Monetary Economics

Portfolios' Risk and Returns
Diversification and Risk Factors

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Reading

- Chapters 11-13, not Appendices
- Chapter 11
  - Skip 11.2
    - Mean-variance optimization in practice
- Chapter 12
  - Skip 12.2 Portfolio Inputs and the SIM
  - Skip 12.3
    - Combining Active and Passive Portfolios
- Chapter 13
  - Skip 13.5
    - Testing the CAPM and Multifactor Models
- Chapters 19 and 20 next time

Risk Factors and Diversification

- International diversification of portfolios
- Factor models of returns
  - Single-index model
  - Arbitrage Pricing Theory (APT)

International Diversification

- Subject of a lot of research
- Home bias puzzle
  - Investors have too few foreign stocks in their portfolio
  - Important because a diversified portfolio has a lower variability of returns when adding stocks
    - Foreign stocks add returns with lower correlations
    - Correlation of returns across countries has been increasing over time since 1950s

Foreign Stocks

- What is a foreign stock?
  - Stock traded on a foreign exchange
  - Same stock traded on different exchanges should trade for the same price in any one currency
  - Stocks traded on an exchange in the country with headquarters
- Why are foreign stocks different than domestic stocks?
  - Headquarters in a different country typically
  - In the same industry, different distribution of business across countries
  - Different industries, different products

Home Bias Puzzle

- Investors in various countries hold fewer foreign stocks than would be suggested by diversification including foreign stocks

Home Bias Puzzle

- Investors in various countries hold fewer foreign stocks than would be suggested by diversification including foreign stocks
- Explanations:
  - Behavioral
  - Legal restrictions
  - Unfamiliar with foreign firms and legal structure
  - Prefer returns in domestic currency

International Diversification

- Foreign stock return has two parts
  - Stock return itself
  - Change in exchange rate

$$R_{us}^{u} = R_{For} + R_{S}$$

  - R_{us}^{u} is the unhedged return to a U.S. investor from a foreign stock
  - R_{For} is the return on a foreign stock in local currency (e.g. British company in Pounds sterling)
  - R_{S} is the part of the return due to a change in the exchange rate

International Diversification

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  - Stock return itself
  - Change in exchange rate

$$R_{us}^{u} = R_{For} + R_{S}$$

  - $R_S = (S_1 - S)/S$ is the proportional change in the exchange rate
    - S is the current spot exchange rate
    - S_1 is the future exchange rate when the stock is sold

Hedging Exchange Rate Risk

- Instead of receiving actual future exchange rate in $R_{us}^{u} = R_{For} + R_{S}$
  - Risk can be reduced by purchasing foreign exchange when the transaction is made
  - Roughly $R_{us}^{h} = R_{For} + \left(F - S \right) / S$
  - where *F* is the current forward rate for buying foreign exchange

Hedging Exchange Rate Risk

- Instead of receiving actual future exchange rate in $R_{us}^{u} = R_{For} + R_{S}$
- Receive $R_{us}^{h} = R_{For} + \left(F - S\right) / S$
  - Roughly
  - Because don't know amount will receive or date
    - Can periodically adjust hedge to overcome this

Hedged or Unhedged Foreign Investments?

- Research unsurprising: Sometimes do better with one and sometimes with the other
  - Evidence may lean toward hedged investments have done better for U.S. investors
- General considerations
  - Depends on covariances of returns
  - No reason to think that hedging reduces covariances
  - It may reduce a source of risk but it may pay to be "exposed to this risk"

