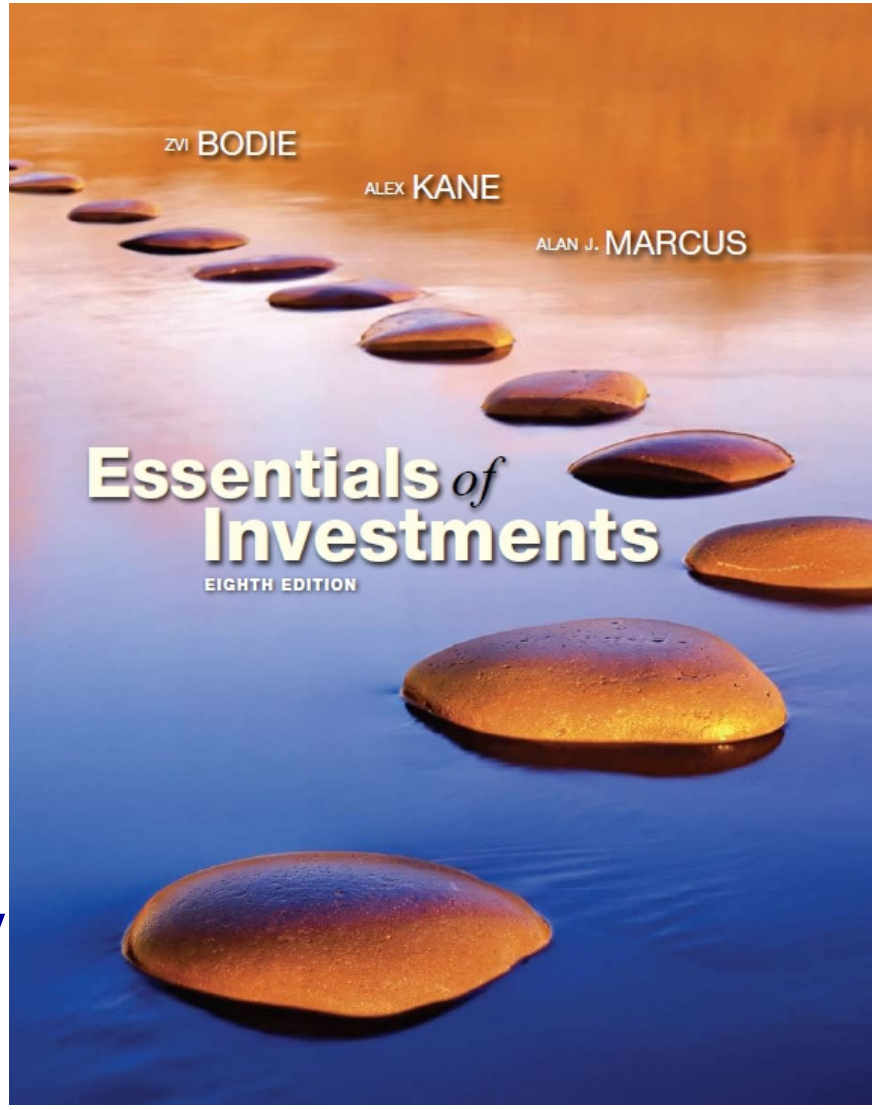
