

# Final Exam

- Bring two 8.5 by 11 formula sheets
- Next Tuesday, May 4, 2-5
- Room 152
- Office Hours: Next Monday, 10:30-1

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# Today

- APT
  - what
  - intuition
- Quick review of main ideas
- Practice exam

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## The APT

- CAPM
  - people only care about mean and variance
  - Intuition: only systematic risk should be priced
- APT
  - not based on investor preferences but on ‘factor model’ for returns

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## APT Model

- Common factors that determine co-movements of returns
- systematic and diversifiable risk
- Intuition of model
  - only systematic risk is rewarded...

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## Factor Model

$$\tilde{r}_i = E[\tilde{r}_i] + \beta_i^1 \tilde{F}^1 + \beta_i^2 \tilde{F}^2 + \dots + \beta_i^K \tilde{F}^K + \tilde{\varepsilon}_i$$

- F: factor
- $\beta$ : factor loading
- $\varepsilon$ : diversifiable risk

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## Pricing

- Expected returns proportional to factor betas
- Intuition: only systematic risk should command higher expected returns

$$E[\tilde{r}_i] = r_{free} + \lambda_1 \beta_i^1 + \lambda_2 \beta_i^2 + \dots + \lambda_K \beta_i^K$$

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## Example

- 3 factors
- Stock  $i$  has
  - $\beta_i^1=1.1$ ,  $\beta_i^2=0.5$ ,  $\beta_i^3=2$
  - $\lambda_1=10\%$ ,  $\lambda_2=10\%$ ,  $\lambda_3=1\%$ , Riskfree rate =5%
- Expected return on stock?

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## Main Ideas

- Replication and pricing
- Sensitivity measures
- Diversification
- Risk vs. return

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# Replication

- Two strategies with same payoff every state must have the same price
  - coupon bonds and pure discount bonds
    - spot interest rates
    - forward interest rates
  - Options
    - put/call parity
    - binomial model

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# Sensitivity Measures

- Bonds
  - duration and convexity, and ‘factor adjusted’
- Other securities
  - beta with respect to market (CAPM)
  - ‘factor models’
- Application to hedging

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## Diversification

- Combine securities to reduce risk
  - portfolio optimization
- Co-movements is the key
  - covariance, or in ‘factor’ settings, sensitivities to factors

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## Risk vs. Return

- Rewarded for systematic risk
  - CAPM-market
  - factor models - factor loading
  - term structure-duration and convexity?

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# Solutions to practice exam

