COURSE OUTLINE (indicative)

Portfolio Theory & Asset Pricing
(FIN50040 – 10 ECTS)

Course Leader: Professor Valerio Potì
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Office hours: After class and by appointment

NB (very important): Please drop me an email if you plan to join us, so that I know you are part of the class, and also please enter your details and e-mail in the Google sheet here below, so that I can add you to the mailing list which I will use to circulate material for the course and to let you know about how to connect to the class:

https://docs.google.com/spreadsheets/d/1WGU0zVqg9QjQWfRj53lgLRBBnz_sKQnnWCTa59_cvt0/edit#gid=0

The seminars/lectures will take place, unless otherwise advised, every Friday of July 2021 for 6 hours (from 9:00 am – 12:00 noon and then from 14:00 pm to 17:00 pm, Irish time), starting on Friday 2nd of July 20121. All efforts will be made to hold all sessions according to the below schedule. I cannot rule out, however, that an extra session might be needed on the 30th of July.

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Aims and objectives

This is a doctoral course examining advanced topics on portfolio choice and, especially, asset pricing. It is assumed that students have an MSc-level understanding of portfolio choice under uncertainly, asset pricing and portfolio theory, allowing the course to concentrate on an advanced treatment of these topics. We will not assume, however, previous exposure to doctoral courses in quantitative finance, financial economics and/or econometrics. In other words, this will be a foundational course in doctoral-level asset pricing. The overarching goal and my hope are that, upon completion of this course, students will be able to go on a journey of discovery of the recent research in asset pricing and will have the conceptual and intellectual tools to contribute to it, as well as to contribute to the dissemination of the insight of rigorous asset pricing to other areas of financial (e.g., corporate finance and risk management, banking) and economic (both micro and macro) research. Therefore, the priority will be to lay down foundations for serious scholarly research in asset pricing and for using asset pricing in autonomous scholarly research in other branches of Finance and Economics, rather than to survey all latest research articles (though we will discuss a good few of them). This means that we will have to devote considerable attention to the classics and to classic problems in portfolio choice and asset pricing. This is the only way to properly understand what recent research is up to. In the process, we will have the opportunity to build intuition and shed light on key properties of important and familiar estimators. For example, we will discover that OLS, Maximum Likelihood and panel estimators are all special cases of GMM. Perhaps more importantly, we will gain familiarity with *proofs*. The aim will be to get students used to read, understand and adapt proofs and, possibly, make them confident enough to develop their own proofs from scratch. More generally, the rigor of asset pricing theory should help students develop the ability to better structure their arguments.

The main theoretical framework of the course is the ongoing revolution in Finance that has gradually replaced static, overly stylized asset pricing and investment evaluation models with richer ones. These new models recognize the complexities of the investment problem and of how economic agents solve it (or attempt to do so). The unifying theme will be the role of *stochastic discount factors* (or pricing kernels) in linking asset prices to asset payoffs. We will learn how they can be used to represent the implications of asset pricing models in different setting (complete and incomplete markets, with or without frictions and over one or more periods). It will be fun to discover how easily (in two lines) familiar models involving risk factor loadings (e.g., the market beta) and risk premia (e.g., the market risk premium) pop out from models expressed in terms of a given stochastic discount factor. Increasingly it is hard to miss the implications of advanced asset pricing for advanced portfolio management, and the lessons the practitioners of the former can gain from the practitioners of the latter. Therefore, the course will treat portfolio choice and asset pricing in a unified manner.

Please keep your laptop ready for action as it will be needed for empirical applications, which are essential to shed light on the theory, how it has developed and the challenges it faces. I expect most students will have access to Matlab and, therefore, the code that I will make available will be mostly for use in Matlab but I will do my best to support also other programming languages (I know R well, which is a good substitute for Matlab) and some of the work can be at least fruitfully prototyped in MS Excel (an excellent learning tool).

Students are encouraged to read the reference material in the textbook before the lecture.

Overview

We will first explore the connections and differences between asset pricing in complete markets (typically assumed in derivatives pricing) and in incomplete markets (the typical setup of equity pricing), thus connecting the dots between topics that, at MSc level, are typically treated in different courses, which often leaves even advanced students with the false impression that there is no or little connection between them. The connecting conceptual device will be the so-called stochastic discount factor (or pricing kernel) previously mentioned, which plays a crucial role in the modern formulation of asset pricing models but is

almost, if not entirely, missing from typical MSc-level courses, even in the most advanced and rigorous MSc programs.

