



University of Cologne

Department of Economics – Chair in Economics and Energy Economics

Prof. Dr. Marc Oliver Bettzüge

Seminar in Energy Economics (Econometrics Focus)

Summer Term 2024

Energy Prices through the Lens of Cointegration Analysis

The liberalization of energy markets and increased trade activities have significantly contributed to the interconnectedness of energy prices, both across and within regional markets. Taking natural gas as an example, European and Asian gas prices often form a long-run equilibrium relationship, largely due to active arbitrage activities between the two regions. Furthermore, within Europe, between continental hubs such as the Dutch and German gas spot markets, there has been noticeable price integration, primarily influenced by regulatory reforms initiated by the European Commission. This phenomenon extends beyond the prices of a single commodity. Different energy commodities, such as natural gas and crude oil, have historically shown co-movements in pricing. This is particularly evident in regions where they are substitutes for each other in sectors like electricity generation and heavy industries. However, with evolving regulatory environments and trading developments, the persistence of this level of integration is now in question.

Reflecting on these dynamics, research in energy economics has primarily focused on three key aspects: the integration of prices at both the regional and intertemporal levels (i.e., futures and spot prices), the interrelationship of different energy commodities' prices, and long-term equilibrium relationships between energy prices and other broader economic indicators, such as GDP growth and exchange rates. Central to these studies is the concept of cointegration, a statistical property indicating that certain variables, though individually random in their paths, move together in the long run.

This seminar aims to provide students with a practical understanding of cointegration theory and its application in empirical research. Students will be introduced first to the fundamental concepts of cointegration, along with the various empirical tests used to identify such relationships in energy economics literature. Building on this foundation, they will review and critically analyze the current state of empirical literature within the previously discussed research areas. By the end of the seminar, participants will have the opportunity to gain theoretical knowledge and practical skills, which will enable them to formulate new ideas and research questions within these domains. These insights could serve as the basis for thesis topics.

Schedule

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| 10.04.2024 10:00-11:30 | Introductory meeting - Organizational Issues - Seminar Introduction and Overview of Topic |
| 16.04.2024 10:00-13:30 | Methodologies Session: Introduction to cointegration theory and tests (part one) |
| 18.04.2024 10:00-13:30 | Methodologies Session: Introduction to cointegration theory and tests (part two) |
| 19.04.2024 10:00-13:30 | - Hands-On Session: Learning how to conduct a cointegration analysis using statistical software. - Presentation and writing skills session |
| 20.04.2024 23:59 | <i>Deadline to Register or Withdraw from the Examination via KLIPS</i> |
| Group Meetings (with Mentor) Scheduled mentor meetings for guidance on presentation structure, topic clarification, and methodological queries. | |
| 20.06.2024 10:00 | <i>Deadline Submission of Presentation Slides to ILIAS</i> |
| 21.06.2024 10:00-13:30 | Group Presentations Mandatory |
| 26.06.2024 10:00-13:30 | Group Presentations Mandatory |
| 27.06.2024 10:00-13:30 | Group Presentations Mandatory |
| Tba | Guest Lecture |
| Individual Meetings (with Mentor) Scheduled mentor meetings for guidance on term paper structure, topic clarification, and methodological queries. | |
| 30.08.2024 23:59 | <i>Deadline Submission of Final Seminar Paper and Research Proposal</i> |

Application

A maximum of 20 applicants can be admitted to the course. Please register for the seminar on KLIPS during the first registration period. After receiving a seat in the seminar, make sure to also register for the examination on KLIPS (select the 'Lehrveranstaltungsprüfung' option for this seminar). Only those who have secured a seat in the seminar are eligible to register for the examination. Therefore, if you decide not to take the seminar, promptly deregister from the course. This allows your peers to enroll for any remaining spots before the exam registration phase ends. Once registered for the examination, your registration is binding. Students who fail to give a presentation or submit their seminar paper on time will receive a failing grade. Therefore, before registering for the course, please ensure that you can meet all requirements within the deadlines and attend the mandatory sessions.

