2025-01 comprehensive exam problems

[시험범위](#_9udlwah43uka)

[자산가격결정론1:이론과컴퓨테이셔널파이낸스 + 자산가격결정론1:이론](#_yhiznnu4alc0)

[양자금융사례연구 & 양자컴퓨터와금융:양자컴퓨터를활용한금융실무기초](#_8n5u67zh44b1)

[헤지펀드기계학습투자전략 + 금융데이터사이언스 + [금융시계열분석]](#_x1su011c2i83)

[인공지능 블록체인 창업금융](#_tip0shwrhho9)

[자산가격결정론1:이론과컴퓨테이셔널파이낸스](#_30j0zll)

[양자금융사례연구](#_15mx5matoz1k)

[헤지펀드기계학습투자전략](#_1fob9te)

[금융시계열분석](#_p6n91bam7bm3)

[금융데이터 사이언스](#_fey3zp22j6y2)

[자산가격결정론1:이론](#_rhd024le4x41)

[인공지능 블록체인 창업금융](#_ueepig16b85f)

### 시험범위

수험은 부분 오픈북입니다. A4 용지에 본인이 직접 손글씨로 작성한 서류를 가지고 올 수 있습니다. (A4만 가능(공책 등 불가), 분량 제한 없음)

#### 자산가격결정론1:이론과컴퓨테이셔널파이낸스 + 자산가격결정론1:이론

* [Asset Pricing, Part 2](https://www.youtube.com/playlist?list=PLAXSVuGaw0KxVUym8IRkObSbUPEFaSbPt). Modules 8-14.
* [Financial time series analysis](https://www.youtube.com/playlist?list=PL62XBUmklIEWk4vtnf0inZO2Kg4tlGdJ1)

Topic 1: CAPM and Market Efficiency

Subjects to Study:

1. Mean-Variance Framework:

- Understanding risk-return trade-offs and portfolio optimization.

- Derivation of the efficient frontier and the Capital Market Line (CML).

- Separation Theorem: the idea that all investors hold a combination of the risk-free asset and the market portfolio.

2. CAPM Derivation:

- Assumptions: homogeneous expectations, frictionless markets, risk-free borrowing and lending, etc.

- Mathematical derivation of the Security Market Line (SML).

- Relationship between individual security returns and systematic risk (beta).

3. Market Efficiency and CAPM:

- Forms of market efficiency (weak, semi-strong, strong).

- The role of CAPM in a world of efficient markets.

- The Efficient Market Hypothesis (EMH) and the implications for CAPM.

4. Empirical Testing of CAPM:

- Data sources: CRSP and other financial databases.

- Regression analysis using realized returns and betas.

- Fama-MacBeth two-stage regression method to test CAPM.

- Issues with empirical testing: measurement error in beta, model misspecification.

5. CAPM Anomalies:

- Size effect, value effect, momentum, and other documented anomalies.

- Empirical papers critiquing CAPM: Banz (1981), Fama and French (1993), Jegadeesh and Titman (1993).

- Discussion on why these anomalies exist and their implications for CAPM's validity.

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Topic 2: Stochastic Discount Factor (SDF) and Asset Pricing Models

Subjects to Study:

1. Stochastic Discount Factor (SDF) Basics:

- Definition and role of the SDF in asset pricing.

- Law of one price and how SDF ensures that arbitrage opportunities are not present.

- General formula for pricing any asset: \( P\_t = \mathbb{E}\_t [m\_{t+1} x\_{t+1}] \).

2. Consumption-Based Asset Pricing:

- Derivation of the Consumption CAPM (C-CAPM) from an intertemporal consumption problem.

- Euler equations, marginal utility of consumption, and their role in pricing assets.

- Relationship between SDF, marginal rate of substitution, and risk aversion.

3. Empirical Estimation with GMM:

- Generalized Method of Moments (GMM) to estimate the parameters of C-CAPM.