The rest of the course will then focus on asset pricing in incomplete markets, especially in a discrete-time setting, leaving the in-depth treatment of asset pricing in complete markets (e.g., derivatives pricing and hedging) and of hybrid approaches (e.g., so-called "no-good deal" pricing) to a dedicated follow-up course.

To get ready to do some serious empirical work, we will early in the course learn that a host of frequentist estimators (in fact pretty much all of them, including good old OLS and Maximum Likelihood and panel-type methods like the Fama and MacBeth procedure) are, under appropriate conditions, instances of a more general estimation method called GMM, and for which Lars Peter Hansen got recently a Nobel Prize alongside Robert Shiller and Eugene Fama. It turns out that understanding the connection between GMM and least squares (and versions thereof, like GLS) is crucial to understanding how and why you may want to switch from so called beta-representations of a given model, involving risk premia and factor loadings (betas), to representations based on the model's stochastic discount factor.

We will also examine the connections between asset pricing and performance attribution, emphasizing that any statement about the goodness of an investment is a statement about whether its "price is right". This will also help us understand and resolve another dichotomy, namely the one between relative and absolute pricing, which is related to the dichotomy above (between asset pricing in complete markets and in incomplete markets).

Moving to the multi-period dimension of the asset pricing and portfolio choice problem, we will then illustrate the links between return predictability, return volatility, variability of discount rates and asset mispricing.

Finally, building on all the above, we will explore the debate on empirical asset pricing and what neoclassical finance, behavioral finance and more recent alternative approaches have to say about it. Among the more recent approaches, and subject to suggestions from students based on their own preferences, we will focus especially on those emphasizing the role of long-run risk, learning and risk-capital availability (as driven, for example, by financial intermediaries' balance-sheet constraints).

All of this will be most obviously useful to students interested in research on empirical asset pricing, investment performance attribution and portfolio management but also to those working on corporate finance and broader risk management topics, as it will help them understand and model the cost of capital of firms in different settings. More generally, the course should be useful to all students interested in gaining a more rigorous understanding of decision making under uncertainty, which should be useful to researchers in the full range of finance topics (from asset pricing itself to corporate finance) and in economics.

Learning Outcomes

Students successfully completing this course will be able to

1. Understand the difference between asset pricing in complete and incomplete markets and identify the circumstances in which either approach is appropriate
2. Understand the asset pricing implications of portfolio choice models and vice-versa
3. Use the above understanding to identify so called market anomalies, inform asset allocation decisions and make inferences on the efficiency (or otherwise) of financial markets
4. Understand the sources of predictability of asset returns, with special regard to the portion thereof arising from variation of discount rates, and its connection to asset price volatility
5. Identify the restrictions that asset pricing models impose on observational data and use appropriate econometric techniques to make inference on such models

6. Read and critically evaluate research articles on portfolio choice and asset pricing and articles in the broader range of financial and economic topics that contain an asset pricing element (e.g., asset pricing models used in corporate finance research)
7. Understand, adapt and possibly autonomously develop proofs and derivations of abstract results, with special emphasis on the type of results and attendant proofs more likely to be encountered in financial economics

Assessment:

- Weekly assignments (group-work, for a total of 50% of the final grade, as further detailed in a dedicated hand-out)
- Final individual project (50% of final grade, choice between individual and groupwork with the choice reflected in the requirements)

The class will likely be small, so we will likely have two or (max) three teams with two or three members each. Nonetheless, working in groups should facilitate learning through the exchange of ideas. So, it is important to retain this element of the assessment despite the small size of the class.

Readings

This course deals with highly debated issues that attract considerable interest by the research community, as well as policy makers and market participants. Because of this ongoing attention, our understanding of the portfolio choice and asset pricing problems evolves on an ongoing basis, due to an incessant flow of new findings and ideas. For this reason, this course cannot rely exclusively on one textbook but must reference a diverse range of sources. It will be therefore necessary to use a combination of reference textbooks, complemented by my lecture notes and by further recommended readings as detailed in the syllabus below and/or as advised later during the course.

The main references are:

1. Cochrane, J.C (2005), Asset Pricing - 2nd edition[1], Princeton University Press; henceforth, JC2005[2]
2. Cochrane, John H., 2017, Macro-finance, Review of Finance 21, 945-985; henceforth JC2017
3. Shefrin, H., 2008. A Behavioral Approach to Asset Pricing, 2nd edition (Elsevier); henceforth, "Shefrin".

