

Московский государственный университет имени М.В.Ломоносова
Московская школа экономики

РАБОЧАЯ ПРОГРАММА УЧЕБНОЙ ДИСЦИПЛИНЫ
«Econometrics Methods for Energy Economics and Finance»

(аспирантура как третий уровень образования)

Направление подготовки – 38.06.01 – Экономика

Направленности: Экономическая теория, Математические и инструментальные методы экономики, Экономика и управление народным хозяйством, Мировая экономика

Квалификация (степень) выпускника аспирантуры:
Исследователь. Преподаватель-Исследователь

Форма обучения в аспирантуре: очная, заочная

Рабочая программа дисциплины (модуля)

1. Наименование дисциплины - Econometrics Methods for Energy Economics and Finance

2. Уровень высшего образования - аспирантура.

3. Направленности подготовки - «Экономическая теория», «Математические и инструментальные методы экономики», “ Экономика и управление народным хозяйством”, « Мировая экономика»

4. Место дисциплины (модуля) в структуре ОПОП: относится к вариативной части ОПОП

Econometrics Methods for Energy Economics and Finance

Instructor: *Dean FANTAZZINI*

- **Course Objectives:** This course consists of two modules: the first one presents the most recent econometric methods to forecast oil prices, gasoline prices, natural gas prices and electricity prices, highlighting both advantages and disadvantages. The second part is devoted to review the theory and the empirical evidence linking fluctuations in energy prices to those in aggregate economic activity. The implications of energy price shocks for monetary policy, fiscal policy and energy policy are discussed.

- **Prerequisites:** This course is intended for master/PhD students with a good background in mathematics, statistics and econometrics.
- **Literature:** There is no single required textbook for this course and my lecture slides form the primary reading. A list of textbooks which can be used as introductory references about energy economics and finance is reported below:
 - Bhattacharyya, S. (2011) *Energy Economics: Concepts, Issues, Markets and Governance*, Springer-Verlag.
 - Kaminski V. (2012) *Energy Markets*, Risk Books.
 - Mack, I. (2014), *Energy Trading and Risk Management*, Wiley.
 - Madureira, N.L. (2014) *Key Concepts in Energy*, Springer.
 - Simkins, B. and Simkins, R. (2013) *Energy Finance and Economics: Analysis and Valuation, Risk Management, and the Future of Energy*, Wiley.

The list of specific readings for each topic is reported within the course outline.

- **Method of Grading:** The course grades will be based on a paper presentation in class (30%) and on an empirical research paper (70%) which considers both the theoretical and applied aspects discussed in the course.

Course Outline [1st part]: Modelling and Forecasting Oil prices, Gasoline prices, Natural Gas prices and Electricity prices

1. Modelling and Forecasting Oil prices: A Review [2 hour]

- 1.1 Introduction: A General Overview
- 1.2 A closer look at naive models (used by some traders):
 - Monthly Historical Averages
 - Comparing the current oil crash with past oil crashes (1985/1986 - 2008/2009)
- 1.3 A closer look at recent econometric models (used by economists):
 - Reduced-form VAR models
 - Forecasts based on the price of non-oil industrial raw materials
 - Forecasts based on oil futures prices
 - Forecasts based on time-varying models of the gasoline and parameter

heating oil spreads

- Forecasts based on U.S. crude oil inventories
- Forecasts based on economic models augmented with Google data

1.4 Forecast combination methods and the evidence so far.

References

- Fantazzini, D., and Fomichev, N. (2014). Forecasting the real price of oil using online search data, *International Journal of Computational Economics and Econometrics*, 4(1), 4-31.
- Kilian, L., Baumeister, C. and K. Lee (2014) Are there Gains from Pooling RealTime Oil Price Forecasts? *Energy Economics*, 46, 33-43.
- Kilian, L., Baumeister, C. (2015) Forecasting the Real Price of Oil in a Changing World: A Forecast Combination Approach, *Journal of Business and Economic Statistics*, forthcoming.
- Kilian, L., and D.P. Murphy (2014), The Role of Inventories and Speculative Trading in the Global Market for Crude Oil, *Journal of Applied Econometrics*, 29, 454-478.