- Practical steps in using GMM, such as choosing moment conditions and weighting matrices.

- Data requirements (e.g., consumption data, market returns).

4. Comparison of SDF Models and CAPM:

- How SDF-based models generalize CAPM and APT.

- Why SDF models provide a more flexible framework for pricing assets.

- C-CAPM's performance in real-world empirical applications (Lettau and Ludvigson, 2001).

5. Performance of C-CAPM:

- Empirical evidence on the ability of C-CAPM to explain asset returns.

- Critiques of C-CAPM: difficulty in measuring consumption, weak empirical performance, etc.

- Possible modifications to improve the model’s predictive power.

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Topic 3: Arbitrage Pricing Theory (APT) and Multi-Factor Models

Subjects to Study:

1. Arbitrage Pricing Theory (APT) Framework:

- Assumptions of APT: no arbitrage opportunities, well-diversified portfolios.

- Linear relationship between asset returns and multiple systematic risk factors.

- Deriving the APT equation.

2. Factor Models in Asset Pricing:

- CAPM as a single-factor model.

- Extending to multi-factor models like the Fama-French three-factor model.

- Understanding the economic intuition behind each factor (market risk, size, value).

3. Empirical Testing of APT and Fama-French Model:

- Data preparation: construction of portfolios sorted by size and book-to-market.

- Cross-sectional regressions to estimate factor loadings.

- Addressing econometric issues such as multicollinearity and omitted variables.

4. Factor-Based Investing and Anomalies:

- The rise of factor-based investing (smart beta strategies).

- Empirical evidence supporting the Fama-French model.

- Whether additional factors (e.g., profitability, investment) improve the model.

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Topic 4: Option Pricing and Asset Pricing Models

Subjects to Study:

1. Derivation of the Black-Scholes Model:

- Assumptions: lognormal asset prices, continuous trading, no dividends.

- Use of Ito’s Lemma and partial differential equations in deriving the option pricing formula.

- Boundary conditions and the solution to the Black-Scholes PDE.

2. Risk-Neutral Valuation:

- Definition and importance of risk-neutral probabilities.

- How option prices can infer risk-neutral distributions.

- Relationship between risk-neutral valuation and expected returns.

3. Volatility Smile and Market Anomalies:

- Empirical evidence of the volatility smile and implied volatility skews.

- Limitations of the Black-Scholes model in explaining the smile (e.g., constant volatility assumption).

- Alternative models: stochastic volatility (Heston model), jump-diffusion models.

4. Option-Implied Volatility and Returns Forecasting:

- Methods for extracting implied volatility from option prices.

- Using implied volatility as a predictor of future market movements.

- Backtesting volatility-based trading strategies.

5. Options and Broader Asset Pricing Models:

- How insights from options (e.g., implied volatility surfaces) can be integrated into asset pricing models.

- Use of option data to calibrate or validate asset pricing models like SDF.

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Topic 5: Behavioral Finance and Asset Pricing

Subjects to Study:

1. Traditional vs. Behavioral Models:

- Key differences in assumptions: rational vs. bounded rationality, efficient vs. inefficient markets.

- Psychological biases affecting investor behavior: overconfidence, representativeness, loss aversion, etc.

2. Noise Traders and Sentiment:

- Role of noise traders in creating deviations from fundamental values.

- Investor sentiment indicators and their use in asset pricing (Baker and Wurgler, 2006).

- Sentiment’s effect on volatility and return predictability.

3. Behavioral Asset Pricing Models:

- Simple models incorporating sentiment: e.g., Barberis, Shleifer, and Vishny (1998).

- Mechanisms by which sentiment drives price deviations from fundamentals.

- Connection to market anomalies: momentum, overreaction, underreaction.

4. Empirical Evidence on Excess Volatility:

- Shiller’s work on excess volatility in financial markets.

- Methods to test for excess volatility: variance bounds tests, structural break analysis.

- Evidence supporting behavioral explanations of excess volatility.

