"Data, indicators and models of historical and contemporary economic dynamics" Satellite Workshop EUSIPCO 2024

Proposed by: Cliometrics & Complexity (CAC-IXXI)
Institute of Complex Systems, Lyon.

Co-organized by: Cécile Bastidon[1] and Pierre Borgnat[2]

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Date: 30th August, 2024, 2:00 PM - 6:00 PM

General aims of the Satellite Workshop

The Cliometrics & Complexity team of the Complex Systems Institute of Lyon is proposing a Satellite Workshop on the "Data, indicators and models of historical and contemporary economic dynamics", aiming to contribute bridging the gap between Social sciences and Signal processing. In a few words, the Cliometrics and Complexity team brings together researchers from two main fields: i) Physics and applied mathematics and ii) Cliometrics (i.e. quantitative economic history), history and economics. This cross-fertilization enables to apply modeling and data processing methods to Social science issues, on the one hand; and to explore specific applications of graph and signal processing methods, in particular, to fields where they are little used to date, on the other hand.

The Satellite Workshop develops 3 themes corresponding to broad fields of application of complexity economics methods, including the design of indicators of volatility, systemic risk and crises; the use of multivariate segmentation and multivariate regimes modelling for the identification of economic cycles; and specific machine learning methods for historical and spatial socio-economic data. For each theme, 3 papers present different disciplinary perspectives.

Program overview

2:00-3:15. Spatial, nonlinear and non parametric methods in support of public decision-making in health and environment issues.

- "Is the U.S. Natural Gas Market Integrated or Segmented? A Dynamic Study of Regional Natural Gas Prices". Hayette Gatfaoui (IESEG School of Management, Univ. Lille, France).
- "Unravelling the dynamics of wealth inequality and the impact on social mobility and health disparities". Caterina AM Laporta (Dep. of Environmental Science and Policy, Univ. Milano, Italy) & Stefano Zaperi (Center for Complexity and Biosystems, Department of Physics, Univ. Milano, Italy)
- "Toward a Non-linear Green Taylor Rule". Fredj Jawadi (LUMEN, Univ. Lille, France), Philippe Rozin (Univ., France) & Abdoulkarim Idi Cheffou (ISG International Business School, Paris, France).

3:15-4:30. Modelling and segmentation of volatility, risk and crises indicators.

- "Jump-Robust Realized-GARCH-MIDAS-X Estimators for Bitcoin and Ethereum Volatility Indices". Julien Chevallier, Bilel Sanhaji (LED, Univ. Paris 8, France).
- "Learning smooth graphs with sparse temporal variations to explore long-term financial trends". Cécile Bastidon (LEAD, Univ. Toulon & CAC-IXXI, Lyon), Myriam Bontounou (ENS de Lyon, Univ. Lyon, France), Pierre Borgnat, Pablo Jensen, Patrice Abry (CNRS, Laboratoire de Physique, ENS de Lyon, Univ. Lyon, France) & Antoine Parent (LED, Univ. Paris 8, OFCE & CAC-IXXI, Lyon, France).
- Systemic risk: from network theory to machine learning. Paolo Barucca (Department of Computer Science, UCL, London, UK).

4:30-4:45. Tea/cofee break.

4:45-6:00. Methodological challenges of spatial data and extended temporal data.

- "Application of information technology of multi-level monitoring in cliometric studies". Nataliia Khymytsia (Lviv Polytechnic National University, Lviv, Ukraine) & Serhii Holub (Cherkasy State Technological University, Cherkasy, Ukraine).
- "Spatial noise in panel regressions." Giovanni Millo (DEAMS, Univ. Trieste, Italy).
- "Complexity economics. A critical assessment of the Santa Fe Institute's perspective". Fabrizio Li Vigni (Centre Internet et Société, CNRS, Paris, France).

2.00-3.15
#1. Spatial, nonlinear and non parametric methods in support of public decision-making in health and environment issues

2:00
Is the U.S. Natural Gas Market Integrated or Segmented? A Dynamic Study of Regional Natural Gas Prices.

Hayette Gatfaoui (IESEG School of Management, Univ. Lille, CNRS, UMR 9221 – LEM),

Abstract. We investigate the potential convergence of natural gas prices at one hub and several city gates in the United States. First, we estimate the fundamental natural gas price component. Second, we gauge if U.S. regional natural gas prices follow the law of one price. Our findings confirm the difference between West and East natural gas prices, but also highlight discrepancies between West and other regional natural gas prices. Third, we measure the distance between the fundamental gas price component and both Henry hub and city gate prices. The proximity/remoteness of regional gas prices with the fundamental gas price component supports market integration/segmentation. We show that the U.S. natural gas market shifts towards a more integrated structure after August 2004. Such shift results from the delayed impact of recent FERC reforms and the development of interstate pipelines. However, intrastate pipeline-deficient regions require an enforced development and improvement of natural gas infrastructures.

