ON THE INFORMATION CONTENT OF OPTION PRICES AND ITS USE IN FINANCE

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MAIN GOAL OF THE WORKSHOP:

This workshop will examine how to use option market data to extract different financial information.

MOTIVATION AND BROAD LIST OF TOPICS

Time serie of historical stock returns are usually used as an input for predicting future market movements. Unfortunately, historical stock returns suffer from being backward looking, and the resulting outputs are neither financially nor statistically robust. Not surprisingly, stock-based results might be suboptimal in periods of high volatility, when the statistical properties of the stock market change the most from the past.

Departing from this issue, I will show you how to use option market data (either alone or jointly with stock market data) to predict future market movements.

More precisely after presenting the above problem in more detail, I will "divide" the remaining of the workshop in three parts, where I will show:

1. How to estimate the conditional risk-neutral and the physical measures, and test if the two measures are among them consistent by analyzing the resulting pricing kernel.
2. How to use the pricing kernel to test the market efficiency and, above all, how a mis-estimated physical measure can lead to puzzling pricing kernels and leads to illusory arbitrages.
3. How to estimate option implied basic statistical quantities, like option-implied quantiles and expectiles that are then used for a) Risk management (option implied Value at Risk (VaR) and Conditional Value at Risk (CVaR)) b) Measures of variability, comparable but less numerically demaning than the VIX index c) Forecasting.

In case of time, I will also present some machine learning techniques to infer the risk-neutral density.

READINGS

Most ot the content will be based on papers I published or that are working papers. I am greatly in debt to my coauthors and the people on whose work we founded ours.

Part 1)

- Barone-Adesi G., N. Fusari, A. Mira and C. Sala "The impact of misalignment of beliefs on the estimation of the pricing kernel", Swiss Finance Institute Research Paper No. 15-66, 2019

- Breeden, Douglas T., and Robert H. Litzenberger. "Prices of State-Contingent Claims Implicit in Option Prices." The Journal of Business 51, no. 4: 621-51, 1978

- Barone-Adesi G., R. Engle and L. Mancini "A GARCH Option Pricing Model with Filtered Historical Simulation", Review of Financial Studies, 21, May 2008, pp.1223-1258.

- Barone-Adesi G., K. Giannopoulos and L. Vosper "VaR without Correlations for Portfolios of Derivative Securities", Journal of Futures Markets, August 1999.

- H. Cuesdeanu and J.C. Jackwerth. "The pricing kernel puzzle: survey and outlook," Annals of Finance, Springer, vol. 14(3), pages 289-329, August 2018.

  (If we have time)
- Sala, Carlo and Barone-Adesi, Giovanni, Sentiment Lost: The Effect of Projecting the Empirical Pricing Kernel onto a Smaller Filtration Set (July 17, 2018). Swiss Finance Institute Research Paper No. 15-58.

Part 2)

- G. Barone-Adesi and C. Sala "Testing market efficiency with the pricing kernel", The European Journal of Finance, 25:13, pages 1166-1193, 2019

- P.H Dybvig,. "Distributional Analysis of Portfolio Choice." The Journal of Business 61 (3): pages 369–393, 1988.

- R. Jarrow. "The Third Fundamental Theorem of Asset Pricing." Annals of Financial Economics 7 (2): 1250007, 2012.

Part 3)

- Barone-Adesi G., C. Legnazzi and C. Sala "Option-Implied Risk Measures: An Empirical Examination on the S&P500 Index", International Journal of Finance and Economics, Forthcoming, 2019

- Barone-Adesi G, Finta MA, Legnazzi C, Sala C. "WTI crude oil option implied VaR and CVaR: An empirical application", Journal of Forecasting, pages 1-12, 2019.

- F. Bellini, E. Rroji and C. Sala "Implicit quantiles and expectiles", Working paper, 2019

<u>PREREQUISITES</u>

It is assumed that student have had prior basic exposure to continuous-time and discrete-time finance and its applications to option pricing under geometric Brownian motion: a basic knowledge of what call and put options are, the distinction between American and European options, the Black-Scholes-Merton models and the basic of no-arbitrage.
A useful introductory textbook that covers that material is:

John C. Hull, "Options, Futures, and Other Derivatives" (The book is now at its ninth edition, but any edition after the seventh is good)