Rotman Finance PhD Course RSM 3034. Fall 2015

Topics in Empirical Asset Pricing

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Preliminary Course Outline. This Version: 2 July 2015

Class time: Wednesdays, 12:00-15:00. First class is September 16, 2015.

Class room: RSM 470 TBC. 105 St George Street.

Preliminary List of Topics Covered

1) Forecasting market returns
2) Volatility and distribution modeling using daily return data
3) Option valuation in single-shock models
4) Option valuation in multiple-shock models
5) Volatility and distribution modeling using intraday data
6) Option valuation using intraday return data
7) Dynamic covariance, correlation and beta
8) Risk factor modeling using dynamic copulas
9) Using option implied information in asset pricing
10) Factor structure in volatility. Option portfolio management
11) Realized skewness
12) Option Illiquidity
13) Student presentations

Student Deliverables

Your grade will be based on the following:

- Matlab exercises will be assigned 3 times during the course: 45% of grade
    - Timing: Due by email on: October 21, November 11, December 2.
- Student presentation of own research idea (25 minutes): 45% of grade
    - Timing: December 16.
- Class participation: 10% of grade
    - Timing: Throughout the course

Preliminary List of Readings

All readings will be available in a Dropbox folder.

0) Course Pre-readings

- Christoffersen (2012), Elements of Financial Risk Management (**EFRM**). 2nd Edition. Chapters 1-3

1) September 16. Forecasting Market returns

- Rapach and Zhou (2013), Forecasting Stock Returns, Handbook of Economic Forecasting, Vol 2A.
- Kelly and Pruitt (2013), Market Expectations in the Cross Section of Present Values, JF.
- Campbell and Thompson (2008), Predicting Excess Stock Returns Out of Sample: Can Anything Beat the Historical Average? RFS.
- Kelly and Pruitt (2015), The Three-Pass Regression Filter: A New Approach to Forecasting Using Many Predictors, J.Econm.
- Ross (2005), Neoclassical Finance, pp. 54-59.
- Moller and Rangvid (2015), End-of-the-year Economic Growth and Time-varying Expected Returns, JFE.
- Garleanu and Pedersen (2013), Dynamic Trading with Predictable Returns and Transaction Costs, JF.

2) September 23. Volatility and distribution modeling using daily return data

- EFRM Chapter 4 and 6.
- Andersen, Bollerslev, Christoffersen and Diebold (**ABCD**, 2013), Financial Risk Measurement for Financial Risk Management, in Handbook of Economics of Finance, Volume 2. Section 2 only.
- Engle and Rangel (2008), The Spline-GARCH Model for Low-Frequency Volatility and Its Global Macroeconomic Causes, RFS.
- Engle, Ghysels and Sohn (2013), Stock Market Volatility and Macroeconomic Fundamentals, REStat.
- Bloom (2014), Fluctuations in Uncertainty, JEP.
- Jurado, Ludvigson and Ng (2015), Measuring Uncertainty, AER.

3) September 30. Option valuation in single-shock models

- Christoffersen, Jacobs, and Ornthanalai (2013), GARCH Option Valuation: Theory and Evidence, Journal of Derivatives.
- Heston and Nandi (2000), A Closed-form GARCH Option Valuation Model, RFS.
- Christoffersen, Elkamhi, Feunou and Jacobs (2010), Option Valuation with Conditional Heteroskedasticity and Non-Normality, RFS.
- Christoffersen, Dorion, Jacobs and Wang (2010), Volatility Components: Affine Restrictions and Non-normal Innovations. JBES.
- Christoffersen, Jacobs, Ornthanalai and Wang (2008), Option Valuation with Long-run and Short-run Volatility Components. JFE.

