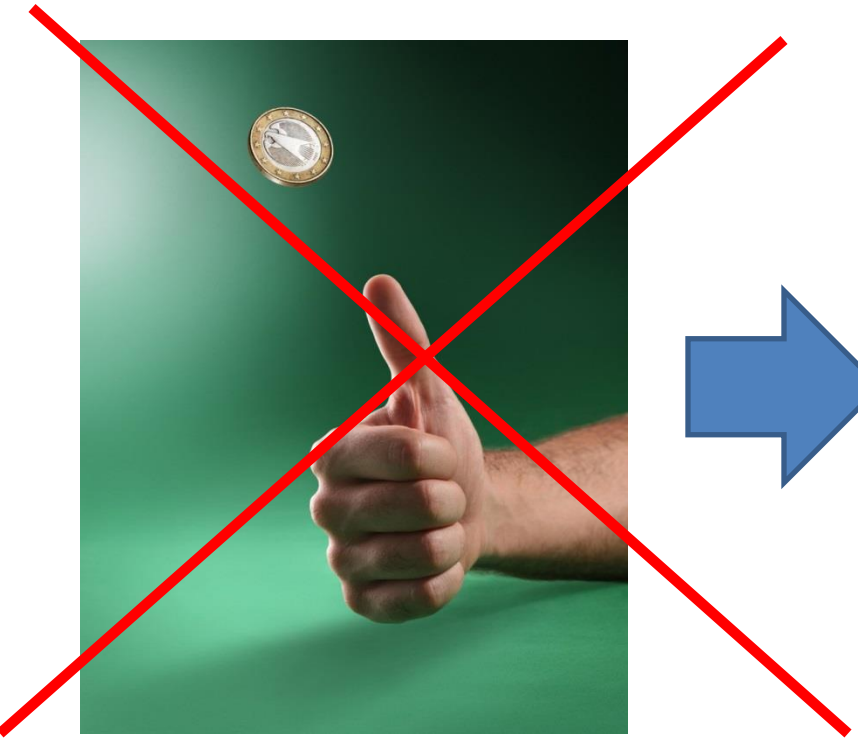
Video 2: The portfolio weights

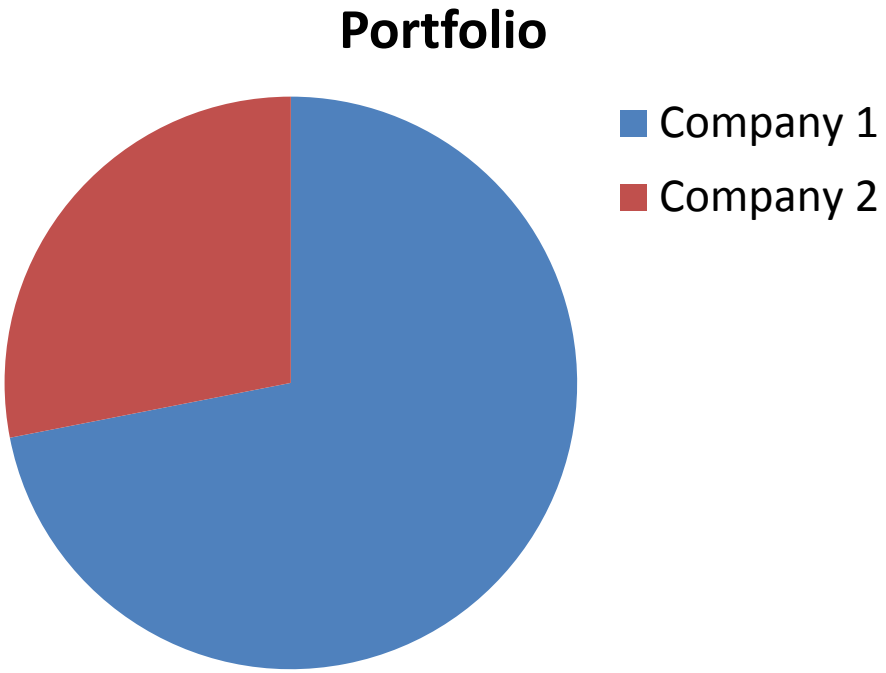
- Two similar companies: Invest in either of them based on tossing a coin?



