

## Lecture 9: The CAPM

ECON435: Financial Markets and the Macroeconomy

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## The Capital Asset Pricing Model

The CAPM describes:

- general equilibrium in capital markets
- expected returns as a function of risk

→ one of the centerpieces of finance

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## Simplifying Model Assumptions

1. investors are price takers
2. time horizon is 1 period
3. all assets are publicly traded assets
4. borrowing and lending at the risk free rate
5. no taxes, no transactions costs
6. rational, mean-variance investors
7. homogenous expectations about assets

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## Main Results (1/4)

**All investors hold the market portfolio**

Equilibrium prices and risk premia are such that each investor finds it optimal to hold the market portfolio

Market portfolio: sum of all portfolios  
= also called "passive" portfolio

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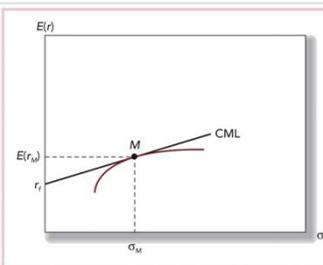
## Main Results (2/4)

**The "passive" strategy is efficient**

- market portfolio = optimal portfolio  $P^*$  for all investors
- market portfolio = tangency of highest Capital Market Line to efficient frontier

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## Efficient Frontier and CML



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## Main Results (3/4)

### Risk premium on the market portfolio

- risk premium = increasing in risk aversion:
- optimal investment  $y = (E[r_m] - r_f)/(A\sigma^2)$
  - in equilibrium: market portfolio has to be held by market participants:  $E[y] = 1$
  - $E[r_m] = A\sigma^2 + r_f$

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## Key Result (4/4)

### Expected returns on individual securities

- risk premium on individual securities  $i$  is determined by overall contribution  $\beta_i$  to aggregate portfolio risk  $r_m$
  - $\beta_i = \text{Cov}(r_i, r_m)/\sigma_m^2$
  - $E[r_i] = r_f + \beta_i(E[r_m] - r_f)$
- linear relationship between expected return and beta

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## Security Market Line (SML)

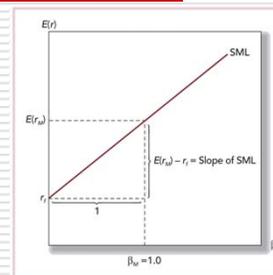
- graphs the relationship  $E[r_i]$  vs.  $\beta_i$  for securities of different riskiness
- captures the risk-return tradeoff

Note: contrast to CML:

- CML looks at efficient *portfolios*
- SML looks at individual *securities*

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## Security Market Line (SML)



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## Beta and Returns

$\beta_i > 1$ : "aggressive" stocks:

- more risky than the market
- $E[r_i] > E[r_m]$

$\beta_i < 1$ : "defensive" stocks:

- less risky than the market
- $E[r_i] < E[r_m]$

$\beta_i < 0$ : hedges

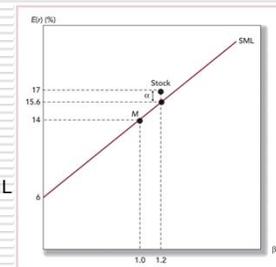
- can be used to hedge risk of other stocks
- $E[r_i] < r_f$

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## Positive Alpha Stocks

Positive alpha stocks:

- investment managers try to find positive alpha stocks to earn excess returns
- buy these stock
- their price rises
- security returns to SML
- should not exist in equilibrium



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## The CAPM and Real Investment

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- CAPM offers guide for companies on which investments to implement
- shareholders require extra return only for systematic risk  
→ determines a "hurdle" rate for real investments
- managers should not worry about diversifiable risk