4) October 7. Option valuation in multiple-shock models

- Christoffersen, Heston and Jacobs (2013), Capturing Option Anomalies with a Variance-Dependent Pricing Kernel, RFS.
- Heston (1993), A Closed-Form Solution for Options with Stochastic Volatility with Applications to Bond and Currency Options, RFS.
- Christoffersen, Jacobs and Mimouni (2010), Volatility Dynamics for the S&P500: Evidence from Realized Volatility, Daily Returns, and Option Prices, RFS.
- Christoffersen, Heston and Jacobs (2009), The Shape and Term Structure of the Index Option Smirk: Why Multifactor Stochastic Volatility Models Work so Well, ManSci.
- Dorion (2015), Option Valuation with Macro-Finance Variables, JFQA.
- Song and Xiu (2015), A Tale of Two Option Markets: Pricing Kernels and Volatility Risk, SSRN.

5) October 14. Volatility and distribution modeling using intraday data

- EFRM Chapter 5. ABCD Section 2 only.
- McCurdy and Maheu (2011), Do high-frequency measures of volatility improve forecasts of return distributions? Journal of Econometrics.
- Hansen, Huang and Shek (2012), Realized GARCH: A Joint Model for Returns and Realized Measures of Volatility, JAE.
- Patton and Verardo (2013), Does Beta Move with News? Firm-Specific Information Flows and Learning about Profitability. RFS.
- Chen and Ghysels (2011), News—Good or Bad—and Its Impact on Volatility Predictions over Multiple Horizons. RFS.
- Fleming, Kirby, and Oestdiek, (2002), The Economic Value of Volatility Timing using Realized Volatility, JFE.
- Hautsch, Kyj, and Malec (2015), Do High-Frequency Data Improve High-Dimensional Portfolio Allocation? JAE.
- Bollerslev, Osterrieder, Sizova and Tauchen (2013), Risk and return: Long-run relations, fractional cointegration, and return predictability. JFE.
- Engle and Sokalska (2012), Forecasting intraday volatility in the US equity market. Multiplicative component GARCH. JFEC.
- Johannes and Stroud (2015), Bayesian modeling and forecasting of 24-hour high-frequency volatility, JASA.

6) October 21. Option valuation using intraday return data

- Andersen, Fusari, and Todorov (2015), Parametric Inference and Dynamic State Recovery from Option Panels, Econometrica.
- Christoffersen, Feunou, Jacobs and Meddahi (2014), The Economic Value of Realized Volatility: Using High-Frequency Returns for Option Valuation, JFQA.
- Corsi, Fusari, and LaVecchia, 2013, Realizing Smiles: Options Pricing with Realized Volatility, JFE.
- Christoffersen, Feunou and Jeon (2014), Option Valuation with Observable Volatility and Jump Dynamics, SSRN.

- Barndorff-Nielsen and Shephard (2002), Econometric analysis of realized volatility and its use in estimating stochastic volatility models, JRSS Series B.
- Yoontae Yeon (2014), Market Liquidity, Variance Dynamics, and Option Prices, Working Paper.

7) October 28. Dynamic Covariance, Correlation and Beta

- ABCD, Section 3.
- EFRM Chapters 7 and 8.
- Christoffersen, Jacobs, Jin, and Errunza (2014), Correlation dynamics and international diversification benefits, International Journal of Forecasting.
- Bali, Engle and Tang (2012), Dynamic Conditional Beta is Alive and Well in the Cross-Section of Daily Stock Returns, SSRN.
- Frazzini and Pedersen, (2013), Betting Against Beta, JFE.
- Gilbert, Hrdlicka, and Siegel (2014), Daily Data is Bad for Beta: Opacity and Frequency-Dependent Betas, RAPS.
- Hansen, Lunde, and Voev (2014), Realized Beta GARCH: A Multivariate GARCH Model with Realized Measures of Volatility.
- Engle and Rangel (2012). The Factor-Spline-GARCH Model for High- and Low-frequency
- Correlations, JBES.
- Brownlees and Engle (2014), SRISK: A Conditional Capital Shortfall Index for Systemic Risk Measurement, SSRN.