Keywords: Distance measure, Fundamental gas price, Market integration, Market segmentation, Natural gas, Unobserved component model.

2:25
Unravelling the dynamics of wealth inequality and the impact on social mobility and health disparities

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Caterina AM Laporta (Dep. of Environmental Science and Policy (ESP), University of Milan, Via Celoria 2, 20133, Milano, Italy), **Stefano Zaperi** (Center for Complexity and Biosystems, Department of Physics, University of Milan, via Celoria 16, 20133 Milano, and Consiglio Nazionale delle Ricerche, Istituto di Chimica della Materia Condensata e di Tecnologie per l'Energia, Via R. Cozzi 53, 20125 Milano, Italy)

Abstract. Inequalities in wealth, income, access to food and healthcare have been rising worldwide in the past decades, approaching levels seen in the early 20th century. Here we study the relationships between wealth inequality and mobility for different segments of the population, comparing longitudinal surveys conducted in the USA and in Italy. The larger wealth inequality observed in the USA is reflected by poorer health conditions than in Italy. We also find that in both countries wealth mobility becomes slower at the two extremes of the wealth distribution. Households trapped in a state of persistent lack of wealth are generally experiencing greater food insecurity and poorer health than the general population. We interpret the observed association between inequality and immobility using a simple agent based model of wealth condensation driven by random returns and exchanges. The model describes well survey data on a qualitative level, but the mobility is generally overestimated by the model. We trace back this discrepancy to the way income is generated for low-wealth households which not correctly accounted by the model. On the other hand, the model is excellent in describing the wealth dynamics within a restricted class of ultra-wealthy, as we demonstrate by analyzing billionaires lists. Our results suggest that different forms of inequality are intertwined and should therefore be addressed together.

Keywords. Wealth inequality, Health disparities, Social mobility.

2:50
Toward a Non-linear Green Taylor Rule.

Fredj Jawadi (University of Lille, ULR 4999 - LUMEN, F-59000 Lille, France), **Philippe Rozin** (University of Lille, ULR 4999 - LUMEN, F-59000 Lille, France), **Abdoulkarim Idi Cheffou** (ISG International Business School, Paris, France).

Abstract. This study explores the greening of the monetary policy from January 2000 to August 2023. We discuss the challenges inherent in the central bank's pursuit of an alternative monetary policy to deal with its main mission of price stability while also taking climate change into account, and propose an augmented green Taylor rule. In particular, we reconsider the Taylor rule model while allowing the central banm to conduct its monetary policy, taking both physical and transition risks into account. To our knowledge, this is the first study on the sensitivity of monetary instruments and monetary policy with respect to physical and transition risks. Our analysis yields two interesting findings. First, greening monetary policy appears feasible, as taking the climate risk factors into account in formulating the policy is not out of step with the main price stability mandate and could yield a climate risk premium. Accordingly, the climate risk measure related to transition and physical risk drives the central bank's rate, and an augmented green Taylor rule would fit the data better than the basic Taylor rule. Second, we find that the central bank's reaction to news related to transition and physical risks in particular and climate risk in general has been more pronounced since the post COVID-19 subperiod than over the period as a whole.

Keywords: New central banking, Interest rate, Augmented green Taylor rule, Physical risk, Transition risk, In-sample forecast.

3:15-4:30
#2. Modeling and segmentation of volatility, risk and crises indicators

3:15
Jump-Robust Realized-GARCH-MIDAS-X Estimators for Bitcoin and Ethereum Volatility Indices.

Julien Chevallier, **Bilel Sanhaji** (Economics Department, Université Paris 8 (LED), 2 rue de la Liberté, 93526 Saint-Denis, France)

Abstract. In this paper, we conducted an empirical investigation of the realized volatility of cryptocurrencies using an econometric approach. This work's two main characteristics are: (i) the realized volatility to be forecast filters jumps, and (ii) the benefit of using various historical/implied volatility indices from brokers as exogenous variables was explicitly considered. We feature a jump-robust extension of the REGARCH-MIDAS-X model incorporating realized beta GARCH processes and MIDAS filters with monthly, daily, and hourly components. First, we estimated six jump-robust estimators of realized volatility for Bitcoin and Ethereum that were retained as the dependent variable. Second, we inserted ten Bitcoin and Ethereum volatility indices gathered from various exchanges as an exogenous variable, each at a time. Third, we explored their forecasting ability based on the MSE and QLIKE statistics. Our sample spanned the period from May 2018 to January 2023. The main result featured the best predictors among the volatility indices for Bitcoin and Ethereum derived from 30-day implied volatility. The significance of the findings could mostly be attributable to the ability of our new model to incorporate financial and technological variables directly into the specification of the Bitcoin and Ethereum volatility dynamics.