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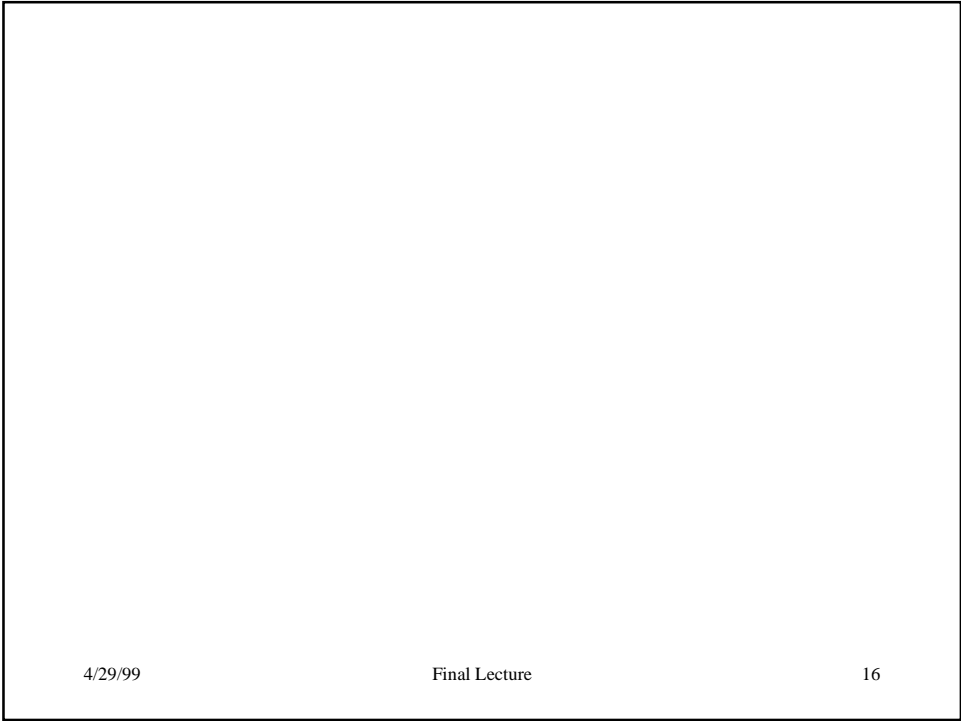
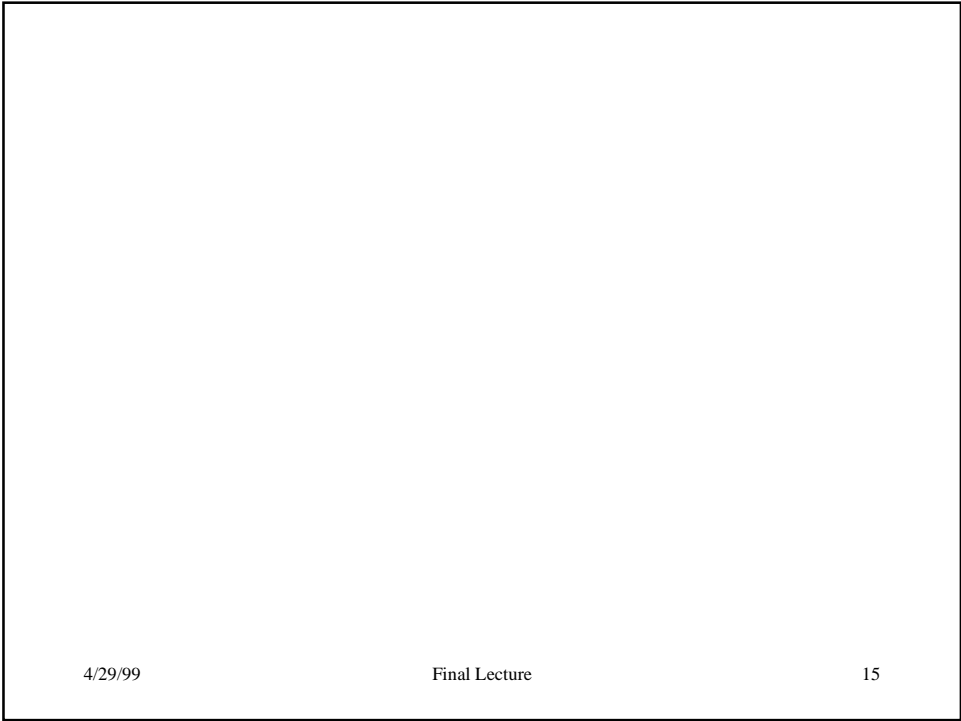
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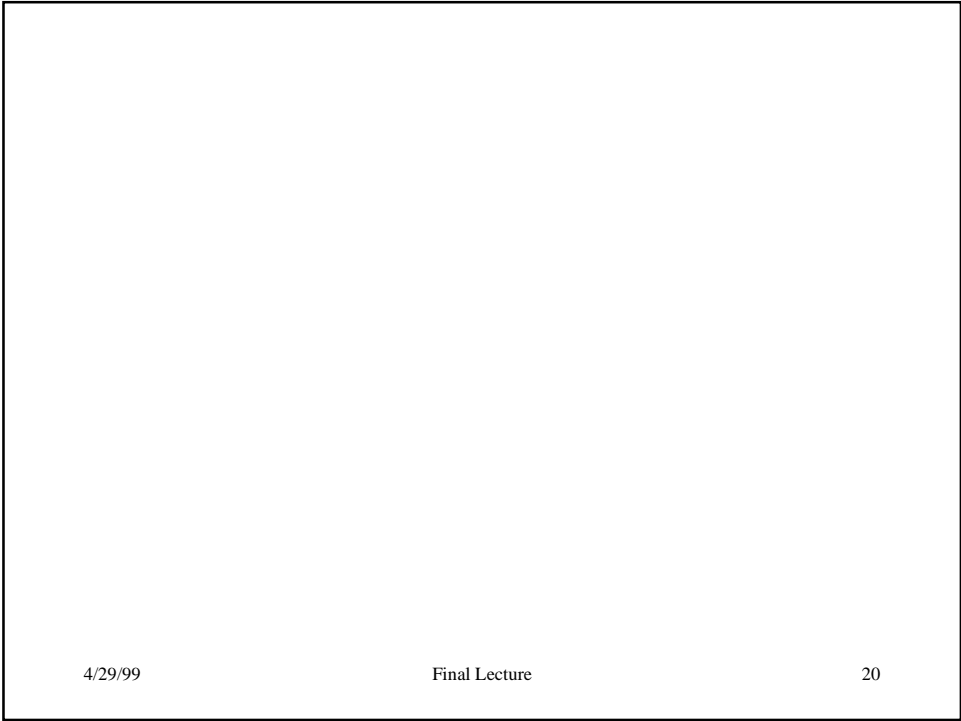