Complementary textbooks are the following:

1. Luenberger, D.G. (1998), Investment Sciences, Oxford University Press (henceforth, "Luenberger").
2. Danthine and Donaldson (2005), Intermediate Financial Theory, 2nd Edition, Elsevier (henceforth, "Danthine").
3. Barter, M. and A. Rennie (1997), Financial Calculus, Cambridge University Press.
4. Campbell, J.Y. (2017), "Financial Decisions and Markets - A Course in Asset Pricing", Princeton University Press.
5. Pooh, S. and R.C. Stapleton (2005), Asset Pricing in Discrete Time: A Complete Markets Approach, Oxford University Press.

[1] The 2nd edition is best but the first (the 2001 one) is also fine.

[2] A nice summary is provided by Culp, C. L., and J. H. Cochrane. 2003. "Equilibrium Asset Pricing and Discount Factors: Overview and Implications for Derivatives Valuation and Risk Management." In Modern Risk Management: A History. Peter Field, ed. London: Risk Books, 2003 (downloadable here: .pdf).

Note: Luenberger's textbook is a great complement to John Cochrane's textbook and to my notes complemented, on matters pertaining to asset pricing in complete markets (typical of derivatives pricing), by the excellent ones authored by Neftci, namely "An introduction to the mathematics of financial derivatives" and "Principles of Financial Engineering".

I considered for a while a switching to John Campbell's textbook, because I thought it would be more up to date, but I have desisted because I find the intuition provided by John Cochrane hard to beat. Also, perhaps equally if not more importantly, Campbell's textbook only treats asset pricing in incomplete markets, whereas I feel that for Finance students the connection between asset pricing in complete and incomplete markets is of fundamental importance. The only real shortcoming of Cochrane's textbook relative to Campbell's textbook is that the former is less up-to-the-minute in terms of coverage of the literature, and it does not contain any chapter devoted to portfolio optimization. I can fix the first problem by providing references to recent papers and articles, with the caveat that a first doctoral course is not about reviewing the latest batch papers to come through finance conferences but rather to build foundations for the serious and autonomous study and application of asset pricing. I can also fix the second problem, by providing my own notes on portfolio choice. So, all in all, I think we are better off with Cochrane's textbook. Besides, by doing that, I put you in the best position to benefit from Cochrane's online delivery of his own doctoral asset pricing course. More information on the latter is available at https://www.johnhcochrane.com/asset-pricing. I have my own take, which is somewhere in between Cochrane's very peculiar approach (which I really enjoy) and the conventional one, but I did learn my asset pricing on his textbook. So, if you want to develop a strong asset pricing background (i.e., if you plan to do research in asset pricing), I do recommend taking Cochrane's course after mine. It would be also a good idea to go through his video lectures before taking my course, and then perhaps go over again Cochrane's video lectures. Either way, you will develop a stronger background in asset pricing than by taking either course alone.

Gentle caveat: Students who choose to use alternative references instead of (rather than alongside) the recommended textbooks must take responsibility for making sure that the former are effective substitutes for the latter, by using them in a proactively organized manner.

Delivery and practical arrangements

The course will be delivered online at a Zoom link that will be e-mailed to those who will register by entering their details in the following Google spreadsheet:

https://docs.google.com/spreadsheets/d/1WGU0zVqg9QjQWfRj53lgLRBBnz_sKQnnWCTa59_cvt0/edit#gid=0

The seminars/lectures will take place, unless otherwise advised, every Friday of July 2021 for 6 hours (from 9:00 am – 12:00 noon and then from 14:00 pm to 17:00 pm, Irish time), starting on Friday 2nd of July 20121. While all efforts will be made to hold all sessions according to the below schedule, I cannot rule out that an extra session might be needed on the 30th of July.

A tentative delivery schedule is as follows:

SESSION	DATE	LECTURE TITLE	TOPICS
I	2 July	Introduction: Alternative approaches to asset pricing	• Fundamentals of decision making under uncertainty • Asset pricing in complete vs. incomplete markets • One-period portfolio choice and asset pricing
II	9 July	Stochastic Discount Factors (SDFs) in depth	• Properties of SDFs • The SDF in complete markets • Alternative representations: Discount Factors, Betas and Mean-Variance Frontiers

			• Estimators and econometric identification of SDFs in incomplete markets
III	16 July	Asset pricing in incomplete markets in depth	• One-period (risk-)factor pricing models and the cross-section of asset returns • Multi-period portfolio choice and asset pricing (time permitting) • The time series of asset returns, their predictability and asset price volatility
IV	23 July	Epilogue and debate	• Anything left over from the previous sessions • Implications of asset pricing models and the debate on market efficiency • New models and research avenues, an overview • Presentations/discussion on final (individual) research project.