Factor Models of Returns

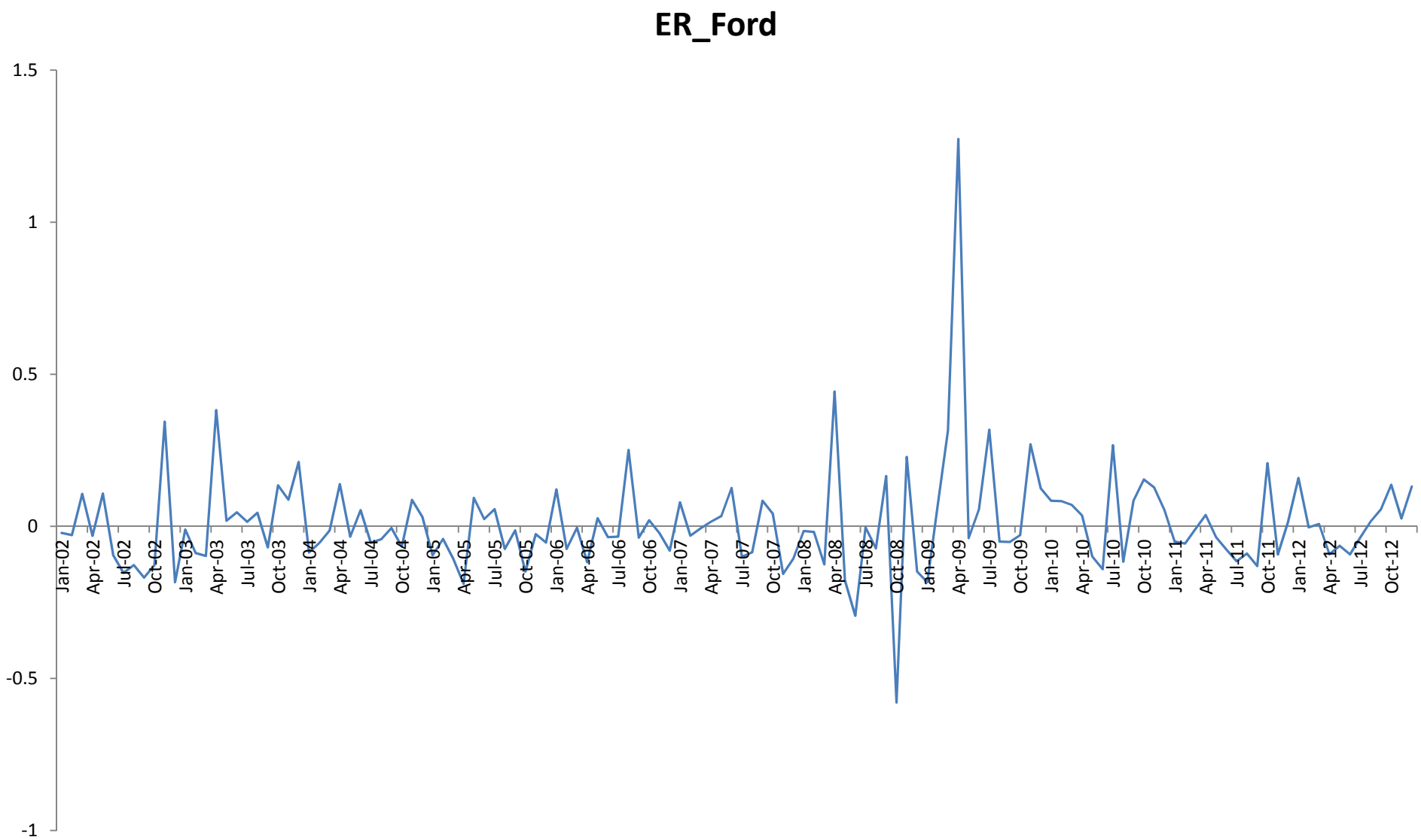
- The CAPM can be interpreted as a subset of factor models
- CAPM equation $R_S = r + \beta\left(R_m - r\right) + \varepsilon_S$
- Single-factor model

