Fisher College of Business
THE OHIO STATE UNIVERSITY

BUSFIN 8250: Advanced Asset Pricing
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Meeting time and place: MoWe, 3:30–5pm, Fisher Hall 700
Office hours: Open door policy

1 Overview

This course provides a broad introduction to modern asset pricing research. Your grades will depend on three aspects of your performance: (i) Assignment (50%); (ii) in-class presentations and referee reports on recent published articles (30%); and (iii) class participation in the form of raising questions and providing comments (20%).

There is no required textbook. But you should be familiar with Cochrane (2005) and Campbell (2017). For better or worse, asset pricing has become excessively technical. I highly recommend that you familiarize yourselves with the intuitive discussion in, for example, Danthine and Donaldson's (2014) Intermediate Finance Theory.

2 Lectures

I will lecture on (i) models for the stock market; (ii) empirics for the cross section, and (iii) models for the cross section. The lectures cover all major open questions in asset pricing. I will discuss extensively the related literature and possible directions for future work.

2.1 Models for the Stock Market

Bai and Zhang, 2021, Searching for the equity premium, Journal of Financial Economics.

Bansal and Yaron, 2004, Risks for the long run, Journal of Finance.

Barro, 2006, Rare disasters and asset markets in the twentieth century, Quarterly Journal of Economics.

Barro, 2009, Rare disasters, asset prices, and welfare costs, American Economic Review.

Beeler and Campbell, 2012, The long-run risks model and aggregate asset prices, Critical Finance Review.

Bessembinder, 2018, Do stocks outperform Treasury bills? Journal of Financial Economics.

Branger, Kraft, and Meinerding, 2016, The dynamics of crises and the equity premium, Review of Financial Studies.

Campbell and Cochrane, 1999, By force of habit, Journal of Political Economy.

Chen, 2017, External habit in a production economy, Review of Financial Studies.

Colacito, Croce, Gavazzoni, and Ready, 2018, Currency risk factors in a recursive multi-country economy, Journal of Finance.

Golez and Koudijs, 2018, Four centuries of return predictability, Journal of Financial Economics.

Gourio, 2012, Disaster risk and business cycles, American Economic Review.

Hansen and Singleton, 1982, Generalized instrumental variables estimation of nonlinear rational expectations models. Econometrica.

Jermann, 1998, Asset pricing in production economies, Journal of Monetary Economics.

Kaltenbrunner and Lochstoer, 2010, Long-run risk through consumption smoothing, Review of Financial Studies.

Kilic and Wachter, 2018, Risk, unemployment, and the stock market: A rare-event-based explanation of labor market volatility, Review of Financial Studies.

Kung and Schmid, 2015, Innovation, growth, and asset pricing, Journal of Finance.

Lettau, Ludvigson, and Ma, 2019, Capital share risk in U.S. Asset pricing, Journal of Finance.

Mehra and Prescott, 1985, The equity premium: A puzzle, Journal of Monetary Economics.

Petrosky-Nadeau and Zhang, 2017, Solving the Diamond-Mortensen-Pissarides model accurately, Quantitative Economics.

Petrosky-Nadeau, Zhang, and Kuehn, 2018, Endogenous disasters, American Economic Review.

Pohl, Schmedders, and Wilms, 2018, Higher order effects in asset pricing models with long-run risks, Journal of Finance.

Stathopoulos, 2017, Asset prices and risk sharing in open economies, Review of Financial Studies.

Wachter, 2013, Can time-varying risk of rare disasters explain aggregate stock market volatility? Journal of Finance.

2.2 Empirics for the Cross Section

Ball, Gerakos, Linnainmaa, and Nikolaev, 2016, Accruals, cash flows, and operating profitability in the cross section of stock returns, Journal of Financial Economics.

Barillas and Shanken, 2018, Comparing asset pricing models, Journal of Finance.

Daniel, Hirshleifer, and Sun, 2021, Short- and long-horizon behavioral factors, Review of Financial Studies.

Ewens, Peters, and Wang, 2023, Measuring intangible capital with market prices, Management Science.