2. Modelling and Forecasting Gasoline prices: A Review [2 hour]

2.1 Introduction

2.2 the Asymmetric ECM (A-ECM) model

2.3 Threshold Autoregressive ECM model

2.4 Auto-Regressive Distributed Lag (ARDL) Models

2.5 Nonlinear Auto-Regressive Distributed Lag (NARDL)

2.6 The evidence so far

- Bastianin, A., Galeotti, M., and Manera, M. (2014). Forecasting the oil-gasoline price relationship: Do asymmetries help? *Energy Economics*, 46, 44-56.
- da Silva, A. S., Vasconcelos, C. R. F., Vasconcelos, S. P., and de Mattos, R. S. (2014). Symmetric transmission of prices in the retail gasoline market in Brazil, *Energy Economics*, 43, 11-21.
- Bagnai, A., and Ospina, C. A. M. (2015). Long-and short-run price asymmetries and hysteresis in the Italian gasoline market, *Energy Policy*, 78, 41-50.

3. Modelling and Forecasting Natural Gas prices: A Review [2 hours]

3.1 Introduction

3.2 Time series modelling involving weather, storage and economic variables (as exogenous regressors)

3.3 Error Correction Models (ECMs) between Oil and Gas

3.4 Modelling Endogeneity: Structural VAR models

3.5 Modelling the break in the oil-gas relationship (the advent of shale gas): VECs with breaks

- 3.6 Modelling the break in the oil-gas relationship (the advent of shale gas): Markov-switching cointegration
- 3.7 Nonlinear models and intensive computational methods
- 3.8 The evidence so far

References

- Brown, S. P., and Yucel, M. K. (2008). What drives natural gas prices? *The Energy Journal*, 45-60.
- Erdos, P.(2012) Have oil and gas prices got separated? *Energy Policy*, 49,707-718
- Mu, X. (2007). Weather, storage, and natural gas price dynamics: Fundamentals and volatility. *Energy Economics*, 29(1), 46-63.
- Nick, S., and Thoenes, S. (2014). What drives natural gas prices? A structural VAR approach, *Energy Economics*, 45, 517-527.
- Brigida, M. (2014) The switching relationship between natural gas and crude oil prices, *Energy Economics* 43 (2014): 48-55.
- Salehnia, N., Falahi, M. A., Seifi, A., and Adeli, M. H. M. (2013) Forecasting natural gas spot prices with nonlinear modeling using Gamma test analysis, *Journal of Natural Gas Science and Engineering*, 14, 238-249.

4. Modelling and Forecasting Electricity prices: A Review [2 hours]

- 4.1 Introduction: general overview
- 4.2 Multi-agent models
- 4.3 Fundamental (or Structural) models
- 4.4 Reduced-form models: jump-diffusion and Markov regime-switching models
- 4.5 Statistical/Econometric models: Regression Models, AR-type time series models, ARX-type time series models, Threshold AR models
- 4.6 Computational models: Neural Networks
- 4.7 Recent developments: Modeling the trend-seasonal components, probabilistic forecasts, Forecast combinations, Multivariate Factor models
- 4.8 The evidence so far

References

- Aggarwal, S. K., Saini, L. M., and Kumar, A. (2009). Electricity price forecasting in deregulated markets: A review and evaluation, *International Journal of Electrical Power and Energy Systems*, 31(1), 13-22.
- Weron, R. (2006) *Modeling and forecasting electricity loads and prices: a statistical approach*. Chichester: Wiley.

- Weron, R., and Misiorek, A. (2008). Forecasting spot electricity prices: a comparison of parametric and semiparametric time series models, *International Journal of Forecasting*, 24, 744-763.
- Weron, R. (2014). Electricity price forecasting: A review of the state-of-the-art with a look into the future, *International Journal of Forecasting*, 30(4), 10301081.