$$R_S - r = \beta\left(R_m - r\right) + \varepsilon_S$$

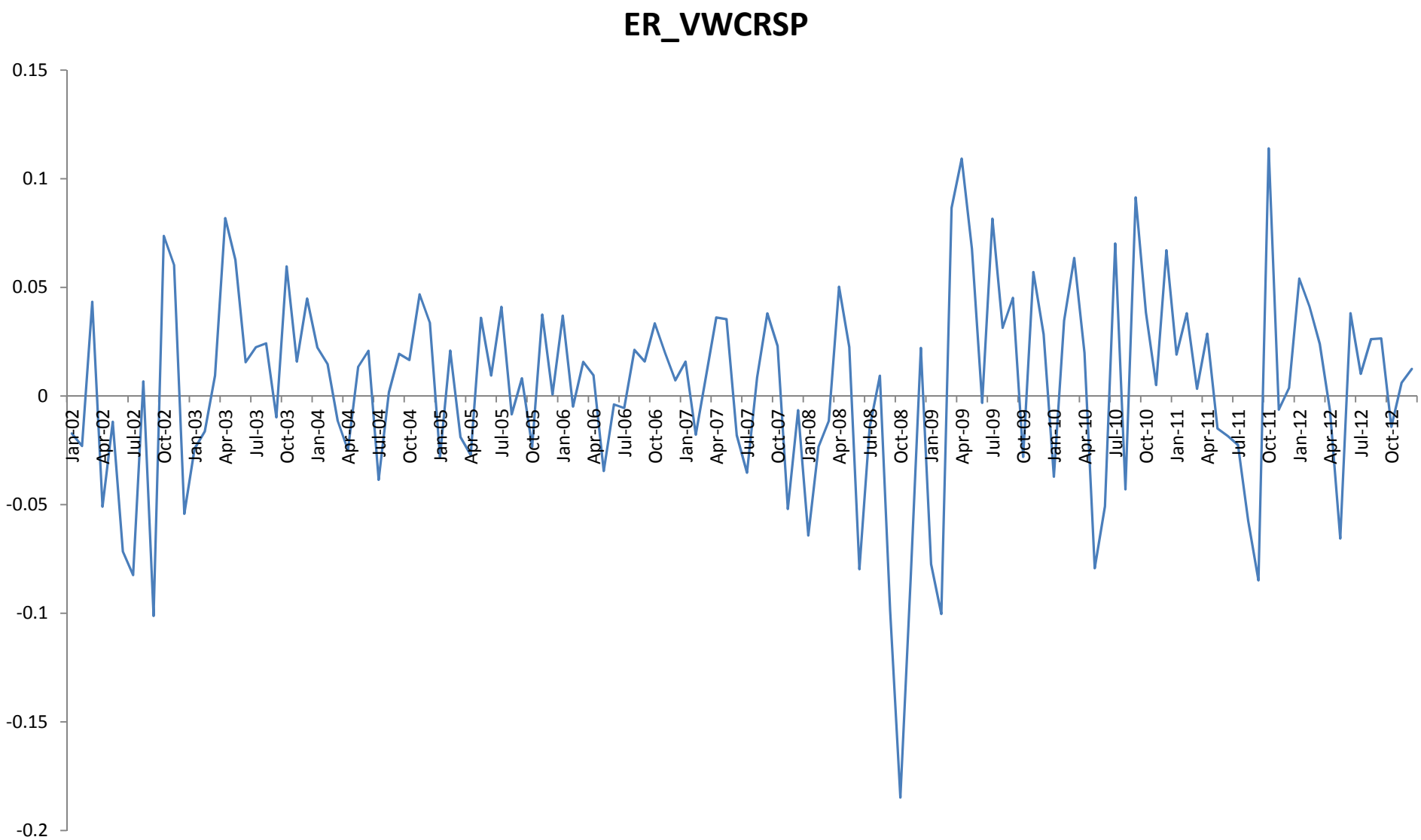
- Expected return

$$\mathrm{E}\,R_s - \mathrm{E}\,r = \beta\left(\mathrm{E}\,R_m - \mathrm{E}\,r\right)$$

