

# **International College of Economics and Finance**

## **Financial Econometrics**

**Fall 2017**

**Lecturers: Svetlana Bryzgalova, Oksana Kabakova**

**Class teacher (TA): Oksana Kabakova**

### **COURSE DESCRIPTION**

This course covers the foundations of financial econometrics with an emphasis on empirical asset pricing. It is designed for second year MSc students. The goal of the course is to introduce students to a variety of tools necessary to analyze financial data, providing both theoretical and empirical foundations for a wide range of applications. The topics include, but are not limited to, event studies, volatility modeling (ARCH, GARCH, etc), trading strategies evaluation and model forecast comparison, identification of cross-sectional patterns in stock returns, estimation of the asset pricing models and introduction to the 'big data' techniques in finance. Most topics are accompanied by applications in E-Views and/or R.

While the course is fairly rigorous, the key objective is not just to equip students with a set of useful technical tools, but rather develop their economic intuition and interpretation of the findings, identify common empirical pitfalls and challenges, focus on economically meaningful patterns of the data and get acquainted with a wide range of financial applications.

The following teaching methods are used:

- lectures (2 hours per week)
- classes (2 hours per week, at least half of which is computer-based)
- home assignments
- lecturers' consultations
- self-study
- group projects

Overall, the course includes 30 lecture hours, 26 class hours and 8 hours of project discussion.

## PREREQUISITES

Students are expected to be familiar with the basic econometric techniques (OLS and IV estimators, maximum likelihood, standard inference techniques in the asymptotic analysis, time series data and their properties) and fundamentals of the theory of finance (CAPM, stochastic discount factor, portfolio optimization, consumption-based asset pricing models, etc). This corresponds to Financial Economics I (Asset pricing) and Econometrics I for ICEF MSc students.

## TEXTBOOKS AND SUPPLEMENTARY READINGS

The main books used in the course are

- **(CLM)** John Campbell, Andrew Lo, Archie MacKinlay (1997) “The Econometrics of Financial Markets”, Princeton University Press. (CLM)
- **(RT)** Ruey S. Tsay (2010) “Analysis of Financial Time Series”, Wiley; 3ed edition
- **(JC)** John Cochrane (2009) “Asset Pricing” (revised edition), Princeton University Press.

Journal articles for the corresponding topics are listed in the Course Outline. Further sources, including useful internet links, may be given during the lectures.

If you are interested in some entertaining supplementary reading on financial markets, the following books can be purchased in many bookstores or from online vendors. The first is an entertaining and informative book about the origins of modern finance:

*Capital Ideas: The Improbable Origins of Modern Wall Street*, by Peter L. Bernstein, Wiley, 2005.

The second is a well-known and enjoyable book that takes a pragmatic look at investing in the stock market:

*A Random Walk Down Wall Street*, by Burton G. Malkiel, W. W. Norton & Company, 11<sup>th</sup> Edition, 2015.

## CLASS PREPARATION

Cold calling may be used to check how well students are prepared. Note that while most of the assignments are given in the syllabus, some may be distributed in class. Those listed in the syllabus are subject to change during the term; changes will be announced in class when applicable.

This course covers a large amount of material in significant depth. It is structured so that each lecture builds upon the concepts introduced in the prior sessions. You are strongly encouraged to be

prepared for class and to keep up with the material as we go along, since it will be difficult to catch up if significant lags in preparation occur. You should also be sure to attend class sessions and/or consult with the instructors if you feel that you are falling behind.

## **OFFICE HOURS**

Weekly office hours for both lecturers will be arranged for the whole duration of the course (subject to availability). Their time and location will be announced in due course.

## **GRADING**

Your course grade will be determined by your class participation (5%), performance on the midterm (20%), group research project (30%), final exam (30-45%), and completion of three homework assignments (0-15%).

The purpose of the homework assignments is to keep you up to date with the course material. The amount you complete correctly will determine the weight put on homework in your grade, up to a maximum of 15%. The remaining weight will be put on the final exam. (For example, if the maximum number of points available through homework is 200, and you get 50, then homework assignments contribute  $50/200 * 15% * 100 = 3$  points to your final grade, and the final exam accounts for 42% of the overall grade. Perfect score on the problem sets adds 15 points to the final grade and lowers the impact of the final exam to 30%). While it may be tempting to skip all the homework and try to score well on the final, it is also worth remembering one of the main principles of finance and its benefits for a risk-averse economic agent, - diversification.

## **ATTENDANCE POLICIES**

As mentioned above, class participation is not a factor in determining the final grade in the course. However, it is expected that when attending, the students should be on time and should not disrupt the class by freely leaving early or by leaving and returning to class, except for the cases when they notified the lecturer/class teacher ex ante.