Fama and French, 1997, Industry costs of equity, Journal of Financial Economics.

Fama and French, 2015, A five-factor asset pricing model, Journal of Financial Economics.

Fama and French, 2018, Choosing factors, Journal of Financial Economics.

Gebhardt, Lee, and Swaminathan, 2001, Toward an implied cost of capital, Journal of Accounting Research.

Goncalves, Liu, Xue, and Zhang, 2023, Investment-based costs of equity.

Gospodinov, Kan, and Robotti, 2019, Too good to be true? Fallacies in evaluating risk factor models, Journal of Financial Economics.

Green, Hand, and Zhang, 2017, The characteristics that provide independent information about average U.S. monthly stock returns, Review of Financial Studies.

Harvey, 2017, The scientific outlook in financial economics, Journal of Finance.

Harvey, Liu, and Zhu, 2016, ...and the cross-section of expected returns, Review of Financial Studies.

Hou, Mo, Xue, and Zhang, 2019, Which factors? Review of Finance.

Hou, Mo, Xue, and Zhang, 2021, An augmented q-factor model with expected growth, Review of Finance.

Hou, Xue, and Zhang, 2015, Digesting anomalies: An investment approach, Review of Financial Studies.

Hou, Xue, and Zhang, 2020, Replicating anomalies, Review of Financial Studies.

Jegadeesh, Noh, Pukthuanthong, Roll, and Wang, 2019, Empirical tests of asset pricing models with individual assets: Resolving the errors-in-variables bias in risk premium estimation, Journal of Financial Economics.

Lee, So, and Wang, 2021, Evaluating firm-level expected-return proxies: Implications for estimating treatment effects, Review of Financial Studies.

Lewellen, 2015, The cross-section of expected stock returns, Critical Finance Review.

Lu and Murray, 2019, Bear beta, Journal of Financial Economics.

Lyle and Wang, 2015, The cross section of expected holding period returns and their dynamics: A present value approach, Journal of Financial Economics.

Pukthuanthong, Roll, and Subrahmanyam, 2019, A protocol for factor identification, Review of Financial Studies.

Stambaugh and Yuan, 2017, Mispricing factors, Review of Financial Studies.

Wahal, 2019, The profitabilty and investment premium: Pre-1963 evidence, Journal of Financial Economics.

2.3 Models for the Cross Section

Abel, 2018, Optimal debt and profitabiltiy in the trade-off theory, Journal of Finance.

Abel, 2018, The effects of q and cash flow on investment in the presence of measurement error, Journal of Financial Economics.

Andrei, Mann, and Moyen, 2019, Why did the q theory of investment start working? Journal of Financial Economics.

Aretz and Pope, 2018, Real options models of the firm, capacity overhang, and the cross section of stock returns, Journal of Finance.

Bai, Hou, Kung, Li, and Zhang, 2019, The CAPM strikes back? An equilibrium model with disasters, Journal of Financial Economics.

Bai, Li, Xue, and Zhang, 2024, Firm-level irreversibility, Critical Finance Review.

Belo, Gala, Salomao, and Vitorino, 2022, Decomposing firm value, Journal of Financial Economics.

Belo, Xue, and Zhang, 2013, A supply approach to valuation, Review of Financial Studies.

Berk, Green, and Naik, 1999, Optimal investment, growth options, and security returns, Journal of Finance.

Carlson, Fisher, and Giammarino, 2004, Corporate investment and asset price dynamics: Implications for the cross-section of returns, Journal of Finance

Corhay, Kung, and Schmid, 2020, Competition, markups, and predictable returns, Review of Financial Studies.

Frank and Shen, 2016, Investment and the weighted average cost of capital, Journal of Financial Economics.

Friewald, Wagner, and Zechner, 2014, The cross-section of credit risk premia and equity returns, Journal of Finance.

Garlappi and Song, 2017, Capital utilization, market power, and the pricing of investment shocks, Journal of Financial Economics.

Goncalves, Xue, and Zhang, 2020, Aggregation, capital heterogeneity, and the investment CAPM, Review of Financial Studies.