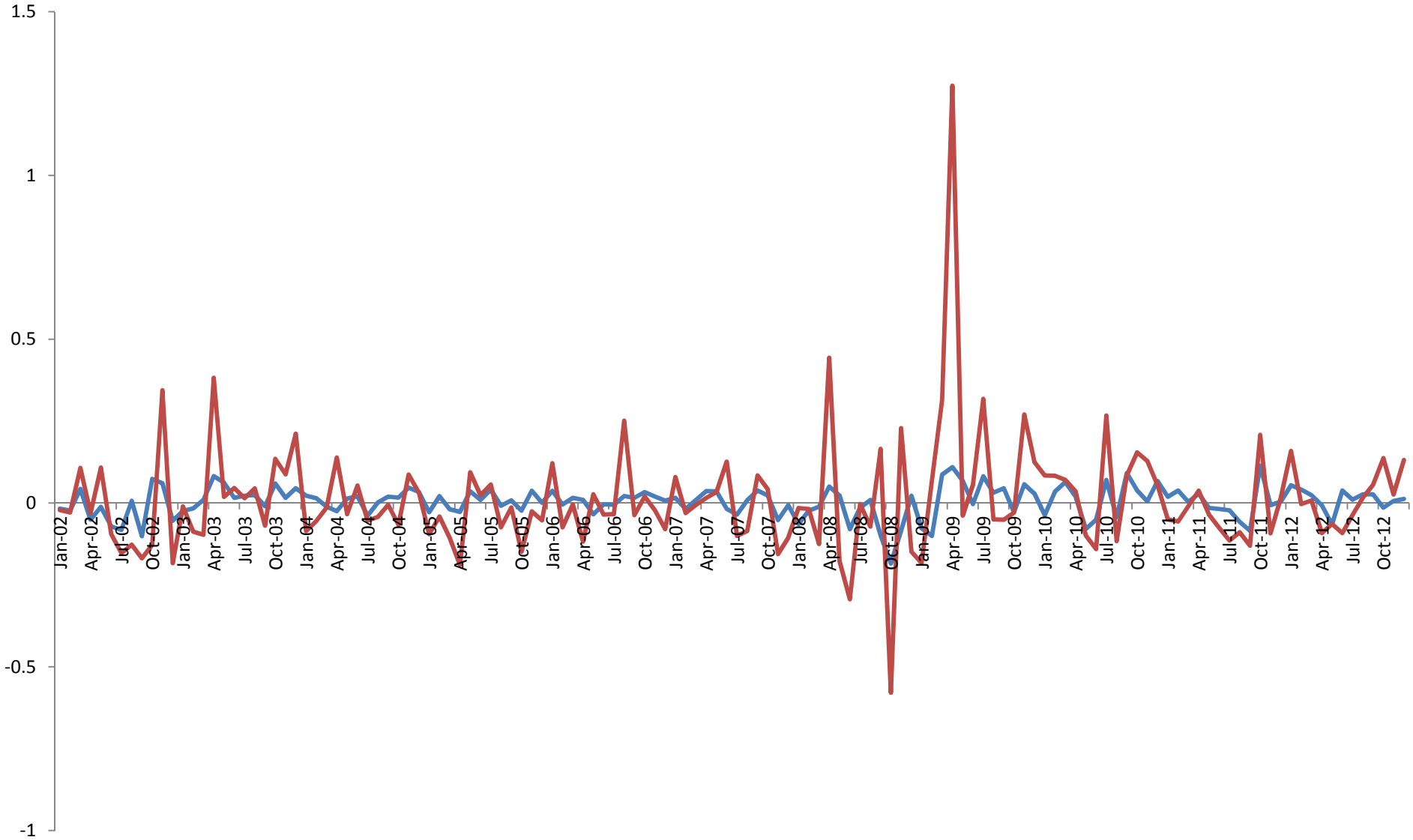
Ford Motor Company's Excess Return



CRSP's Excess Return



Ford (red) and CRSP (blue)



Single Index Model (SIM)

- Single risk factor

$$R_S - r = \alpha + \beta\left(R_m - r\right) + \varepsilon_S$$

- Constant term α need not equal zero
  - On average the error term ε_S is zero

Estimate Beta

Dependent Variable: ER_FORD
Method: Least Squares
Date: 10/20/13 Time: 14:45
Sample: 2002M01 2012M12
Included observations: 132
ER_FORD = C(1) + C(2) * ER_VWCRSP

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.002866	0.012610	0.227280	0.8206
C(2)	2.095982	0.270837	7.738901	0.0000

