

## Chapter 21 International Asset Pricing

- 21.1 The Traditional CAPM
- 21.2 The International Asset Pricing Model (IAPM)
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- 21.5 The Currency Risk Factor in Stock Returns
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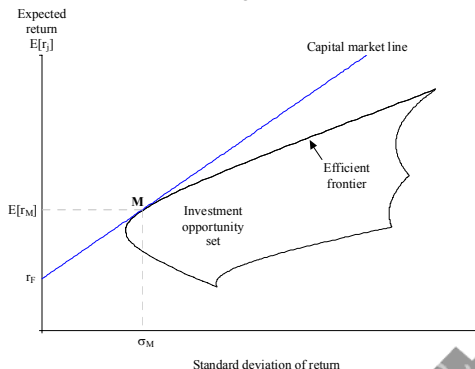
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### The traditional capital asset pricing model (CAPM)

- **Perfect financial markets**
  - Frictionless markets
  - Rational investors with equal access to costless information and market prices
- **Homogeneous expectations**
- **Everyone can borrow and lend at the riskless rate of interest  $r_f$**

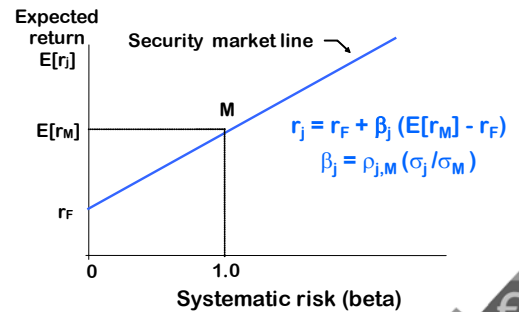
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### The CAPM capital market line



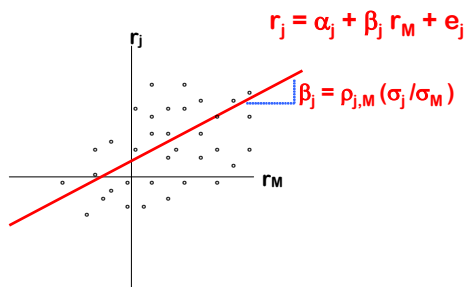
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### The CAPM security market line



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### The one-factor market model



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### An international version of the CAPM

In addition to the CAPM assumptions, suppose

- **Purchasing power parity holds**
- **Investors in each country have the same consumption basket**

This leads to an international version of the CAPM called the **International Asset Pricing Model (IAPM)**

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## The International Asset Pricing Model

- Like the CAPM, the **market portfolio** in the **IAPM** includes all assets in the world weighted according to their market values
- Investors also hold a **hedge portfolio** of domestic and foreign bonds
  - as a **store** of value (like  $r_F$ )
  - as a **hedge** of the market portfolio's currency risk

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## Integrated vs segmented markets

- **Integrated financial markets**  
There are no barriers to financial flows and purchasing power parity holds across equivalent assets wherever they are traded.
  - **Segmented financial markets**  
Prices are set independently in each national market.
- Financial markets fall somewhere between these two extremes.**

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## Roll's critique

- If performance is measured relative to an **ex post efficient index**, then all securities will lie along the security market line.
- If performance is measured relative to an **ex post inefficient index**, then any ranking of portfolio performance is possible depending on the inefficient index chosen.

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## Roll's critique

- Because of home asset bias, investors do not hold the world market portfolio.
- Consequently, market beta may be of little use in measuring risk in an internationally diversified portfolio.

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## Arbitrage pricing theory (APT)

$$r_j = \mu_j + \beta_{1j}F_1 + \dots + \beta_{Kj}F_K + e_j \quad (21.5)$$

where  $r_j$  = random rate of return on asset j  
 $\mu_j$  = expected return on asset j  
 $\beta_{kj}$  = **sensitivity** of asset j to factor k where  $k=1, \dots, K$   
 $F_k$  = **systematic risk** factor k  
 $e_j$  = a random error term

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## The one-factor market model

- Regressing  $r_j$  on  $r_M$  yields
 
$$r_j = \alpha_j + \beta_j r_M + e_j \quad (21.6)$$

- Subtracting asset j's mean return

$$\mu_j = \alpha_j + \beta_j \mu_M$$

from both sides of (21.6) and rearranging yields a **one-factor market model in excess return form**

$$r_j = \mu_j + \beta_j F_M + e_j \quad (21.7)$$

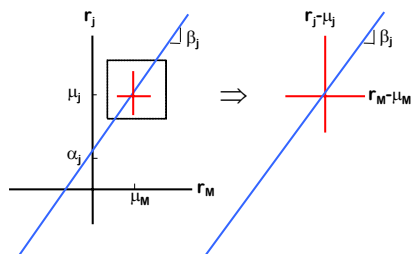
where  $F_M = (r_M - \mu_M)$

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### Beta as a regression coefficient

$$r_j = \alpha_j + \beta_j r_M + e_j \Rightarrow r_j - \mu_j = \beta_j F_M + e_j$$

$$\text{where } F_M = r_M - \mu_M$$



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### APT factors

Chen, Roll & Ross identified 5 APT factors

$$r_j = \mu_j + \beta_{1j}F_1 + \beta_{2j}F_2 + \beta_{3j}F_3 + \beta_{4j}F_4 + \beta_{5j}F_5 + e_j$$