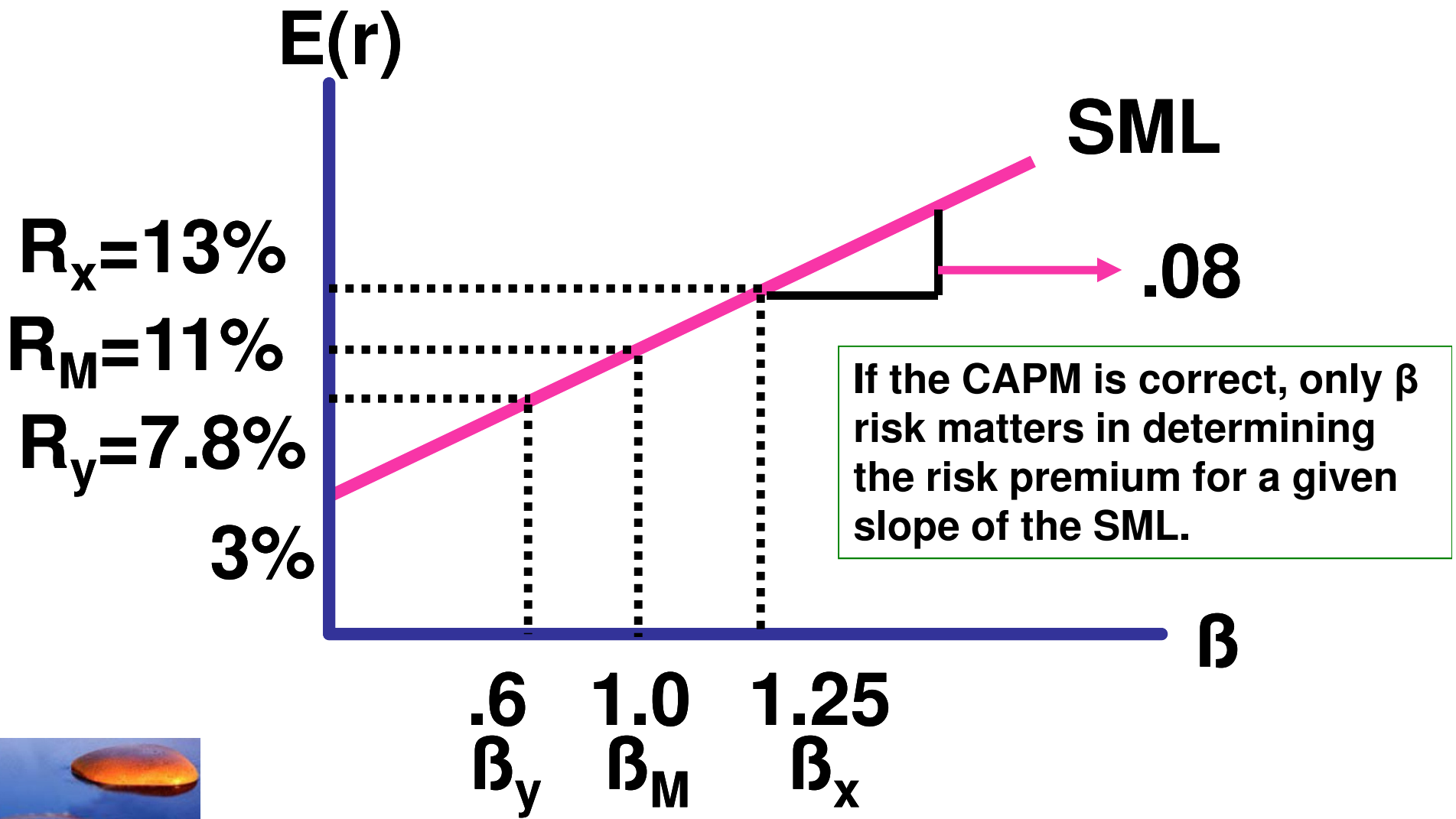
Chapter 7