R-squared	0.315395	Mean dependent var	0.011499
Adjusted R-squared	0.310129	S.D. dependent var	0.173739
S.E. of regression	0.144305	Akaike info criterion	-1.018737
Sum squared resid	2.707117	Schwarz criterion	-0.975059
Log likelihood	69.23667	Hannan-Quinn criter.	-1.000988
F-statistic	59.89059	Durbin-Watson stat	2.334773
Prob(F-statistic)	0.000000		

Estimate Beta
2002 to end of 2006

Dependent Variable: ER_FORD
Method: Least Squares
Date: 10/20/13 Time: 14:50
Sample: 2002M01 2006M12
Included observations: 60
ER_FORD = C(1) + C(2) * ER_VWCRSP

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.015589	0.012125	-1.285652	0.2037
C(2)	1.890036	0.334707	5.646840	0.0000

R-squared	0.354744	Mean dependent var	-0.005147
Adjusted R-squared	0.343619	S.D. dependent var	0.114574
S.E. of regression	0.092825	Akaike info criterion	-1.883443
Sum squared resid	0.499753	Schwarz criterion	-1.813631
Log likelihood	58.50329	Hannan-Quinn criter.	-1.856136
F-statistic	31.88680	Durbin-Watson stat	2.481422
Prob(F-statistic)	0.000001		

Estimate Beta
2009 to end of 2012

Dependent Variable: ER_FORD
Method: Least Squares
Date: 10/20/13 Time: 14:53
Sample: 2009M01 2012M12
Included observations: 48
ER_FORD = C(1) + C(2) * ER_VWCRSP

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.021127	0.026905	0.785247	0.4363
C(2)	2.392181	0.513496	4.658620	0.0000

R-squared	0.320559	Mean dependent var	0.052673
Adjusted R-squared	0.305789	S.D. dependent var	0.216518
S.E. of regression	0.180401	Akaike info criterion	-0.546494
Sum squared resid	1.497051	Schwarz criterion	-0.468527
Log likelihood	15.11585	Hannan-Quinn criter.	-0.517030
F-statistic	21.70274	Durbin-Watson stat	2.065772
Prob(F-statistic)	0.000027		

Event Studies

- Can use the result of estimating the CAPM or SIM – the residuals – to examine the effects of announcements

$$R_S = r + \beta\left(R_m - r\right) + \varepsilon_S$$

- Estimate the equation

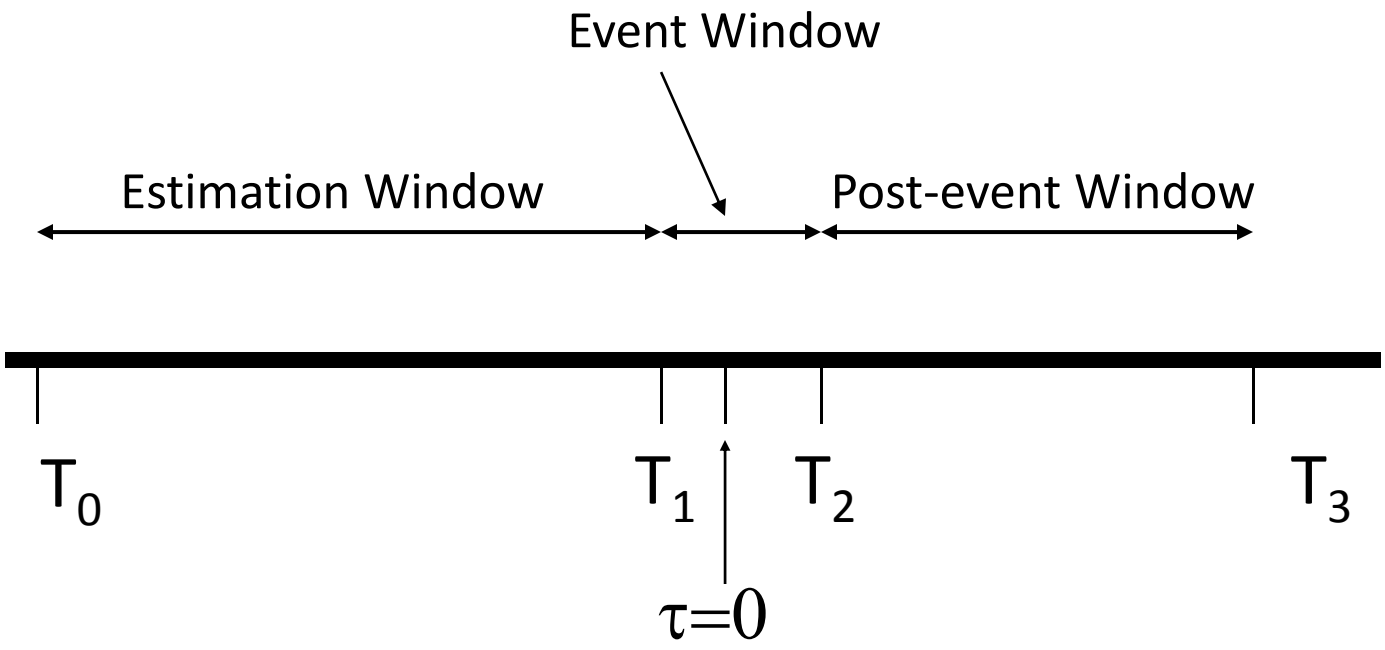
$$R_S = r + \hat{\beta}\left(R_m - r\right) + \hat{\varepsilon}_S$$

