Final Review[*] [†]

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[*]This is a review lecture on financial economics 2019S taught by Xu Gao.

[†]Wish you all the best for the final exam.

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1 Introduction

2 Absolute pricing

3 Relative pricing

4 Financial fractions

5 Conclusion

Overview

　　这份讲义的 25 讲可以大致分成五部分。第一部分包含第 1 到第 4 讲，是课程的介绍部分，意在让那些初次接触金融学的读者了解金融的基本概念。第二部分包含第 5 讲到第 12 讲，是均衡资产定价的部分，介绍了均值方差分析、CAPM、C-CAPM 等内容。第三部分包含第 13 讲到第 19 讲，是无套利定价的部分，介绍了风险中性定价、二叉树、对冲等内容。第四部分包括第 20 讲到第 24 讲，重点在于把信息不对称、有限套利、非理性等摩擦因素引入金融分析，以丰富金融理论对现实世界的解释力。第 25 讲自成一部分，站在金融理论的外部来看理论的方法论基础和应用边界。

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Introduction Lecture 1-4

1. Introduction to Financial Economics
   - ▶ Finance: intertemporal and uncertainty
   - ▶ Asset pricing
     - Equilibrium pricing
     - No arbitrage pricing
     - Rate of return: good assets V.S. bad assets
   - ▶ Corporate finance: fractions, asymmetric information
   - ▶ Behavioral finance → Effective market

2. Bonds
   - IRR & Reinvestment Risk
   - Spot Rate(r_i) & Yield to maturity(y_i) & Forward Rate$(fr_{i,j})$
   - Duration

3. Stocks
   - DDM & Gordon model
   - Transversality Condition(TVC)
   - PE ratWio
   - Dividend decision & Fisher Separation Theorem

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CAPM Lecture 5-7

1. Preference: Mean-Variance Analysis
   - ex ante & ex post
   - Risk premium, Sharpe ratio

2. Behavior and Equilibrium

CML(efficient frontier,Two-fund separation):$E(r_i) - r_f = \frac{\sigma_i}{\sigma_M}[E(r_M) - r_f]$

SML(pricing model):$E(r_i) - r_f = \beta_i[E(r_M) - r_f]$

3. Properties: CAPM
   - Determination of discount rate & Portable alpha

4. Three Questions(7.1.2)
   - Steel V.S. Pharmaceutical
   - It is possible that $E(r_i) < r_f$
   - $E(r_i) = E(r_j), \sigma_i < \sigma_j$, investors choose which one?

C-CAPM Lecture 8-12

1. Preference: Expected Utility(Lecture 8)
   - Expected Utility Theorem: Rational+Continuous+Independence
   - Risk aversion & Certainty equivalent
   - Utility functions(HARA,CARA,CRRA)

2. Behavior: Behavior under risks(Lecture 9)
   - Risky Assets [Different State]
     - Proposition1: $a^* > 0 \Leftrightarrow E(\tilde{r}) > r_f$
     - Proposition2: $a^{*\prime}(w_0) > 0 \Leftrightarrow R'_A(\cdot) < 0$
     - Proposition3: $e(w_0) > 1 \Leftrightarrow R'_R(\cdot) < 0$
   - Savings under risk(R_B is more risky than R_A) [Different Time]
     - Proposition4: $s_A < s_B \Leftrightarrow P_R(sR) > 2$
     - Precautionary saving V.S. Substitution effect

