Full Name

Jeroen Dalderop

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Economics

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Research Title and Abstract as provided upon your funding application to CERF

Empirical Analysis of Asset Prices My research focuses on flexible econometric methods to estimate and test asset pricing models. Nonparametric methods can overcome the risk of misspecifying return distributions or making strict assumptions on preferences of representative agents. They can test a large variety of hypotheses and reveal nonlinear relationships between economic variables. Their applicability is further stimulated by increasingly large datasets, arising from high frequency recording and expanding trading volumes in financial assets and derivative products. There are still many challenges in making efficient use of such financial data and reconciling them with macroeconomic time series that my research aims to address.

Project Start and End Date

2013-2017

Key Research Findings to date

In my first working paper 'Nonparametric State-Price Density Estimation using High Frequency Data' I develop a method to filter the call pricing function, or equivalently, the state-price density, in continuous time using high frequency data. I focus on the optimal choice of smoothing parameter or bandwidth. I find considerable time-variation during the day which is important for pricing and hedging.

Dissimination

I have received two academic awards for my first research paper 'Nonparametric State-Price Density Estimation using High Frequency Data' . The first is the Cambridge Finance Best Student Paper Award 2015, and the second is the annual GResearch PhD Prize 2016 for the best PhD research in quantitative finance. Furthermore my paper got accepted and is presented at several conferences (see attached list).

Major Difficulties and Other Issues

Comments and Additional Information

CERF Studentship Report – Project Update March 2016

Jeroen Dalderop

Working Papers

'Nonparametric State-Price Density Estimation using High Frequency Data'

Link: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2718938

Abstract:

" This paper studies the use of irregularly spaced high frequency data to estimate the state-price density (SPD) implicit in option prices. Their large sample size allows estimation of the conditional SPD at any time point of interest, which can be directly used for model-free pricing, hedging and conditional risk measurement. We develop asymptotic theory for a time-varying kernel estimator when the trading times are modelled by point processes whose intensity goes to infinity. The pricing errors and strike prices are mixing, locally stationary time series, which can be weakly dependent with the trading times. Unlike realized volatility estimation, the market microstructural noise in recorded option prices is averaged out and there is no need to subsample the data. We apply the estimator to S&P 500 E-mini European call and put option mid quotes using an iterated plug-in bandwidth, and document the intraday dynamics of the SPD and derived quantities."

Awards:

Cambridge Finance Best Student Paper Award 2015

GResearch PhD Prize 2016 for the best research in quantitative finance by a PhD student at Cambridge

Non-technical Summary:

Option prices contain detailed information about the risk perception of market participants. My research concerns developing new methods to analyse this information as summarized in the state-price density, which tells us how much value investors attach to payoffs in different states of the economy. My expected contribution is to use high-frequency data to model the dynamic behaviour of the state-price density. This tells us how the perception of market risk of investors changes over time, that is, in reaction to market events.

The availability of high-frequency data has dramatically increased the number of observed prices of European options and their underlying. This makes it feasible to estimate the state-price density at different time point within a day, as opposed to say only at the close of the trading day. This can be done by 'smoothing' transaction data over time using a time-varying nonparametric regression function.

The clear advantages of the large sample sizes in high-frequency data also come with some methodological challenges. In particular, trading times do not occur at a regular frequency, such as at the end of a trading day or month, but instead should be treated as random variables themselves. For example, transactions may cluster together in time in reaction to some particular news, or there can be time-of-the-day effects such as a lunch breaks. These contribute to the random behaviour of the nonparametric estimator and hence cannot be ignored. Another motivation to model trading times explicitly is that they may be related to the outcomes of the traded assets themselves, for example via a large stock price change which triggers new transactions.

I have focused on the theoretical part of this project, i.e. the econometric theory of random sampling times and a dynamic nonparametric estimator. I mainly worked on deriving the mean square error of the estimator and the practical issue of choosing bandwidths. This comes effectively down to choosing how many data points to include for the estimated state-price density at a specific point in time. The faster the state-price density changes, the less data points we can use without introducing large biases.

The dynamic model for the state-price density can also be used to analyse the costs of static models, such as the common practice to 'pool' together data points during a specific trading period. Also other specifications of option pricing models can be tested, such as the commonly used 'homogeneity' assumption of the stock and strike price.

To summarize, the main scientific aims of my first working paper are to

- Develop econometric methods to model time-variation in the state-price density, i.e. incorporate random observation times within a nonparametric time series regression
- Apply the model to high-frequency S&P500 options data, report stylized facts on the dynamics of the state-price density and test existing option price models

Presentations:

April 2014: Econometrics Workshop, Faculty of Economics, University of Cambridge

November 2014: Econometrics Workshop, Faculty of Economics, University of Cambridge

May 2015: CERF Cavalcade, Judge Business School, University of Cambridge

June 2015: SoFiE Spring School, Belgian Central Bank, Brussels

June 2016 (scheduled): SoFiE Conference 'Financial Econometrics and Empirical Asset Pricing', Lancaster UK

June 2016 (scheduled): 3th IAAE Conference at University of Milan-Bicocca, Italy

Discussions (in Econometrics Workshop at Cambridge):

Gospodinov and Otsu (Journal of Econometrics 2012) - Local GMM estimation of time series models with conditional moment restrictions

Palumbo, D. (2015) – Joint Modelling of the Term Structure of Interest Rates and Credit Spreads