- Calculate

$$\hat{\varepsilon}_S = R_S - r + \hat{\beta}\left(R_m - r\right)$$

- Look at residual associated with event
  - Were returns higher or lower than would expect given the market return?

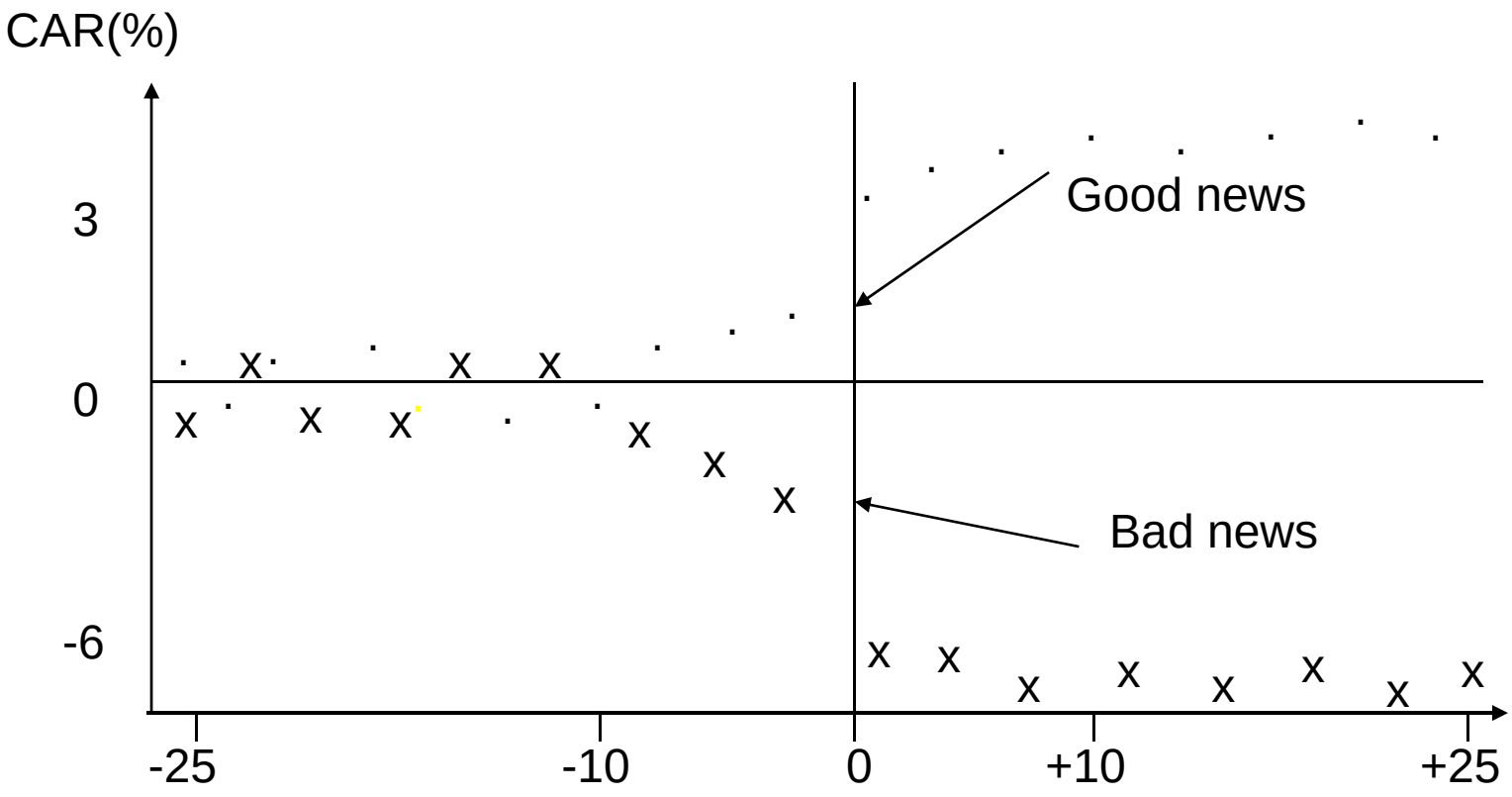
Figure 3 : Event study



An Interesting Result

- Stock issues and repurchases generate lower returns
- Low returns tend to persist for a few days
- Analyst recommendation changes and announcement of changes in dividends also tend to have persistent effects
- Not entirely consistent with an efficient market

Figure 4 : Cumulative abnormal returns



Event time in trading days, relative to “event-day” at t=0

CAPM and Mean-Variance Portfolio Theory

- Mean-variance portfolio theory and the CAPM are intimately related
- If the mean-variance portfolio theory is correct, the CAPM for returns is implied

$$R_S = r + \beta\left(R_m - r\right) + \varepsilon_S$$

- As we saw before, the implication for excess returns on stocks is that

$$\mathrm{E}\,R_s - \mathrm{E}\,r = \beta_s\left(\mathrm{E}\,R_m - \mathrm{E}\,r\right)$$

- Expected excess returns vary across stocks only due to different betas

Arbitrage Pricing Theory

- APT for an individual stock, say A, is a multi-factor model

$$R_A = a_A + b_{A,1}F_1 + b_{A,2}F_2 + \ldots + b_{k,A}F_k + \varepsilon_A$$