NB:

- In the typical session, before and after lunch, we will alternate theory and practice (e.g., practical implementation, including coding), so please install Matlab and R on your laptop.
- We can arrange the submission deadline for the final individual project according to the class needs. My suggestion would be however to keep it tight, say within 2 or 3 weeks after the final lecture, to maintain focus and avoid excessive overlapping/interference with the students' doctoral research.
- In the unlikely event that an unavoidable need for a change arises, I would let the class know by e-mail. So, it is very important that anybody wishing to attend enters an email address in the registration Google spreadsheet at the link provided above.

Course syllabus (tentative)

The syllabus below represents a good indication of the asset pricing and related (econometric) topics that, in my view, are most important for Finance students, whether they plan to specialize in asset pricing or otherwise. The menu from which we may choose, however, is rather wide (a sign of health of the discipline) so I would be happy to fine-tune according to the needs of the class participants, subject to having enough time to prepare, if it does not fall within my research specialties. So, class participants and/or their supervisors are very welcome to let me know of any topic that they feel would be of special interest. I will also regularly solicit the feedback of class participants on where the course is going.

Syllabus summary (see overleaf for details)

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Session I

Introduction: Alternative approaches to asset pricing

0.a Preliminaries, introduction and overview

Returns as random variables, average returns, standard errors of the mean and expected return sampling error, historical stylized facts about stock market returns (self-study from references).

References:

- Luenberger Ch 8.5-6

0.b Decision-making under uncertainty: Introduction and/or revision

Theory of choice under uncertainty, investors' preferences and alternative specifications of the utility function, measures of risk aversion (the treatment will be of necessity at a very brisk pace, hoping students have had previous exposure to this).

References (either one of the following):

- Danthine Ch 3-4
- Luenberger, Ch 9.1-4, 9.6-7

Exercises:

- Danthine Ch 4: see back of slides
- Luenberger Ex 9.1-6 and 9.8

1. Asset pricing in complete and incomplete markets: Introduction and overview

Investors' marginal utility, portfolio choice and asset prices; the pricing kernel/stochastic discount factor (SDF) and its role in asset pricing; "absolute" vs "relative" pricing; the CAPM and the APT as the prototypical "absolute pricing" and "relative" pricing model, respectively; implications of asset pricing models and the debate on market efficiency; implications for corporate finance and capital budgeting.

References:

- Lecture notes
- JC2005, Ch. 1.1-1.3, 1.5, 3-4
- Ross, S.A., 2005. Neoclassical finance (Princeton Univ Pr), Ch. 1

Exercises:

- Luenberger Ex 9.10-11, 9.12 (proof of "Positive State-Price Theorem"), 9.12-14.

2. One-period portfolio choice and asset pricing

The one-period MV portfolio choice problem and its solution from the point of view of a single investor, with emphasis on the minimum-variance frontier (MVF) with and without a risk-less asset; the beta-pricing representation of mean returns, spanning payoffs, efficient portfolios and Roll's Theorem; the solution from the point of view of the representative investor, the Capital Market Line (CML) and the Capital Asset Pricing Model (CAPM); separation theorems; generalization of implications for asset pricing; MV-spanning and the APT, arbitrage portfolios as MV-efficient in the cross-section of diversified portfolios though possibly (arbitrarily) inefficient in the cross-section of individual assets.

References:

- Portfolio Theory Notes – Part II, Ch. 1 (self-study revision, if needed) and 2
- JC2005, Ch. 5
- Danthine Ch 6 (on MV portfolio theory) and, if needed, Ch 7 (on the CAPM)
- Luenberger, Ch 7.1-7.6, 9.5, 9.7

Exercises:

- Exercises on "MVA analysis and related"
- "The efficient frontier and asset pricing using Fama and French data" (see starting code and instructions sent by e-mail)
- Luenberger:
    1. On portfolio choice: Ex 6.7 (MV optimization with 3 assets), 7.3 (on MVF spanning and the market portfolio, see spread-sheet), 7.7 (very important one to understand zero-beta portfolios);
    2. On asset pricing: Ex 6.5, 7.1 (elementary one on CML), 7.2 (a small CAPM world), 7.4 (quick SML derivation), 9.10 and 9.13 (on portfolio optimization orthogonality conditions and the SML, respectively)
    3. On APT: Ex 8.1-2

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Session II

The SDF(s) in depth

1. Properties of SDFs

In-depth look at the characterization of the SDF and its properties (LOOP and existence of the SDF, no-arbitrage and positivity of the SDF, uniqueness in complete markets, the SDF as a change of measure).