- ❸ Equilibrium: General Equilibrium(Lecture 10-11)
  - ▶ Property of best risk sharing
    - ❶ Consumptions of all consumers are perfectly correlated
    - ❷ Consumption is only determined by aggregated risk
    - ❸ Wilson Theorem: $\frac{dc_{ks}}{de_s} = \frac{T_k(c_{ks})}{\sum_{k=1}^{K} T_k(c_{ks})}$
  - ▶ Aggregated risk V.S. Idiosyncratic risk
  - ▶ Representative consumer, HARA $\frac{(c-d)^{1-\gamma}}{1-\gamma}$
- ❹ Properties: C-CAPM(Lecture 12)
  - ▶ SDF: $\tilde{m} = \delta \frac{u'(\tilde{c}_1)}{u'(c_0)}, \ \ p = E(\tilde{m}\tilde{x})$
  - ▶ Risk-free rate: $r_f \approx \frac{1-\delta}{\delta} + R_R \bar{g} - \frac{1}{2} R_R P_R \sigma_g^2$ (Determination)
  - ▶ Risk premium: $E[\tilde{r}_j] - r_f = -\frac{\delta(1+r_f)}{u'(c_0)} cov(u'(\tilde{c}_1), \tilde{r}_j)$ (Covariance)
- ❺ Two puzzles
  - ▶ Risk free rate puzzle
  - ▶ Equity premium puzzle
    - • Two economic forces(time smoothing and state smoothing)
    - • One parameter

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APT Lecture 13

1. APT model [**Exercise 13.1**]
   - CAPM → Fama-French three-factor model

     $\tilde{r}_i - r_f = \alpha_i + \beta_{i,M}(\tilde{r_M} - r_f) + \tilde{\epsilon}_i$

     $\tilde{r}_i - r_f = \alpha_i + \beta_{i,M}(\tilde{r_M} - r_f) + \beta_{i,S}S\tilde{M}B + \beta_{i,H}H\tilde{M}L + \tilde{\epsilon}_i$

   - $\tilde{r}_i = \alpha_i + \sum_{k=1}^{K} \beta_{i,k}\tilde{f}_k + \tilde{\epsilon}_i, \quad i = 1, 2, \cdots, N$

   - $\tilde{r}_p = \sum_{i=1}^{N} w_i\alpha_i + (\sum_{i=1}^{N} w_i\beta_{i,1})\tilde{f}_1 + \cdots + (\sum_{i=1}^{N} w_i\beta_{i,K})\tilde{f}_K + \sum_{i=1}^{N} w_i\tilde{\epsilon}_i$

   - $\lambda_k = E(\tilde{r_{pk}}) - r_f - E(\tilde{f}_k)$

   - $E(\tilde{r}_i) = r_f + \sum_{k=1}^{K} \beta_{i,k}\big[\lambda_k + E(\tilde{f}_k)\big] = r_f + \sum_{k=1}^{K} \beta_{i,k}\big[E(\tilde{r_{pk}}) - r_f\big]$

2. Parameters: $\tilde{f}_k \; \beta_{i,k} \; \tilde{\epsilon}_i \; \tilde{r_{pk}} \; \lambda_k$

3. Application: Portable alpha, Statistical arbitrage

NA-Pricing Lecture 14-15

1. Options & Futures [**Exercise 14.1 14.2**]
   - Forward price v.s. Expectation of spot price in the future
   - Put-call Parity(European v.s. American)
   - Options and Complete: State-index asset, butterfly spread
   - Pricing idea: replicate bond/options, Risk Neutral World

2. Fundamental Theorem of Asset Pricing
   - Complete N.A. $\Leftrightarrow \exists \, !\varphi$ s.t. $P_j = \sum\limits_{s=1}^{S} \varphi_s x_s^j$ [**Exercise 15.2**]
     - $P = \sum\limits_{s=1}^{S} \pi_s \frac{\varphi_s}{\pi_s} x_s = \sum\limits_{s=1}^{S} \pi_s m_s x_s = E(\tilde{m}\tilde{x})$
     - $P = \sum\limits_{s=1}^{S} \varphi_s x_s = e^{-r} \sum\limits_{s=1}^{S} \frac{\varphi_s}{\sum\limits_{k=1}^{S} \varphi_k} x_s^j = e^{-r} \sum\limits_{s=1}^{S} q_s x_s = e^{-r} E^Q[\tilde{x}]$
     - $P = \sum\limits_{s=1}^{S} \pi_s \frac{\delta u'(c_{1,s})}{u'(c_0)} x_s \rightarrow q_s = \delta \pi_s \frac{u'(c_{1,s})}{u'(c_0)} / \sum\limits_{s=1}^{S} \delta \pi_s \frac{u'(c_{1,s})}{u'(c_0)} = \frac{\pi_s u'(c_{1,s})}{\sum\limits_{s=1}^{S} \pi_s u'(c_{1,s})}$