Course Outline [2nd part]: Energy Prices and Economic Activity

1. Introduction: How energy prices influence economic activity [2 hours]

- 1.1 Developments up to the early 2000s: the demand channel of transmission.
- 1.2 Energy - economic activity : an asymmetric relationship?
- 1.3 Energy - economic activity : a weakened relationship?
- 1.4 Initial Policy recommendations (before the global crisis in 2007-2009.)

References

- Bernanke, B. S., M. Gertler, and M. Watson (1997), Systematic monetary policy and the effects of oil price shocks. *Brookings Papers on Economic Activity*, 1, 91-142.
- Bernanke, B. S., M. Gertler, and M. Watson (2004), Oil shocks and aggregate macroeconomic behavior: The role of monetary policy: A reply. *Journal of Money, Credit, and Banking*, 36, 287-291.
- Brown, S. P., and Yucel, M. K. (2002). Energy prices and aggregate economic activity: an interpretative survey, *The Quarterly Review of Economics and Finance*, 42(2), 193-208.
- Hamilton, J. D. (2003), What is an oil shock? *Journal of Econometrics*, 113, 363-398.
- Hamilton, J.D. (2009), Causes and consequences of the oil shock of 2007-08, *Brookings Papers on Economic Activity*, 1 (Spring), 215-261.
- Mork, K. A. (1989), Oil and the macroeconomy. When prices go up and down: An extension of Hamilton's results. *Journal of Political Economy*, 97, 740-744.
- Mork, K.A., Olsen, O., and H.T. Mysisen (1994), Macroeconomic responses to oil price increases and decreases in seven OECD countries, *Energy Journal*, 15, 19-35

2. Academic research during and after the global crisis [2 hours]

- 2.1 Nonlinearity and symmetry of energy shocks
 - 2.2 Disentangling energy price shocks
 - 2.3 The role of financial speculation
 - 2.4 Coal, Oil, and Natural Gas shocks in perspective
 - 2.5 Historical price shocks in the long run
- Hamilton, J. D. (2011) Nonlinearities and the macroeconomic effects of oil prices, *Macroeconomic dynamics*, 15(3), 364-378.
 - Van de Ven D.J., and R. Fouquet (2014) Historical Energy Price Shocks and their Changing Effects on the Economy, Centre for Climate Change Economics and Policy Working Paper No. 171 - Grantham Research Institute on Climate Change and the Environment Working Paper No.

References

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- Kilian, L. (2008), The Economic Effects of Energy Price Shocks, *Journal of Economic Literature*, 46, 871-909.
- Kilian, L. (2009), Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market, *American Economic Review*, 99, 1053-1069
- Kilian, L. (2015), Energy Price Shocks, *New Palgrave Dictionary of Economics*, March 2015.
- Kilian, L., and D. Murphy (2012), Why Agnostic Sign Restrictions Are Not Enough: Understanding the Dynamics of Oil Market VAR Models, *Journal of the European Economic Association*, 10, 1166-1188
- Kilian, L. and D. Murphy (2014), The Role of Inventories and Speculative Trading in the Global Market for Crude Oil, *Journal of Applied Econometrics*, 29, 454-478.
- Kilian, L., and R.J. Vigfusson (2011a), Are the Responses of the U.S. Economy Asymmetric in Energy Price Increases and Decreases? *Quantitative Economics*, 2, 419-453.
- Kilian, L., and R.J. Vigfusson (2011b), Nonlinearities in the Oil Price-Output Relationship, *Macroeconomic Dynamics*, 15, 337-363.
- Kilian, L., and R.J. Vigfusson (2013), Do Oil Prices Help Forecast U.S. Real GDP? The Role of Nonlinearities and Asymmetries, *Journal of Business and Economic Statistics*, 31, 78-93.