INTRODUCTION TO PORTFOLIO ANALYSIS

The (Annualized) Sharpe Ratio

Benchmarking Performance

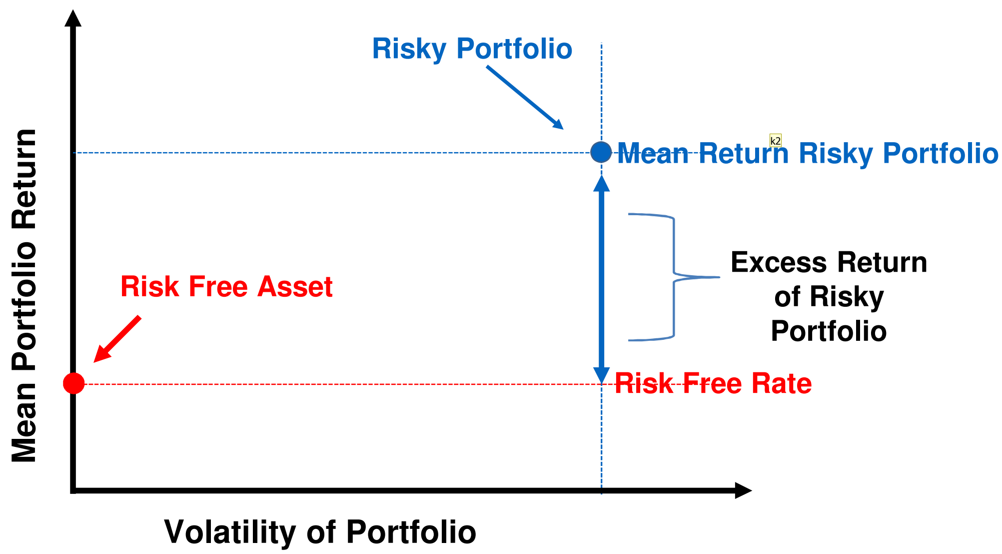
- Use risk free assets

Risky Portfolio **E.g:** portfolio invested in stocks, bonds, real estate, and commodities	**Risk Free Asset** **E.g:** US Treasury Bill
Reward: measured by mean portfolio return	**Reward**: measured by risk free rate
Risk: measured by volatility of the portfolio returns	**Risk**: No risk. The return is always equal to the risk free rate, thus volatility is 0