References:

- Lecture notes
- JC2005, Ch. 3-4
- Ross, S.A., 2005. Neoclassical finance (Princeton Univ Pr), Ch. 1-2

2. The SDF in complete markets

The SDF as a change of measure, state prices and risk neutral valuation; state prices, risk-neutral valuation and martingale pricing; the risk-neutral distribution and the price of derivatives; extracting the risk-neutral distribution from prices of options with different strike prices.

References:

- Lecture notes
- JC2005, Ch. 9.4-5
- Ross, S.A., 2005. Neoclassical finance (Princeton Univ Pr), Ch. 1

Readings:

- Breeden, Douglas T., and Robert H. Litzenberger, 1978, Prices of state-contingent claims implicit in option prices, The Journal of Business 51, 621-651 (this is the seminal reference on extracting the risk-neutral distribution from prices of options)

Exercises:

- Luenberger Ex 9.11, 9.12.

3. Alternative representations: Discount Factors, Betas and Mean-Variance Frontiers

The SDF representation and the beta-pricing representation of the implications of a given asset pricing model, risk prices and risk premia, mean-variance efficiency and asset pricing, beta-pricing representation of mean returns, minimum-variance frontiers of returns and SDFs.

References:

- Lecture notes
- JC2005, Ch. 6

4. Estimators and econometric identification of SDFs in incomplete markets

GMM as a unifying estimation theory, maximum likelihood and OLS as instances of GMM; tests of SDF-based representations and of beta-pricing representations of the implications of a given asset-pricing model under the EMH; approaches based on a partial identification of the model implications (SDF volatility bounds); mean-variance frontiers and asset pricing tests, testing for spanning; a reappraisal of whether linear pricing can be used to infer risk premia and prices in the APT, role of SDF volatility bounds; tests of efficient market learning (Bossaerts' Efficient Market learning hypothesis, time permitting).

References:

- Lecture notes
- JC2005, Ch. 9.4, 10-15, 18

Readings:

- Bekaert, G., and J. Liu, 2004, Conditioning information and variance bounds on pricing kernels, Review of Financial studies 17, 339-378.
- Bossaerts, Peter, 2004, "Filtering returns for unspecified biases in priors when testing asset pricing theory", The Review of Economic Studies 71, 63-86.
- Ferson, Wayne E., and Andrew F. Siegel, 2009, Testing portfolio efficiency with conditioning information, Review of Financial studies 22, 2735-2758.
- Lewellen, Jonathan, Stefan Nagel, and Jay Shanken, 2010, "A skeptical appraisal of asset pricing tests", Journal of Financial Economics 96, 175-194.

Paper replication discussion (first in Excel, then in the programming language of choice):

- Potì, V., and D.L. Wang, 2010, "The coskewness puzzle", Journal of Banking & Finance 34, 1827-1838.[3]

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[3] See also: Post, T., P. Van Vliet, and H. Levy, 2008, Risk aversion and skewness preference, Journal of Banking & Finance 32, 1178-1187.

Session III

Asset pricing in incomplete markets in depth

1. One-period (risk-)factor pricing models and the cross-section of asset returns

The consumption-CAPM, substitution of the market return for consumption growth in the CAPM; single and multi-factor pricing models; factor models and performance evaluation, performance attribution exercises as tests of a given asset-pricing model, market 'anomalies' (size and value effects, liquidity premia, "quality", "low risk", etc), risk vs. mispricing interpretations.

References:

- Lecture notes
- JC2005, Ch. 2, 9.1, 20.2-3
- Luenberger, Ch 7.6
- Shefrin, Ch 17-18
- Cochrane, J.H. (1999), Portfolio Advice for a Multifactor World, Economic Perspectives, Federal Reserve Bank of Chicago.
- Cochrane, J.H. (2001), New Facts in Finance, Economic Perspectives, Federal Reserve Bank of Chicago.