## **COURSE ETIQUETTE**

Laptop computers and/or tablets may be used in class as long as they are used for note taking or to support class participation. As a result, an open laptop/tablet is taken as an indication of a student's willingness to participate in class discussion. Cell phones, etc. should never be used in class.

Students are expected to respect the academic honor code and to behave with integrity in all aspects

of the course.

## RESEARCH PROJECTS

Group research projects submitted by the end of the course pursue multiple goals:

- Demonstrate a variety of economic questions/phenomena that can be studied using the techniques covered during the course
- Replicate and/or expand the studies by working with alternative data, estimators, etc
- Provide fellow students with the notes, data and codes used to carry out the projects to build a set of routines/tools that could be used in further independent work (writing MSc thesis, etc)
- Learning about different datasets and institutional details of financial markets in Russia and/or other countries
- Help students prepare for the final exam that will include questions on the papers used for group projects.

Each project will be based on a particular research paper, and is designed to engage a group of 4-5 students. Each group will be provided with a short list of questions/potential extensions that could be done to complement the study, though any original initiative is equally welcome. Students are not expected to produce a fundamentally new independent study.

At the end of the course each group should prepare the following:

- A 2-5 page written summary of the paper<sup>1</sup>, with the focus on explaining the economic question, the logic of the paper, empirical design and details of the implementation, as well as presenting the main findings of the paper and discussing their importance/relevance.
- A 2 page summary of a short research project that students have carried out.
- All the data and codes (if available) with comments that are needed to replicate their work.
- A 30 minute presentation of their project, covering both the original paper and their own work.

Student performance is evaluated on three dimensions (each contributing 10%): written summary of the paper and independent work, project presentation, independent research component. In presenting each project, the ultimate goal is to deliver a thoughtful, coherent, careful and internally consistent empirical argument. Paper presentations should focus on explaining why the paper raises an interesting economic question, what we learn about financial markets, what are the relevant institutional details to consider, what kind of analytic tools are suitable for studying this question

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<sup>1</sup> It is suggested to use Times New Roman font, 12pt, single spacing.

and how they can be implemented. The goal of the project sessions is not to cram as much as possible into the set of slides or try to impress the audience with technical difficulty/abundance of empirical results, but rather explain the baseline study and its potential extensions/alternatives in a most approachable way.

Summaries of the projects and data/codes (if available) should be sent to the TA 3 days before the presentation. For example, if the date of the presentation is December, 20, the deadline is 11.59pm on December 17.

## **EXAMS**

Midterm and final exams will be held in class. Students are not allowed to use anything except for a calculator and a single formula cheat-sheet (one-sided sheet of paper, hand-written, with any formulas/information the student deems fit, copies of others students' cheat-sheets are not allowed). Final exam will include questions on some of the papers used for the research projects.

## RESEARCH PROJECTS (TENTATIVELY)

1. **Event studies:** Enikolopov, R., M. Petrova and K. Sonin (2017) “ Social media and corruption”, American Economic Journals: Applied Economics, forthcoming.
2. **Cross-sectional asset pricing:** Hong, H. and M. Kacperczyk (2009) “The price of sin: The effects of social norms on markets”, Journal of Financial Economics, 93, pp.15-36.
3. **Event studies:** Lucca, D. and E. Moench, (2015) “The pre-FOMC announcement drift”, Journal of Finance, 70 (1), pp. 329-71.
4. **Event studies and market models:** Lou, D., H. Yan, and J. Zhang (2013) “Anticipated and repeated shocks in liquid markets”, Review of Financial Studies, pp. 1891-912.
5. **Kalman filter:** Kroencke, T. (2017) “Asset pricing without garbage”, Journal of Finance, 72(1), pp.47-98.
6. **Return predictability:** Novy-Marx, R. (2014) “Predicting anomaly performance with politics, the weather, global warming, sunspots, and the stars,” Journal of Financial Economics, 112, pp.137-46.
7. **Cross-sectional predictability and big data:** Chinco, A., A. Clark-Joseph, and M. Ye (2017) “ Sparse signals in the cross-section of stocks” , working paper, available at SSRN: <https://ssrn.com/abstract=2606396>
8. **Cross-sectional asset pricing and big data:** Loughran, T. and B. McDonald (2011) “When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks”, Journal of Finance, 66 (1), pp. 35-65.

## TENTATIVE COURSE OUTLINE

### 1. Stylized facts of financial returns and sources of financial data.

#### Reading:

- CLM: Ch. 1
- RT: Ch. 1

#### a. Stylized facts of the stock market returns: predictability, distribution, factor structure, CAPM

##### Reading:

- Cont, R. (2001) “Empirical properties of asset returns: stylized facts and statistical issues”, Quantitative Finance, 1, pp. 223–36.