- The implied pricing equation for the cross section of returns is the more general

$$\mathrm{E}\,R_s = \lambda_0 + \lambda_1 b_{1,s} + \lambda_2 b_{2,s} + \ldots + \lambda_k b_{k,s}$$

- For s=A,B,…,i.e., all stocks

APT and Idiosyncratic Risk

- APT has

$$R_A = a_A + b_{A,1}F_1 + b_{A,2}F_2 + \ldots + b_{k,A}F_k + \varepsilon_A$$

- The term ε_A is idiosyncratic risk and can be diversified away, as in CAPM

Arbitrage Pricing Theory

- If the stock market is efficient, then the excess return on stocks reflect news
- News consists of unexpected changes in factors

Fama-French Three Factor Model

- Can interpret factors
  - Excess return on market
  - Book to market values
  - Firms' sizes
- As "risk factors" in the APT

Summary

- It is widely thought that international diversification is worthwhile
  - The evidence is not so strong that someone who was quite doubtful it is worthwhile would be convinced it is worthwhile
  - The evidence is strong enough that someone who wasn't sure would be convinced it is worthwhile
- Financial economists convinced enough to have created the "Home bias puzzle"

Summary

- Factor models of returns are a very general way of thinking about stocks
- Expected excess returns above the riskfree rate reflect risk factors
- The sensitivity of a stock to a risk factor determines the effect of the risk factor on the stock's expected return