Readings:

- Amihud, Yakov, Haim Mendelson, and Lasse Heje Pedersen, 2006, "Liquidity and asset prices", Foundations and Trends in Finance 1, 269-364.
- Asness, C. S., A. Frazzini, and L.H. Pedersen, 2011, "Leverage aversion and risk parity, Financial Analysts Journal" 68, 47-59.
- Asness, Clifford S., Tobias J. Moskowitz, and Lasse Heje Pedersen, 2013, "Value and momentum everywhere", The Journal of Finance 68, 929-985.
- Fama, Eugene F., and Kenneth R. French, 2015, "A five-factor asset pricing model", Journal of Financial Economics 116, 1-22.
- Hou, Kewei, and Roger K. Loh, 2016, "Have we solved the idiosyncratic volatility puzzle?", Journal of Financial Economics.
- Koijen, Ralph S. J., Hanno N. Lustig and Stijn Van Nieuwerburgh, 2017, "The Cross-Section and Time-Series of Stock and Bond Returns".

Paper replication (please read them all but replicate to the extent possible at least the 'gist' of one; it's best to do it first in Excel, then in the programming language of choice):

- Fama, E.F. and K. French, 1996, Multifactor Explanations of Asset Pricing Anomalies, Journal of Finance 51, 55-84.
- Asness et al, 2001, "Do Hedge Funds Hedge?", Journal of Portfolio Management 28(1), 6-19 (see starting code and instructions available in Blackboard)
- Baker, M. and J. Wurgler, 2006, "Investor Sentiment and the Cross-Section of Stock Returns", Journal of Finance 61(4), 1645-1680.
- Lustig, H., Roussanov, N. and A. Verdelhan, 2011, Common risk factors in currency markets, The Review of Financial Studies 24, 3731-3777.

2. Multi-period portfolio choice and asset pricing (time permitting)

The consumption/saving/investment decision, allocation to risky and non-risky assets, implications for the multi-period portfolio choice problem, the solution to the simplified inter-temporal portfolio problem in which returns are log-normal and i.i.d., Merton's solution[4] to this problem for the case of log-utility and non-i.i.d. returns; conditioning information and conditional and unconditional implications of asset pricing models

References:

- Portfolio Theory Notes – Part II, Ch. 4.1-2 and overview (key ideas/intuition) of 4.3
- JC2005, Ch. 1.5, 8, 9.2-3
- Danthine Ch 5 (also an overview of 14 might be useful)
- Luenberger Ch 15 (limited to the case with log-utility, but offering very intuitive arguments that are useful to understand the multi-period problem in depth)

Readings:

- Campbell, John Y., and Tuomo Vuolteenaho, 2004, "Bad beta, good beta", The American Economic Review 94, 1249-1275.

Exercises:

- Danthine Ch 5: see back of slides

3. The time series of asset returns

The link between price volatility, return predictability and asset mispricing from the point of view of an investor endowed with rational expectations; the debate on return predictability and the risk-free rate, equity premium and volatility puzzles, the puzzles across asset classes (FX, bonds), risk vs. mispricing interpretations; rational expectations and cross-equation restrictions on VAR systems of equations capturing return predictability; the issue of sampling error of mean returns; learning, Bayesian portfolio theory (overview) and implications for return predictability; recent evidence (mention) on the existence of a term structure of risk premia.

References:

- JC2005, Ch. 20.1, 21
- Cochrane, J.H., 2011, "Presidential address: Discount rates", Journal of Finance 66, 1047-1108.

Readings:

- Campbell, J.Y., and R.J. Shiller, 1988, The dividend-price ratio and expectations of future dividends and discount factors, Review of Financial studies 1, 195-228.
- Kirby, Chris, 1998, The restrictions on predictability implied by rational asset pricing models, Review of Financial Studies 11, 343-382.
- Barberis, N, 2000, "Investing for the Long Run when Returns Are Predictable", Journal of Finance 55, Issue 1, pages 225-264.
- Chen, Long, 2009, On the reversal of return and dividend growth predictability: A tale of two periods, Journal of Financial Economics 92, 128-151.

[4] With special regard to the importance of return predictability and hedging of re-investment risk.

- Lof, Matthijs, 2015, Rational speculators, contrarians, and excess volatility, Management Science 61, 1889-1901
- van Binsbergen, Jules H., and Ralph S. J. Koijen, 2017, "The term structure of returns: Facts and theory", Journal of Financial Economics 124, 1-21.
- Golez, Benjamin, and Peter Koudijs, 2018, Four centuries of return predictability, Journal of Financial Economics 127, 248-263 (excellent Matlab code available).
- Potì, Valerio, 2018, A new tight and general bound on return predictability, Economics Letters 162, 140-145.

Exercise:

- See handout "Bayesian Portfolio Theory and Implications for Return Predictability and Asset Pricing"
- See Matlab code for the paper of Golez et al.