#### b. Stylized facts on the bond returns and yield curve: predictability, yields, Nelson-Siegel curves

##### Additional reading:

- Nelson, C., A. F. Siegel (1987) “Parsimonious modelling of yield curves”, Journal of Business, 60 (4), pp.473-89.
- Litterman, R. and J. Scheinkman (1991) “Common factors affecting bond returns”, Journal of Fixed Income, Vol. 1, pp. 51-61.

#### c. Simulation-based analysis and derivatives: example of mortgage-backed securities.

##### Additional reading:

- Fabozzi, F. J., Bhattacharya, A. K. and W.S. Berliner (2008) “Introduction to Mortgage-Backed Securities, Handbook of Finance, 3 (32).

### **Problem Set #1: review of CAPM, portfolio optimization and a linear regression model.**

### 2. Event studies

#### Reading:

- CLM: Ch. 4

#### a. Methodology of the event studies

#### b. Event studies in consulting: fraud on the market cases

##### Additional reading:

- Allen, M., R. E. Hall, and V. A . Lazear (2011) “Reference guide on estimation of economic damages”, in “Reference Manual on Scientific Evidence”, The National Academic Press.

### 3. Tests of return predictability

#### Reading:

- CLM: Ch. 2-3

#### a. Forecast selection and comparison

Reading:

- Diebold, F. (2014) “Comparing predictive accuracy, twenty years later: A personal perspective on the use and abuse of Diebold-Mariano tests” , Journal of Business and Economic Statistics, 33, pp. 1-24.
- Diebold, F.X. and R.S. Mariano (1995), “Comparing predictive accuracy,” Journal of Business and Economic Statistics, 13, 253–263.
- Giacomini, R. and White (2006) “Tests of conditional predictive ability”, Econometrica, 74, pp. 1545-78

Additional reading:

- Giacomini, R. and B. Rossi (2009) “Detecting and predicting forecast breakdowns”, Review of Economic Studies, 76, 669-705.
- Clark, T.E. and M.W. McCracken (2013), “Advances in forecast evaluation,” In G. Elliott and A. Timmerman (eds.), Handbook of Economic Forecasting, Volume 2, Elsevier, 1107-1201.

**b. Interpreting predictability, Campbell-Shiller decomposition, forecasting with persistent predictors**

Reading:

- Campbell, J. Y. (1991) “A variance decomposition for stock returns”, Economic Journal 101 (405), pp. 157-79.
- Stambaugh, R. (1999) “Predictive regressions “, Journal of Financial Economics, 54, pp. 375-421.
- Welch, I. and A. Goyal (2008) “A comprehensive look at the empirical performance of equity premium prediction”, Review of Financial Studies, 21, 1455-508.

**c. Performance evaluation: trading strategies and mutual funds**

Reading:

- Sullivan, R., A. Timmermann, A. and H. White (1999) “Data-snooping, technical trading rule performance, and the bootstrap”, Journal of Finance 54, pp.1647–91.
- Berk, J. and J. van Binsbergen (2014) “Measuring skill in the mutual fund Industry”, Journal of Financial Economics, 118, Issue 1, pp. 1-20.

Additional reading:

- Cowles, A. (1933) “Can stock market forecasters forecast?” Econometrica, 1, pp. 309-324.
- White, H. (2000) “A reality check for data snooping”, Econometrica 68, pp. 1097–126.
- Ingersoll, E., M. Spiegel, W. Goetzmann, and I. Welch (2007) "Portfolio performance manipulation and manipulation-proof performance measures," Review of Financial Studies 20-5, pp. 1503-46

**4. Volatility modeling**

Reading:

- RT: Ch. 3,4.

**a. Volatility clustering, ARCH and GARCH**

Additional reading:

- Engle, R. F. (1982) “Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation, *Econometrica*, 50, pp. 987–1008.
- Bollerslev, T. (1986) “Generalized autoregressive conditional heteroscedasticity, *Journal of Econometrics* 31, pp. 307–27.

**b. Asymmetric extensions to GARCH models**

Additional reading:

- Andersen, T.G., T. Bollerslev, T., P.F. Christoffersen and F.X. Diebold (2013) "Financial risk measurement for financial risk management", in *Handbook of the Economics of Finance, Vol.II* (eds. George Constantinides, Milton Harris and Rene Stulz), Chapter 17, pp.1127-1220. Amsterdam: Elsevier Science B.V.
- Zakoian, J. M. (1994) “Threshold heteroscedastic models”, *Journal of Economic Dynamics and Control* 18, pp. 931-55.
- Andersen, T. G. and T. Bollerslev, T. (1998) “Answering the skeptics: Yes, standard volatility models do provide accurate forecasts”, *International Economic Review*, 39(4), pp. 885–905.