Methodologies and Skills Sessions

Over the course of three sessions, this seminar will offer a comprehensive introduction to cointegration theory and its practical applications. The first two sessions, scheduled on the 16th and 18th of April, will provide an in-depth exploration of cointegration theory and methodologies used in testing for cointegration. On the 19th of April, the seminar will shift to a more interactive format with a hands-on session. In this session, students will apply their newly acquired knowledge by conducting a cointegration analysis on a simple real example using statistical software. Additionally, this part of the seminar will also focus on enhancing presentation and writing skills.

Examination

The final grade consists of an oral and two written examination parts. To pass the examination, students are required to participate in all parts of the examination.

The final grade for this course will be a weighted average of (the quality of):

- A) presentation of overall topic (35% - 10 minutes - individual grade)
- B) individual seminar paper (50% - 4.000 words)
- C) research proposal (15% - <https://energie.uni-koeln.de/sites/energie/user/Lehre/Lehrstuhl/ProposalTry1.pdf>)

Participation in all examination parts and dates is mandatory in order to complete the course successfully.

Examination part A: a presentation (April – June):

This is the oral part of the examination, aimed at providing and receiving a general overview of the various aspects of quantitative analysis concerning the cointegration analysis of energy prices. Students will be assigned a specific topic within the seminar's scope and placed into groups. The Chair in Energy Economics will have sole discretion over topic and group allocations. In June, students are expected to present their topics to their peers and engage in discussions with industry experts. Each presentation should offer a comprehensive overview of the assigned topic, analyze the current state of the literature (including relevant sources and methods), identify compelling research questions, and critically examine potential future developments in the field. Students must effectively structure their topic, divide the presentation components among group members, and ensure that the presentation slides are coherent and consistent. Each student is required to present for 8-10 minutes. Grading will be based on individual performance. For assistance in preparing the presentation, a mentor will be available to help the group.

Examination part B: a seminar paper (June – August):

The aim of this part is for students to become experts in a specific topic within the empirical literature covered in this seminar. Individual seminar topics will be assigned after the group presentations in June. The Chair in Energy Economics holds the sole discretion over topic allocation. Each student will receive a seminar topic different from their presentation topic, enabling them to explore two distinct aspects of the literature. The written paper should be approximately 4,000 words, with a 10% margin above or below this word count. Students are expected to refine their paper's focus by selecting a research question, providing a comprehensive literature overview, and conducting an in-depth critical analysis of their chosen question. Additionally, each student will have access to a mentor for guidance and support in composing their seminar paper.

Examination part C: a research proposal (June – August):

The aim of this part is to submit a research proposal that may serve as a blueprint for your master's thesis. In your proposal, you should clearly define the research question and its motivation, explain who will be interested in this research and why, outline the contribution to existing literature, describe the methods and data to be used, and highlight any potential empirical or methodological challenges. Please use the template provided by the chair to write the proposal:

<https://energie.uni-koeln.de/sites/energie/user/Lehre/Lehrstuhl/ProposalTry1.pdf>

General Requirements

The seminar is designed to prepare students for a master's thesis in the Empirical Analysis of Energy Economics. Participants are expected to independently gain in-depth insights into their topic. Therefore, we expect students to have a solid foundation in Energy Economics and Econometrics (i.e., have taken other courses in the Energy specialization and Econometrics) prior to enrolling in the seminar. Should a student not meet these prerequisites, they are encouraged to contact the seminar organizer to discuss alternative arrangements or preparatory options. A deep knowledge of cointegration theory is not a prerequisite, as the seminar will include two dedicated sessions to introduce and explain this concept to students.

While the seminar topics will be distributed by the chair, students are expected to determine the main focus of their presentations and seminar paper themselves. The emphasis within the own topic as well as the draft structure of the paper, shall be discussed with the mentor at an early stage. Furthermore, students should deal critically with the contributions of other participants. Active participation in the seminar discussion is expected. Attendance during all presentation days is therefore required. We provide a guideline for the preparation of seminar papers. This includes all design requirements. (https://energie.uni-koeln.de/sites/energie/pdf/Guideline_English.pdf)

Further Information

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| Allocated Modules | EM Energy and Climate Change III |
| Credits | 6 |
| Language | English |
| Examiner | Prof. Dr. Marc Oliver Bettzüge |
| Mentor | Markos Farag (mfarag1@uni-koeln.de) |
| Organization | Markos Farag |