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Session IV

Epilogue and debate

1. Implications of asset pricing models and the debate on market efficiency

Conditional and unconditional implications of asset pricing models, the Efficient Markets Hypothesis (EMH), the rational valuation formula and SDF-deflated asset prices as martingales; the link between expected and average returns and unpredictability of abnormal risk-adjusted returns from the point of view of an investor endowed with rational expectations, the behavioural economics critique to rational expectations; implications for portfolio choice and economic policy.

References:

- Luenberger Ch 7-8, 9.1-5
- JC2005, Ch. 1.4, 2
- Shefrin, Ch 8-9, 15

Readings:

- Ross, S.A., 2005. Neoclassical finance (Princeton Univ Pr.), Ch. 3 and 4.
- Lo, A., 2005, "Reconciling Efficient Markets with Behavioural Finance: The Adaptive Market Hypothesis", The Journal of Investment Consulting 7(2).

2. New models and research avenues, an overview

Recent rational asset pricing models (with long-run risk, habits, uninsurable idiosyncratic risk) and behavioural ones (with exotic preferences, allowing for learning); the role of frictions, market-microstructure and institutional arrangements (especially balance-sheet limits and risk capital constraints of financial intermediaries); the multiplicative structure of the SDF of many models and its connection with the extent to which the models help solve the "excess-volatility" puzzle; the possibility of "peso problems" and the role of rare disasters; learning; concerns about data-snooping and model robustness.[5]

[5] All this will discussed more or less in depth depending on a number of factors, including students' appetite, research interests, and how we are set for time left towards the end of the course.

References:

- JC2017

Readings:

- Chen, Hui, Winston Wei Dou and Leonid Kogan, 2015, "Measuring the 'Dark Matter' in Asset Pricing Models"
- Hou, Kewei, Chen Xue, and Lu Zhang, 2015, "Digesting anomalies: An investment approach", The Review of Financial Studies 28, 650-705.
- Hansen, Lars Peter, and Thomas J. Sargent, 2010, "Fragile beliefs and the price of uncertainty", Quantitative Economics 1, 129-162.
- Gârleanu, Nicolae B., and Lasse H. Pedersen, 2015, "Efficiently inefficient markets for assets and asset management", National Bureau of Economic Research Working Paper Series No. 21563.
- McLean, R. David, and Jeffrey Pontiff, 2016, "Does academic research destroy stock return predictability?", The Journal of Finance 71, 5-32.
- Harvey, Campbell R., Yan Liu, and Heqing Zhu, 2016, "… and the cross-section of expected returns", The Review of Financial Studies 29, 5-68.
- Harvey, Campbell R., 2017, "Presidential address: The scientific outlook in financial economics", The Journal of Finance 72, 1399-1440.
- Fama, Eugene F., and Kenneth R. French, 2018, "Choosing factors", Journal of Financial Economics 128, 234–252.

Paper replication (please choose one as the basis for the project submission)*:*

- Constantinides, G.M., and A. Ghosh, 2012, "Asset pricing tests with long-run risks in consumption growth", Review of Asset Pricing Studies 1, 96-136.
- Paper of student's choice (to be agreed upon with me, please)

Valerio's Bios

Valerio is Professor of Finance in the Business School of University College Dublin, where he teaches portfolio and risk management and Banking & Finance. He is also a visiting professor of Econometrics in the University of Bari in Italy. He was previously in Dublin City University, where he was head of Economics, Finance and Entrepreneurship. He graduated in Banking and Finance from Bocconi University Milan and gained a PhD in Finance from Trinity College Dublin, while also visiting the Finance department of New York University Stern Business School as an International Visiting Research Scholar. There, he worked under the mentorship of Professor Richard Levich, with whom he has had a prolific research collaboration on currency markets and financial market econometrics ever since. Valerio's research interests include asset pricing, portfolio choice and analysis, investment performance attribution, market efficiency, behavioural finance, financial econometrics, corporate finance and SMEs financing and, more recently, digital finance and financial data science. His research has been published in international peer reviewed journals such as *Management Science*, the *International Journal of Forecasting*, the *Journal of Banking and Finance*, the *Journal of International Money and Finance*, the *Journal of Business Ethics*, *European Financial Management*, and he has contributed to practitioner-oriented books on portfolio and risk management. He is the Main Proposer and co-Chair of the H2020 COST Action "Fintech and Artificial Intelligence in Finance - Towards a transparent financial industry" (CA19130) and a funded principal investigator on the Coordination and Support Action "FIN-TECH: a knowledge exchange platform for FINancial TECHnology risk management", which are two large-scale research projects on FinTech and Financial Data Science involving a very large network of universities, companies and regulators. He is a founding associate editor of the peer-reviewed scientific journal Digital Finance (Springer, https://www.springer.com/journal/42521). He has held visiting appointments at the European University Institute, New York University Stern School of Business, Humboldt University Berlin, Nazarbayev University Graduate School of Business, Cattolica University at Piacenza. He also engages in consulting activities on risk and performance attribution and on issues related to the usage of derivatives to generate economic value. In the past, he taught International Finance at Queen's University Belfast and, before moving to academia, he worked as an equity option market maker on the Milan derivatives exchange and was the head of the Financial Engineering desk of the Dublin subsidiary of Banca Monte dei Paschi di Siena.