**Problem Set #2: ARCH, GARCH and their extensions.**

**Midterm Exam**

**5. Cross-sectional asset pricing**

Reading:

- CLM: Ch. 5-6
- RT: Ch. 9
- JC: Ch. 12, 14

**a. Tests of CAPM and stock characteristics, Fama-MacBeth regressions**

Reading:

- Chen, N.-F., R. Roll and S. Ross (1986), “Economic forces and the stock market” , *Journal of Business*, 59 (3), pp. 383–403.
- Fama, E. F. and J.D. MacBeth, J. D. (1973) “Risk, return, and equilibrium: Empirical tests”, *The Journal of Political Economy*, 81, pp. 607–36.
- Fama, E. F. and K.R. French (1993) “Common risk factors in the returns on stocks and bonds”, *Journal of Financial Economics*, 33 (3), pp.3-56.

**b. Generalized Method of Moments**

Reading:

- JC: Ch. 10-11, 13, 15-16

Additional reading:

- Hansen, L. P. (1982) “Large sample properties of generalized method of moments Estimators”, *Econometrica* 50(4), pp. 1029–54.
- Hansen, L. P. and K. Singleton (1982) “Generalized instrumental variables estimation of nonlinear rational expectations models”, *Econometrica* 50(5), pp. 1269-86.

### c. Testing asset pricing models with GMM: SDF and linear factor models

#### Reading:

- JC: Ch. 10-11, 13, 15-16

### **Problem Set #3: GMM and SDF-based asset pricing**

### d. Pitfalls of cross-sectional asset pricing: identification, p-hacking, etc.

#### Reading:

- Campbell R. Harvey Yan Liu Heqing Zhu (2016) "... and the cross-section of stock returns", Review of Financial Studies, 29 (1), pp. 5-68.
- Berk, J. and J. van Binsbergen (2016) "Assessing asset pricing models using revealed preference," Journal of Financial Economics, 119 (1), pp. 1-21
- Burnside, C. (2011) "The cross-section of foreign currency risk premia and consumption growth risk: comment", American Economy Review, 101 (7), pp. 3456-76.

#### Additional reading:

- Lewellen, J., S. Nagel and J. Shanken (2010) "A skeptical appraisal of asset pricing tests", Journal of Financial Economics, 96 (2), pp. 175-194.
- Gospodinov, N., R. Kan and C. Robotti (2014) "Misspecification-robust inference in linear asset-pricing models with irrelevant risk factors", Review of Financial Studies, 27, pp. 2139-70

## 6. Kalman filter

### a. Asset pricing with time varying parameters

#### Reading:

- RT: Ch. 4, 10
- Meinhold, R. J. and Singpurwalla, N. D. (1983) "Understanding the Kalman Filter", The American Statistician, 37, pp. 123-127

## 7. Forecasting in big data environment

### a. Dimension reduction with Principal Components

#### Reading:

- RT: Ch. 9

#### Additional reading:

- Litterman, R. and J. Scheinkman (1991) "Common factors affecting bond returns", Journal of Fixed Income, Vol. 1, pp. 51-61.
- Stock, J.H. and M. Watson (2002), "Forecasting using principal components from a large number of predictors", Journal of the American Statistical Association, 97 (460), pp. 1167-79
- Stock, J.H and M. Watson (2006), "Macroeconomic forecasting using many predictors", Handbook of Economic Forecasting, Graham Elliott, Clive Granger, Allan Timmerman (eds.), North Holland.

### b. Forecasting with many predictors: sparsity and lasso

#### Reading:

- Brodie, J., C. De Mol, D. Giannone, I. Daubechies and I. Loris (2009) "Sparse and

stable Markowitz portfolios”, Proceedings of the National Academy of Science (PNAS), 106 (30), pp. 1267-72.

Additional reading:

- Tibshirani, R. (1996): “Regression shrinkage and selection via the lasso,” Journal of the Royal Statistical Society Series B, 58, pp. 267–288.
- De Miguel, V., L. Garlappi, F.J. Nogales and R. Uppal (2009): “A generalized approach to portfolio optimization: Improving performance by constraining portfolio norms”, Management Science, 55(5), pp. 798-812.
- Hastie, T., R. Tibshirani and J. Friedman (2009) “The elements of statistical learning: Data Mining, Inference, and Prediction”, Springer, Ch. 3, available at <https://web.stanford.edu/~hastie/ElemStatLearn/>

## 8. Research projects

### Final exam