Capital Asset Pricing and Arbitrage Pricing Theory

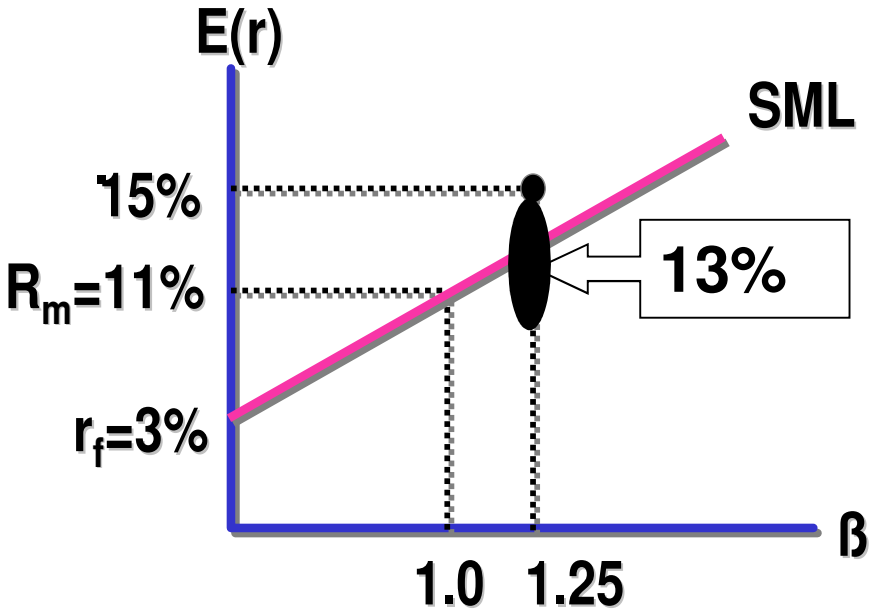


Graph of Sample Calculations



If the CAPM is correct, only β risk matters in determining the risk premium for a given slope of the SML.

Disequilibrium Example



Suppose a security with a β of 1.25 is offering an expected return of 15%

According to the SML, the E(r) should be 13%

