IV Residential SUMMER SCHOOL
MODELLING AND FORECASTING ENERGY MARKETS
Florence, 7-11 September 2020

In the last two decades, the deregulation of energy markets and the increasing adoption of renewable energy have resulted in significant volatility of both energy price and demand worldwide. The modelling and forecasting of energy demand and price has therefore become of utmost importance, not only to energy producers themselves, but also to commodity traders and financial analysts focusing on the energy sector. The statistical features of energy data, which tends to follow periodic patterns and exhibit spikes, non-constant means and non-constant variances, renders the task of forecasting and modelling of energy data somewhat challenging.

The objective of TStat's "Modelling and Forecasting Energy Markets" Summer School is therefore to provide participants with the specific analytical tools to undertake a rigorous and in-depth analysis of both prices and demand in international energy markets. The programme covers a wide range of econometric methods currently available to researchers and practitioners, such as: i) univariate and multivariate time series models to estimate and forecast prices and demand and ii) univariate and multivariate GARCH models for the estimation and forecast of price volatility and risk management in energy markets.

Following TStat's training philosophy, the teaching style features both theoretical sessions, where participants are given the intuition behind the choice of a specific technique, and several practical sessions using Stata. In this manner, the course leaders are able to bridge the "often difficult" gap between abstract theoretical methodologies, and the practical issues one encounters when dealing with real data.

The Summer School opens with a one-day full-immersion module on energy data analysis with the statistical software Stata, which aims at developing the necessary practical skills to actively participate in the applied sessions during the course of the week.

The 2020 edition also includes an extended Case Study Group session during which participants will either work in small groups on a short applied case study analysis or on a presentation of their own research work using the techniques illustrated during the course of the week. Course leaders will discuss with participants the appropriateness of the methodologies adopted in their case study, the interpretation of the results obtained and also to indicate potential problems to be aware of given the characteristics of the underlying data, as well as providing feedback and guidance on possible future developments of individual research agendas.

At the end of the school participants are expected to be in a position to autonomously conduct energy markets analysis, with the aid of the Stata routines developed specifically for the Summer School. In particular, participants will be able to evaluate which econometric method is more appropriate to the analysis in hand and will be able to test the appropriateness of their estimated model and the robustness of the results obtained.

WORKSHOP CODE

I-SS12

DATE AND LOCATION

Florence, 7-11 September 2020
CISL Studium Center
Via Della Piazzola, 71
I-50123 Florence
http://www.centrostudi.cisl.it

PREREQUISITES

Intermediate knowledge of econometrics and/or statistics

MODELLING AND FORECASTING ENERGY MARKETS

TARGET AUDIENCE

Researchers and professionals working either: i) in the energy and related sectors, needing to model energy price and demand, and ii) on trading desks in financial institutions. Economists based in research policy institutions. Students and researchers in engineering, econometrics and finance needing to learn the econometrics methods and tools applied in this field.

PROGRAMME

DAY 1

ENERGY DATA ANALYSIS WITH STATA

SESSION I:
AN INTRODUCTION TO STATA

1. Using Stata interactively and understanding the basics of Stata's language syntax
2. Fundamental data management tasks in Stata: importing datasets, renaming and relabelling variables, creating new variables, dealing with string variables, data aggregation
3. Date and time functions for working with time series in Stata
4. Saving your work: log files and do files

SESSION II:
ENERGY DATA ANALYSIS

1. Graphical analysis of energy time series: creating line plots, histograms, correlograms, scatter plots with Stata
2. Descriptive Statistics in Stata
3. Test for autocorrelation and heteroscedasticity
4. Normality test
5. Non-stationarity and unit root tests

DAY 2

MODELLING AND FORECASTING ENERGY PRICE AND DEMAND

SESSION I:
UNIVARIATE TIME SERIES MODELS FOR ENERGY PRICES AND DEMAND (ELECTRICITY, CRUDE OIL, NATURAL GAS...)

1. Univariate time series models for modelling and forecasting energy data (ARMA, ARIMA, ARFIMA, SARIMA)
2. Markov switching models for capturing stable and spiky regimes in energy prices
3. Practical applications: estimating and forecasting energy price and demand with univariate models in Stata

SESSION II:
MULTIVARIATE TIME SERIES MODELS FOR ENERGY PRICES AND DEMAND (ELECTRICITY, CRUDE OIL, NATURAL GAS...)

1. Vector autoregressive (VAR) models for forecasting energy prices and for understanding interdependences between energy markets
2. Granger predictability of energy prices
3. Practical applications: fitting VAR models with Stata

DAY 3

COINTEGRATION AND UNOBSERVED COMPONENT MODELS

SESSION I:
COINTEGRATION MODELS OF ENERGY DEMAND (ELECTRICITY, CRUDE OIL, NATURAL GAS...)