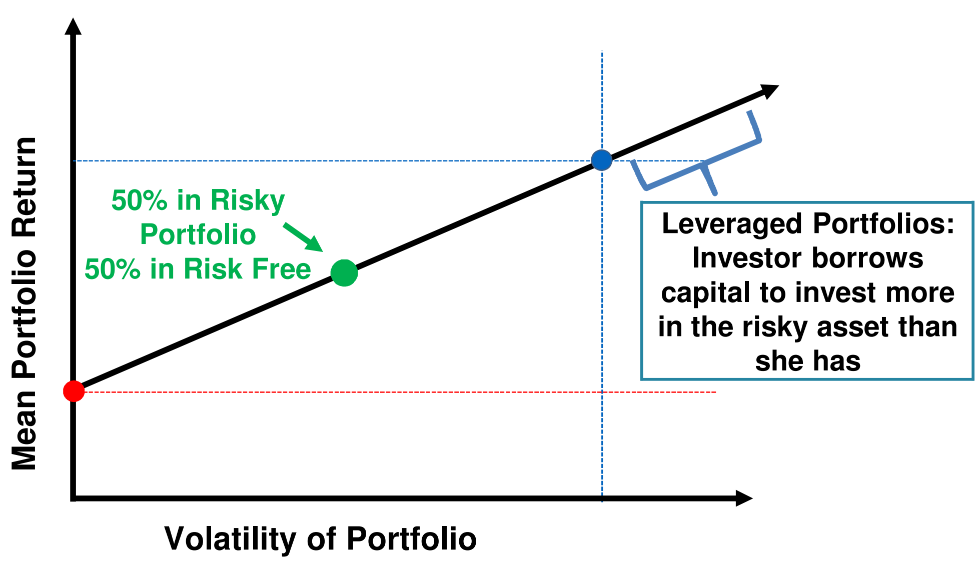
Slide 2

k1 i deleted the word exaxtly to have everyithing on two lines
kboudt; 5/31/2016

Risk-Return Trade-Off



Capital Allocation Line



Slide 3

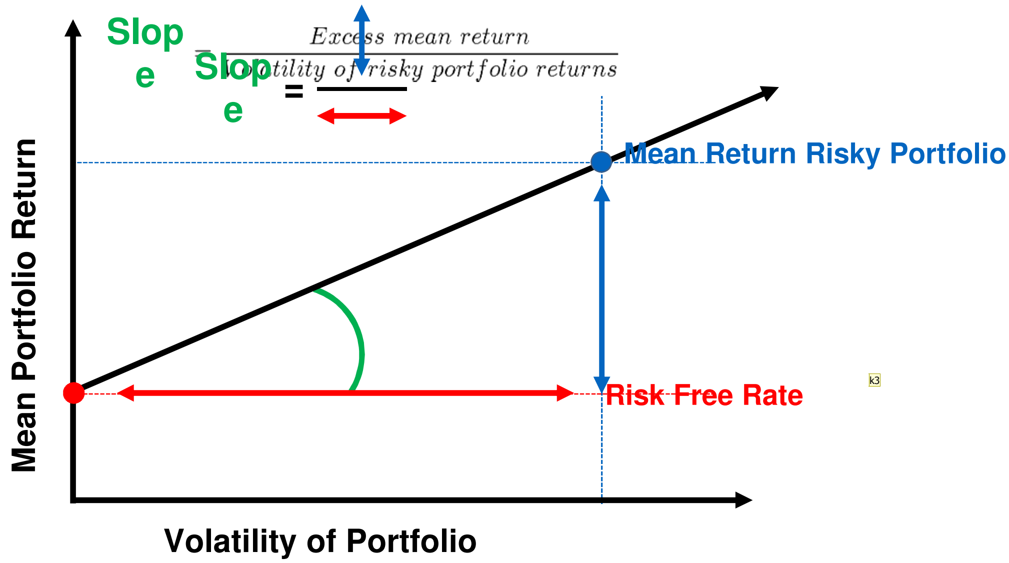
k2 i moved the names to the right and changed to mean return
kboudt; 5/31/2016

Slide 4

k4 deleted risk free rate and mean portfolio return
kboudt; 5/31/2016

DataCamp Course Title

The Sharpe Ratio



DataCamp Course Title

Performance Statistics In Action

```
> library(PerformanceAnalytics)
> sample_returns <- c( -0.02, 0.00, 0.00, 0.06, 0.02, -0.01,  -0.01, 0.04)

> mean(sample_returns) # arithmetic mean
[1] 0.015

> mean.geometric(sample_returns) # geometric mean
[1] 0.01468148

> StdDev(sample_returns) # volatility
[1] 0.02725541

> Rf <- 0.004 # risk free

> # Sharpe Ratio with arithmetic mean
> (mean(sample_returns) - Rf)/StdDev(sample_returns)
[1] 0.4035897
```

Slide 5

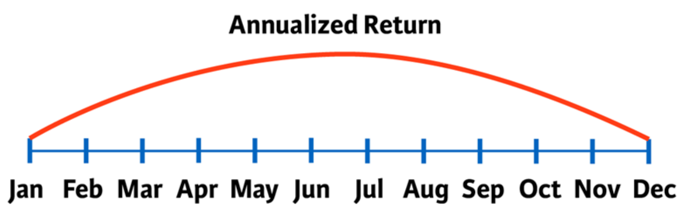
k3 move to the right
kboudt; 5/31/2016

Slide 6

k5 kboudt; 5/31/2016

k6 remove the space please
kboudt; 5/31/2016

Annualize Monthly Performance



- **Arithmetic mean**: monthly mean * 12
- **Geometric mean,** when **R**$_i$ are monthly returns:

$$[(1+R_1)*(1+R_2)*\cdots(1+R_T)]^{\frac{12}{T}}-1$$

- **Vol**: monthly vol * sqrt(12)

Performance Statistics In Action

```
> mean(sample_returns) # arithmetic mean
[1] 0.015

> mean.geometric(sample_returns) # geometric mean
[1] 0.01468148
```

*** 12**

```
> Return.annualized(sample_returns, scale = 12, geometric = FALSE)
[1] 0.18

> Return.annualized(sample_returns, scale = 12, geometric = TRUE)
[1] 0.1911235
```

Performance Statistics In Action

```
> # Volatility
> StdDev(sample_returns)
[1] 0.02725541
```

*** sqrt(12)**

```
> StdDev.annualized(sample_returns, scale = 12)
[1] 0.0944155
```

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Performance Statistics In Action

```
> # Sharpe Ratio with arithmetic mean
> Rf <- 0.004 # risk free

> (mean(sample_returns) - RF) / StdDev(sample_returns)
[1] 0.4035897
```

*** sqrt(12)**

```
> Return.annualized(sample_returns, scale = 12) /
Std.Dev.annualized(sample_returns, scale = 12)
[1] 1.398076
```