1. Dynamic complete: Long-lived asset $\geq$ Maximum of successor node

2. Law of iterated expectation: $E_t(\tilde{x}) = E_t\big[E_{t+1}(\tilde{x})\big]$

3. Dynamic pricing

   - Martingale: Define $\hat{S}_t = e^{-rt}S_t$ as deflated stock price, we have
     $E_0[\hat{S}_2] = E_0[\hat{S}_1] = \hat{S}_0$ & $E_1[\hat{S}_2] = \hat{S}_1$
   - $q = \frac{e^r - d}{u - d}$
   - $C_u = e^{-r}[qC_{uu} + (1-q)C_{ud}], C_d = e^{-r}[qC_{ud} + (1-q)C_{dd}]$
   - $C_0 = e^{-2r}[q^2 C_{uu} + 2q(1-q)C_{ud} + (1-q)^2 C_{dd}]$
   - **Derivatives Payoff Function**: European options, American options, Floating strike lookback call options [**Exercise 16.1**], Asian options

1. Problem1

$$V(R, G) = max\{0, \frac{R}{R+G}[1+V(R-1, G)] + \frac{G}{G+R}[-1+V(R, G-1)]\}$$

2. Problem2

$$P = max\{max\{K-S, 0\}, \frac{1}{1+r}[qP_u + (1-q)P_d]\}$$

3. Problem3

$$V_s =$$

$$min\{B_t, \frac{1}{1+r_s}[q(\bar{r}B_t + B_t - B_{t+1} + V_{su}) + (1-q)(\bar{r}B_t + B_t - B_{t+1} + V_{sd})]\}$$

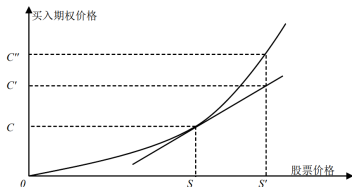**[Exercise 17.2]**

1. Concepts
   - ▶ Random Walk, Brownian motion, Wiener Process
   - ▶ Ito's Lemma
   - ▶ geometric Brownian motion(Assets price)

2. BS equation(European Option)
   - ▶ $C_0 = S_0 N(d_1) - e^{-rT} K N(d_2)$
   - ▶ $P_0 = -S_0 N(-d_1) + e^{-rT} K N(-d_2)$
   - ▶ Put-Call Parity(Verify) $P_0 + S_0 = C_0 + K e^{-rT}$
   - ▶ Intuition: $S_0 N(d_1), N(d_2)$

Dynamic Hedging Lecture 19

1. Naked position & Covered position, Stop loss strategy

2. Delta Hedge: $\Delta = \frac{\partial \Pi}{\partial S}$

3. Greeks [**Exercise 19.1**]
   - ▶ Gamma: $\Gamma = \frac{\partial \Delta}{\partial S} = \frac{\partial^2 \Pi}{\partial S^2}$. Curvature & Hedging error
   - ▶ Vega: $\nu = \frac{\partial \Pi}{\partial \sigma}$

4. Portfolio Insurance: replicate option[**Exercise 19.2**]

   * Δ is the position, not flow

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Asymmetric Information Lecture 20-21

1. Moral Hazard(ex-post): Credit rationing
   - ▶ IC constraint & IR constraint [**Exercise 20.1**]
   - ▶ Application：Financial Accelerator, Debt Overhang, Debt-deflation, Fiscal & Monetary Policy

2. Adverse Selection(ex-ante): Capital Structure
   - ▶ MM Theory & Tradeoff Theory
   - ▶ Pecking Order Theory
     - • Information Intensity: Low $\to$ High
     - • Internal Financing, External Financing(Debt, Equity)

Maturity Mismatch Lecture 22

1. DD Model [**Exercise 22.2**]
   - ▶ Autarky(ATK)
   - ▶ Market (MKT, Open in period 1)
   - ▶ Central Planner(BST)
   - ▶ Bank(BNK)