1. An introduction to the theory of cointegration
2. Cointegration models for energy data: autoregressive distributed lag models and error correction models. The Engle & Granger procedure and the Johansen's approach
3. Practical applications: Estimating energy demand models with Stata

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SESSION II:
UNOBSERVED COMPONENT
ENERGY MODELS (ELECTRICITY,
CRUDE OIL, NATURAL GAS...)

1. Unobserved component models to decompose energy demand time series into trend, seasonal, cyclical, and idiosyncratic components
2. Practical applications: estimating the underlying energy demand trend

DAY 4   ## ENERGY MARKETS VOLATILITY

SESSION I:
UNIVARIATE GARCH MODELS
FOR ESTIMATING AND
FORECASTING ENERGY PRICES
VOLATILITY (ELECTRICITY,
CRUDE OIL, NATURAL GAS...)

1. ARCH, GARCH, GARCH-in-mean and IGARCH models for energy prices
2. Inverse leverage effect in energy markets. Estimating asymmetric GARCH models (SAARCH, EGARCH, GJR, TGARCH, APARCH)
3. Practical applications: testing for inverse leverage effect in energy markets and fitting symmetric and asymmetric GARCH models with Stata

SESSION II:
APPLIED CASE STUDY ANALYSIS

1. In this session, participants will be encouraged to discuss their own research projects and data issues. Course leaders are available for feedback and guidance on how to deal with research projects

DAY 5   ## RISK MANAGEMENT TOOLS FOR ENERGY MARKETS

SESSION I:
MULTIVARIATE GARCH
MODELS FOR ENERGY PRICES
VOLATILITY ((ELECTRICITY,
CRUDE OIL, NATURAL GAS...)

1. VECH and Diagonal VECH model, Constant Conditional Correlation (CCC) model, Dynamic Conditional Correlation Model (DCC) by Engle (2002) and Dynamic Conditional Correlation Model (DCC) by Tse and Tsui (2002)
2. Practical applications: testing for interdependencies between energy markets volatility using CCC and DCC models

SESSION II:
RISK MANAGEMENT TOOLS

1. Value-at-Risk (VaR) to measure market risk of energy markets: Parametric VaR, historical simulation VaR, Monte Carlo VaR
2. Backtesting procedures: unconditional coverage, independence, conditional coverage, and duration based tests of independence
3. Practical applications: Value-at-Risk estimation of oil market with Stata

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MODELLING AND FORECASTING ENERGY MARKETS

COURSE REFERENCES

Financial Econometrics Using Stata, Boffelli, S. e G. Urga (2016) Stata Press

Introductory Econometrics for Finance, 3rd Edition, C. Brooks (2014) Cambridge University Press

COURSE LEADERS

Dr. Elisabetta PELLINI, Centre for Econometric Analysis, Cass Business School, London (UK)

Professor Giovanni URGA, Centre for Econometric Analysis, Cass Business School, London (UK) and Bergamo University (Italy)

REGISTRATION DEADLINE

Individuals interested in attending this summer school must return their completed registration forms to TStat by e-mail (training@tstat.eu) by the 7th August 2020.

CONTACTS

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REGISTRATION FEES

Full-Time Students*: € 1350.00
Academic: € 2200.00
Commercial: € 3250.00

*To be eligible for student prices, participants must provide proof of their full-time student status for the current academic year. Residential costs for full time students are completely sponsored by TStat Training through our **Investing in Young Researchers Programme**. Participation is however restricted to a maximum of 3 students.

Fees are subject to VAT (applied at the current Italian rate of 22%). Under current EU fiscal regulations, VAT will not however applied to companies, Institutions or Universities providing a valid tax registration number.

Please note that a *non-refundable deposit* of €100.00 for students and €250.00 for Academic and Commercial participants, is required to secure a place and is payable upon registration. The number of participants is limited to 15. Places will be allocated on a first come, first serve basis.

Course fee covers: teaching materials (copies of lecture slides, databases and Stata routines used during the school); a temporary licence of Stata valid for 30 days from the beginning of the school; half board accommodation (breakfast, lunch and coffee breaks) in a single room at CISL Studium Center or equivalent (5 nights). Participants requiring accommodation the night of the final day of the school, are requested to contact us as soon as possible.

To maximize the usefulness of this summer school, we strongly recommend that participants bring their own laptops with them, to enable them to actively participate in the empirical sessions.

Further details regarding our registration procedures, including our commercial terms and conditions, can be found at https://www.tstattraining.eu/training/modelling-energy-markets/