E(r) = 0.03 + 1.25(.08) = 13%

Is the security under or overpriced?

Underpriced: It is offering too high of a rate of return for its level of risk

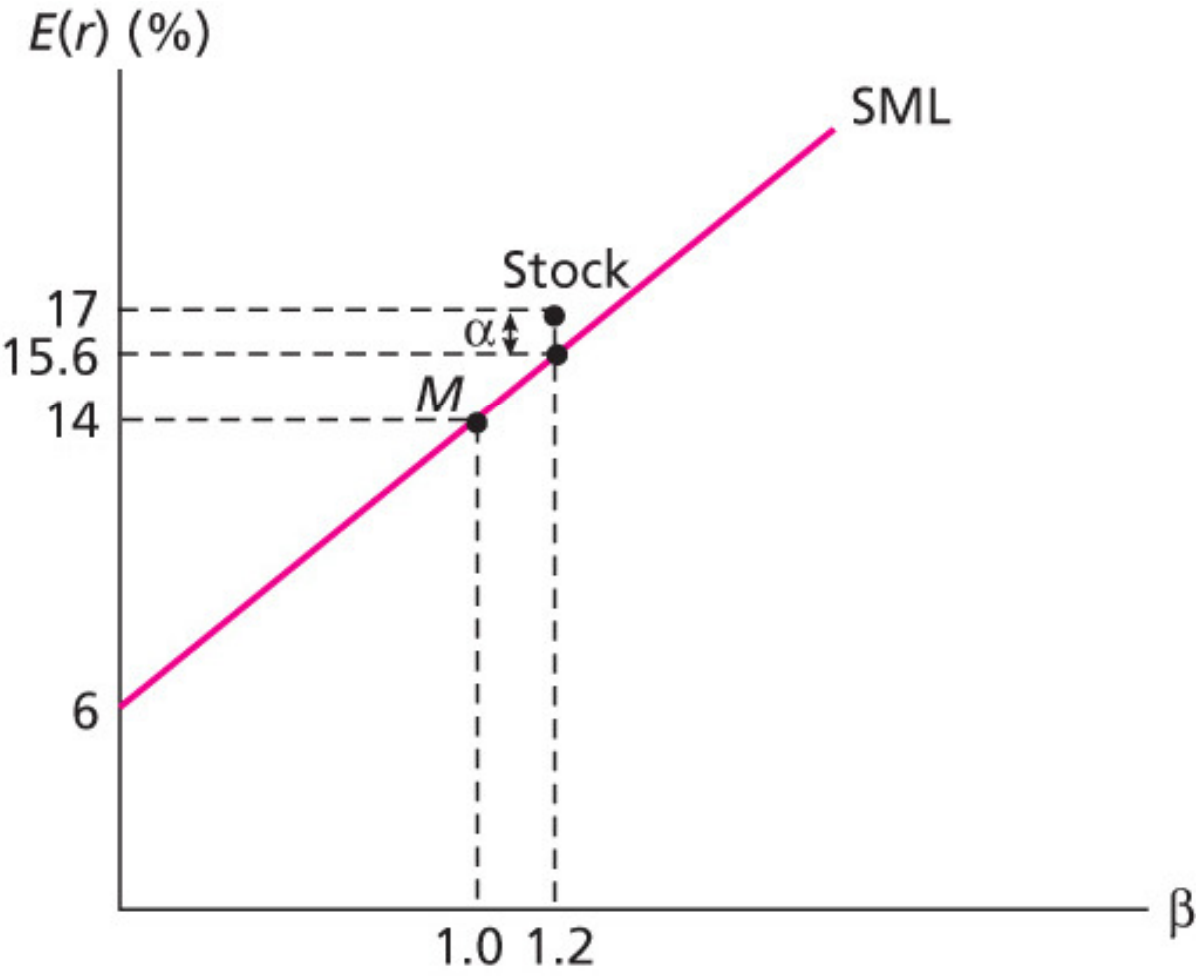
The difference between the return required for the risk level as measured by the CAPM in this case and the actual return is called the stock's alpha denoted by α