Appendix: Topics left for a more advanced course

Due to lack of time and not to overburden the students of the present course, some topics cannot be realistically covered in this course. The following is a suggestion of courses that I would leave for a follow-up course. For example, it may be possible to ask Professor Post, if he visits us again (as I hope), to deliver a workshop on the last of the topics listed below. I am also open to treat some of the below topics in the current course, if there is a string interest, but of course dropping something else.

Continuous-time "relative" pricing

Derivatives pricing and hedging using dynamic replication of options and option-like payoffs; volatility trading and un-spanned volatility risk, equity, FX and real option applications; recovery of the risk-neutral and physical distribution.

References:

- Lecture notes
- JC2005, Ch. 9.5, 17, 18
- Luenberger, Ch 13 ("Additional Option Topics")

Readings:

- Ross, S., 2015, "The recovery theorem", *Journal of Finance* 70, 615-648.
- Borovicka, J., L.P. Hansen, and J.A. Scheinkman, 2016, "Misspecified recovery", *Journal of Finance* 71, 2493-2544.

Exercises:

- Luenberger Ex 13.3, 13.4-6 (but 'quants' can give 13.8-11 a try, ask me if unfamiliar with Monte Carlo simulation)

The term structure of interest rates

Yield curve and expectation hypothesis, term-structure models in discrete time and continuous time (overview)

References:

- Lecture notes
- JC2005, Ch. 19

Readings:

- Bulkley, George, Richard D. F. Harris, and Vivekanand Nawosah, 2015, "Can behavioral biases explain the rejections of the expectation hypothesis of the term structure of interest rates?", *Journal of Banking & Finance* 58, 179-193.
- Cochrane, John H., and Monika Piazzesi, 2005, "Bond risk premia", American Economic Review 95, 138-160.
- Bauer, Michael D., and James D. Hamilton, 2017, "Robust bond risk premia,", National Bureau of Economic Research Working Paper Series No. 23480.
- Koijen, Ralph S. J., Tobias J. Moskowitz, Lasse Heje Pedersen and Evert B. Vrugt, 2017, "Carry".
- Avdjiev, Stefan, Wenxin Du, Catherine Koch, and Hyun Song Shin, 2016, "The dollar, bank leverage and the deviation from covered interest parity", BIS Working Paper 592.

Paper replication:

- Fama, Eugene F., and Robert R. Bliss, 1987, "The information in long-maturity forward rates", The American Economic Review 77, 680-692.

Stochastic dominance

Stochastic spanning; derivatives pricing and hedging under stochastic dominance-determined partial orderings of prospects.

References:

- Lecture notes
- JC2005, Ch. 9.5, 17, 18

Readings:

- Post, Thierry, and Valerio Potì, 2017, Portfolio analysis using stochastic dominance, relative entropy, and empirical likelihood, *Management Science* 63, 153-165
- Arvanitis, Stelios, Mark Hallam, Thierry Post, and Nikolas Topaloglou, 2017, Stochastic spanning, *Journal of Business & Economic Statistics* 1-13.

Burgeoning literature on "no good-deal bounds" and "shrinking the cross-section"

Asset pricing and hedging under restrictions on the curvature/volatility of the SDF.

References:

- Lecture notes
- JC2005, Ch. 9.5, 17, 18

Readings:

- Cochrane, J. H. and J. Saa-Requejo, 2000, "Beyond arbitrage: Good-deal asset price bounds in incomplete markets", *Journal of Political Economy* 108, 79-119.
- Potì, Valerio, and D. Wang, 2010, "The Coskewness Puzzle", Journal of Banking & Finance 34, Issue 8, August 2010, Pages 1827-1838.
- Kozak, Serhiy, Nagel, Stefan and Shrihari Santosh, 2020, Shrinking the cross-section, Journal of Financial Economics 135, 271–292.