http://hubpages.com/education/Coin-Tossing-How-Random-Is-It

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

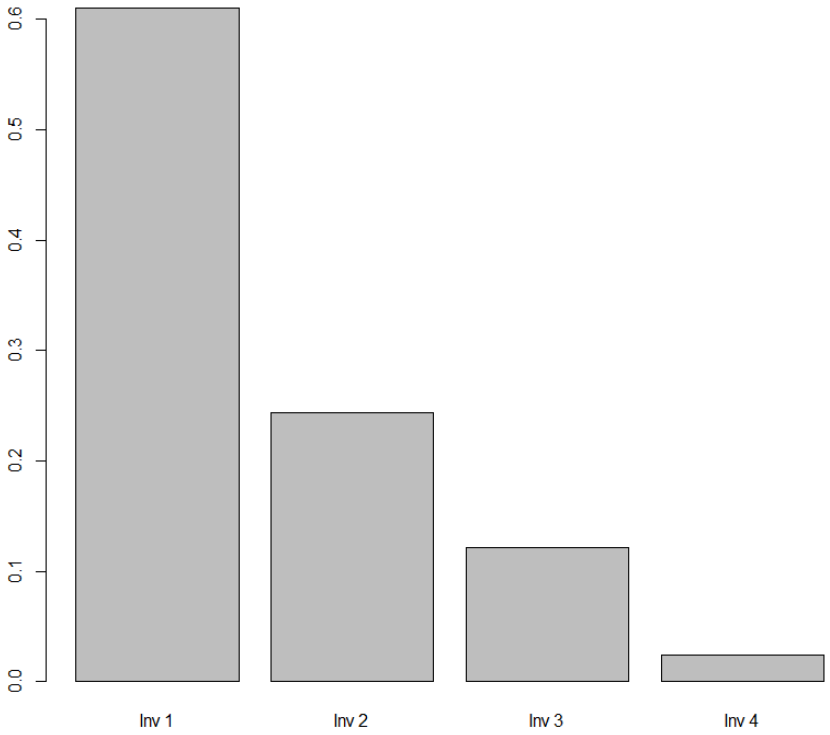




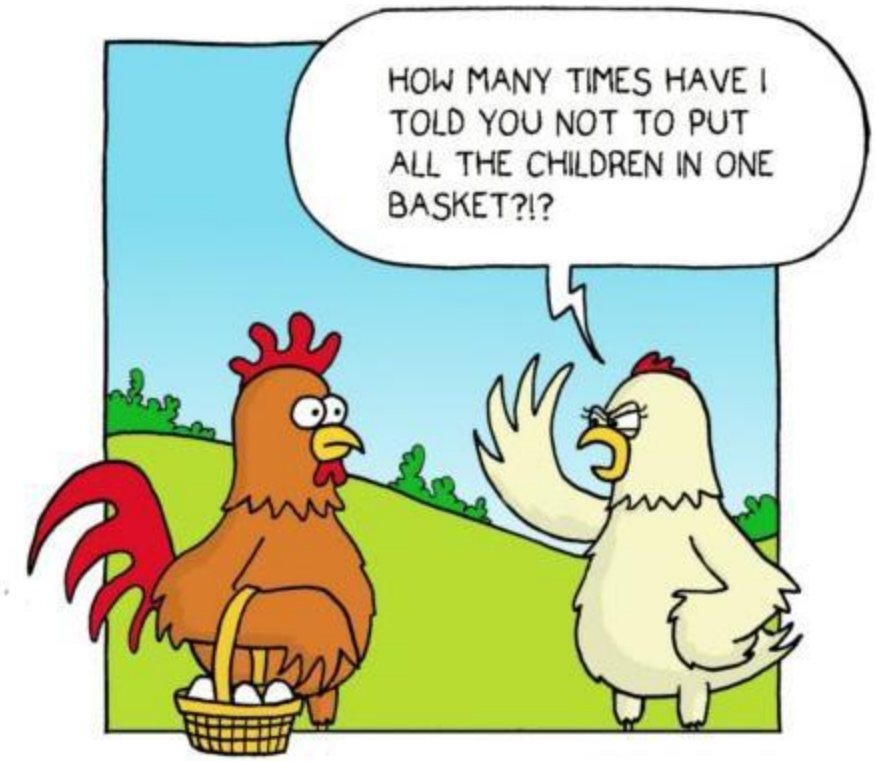
Portfolio weights

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

```
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:

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

Initial value	100
Final value	120

$$\frac{120-100}{100}=20\%$$

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

$InValue.Portfolio = InValue.Asset_1 + \ldots + InValue.Asset_N$
$FinValue.Portfolio = FinValue.Asset_1 + \ldots + FinValue.Asset_N$

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

Asset 1	Asset 2
$InValue.Asset_1 = \$200$	$InValue.Asset_2 = \$300$
$FinValue.Asset_1 = \$180$	$FinValue.Asset_2 = \$330$

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

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

- New formula

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

with: $$R_i = \frac{FinValue.Asseti - InValue.Asseti}{InValue.Asseti}$$

$$w_i = \frac{InValue.Asseti}{\sum_{j=1}^{N} InValue.Asset_j}$$

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

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

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

Asset 1	Asset 2
$InValue.Asset_1 = \$200$	$InValue.Asset_2 = \$300$
$FinValue.Asset_1 = \$180$	$FinValue.Asset_2 = \$330$

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

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

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
```

```
                 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
```

head(prices)

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

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

	AAPL	MSFT
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
2006-01-11	0.037595802	0.0107407783

head(prices)

```
returns <- Return.calculate(prices)
returns <- returns[(-1),]
head(returns)
```

Definiting the time series of portfolio weights:

- Set initial weights and do not intervene such that subsequent weights are only a consequence of price dynamics.
- Dynamic portfolio allocation: frequently buy and sell assets to actively change the portfolio weights (portfolio rebalancing).

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