What is the α in this case?

α = +2% Positive α is good, negative α is bad

+ α gives the buyer a + abnormal return

More on alpha and beta



More on alpha and beta

$E(r_M)$ = **14%**

β_S = **1.5**

r_f = **5%**

Required return = $r_f + \beta_S [E(r_M) - r_f]$

= **5 + 1.5 [14 – 5] = 18.5%**

If you believe the stock will actually provide a return of **17%**, what is the implied alpha?

α = **17% - 18.5% = -1.5%**

A stock with a negative alpha plots below the SML & gives the buyer a negative abnormal return

Portfolio Betas

$\beta_P = \Sigma W_i \beta_i$

If you put half your money in a stock with a beta of **1.5** and **30%** of your money in a stock with a beta of **0.9** and the rest in T-bills, what is the portfolio beta?

$\beta_P =$ **0.50(1.5) + 0.30(0.9) + 0.20(0) = 1.02**

- **All portfolio beta expected return combinations should also fall on the SML.**
- **All $(E(r_i) - rf) / \beta_i$ should be the same for all stocks.**

Measuring Beta

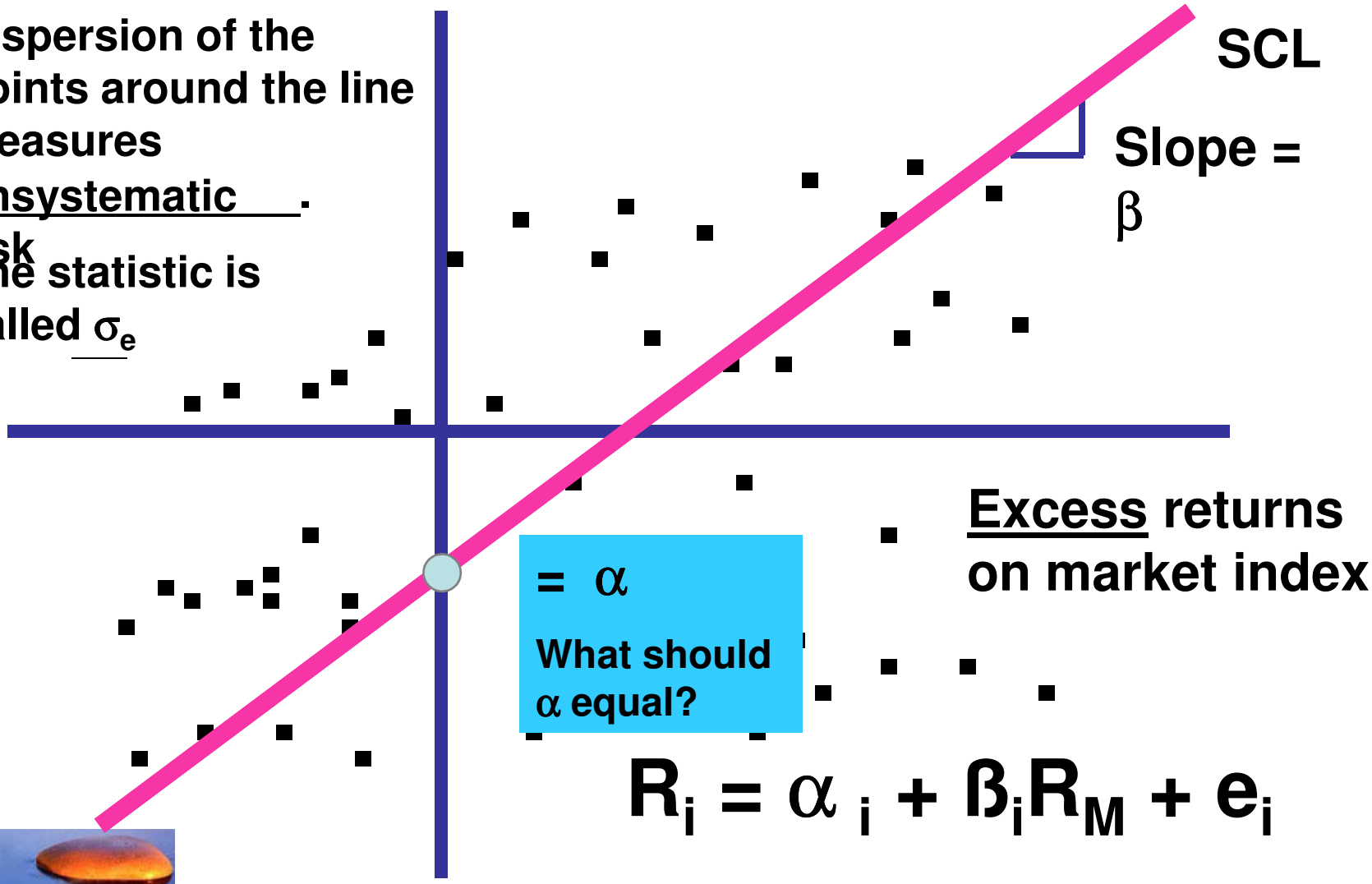
- Concept:

  We need to estimate the relationship between the security and the "Market" portfolio.

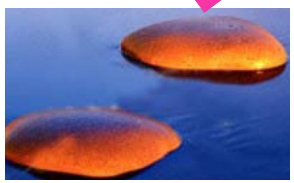
- Method

  Can calculate the Security Characteristic Line or SCl using historical time series excess returns of the security, and unfortunately, a proxy for the Market portfolio.

Security Characteristic Line (SCL)