$F_1$  industrial production

$F_2$  risk premia (corporate – government bond yield)

$F_3$  term premia (long-term T-bond minus T-bill yield)

$F_4$  expected inflation

$F_5$  unexpected inflation

> When the market return was included as a sixth factor, its coefficient was not significant.

Chen, Roll & Ross, "Economic Forces and the Stock Market," *Journal of Business*, July 1986.

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### A comparison of industry, national, and international factors

$$r_j = \mu_M + \beta_{Cj}F_{Cj} + \beta_{Ij}F_{Ij} + e_j \quad (21.9)$$

where  $r_j$  = local currency excess return to stock  $j$

$\mu_M$  = return to the global market factor

$F_{Cj}$  = return to stock  $j$ 's country factor

and  $F_{Ij}$  = return to stock  $j$ 's industry factor

Beckers, Connor & Curds, "National versus Global Influences on Equity Returns," *Financial Analysts Journal*, March/April 1996.

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### Relative importance of industry, national, and international factors

Global factor alone <b>0.2107</b>	Global and industry factors <b>0.2537</b>
Global & national market factors <b>0.3620</b>	Global, industry & national market factors <b>0.3970</b>

Average EP (explanatory power) statistics

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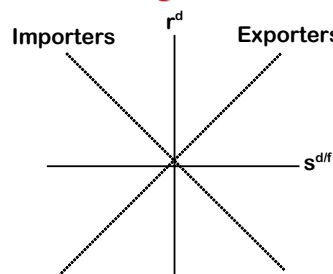
### National and international factors dominate

> **Global** and **national** stock market factors play important roles in explaining stock return variability.

> The exposure of stocks to industry factors is low.

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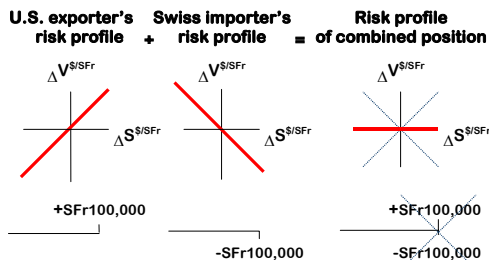
### Exposure to currency risk as a regression coefficient



$$r^d = \mu^d + \beta^f s^{dif} + e^d$$

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## The diversifiability of currency risk exposure



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## Is currency risk priced in the US?

Jorion added a currency risk factor

$$r_j^d = \mu_j^d + \beta_{1j}(r_M^d - \mu_M^d) + \beta_{Sj}f_s^{diff} + e_j^d \quad (21.13)$$

$$r_j^d = \mu_j^d + \beta_{1j}F_1^d + \dots + \beta_{4j}F_4^d + \beta_{Sj}f_s^{diff} + e_j^d \quad (21.14)$$

- > In actively traded US markets, the currency risk factor is subsumed into the other factors
- > There remains considerable cross-sectional variation among US-based MNCs

Jorion, "The Pricing of Exchange Rate Risk in the Stock Market," *Journal of Financial and Quantitative Analysis*, Sep. 1991.

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## Is currency risk priced outside the US?

De Santis and Gérard fit a **conditional** version of a 2-factor model

- Conditional models allow risks to vary over time
- Different national markets had different exposures
- > Currency risk was a small fraction of total risk in the United States
- > Currency risk was a significant proportion of total risk in Germany, Japan, and the United Kingdom

De Santis & Gérard, "How Big is the Premium for Currency Risk," *Journal of Financial Economics*, September 1998.

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## Fama & French's value premium

Fama & French fit a 3-factor model

$$r_j = \mu_j + \beta_j(r_M - \mu_M) + \beta_{Zj}F_{Size} + \beta_{Dj}F_{Distress} + e_j$$

$F_{Size}$  = the difference in mean return between the smallest 10% and the largest 10% of firms

$F_{Distress}$  (relative financial distress) = the difference in mean return between value stocks and growth stocks

- **Value stocks** = high equity book-to-market ratios
- **Growth stocks** = low equity book-to-market ratios

Fama & French, "The Cross-Section of Expected Stock Returns," *Journal of Finance* (1992).