5. Strengths and Limitations of Behavioral Models:

- Strengths: explaining anomalies like bubbles, crashes, and momentum.

- Weaknesses: lack of unified theory, difficulty in predicting behavioral effects.

- Discussion of whether behavioral models provide a better framework for asset pricing.

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* <https://en.wikipedia.org/wiki/Endogeneity_(econometrics)>
* <https://en.wikipedia.org/wiki/Heckman_correction>
* <https://en.wikipedia.org/wiki/Propensity_score_matching>
* <https://en.wikipedia.org/wiki/Difference_in_differences>

#### 헤지펀드기계학습투자전략 + 금융데이터사이언스 + [금융시계열분석]

* VAR (vector autoregression)
* VECM (vector error correction model)
* Granger causality
* Everything at [A full course in econometrics - undergraduate level part 2](https://www.youtube.com/playlist?list=PLwJRxp3blEvb7P-7po9AxuBwquPv75LjU)
* <https://en.wikipedia.org/wiki/Difference_in_differences>
* <https://en.wikipedia.org/wiki/Autoregressive_conditional_heteroskedasticity>
* Value-at-Risk (VaR)
* [Asset Pricing, Part 2](https://www.youtube.com/playlist?list=PLAXSVuGaw0KxVUym8IRkObSbUPEFaSbPt). Modules 8-14.
* [Financial time series analysis](https://www.youtube.com/playlist?list=PL62XBUmklIEWk4vtnf0inZO2Kg4tlGdJ1)

#### 인공지능 블록체인 창업금융

* [Entrepreneurial finance practice](https://www.youtube.com/playlist?list=PL62XBUmklIEXjfq0YrbjxmkEne32tACGg)
* [Alternative investments](https://www.youtube.com/playlist?list=PL62XBUmklIEX4VX-IkNhipkBHwh0ZhbGK)

1. Artificial Intelligence (AI) in Entrepreneurial Finance:

- AI in Venture Capital: Understanding how AI is transforming venture capital decision-making, including data-driven analysis, risk assessment, and automation of due diligence processes.

- AI in Startups: Applications of AI in improving startup performance, such as customer targeting, operational efficiency, and financial forecasting.

- AI’s Role in Behavioral Finance: Insights on how AI can assess entrepreneurial leadership and predict future startup performance through behavioral analysis.

2. Blockchain Technology and Entrepreneurial Finance:

- Smart Contracts: How smart contracts on blockchain reduce agency costs, ensure transparency, and improve contractual performance in entrepreneurial ventures.

- Challenges of Blockchain Adoption: Key obstacles entrepreneurs face when integrating blockchain into their business models, including regulatory uncertainty, technical complexity, market volatility, and trust issues.

- Blockchain-Based Fundraising: Exploration of Initial Coin Offerings (ICOs), tokenized securities, and other blockchain-driven fundraising mechanisms for startups.

3. Tokenization of Assets:

- Concept of Tokenization: How assets like equity, real estate, or intellectual property can be tokenized and traded on blockchain platforms.

- Impact on Liquidity and Market Access: How tokenization democratizes access to traditionally illiquid markets, increases liquidity, and reduces costs.

- Real-World Examples: Case studies of tokenization in industries such as real estate, art, or venture capital.

4. Entrepreneurial Finance:

- Fundraising Strategies: The role of innovative financial instruments such as tokenized assets, crowdfunding, and alternative financing models in raising capital for startups.

- Risk Management: Tools and strategies entrepreneurs can use, including AI-based risk prediction models, to manage financial risks in the early stages of their ventures.

- Scaling with Technology: How startups can leverage AI and blockchain technologies to scale operations, attract investment, and optimize financial performance.

5. Case Studies and Applications:

- Real-world examples of AI and blockchain in entrepreneurial ventures.

- Understanding the financial, operational, and strategic implications of integrating these technologies into early-stage businesses.

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