$$R_i = \alpha_i + \beta_i R_M + e_i$$



GM Excess Returns May 00 to April 05

Month	GM ER	Rm- Rf	Month	GM ER	Rm- Rf
Apr-05	-0.12382	-0.0258	Nov-02	0.192943	0.0601
Mar-05	-0.17793	-0.0187	Oct-02	-0.14659	0.079
Feb-05	-0.03366	0.019	Sep-02	-0.1886	-0.1044
Jan-05	-0.0831	-0.0275	Aug-02	0.026767	0.0042
Dec-04	0.036243	0.0339	Jul-02	-0.13052	-0.0825
Nov-04	-0.00072	0.0456	Jun-02	-0.14143	-0.0717
Oct-04	-0.09401	0.0145	May-02	-0.03264	-0.0138
Sep-04	0.026922	0.0162	Apr-02	0.059749	-0.0527
Aug-04	-0.04367	0.0006	Mar-02	0.139472	0.0431
Jul-04	-0.07518	-0.0404	Feb-02	0.034513	-0.0231
Jun-04	0.025363	0.0185	Jan-02	0.050863	-0.0144
May-04	-0.04368	0.0124	Dec-01	-0.02357	0.0152
Apr-04	0.002798	-0.0184	Nov-01	0.201216	0.0764
Mar-04	-0.01887	-0.0129	Oct-01	-0.03866	0.0247
Feb-04	-0.03218	0.0133	Sep-01	-0.21868	-0.0929
Jan-04	-0.07041	0.0207	Aug-01	-0.14202	-0.0637
Dec-03	0.247489	0.0436	Jul-01	-0.01465	-0.0212
Nov-03	0.001786	0.0129	Jun-01	0.127956	-0.0193
Oct-03	0.041728	0.0607	May-01	0.035048	0.0074
Sep-03	-0.00494	-0.0124	Apr-01	0.053779	0.0808
Aug-03	0.097241	0.0227	Mar-01	-0.03135	-0.0728
Jul-03	0.038956	0.0236	Feb-01	-0.01125	-0.1
Jun-03	0.018181	0.0137	Jan-01	0.049825	0.0336
May-03	-0.02088	0.0608	Dec-00	0.02409	0.0126
Apr-03	0.07132	0.0816	Nov-00	-0.20852	-0.1063
Mar-03	-0.0054	0.0106	Oct-00	-0.04947	-0.0253
Feb-03	-0.07146	-0.0179	Sep-00	-0.07658	-0.0556
Jan-03	-0.01537	-0.0251	Aug-00	0.224185	0.0703
Dec-02	-0.07254	-0.0582	Jul-00	-0.02449	-0.0247
			Jun-00	-0.18276	0.0441
			May-00	-0.25065	-0.0425

Regression of GM ER and Rm-Rf from FF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.585804
R Square	0.343166
Adjusted R	0.331841
Standard E	0.085658
Observatio	60

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	1	0.222336	0.222336	30.30238	8.79E-07
Residual	58	0.42556	0.007337		
Total	59	0.647896			

	Coefficients	*tandard Erı*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.0143	0.011077	-1.29047	0.202008	-0.03647	0.007879
Rm- Rf	1.276019	0.231803	5.50476	8.79E-07	0.812016	1.740022

"True" β is between 0.81 and 1.74!

If rf = 5% and $r_m - r_f$ = 6%, then we would predict GM's return (r_{GM}) to be

5% + 1.276(6%) = 12.66%

Regression Results:

$r_{GM} - r_f = \alpha + ß(r_m - r_f)$

	α	ß
Estimated coefficient	-0.0143	1.276
Std error of estimate	0.01108	0.2318

ρ = 0.5858

R^2 = (Adjusted) = 33.18%

σ_e = 8.57%

Evaluating the CAPM

- The CAPM is "false" based on the **validity of its assumptions**.

- **The CAPM could still be a useful predictor of expecte returns. That is an empirical question.**

  Huge measurability problems because the market portfolio is unobservable.

  ***Conclusion: As a theory* the CAPM is untestable.**

Evaluating the CAPM

- However, the **practicality** of the CAPM is testable.

  Betas are **not as useful** at predicting returns as other measurable factors may be.

  - More advanced versions of the CAPM that do a better job at **estimating the market portfolio** are useful at predicting stock returns.

Still widely used and well understood.

Evaluating the CAPM

- The **principles** we learn from the CAPM are still entirely valid.
  - **Investors should diversify.**
  - **Systematic risk is the risk that matters.**
  - **A well diversified risky portfolio can be suitable for a wide range of investors.**
    - **The risky portfolio would have to be adjusted for tax and liquidity differences.**
    - **Differences in risk tolerances can be handled by changing the asset allocation decisions in the complete portfolio.**
- **Even if the CAPM is "false," the markets can still be "efficient."**