Gu, Hackbarth, and Johnson, 2018, Inflexibility and stock returns, Review of Financial Studies.

Hennessy and Whited, 2005, Debt dynamics, Journal of Finance.

Kruger, Landier, and Thesmar, 2015, The WACC fallacy: The real effects of using a unique discount rate, Journal of Finance.

Kuehn, and Schmid, 2014, Investment-based corporate bond pricing, Journal of Finance.

Kuehn, Simutin, and Wang, 2017, A labor capital asset pricing model, Journal of Finance.

Kumar and Li, 2016, Capital investment, innovative capacity, and stock returns, Journal of Finance.

Liu, Whited, and Zhang, 2009, Investment-based expected stock returns, Journal of Political Economy.

Sun and Xiaolan, 2019, Financing intangible capital, Journal of Financial Economics.

Tuzel and Zhang, 2017, Local risk, local factors, and asset prices, Journal of Finance.

Zhang, Lu, 2005, The value premium, Journal of Finance.

Zhang, 2019, Labor-technology substitution: Implications for asset pricing, Journal of Finance.

3 In-class Presentations (Last Week of Class)

During the last week (2 classes) we will do two presentations in each class. Please treat the presentation as a conference discussion. I will have you search the top 3 journals for papers that interest you. My only requirement is that the papers you choose to present must be published recently (within the last 5 years or so). The papers should be on asset pricing, broadly defined. For the presenter, please prepare slides and lead the discussion in class. If you are not presenting a given paper, please write a referee report on the article. A referee report should contain a summary of the article's main contributions, a list of comments on its execution, and more important, for our purpose, likely directions of future work.

4 Assignment (Due on the Last Day of Class)

The homework problems aim to familiarize you with the technical tools in asset pricing. While you are allowed to discuss among yourselves, please complete each question independently. Learning by doing is the best way to learn.

1. Start with Liu, Whited, and Zhang (2009, Journal of Political Economy) titled "Investment-Based Expected Stock Returns."

   (a) Simplify their model described in Section 2 "The Model of the Firms" by getting rid of taxes and debt. What form will their equation (4) now take? What form will the investment return in their equation (3) now take? Show me the proofs.

   (b) Design an empirical test following the same idea in Section 3 "Econometric Methodology." You only need to match expected returns of the testing portfolios.

   (c) Implement the test using the Fama-French 25 size and book-to-market portfolios. You can find detailed instructions on constructing these portfolios in Fama and French (1996, Journal of Finance). Following the variable definitions and timing alignment discussed in Liu, Whited, and Zhang (2009).

   (d) Present your results in a similar way as in Liu, Whited, and Zhang (2009):

   - Table 1: Descriptive Statistics of Testing Portfolio Returns. Report the average returns, volatilities, CAPM alpha and m.p.e. Fama-French alpha and m.p.e, GRS tests for the CAPM and Fama-French, consumption CAPM tests
   - Table 2: Parameter Estimates and Tests of Overidentification.
   - Table 3: Euler Equation Errors
   - Table 4: Expected Return Accounting
   - Figures 1-4: The same format as in Liu, Whited, and Zhang (2009)

   (e) Describe your results and interpret them economically. How do you compare your results with Liu et al.'s (one-way sorted book-to-market portfolios)? Does the investment-based expected return model improve on the traditional asset pricing models? Why or why not? What do you suggest to do to improve the model's performance? Please be clear and concise in your writings.

2. Consider a baseline investment model. The production function is:

$$\Pi_{it} = X_t Z_{it} K_{it}^{\alpha} - f \tag{1}$$

in which Π_{it} is firm i's operating profits, K_{it} is capital, $0 < \alpha < 1$ is the curvature parameter, and $f > 0$ is the fixed cost of production. The aggregate productivity, X_t, has a stationary Markov transition function. Let $x_t = \log X_t$, the transition function is as follows:

$$x_{t+1} = \bar{x}(1 - \rho_x) + \rho_x x_t + \sigma_x \mu_{t+1}, \tag{2}$$

in which μ_{t+1} is an iid standard normal shock. Z_{it} is the firm-specific productivity for firm i. Let $z_{it} = \log Z_{it}$, then it follows a transition function as follows:

$$z_{it+1} = \rho_z z_{it} + \sigma_z \nu_{it+1} \tag{3}$$

in which ν_{it+1} is an iid standard normal shock that is uncorrelated with μ_{t+1}. Also, ν_{it+1} and ν_{jt+1} are uncorrelated for $i \neq j$.