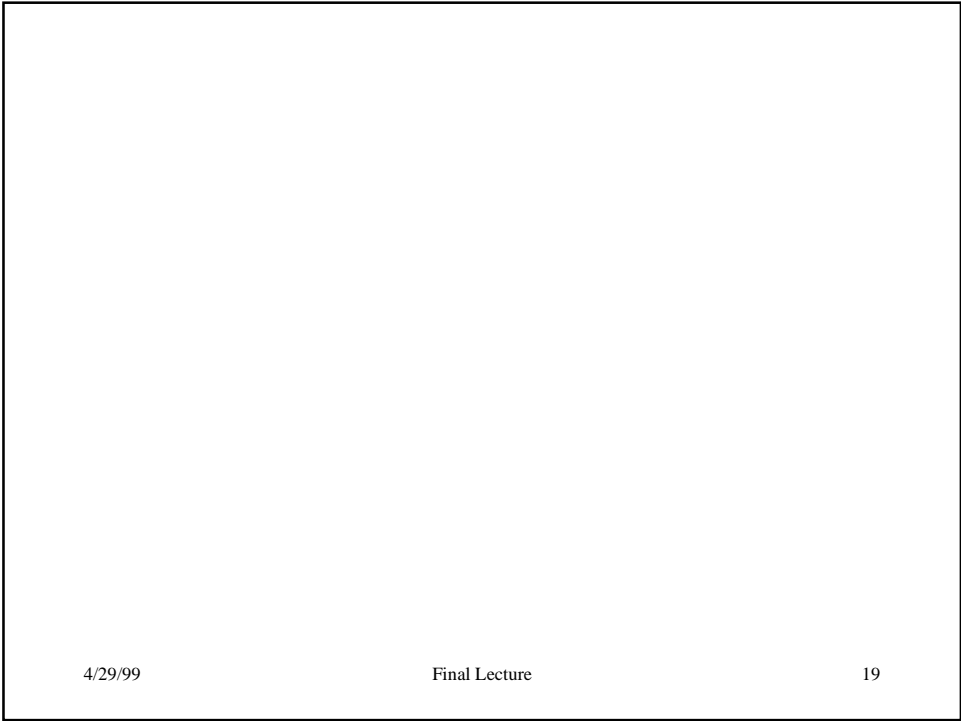
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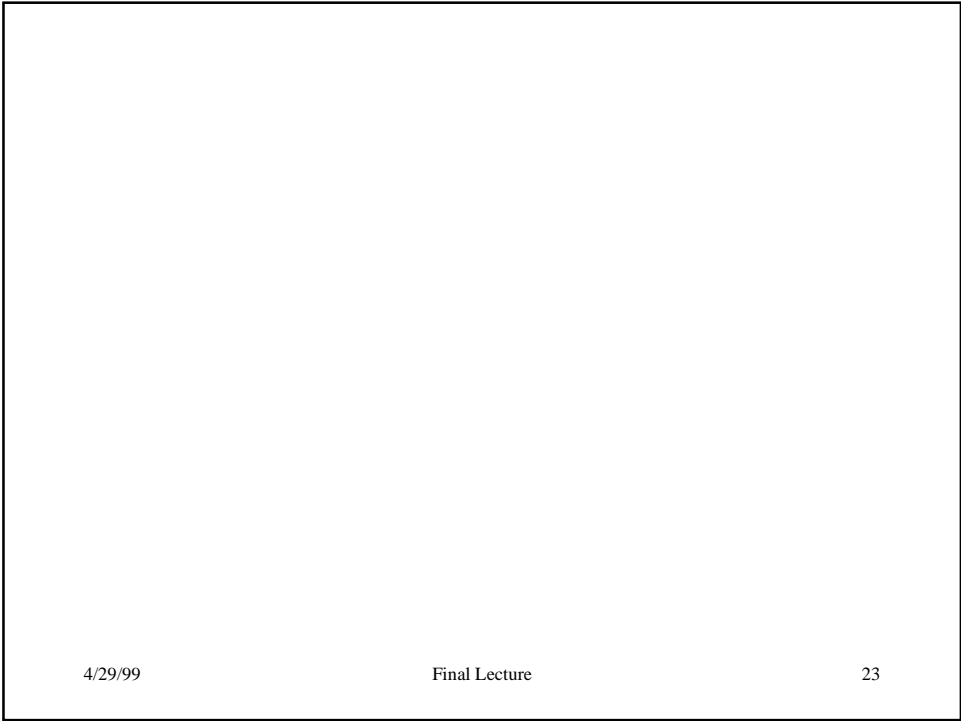












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