2. Bank
   - ▶ Maturity Transformation(Cash Pool)
   - ▶ Bank Run(Self-fulfilling) & Deposit Insurance
   - ▶ Morale Hazard & Regulation
   - ▶ Shadow Banking
   - ▶ Internet Finance [**Exercise 22.1**]

Behavioral Finance Lecture 23

1. Limits to Arbitrage
   - ▶ Fundamental Risk & Implementation Costs & Noise Trader Risk

2. Performance-based Arbitrage [**Exercise 23.1**]
   - ▶ Performance-based → Expand market volatility
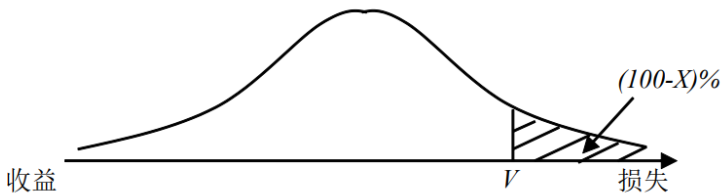
3. Systematic Bias
   - ▶ Overconfidence & Optimism & Belief Perseverance
   - ▶ Prospect Theory & Loss Aversion

4. Comments: Behavioral Finance

Financial Risk Lecture 24

1. Market Risk & Credit Risk & Operation Risk
   - ▶ Greeks: Delta, Gamma, Vega, Theta, Rho
   - ▶ Value ar Risk: V(T,X)

(100-X)%

收益   V   损失

2. Subprime Mortgage Crisis
   - ▶ ABS & CDO
   - ▶ CDS & Synthetic CDO

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Conclusion

▶ https://finaecon2019s.github.io/FinaEcon2019S/

12	Mon,5.6	第20讲.道德风险与信贷配给（slides）	提取码：gtny	HW11:20.1 Due:5月13日	从本讲开始，我们进入金融摩擦的领域 理解本讲模型设定和信贷配给理论的四个应用
12	Sat,5.11	第21讲.逆向选择与资本结构（slides）	提取码： 975L		理解模型的setup，掌握信息强度与啄庶假说的概念
13	Mon,5.13	第22讲.银行与期限错配（slides）	提取码： PY18	HW12:22.2 Due:5月20日	理解模型setup，理解银行实现的期限转换功能，及其对应带来的期限错配问题
14	Mon,5.20	第23讲.行为金融学初探（slides）	提取码：c6P1	HW13:23.1 Due:5月27日	理解模型setup，有限套利
15	Mon,5.27	第24讲.风险管理与次贷危机（slides）	提取码： o4Ly		掌握相关概念，例如风险价值、希腊字母、CDO、CDS、合成CDO等等，次贷危机爆 发的原因
18	Mon,6.17	期末考试			

▶ https://shimo.im/sheets/uc7QXLuatNwG8UBC/MODOC

▶ 平时成绩 23 + 2[*†] & 期中考试 25 **!!! DDL [23:00, June 16, 2019]**

▶ 期末考试：50 **[2019 年 6 月 17 日（周一）18：30-20：30]**

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[*]Method1：教材勘误，PPT 勘误
[†]Method2：教材答案征集 https://www.wjx.cn/jq/11554255.aspx

Model

NA Pricing

1. APT [**Exercise 13.1**]

2. Fundamental Theorem of Asset Pricing [**Exercise 15.2**]

3. Multiperiod Pricing [**Exercise 16.1**]

4. Optimal Stopping [**Exercise 17.2**]

5. Dynamic Hedging [**Exercise 19.1 & 19.2**]

Financial Frictions

1. Credit Rationing [**Exercise 20.1**] & Capital Structure

2. Diamond-Dybvig Model [**Exercise 22.2**]

3. Performance-based Arbitrage [**Exercise 23.1**]

End

时间：**2019.06.17，18：30-20：30**

地点：

50-60 计算 & 40-50 简答，请务必携带计算器

May you suffer the examination and be stronger

Financial Economics 2019 Spring, Xu Gao(徐高)

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