Testing the CAPM

Econ 424
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Monthly Returns: Jan 1978 – Dec 1987

```
> colIds(berndt.dat)
 [1] "CITCRP" "CONED"  "CONTIL" "DATGEN" "DEC"    "DELTA"
 [7] "GENMIL" "GERBER" "IBM"    "MARKET" "MOBIL"  "PANAM"
[13] "PSNH"   "TANDY"  "TEXACO" "WEYER"  "RKFREE"

# create excess returns by subtracting off risk free rate

> returns.mat = as.matrix(seriesData(berndt.dat))
> excessReturns.mat = returns.mat - returns.mat[,"RKFREE"]
> excessReturns.df = as.data.frame(excessReturns.mat)
```

```
Coefficients:
            Value Std. Error t value Pr(>|t|)
(Intercept) 0.001 0.009       0.065   0.948
    MARKET  0.447 0.119       3.746   0.000
Residual standard error: 0.0703 on 58 degrees of freedom
Multiple R-Squared: 0.195
```


CAPM regression for CITCRP

$\alpha = 0$

```
Coefficients:
            Value Std. Error t value Pr(>|t|)
(Intercept) 0.000 0.007      -0.036   0.971
    MARKET  0.339 0.089       3.818   0.000
Residual standard error: 0.0524 on 58 degrees of freedom
Multiple R-Squared: 0.201
```


CAPM regression for IBM

$\alpha = 0$

Test CAPM: H_0: $\alpha_i = 0$

$$t = \frac{\hat{\alpha}_i}{SE(\alpha_i)}$$

Decision: Reject H_0 at 5% level if $|t| > 2$

```
> tstats
  CITCRP  CONED  CONTIL DATGEN      DEC   DELTA GENMIL    GERBER
 0.06502 1.2141 -0.6703 -1.043 0.030922 0.62137 0.5411 -0.068848

      IBM    MOBIL    PANAM     PSNH TANDY   TEXACO  WEYER
-0.036301 0.085956 -0.89396 -0.27455 1.997 -0.40445 -0.52
```

Conclusion: Do not reject CAPM for any of the assets!

Relationship Between Average Return and β

```
> print(rbind(mu.hat,betas), digits=3)
        CITCRP  CONED   CONTIL   DATGEN     DEC DELTA GENMIL  GERBER
mu.hat  0.0056 0.0098 -0.00319 -0.00372 0.00818 0.012 0.00535 0.00453
 betas  0.4466 0.1405  0.38855  1.00562 0.70677 0.392 0.09874 0.46316

          IBM   MOBIL   PANAM     PSNH  TANDY  TEXACO   WEYER
mu.hat 0.00355 0.00838 -0.0053 0.000831 0.0427 0.00371 0.00325
 betas 0.33901 0.67978  0.7466 0.218017 1.0308 0.64326 0.70789
```

Estimated Security Market Line (SML)

$$\hat{\mu}_i = \gamma_0 + \gamma_1 \hat{\beta}_i + error_i$$
$$CAPM \Rightarrow \gamma_0 = 0, \ \gamma_1 = \hat{\mu}_M - r_f = 0.011$$

Jan 1978 – Dec 1982

TRUE and Estimated SML

Coefficients:

	Value	Std. Error	t value	Pr(>|t|)
(Intercept)	0.000	0.006	0.068	0.947
betas	0.011	0.010	1.069	0.304

$$t_{\gamma_0 = 0} = 0.068, \ t_{\gamma_1 = \mu_M - r_t} = \frac{0.011 - 0.011}{0.010} = 0$$

Jan 1983 – Dec 1987

TRUE and Estimated SML

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