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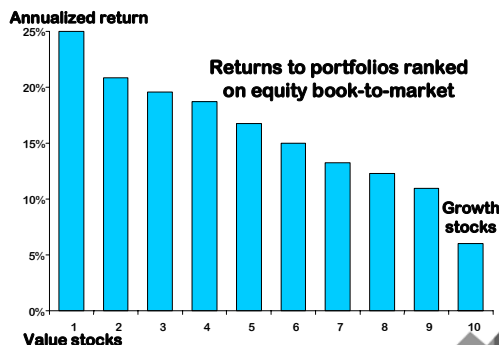
## The value premium and the size effect

- > **Firm size**: Small firms outperformed large firms by an average of 7 percent per year
- > **Relative financial distress**: Value stocks outperformed growth stocks by an average of 12 percent per year
- > After controlling for size and relative financial distress, the market factor contributed nothing to the explanatory power of the regression

Fama & French, "The Cross-Section of Expected Stock Returns," *Journal of Finance*, June 1992.

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## The value premium in U.S. stocks



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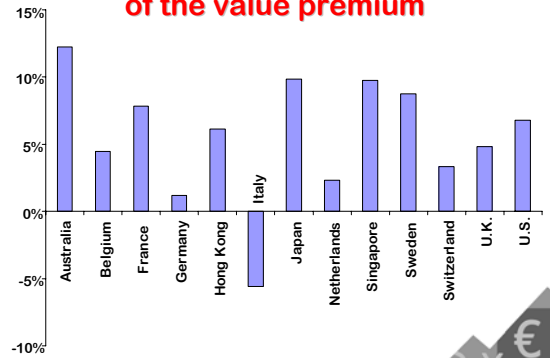
## The international value premium

Fama and French extended their study to international stocks

- > **Value stocks** have higher mean returns than **growth stocks** in 12 of 13 international markets
- > The difference in mean return is 7.60% per year

Fama & French, "Value versus Growth: The International Evidence," *Journal of Finance*, December 1998.

## A cross-country comparison of the value premium



## Jegadeesh & Titman: Momentum

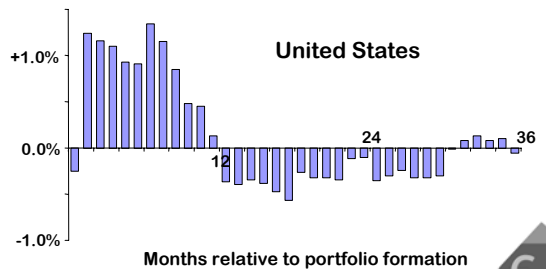
Categorized stocks into 10 equal-sized portfolios according to return over the preceding 6 months

- **Winners** - stocks with the **highest** return over the preceding 6 months
- **Losers** - stocks with the **lowest** return over the preceding 6 months

Jegadeesh & Titman, "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency," *Journal of Finance*, March 1993.

## Momentum in U.S. stocks

mean monthly return (winners - losers)



## Momentum in international stocks

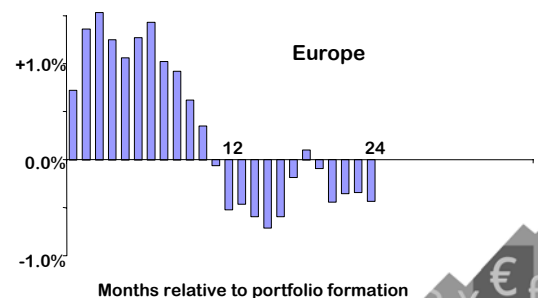
Rouwenhorst examined momentum in 12 European stock markets

- Past **winners outperformed losers** by more than one percent per month after correcting for risk
- Return continuation lasts for about one year, and then is partially reversed

K. Geert Rouwenhorst, "International Momentum Strategies," *Journal of Finance*, February 1998.

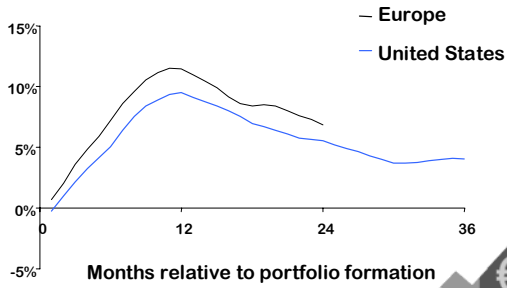
## Momentum in European stocks

Difference in mean monthly return (winners - losers)



### Cumulative momentum returns

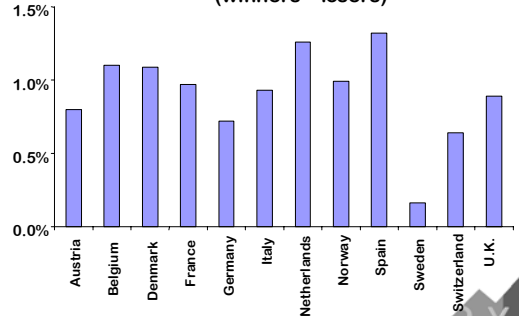
Winner minus loser  
cumulative returns



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### Cross-country momentum returns

Difference in mean monthly return  
(winners- losers)



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