8) November 4. Risk factor modeling using dynamic copulas

- EFRM, Chapter 9.
- Christoffersen, Errunza, Jacobs and Langlois (2012), Is the Potential for International Diversification Disappearing? A Dynamic Copula Approach, RFS
- Christoffersen and Langlois (2013), The Joint Dynamics of Equity Market Factors, JFQA
- Christoffersen, Jacobs, Jin, and Langlois (2014), Dynamic Dependence and Diversification in Corporate Credit, SSRN.

9) November 11. Using option implied information in asset pricing.

- Christoffersen, Jacobs and Chang (2013), Forecasting with Option Implied Information, Handbook of Economic Forecasting, Volume 2A.
- Chang, Christoffersen and Jacobs (2013), Market skewness risk and the cross section of stock returns, JFE.
- Chang, Christoffersen, Jacobs, and Vainberg (2012), Option-Implied Measures of Equity Risk, RF.
- Ang, Hodrick, Xing and Zhang (2006), The Cross-Section of Volatility and Expected Returns, JF
- Conrad, Dittmar and Ghysels (2013), Ex Ante Skewness and Expected Stock Returns, JF.
- Brandt, Santa-Clara and Valkanov (2009), Parametric Portfolio Policies: Exploiting Characteristics in the Cross-Section of Equity Returns, RFS.
- Christoffersen, Fournier, Jacobs and Karoui (2015), The Conditional Price of Coskewness and Cokurtosis Risk: A New Approach, Working Paper.

- Christoffersen and Pan (2014), Oil Volatility Risk and Expected Stock Returns. SSRN.
- Christoffersen and Pan (2014), Equity Portfolio Management Using Option Price Information, SSRN.
- Bakshi, Kapadia and Madan (2003), Stock Return Characteristics, Skew Laws, and the Differential Pricing of Individual Equity Options, RFS.
- Cremers, Halling and Weinbaum, (2015), Aggregate Jump and Volatility Risk in the Cross-Section of Stock Returns, JF.
- Ross, (2015), The Recovery Theorem, JF.

10) November 18. Factor structure in volatility. Option portfolio management.

- Christoffersen, Fournier, and Jacobs (2014), Factor Structure in Equity Options. SSRN.
- Faias and Santa-Clara (2014), Optimal Option Portfolio Strategies, SSRN.
- Broadie, Chernov and Johannes (2009), Understanding Index Option Returns. RFS.
- Chen and Petkova (2012) Does Idiosyncratic Volatility Proxy for Risk Exposure? RFS.
- Duarte, Kamara, Siegel and Sun (2014), The Systematic Risk of Idiosyncratic
- Volatility, SSRN.
- Herskovic, Kelly, Lustig, and Van Nieuwerburgh (2014) The Common Factor in Idiosyncratic Volatility: Quantitative Asset Pricing Implications, SSRN.
- Boyer and Vorkink (2014), Stock Options as Lotteries, JF.
- Malamud (2014), Portfolio Selection with Options. SSRN.

11) November 25. Realized skewness

- Chang, Christoffersen and Jacobs (2013), Market skewness risk and the cross section of stock returns, JFE.
- Amaya, Christoffersen, Jacobs and Vasquez (2015), Do Realized Skewness and Kurtosis Predict the Cross-Section of Equity Returns? JFE.
- Neuberger, (2012), Realized Skewness, RFS.

12) December 2. Option Illiquidity

- Christoffersen, Goyenko, Jacobs and Karoui (2014), Illiquidity Premia in Equity Options, SSRN.
- Goyenko, Holden and Trzcinka (2009), Do Liquidity Measures Measure Liquidity, JFE.
- Goyenko, Ornthanalai, Tang (2015), Trading Cost Dynamics of Market Making in Equity Options, SSRN.
- Kyle and Obizhaeva (2011), Market Microstructure Invariants: Empirical Evidence from Portfolio Transitions, SSRN.

  Andersen et al (2015), MM invariants for ES futures. Work in progress.