Capital accumulates as:

$$K_{it+1} = I_{it} + (1 - \delta)K_{it}, \tag{4}$$

in which δ is the rate of depreciation. Capital investment entails adjustment costs:

$$\Phi(I_{it}, K_{it}) = \begin{cases} a^+ K_{it} + \frac{c^+}{2}\left(\frac{I_{it}}{K_{it}}\right)^2 K_{it} & \text{for} \quad I_{it} > 0 \\ 0 & \text{for} \quad I_{it} = 0 \\ a^- K_{it} + \frac{c^-}{2}\left(\frac{I_{it}}{K_{it}}\right)^2 K_{it} & \text{for} \quad I_{it} < 0 \end{cases} \tag{5}$$

in which $a^- > a^+ > 0$, and $c^- > c^+ > 0$ capture nonconvex adjustment costs.

The stochastic discount factor, denoted M_{t+1}, follows:

$$M_{t+1} = \eta \exp\left[[\gamma_0 + \gamma_1(x_t - \overline{x})](x_t - x_{t+1})\right], \tag{6}$$

in which $0 < \eta < 1$, $\gamma_0 > 0$, and $\gamma_1 < 0$ are constant parameters. Upon observing X_t and Z_{it}, firm i chooses optimal investment, I_{it}, to maximize its market value of equity, given by:

$$V_{it} \equiv V(K_{it}, X_t, Z_{it}) = \max_{\{I_{it}\}} \left[\Pi_{it} - I_{it} - \Phi(I_{it}, K_{it}) + E_t\left[M_{t+1} V(K_{it+1}, X_{t+1}, Z_{it+1})\right]\right], \tag{7}$$

subject to equation (4). At the optimum, $V_{it} = D_{it} + E_t[M_{t+1}V_{it+1}]$, with $D_{it} \equiv \Pi_{it} - I_{it} - \Phi(I_{it}, K_{it})$. Equivalently, $E_t[M_{t+1} r^S_{it+1}] = 1$, in which $r^S_{it+1} \equiv V_{it+1}/(V_{it} - D_{it})$ is the stock return. Rewriting in the beta pricing form yields $E_t[r^S_{it+1}] = r_{ft} + \beta^M_{it}\lambda_{Mt}$, in which $r_{ft} = 1/E_t[M_{t+1}]$ is the real interest rate, $\beta^M_i \equiv -\text{Cov}_t[r^S_{it+1}, M_{t+1}]/\text{Var}_t[M_{t+1}]$

is the true conditional beta, and $\lambda_{Mt} \equiv \text{Var}_t[M_{t+1}]/E_t[M_{t+1}]$ is the price of risk.

(a) Calibrate the model. Please do a careful job in defending the specific parameter values that you choose to use.

(b) Solve the model via, for example, value function iteration.

(c) Simulate 25 panel data sets with 3,000 firms and 600 months (50 years). On each simulated panel, construct ten book-to-market portfolios, calculate their average returns, t-statistics, and the CAPM regressions. Can the model reproduce the value premium as in the data? What about the failure of the CAPM in explaining the value premium? Report the simulated results averaged across the 25 panels.

3. Replication. Take Hou, Xue, and Zhang (2015, "Digesting anomalies: An investment approach," Review of Financial Studies). Please reproduce Table 1 on "Empirical properties of the q-factors." Take Hou, Mo, Xue, and Zhang (2021, "An augmented q-factor model with expected growth," Review of Finance). Please reproduce Table III on "Properties of the expected growth factor."