13) December 16. Student presentations

Matlab Homework 1. Due October 21 by email.

a) Replicate Figures 1 and 2 in Rapach and Zhou's Handbook chapter. Replicate Figures 3 and 4 but only for Kitchen Sink and Pool-Avr. Note: You don't need to include the NBER dates in the figures.
b) Using daily closing prices on the S&P500 from 1/1/1991 through 31/12/2013 estimate an HN-GARCH(1,1) model with Gaussian errors. Show the ACF of the raw returns, the squared returns and the GARCH squared residuals. Show the QQ plots of raw returns and GARCH residuals. Estimate the NGARCH model also and compare fit with the HN-GARCH model.
c) Code up the Heston-Nandi GARCH(1,1) option valuation model. Confirm the two option prices at the bottom of page 620. Verify the formula using Monte Carlo pricing.

Matlab Homework 2. Due November 11 by email.

1) Using the RV data supplied in xlsx illustrate the stylized facts of RV from EFRM Chapter 5.
2) Using the RV data supplied in xlsx estimate a HAR model on the RV for 1-day, 5-day and 10-day log variance. How well does the model fit the data?
3) Compute average RV (use 5 minute log returns) and average BPV using the one-minute log returns supplied for S&P500 index in the .mat file. The variables in the mat file are:
   1st column: Date in YYYYMMDD,
   2nd column: Time in HHMM (Hour and Minute) Eg) 931 represents 9:31 AM.
   3rd column: One-minute Return. Eg) Return for 931 represents return from 9:30 AM to 9:31 AM of the day.
4) Code up the Heston SV option valuation model. Reproduce Figure 4 in Heston (RFS, 1993).

Matlab Homework 3. Due December 2 by email.

Part I: Use the International equity data circulated.

1) On the GARCH resids please estimate the standard symmetric DCC model for all the countries at once. (Don't worry about the Aielli modification.) Please use composite MLE for estimation.
2) Please construct two subplots: One for all DMs and one for all EMs. For each country plot the time series of the DCC correlation with the US.
3) Please construct two subplots: One for all DMs and one for all EMs. For each country plot the threshold correlations with the US. Only include a threshold if you have at least 30 observations. Construct threshold correlations for both raw returns and GARCH resids.

Part II: Use the option data circulated. The variables are:

(1) date (matlab)

(2) date (yyyymmdd)
(3) days to maturity
(4) strike
(5) mid-price
(6) ex-dividended underlying price
(7) interest rate
(8) call/put flag (call=1, put=0) (9)highest bid (10)lowest ask
(11) trading volume
(12) open interest
(13) BS-IV from OptionMetrics (if 0, it means N/A)
(14) optionID
(15) last traded date (yyyymmdd, if =0, it means N/A)
(16) own BS-IV for comparison with (13)
(17) weekday indicator

For each day available in 2003, compute the 30-day option-implied variance, skewness and kurtosis using the formulas in Bakshi, Kapadia and Madan (RFS, 2003). Plot each moment over time in a 3 by 1 subplot. The data has already been filtered. Use the following implementation procedure in Chang, Christoffersen and Jacobs (JFE, 2013) to compute the moments:

"We estimate only the moments for days that have at least two OTM call prices and two OTM put prices available. Because we do not have a continuity of strike prices, we calculate the integrals using cubic splines. For each maturity, we interpolate implied volatilities using a cubic spline across moneyness levels (K/S) to obtain a continuum of implied volatilities. For moneyness levels below or above the available moneyness level in the market, we use the implied volatility of the lowest or highest available strike price. After implementing this interpolation-extrapolation technique, we obtain a fine grid of one thousand implied volatilities for moneyness levels between 0.01% and 300%. We then convert these implied volatilities into call and put prices using the following rule: Moneyness levels smaller than 100% (K/S<1) are used to generate put prices and moneyness levels larger than 100% (K/S > 1) are used to generate call prices using trapezoidal numerical integration. Linear interpolation between maturities is used to calculate the moments at a fixed 30-day horizon."