Keywords. Realized volatility, jumps, Bitcoin, Ethereum, REGARCH-MIDAS-X, forecasting.

3.40
Learning smooth graphs with sparse temporal variations to explore long-term financial trends.

Cécile Bastidon (LEAD, Université de Toulon & CAC-IXXI, Institute of Complex Systems, Lyon, France), **Myriam Bontounou** (ENS de Lyon, Univ. Lyon, France), **Pierre Borgnat** (CNRS, Laboratoire de Physique, ENS de Lyon, Univ. Lyon, France), **Pablo Jensen** (CNRS, Laboratoire de Physique, ENS de Lyon, Univ. Lyon, France), **Patrice Abry** (CNRS, Laboratoire de Physique, ENS de Lyon, Univ. Lyon, France), **Antoine Parent** (LED, Univ. Paris 8, Saint-Denis & OFCE, Paris & CAC-IXXI, Institute of Complex Systems, Lyon, France).

Abstract. The return of inflation raises the issues of assessing cross-dependencies in long-term government bonds interest rates. Learning cross-dependencies directly from data is framed as a graph learning problem that requires to address the issues of bond rates temporal nonstationary evolutions, with sharp changes along time and across countries, as well as of managing missing samples. As a first contribution, the present work devises a data driven time-dependent graphs for bonds markets, specifically based on risk premia. As a second contribution, it shows the relevance of such constructions when applied to a broad database of 29 countries over 6 decades (1960-2020) including the high inflation episode of the 1970s.

Keywords. Financial networks, dynamic graphs, smoothness-based graph learning, long-term interest rates, financial crises, contagion, system risk.

4:05
Systemic risk: from network theory to machine learning.

Paolo Barucca (Department of Computer Science, University College London, London, UK).

Abstract. Systemic risk is recognised as a crucial risk component in financial markets which both regulators and market players are interested in quantifying. The number of financial transactions happening every second is ever-increasing, occurring on a variety of marketplaces, performed by different market players, and related to more and more interdependent complex instruments. Ensuring financial stability and monitoring systemic risk require making sense of multiple data structures and data sources, describing our societies and economies, not only our markets. Stochastic modeling remains a fundamental benchmark, but complex market behaviours require data-driven modeling hardly captured by standard theory. Network theory is a powerful framework for modeling dynamic multi-layered relationships between financial institutions and for training non-linear multivariate models -including machine learning ones- needed to capture the complex interdependencies of financial variables and to provide timely and informative indicators about the financial system.

References.

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4:30-4:45
Tea/cofee break

4.45-6.00
#3. Methodological challenges of spatial data and extended temporal data.

4:45
Application of information technology of multi-level monitoring in cliometric studies.

Nataliia Khymytsia (Lviv Polytechnic National University, S. Bandera street,12, Lviv, Ukraine.), **Serhii Holub** (Cherkasy State Technological University, Shevchenko Boulevard 460, 18006 Cherkasy, Ukraine.).

Abstract. The results of the application of the technology of multilevel intellectual monitoring for solving one of the tasks of Cliometrics were presented. The method of determining the similarity of historical periods was investigated. Historical periods were determined similarly in the case when their vectors of attributes were assigned to one cluster. Common features of those periods of the history of Ukraine, the vectors of signs of which have been combined into one cluster were analyzed by experts. The new method of clustering based on modeling results was used. The processes of the formation of the input data array and the determination of the influence of the features are described. The expediency of using a new method for determining the similarity of historical periods has been experimentally confirmed.

Keywords. information technology; monitoring; clustering; cliometrics; historical research; historical sources; historical informatics.

5:10
Spatial noise in panel regressions.

Giovanni Millo, DEAMS, Università di Trieste, Italy).

Abstract. Following the recent contribution of Kelly, we address the bias in estimated standard errors arising from variables sharing a common spatial structure. To illustrate the issue, we fit independently-generated, stationary but spatially correlated variables ("spatial noise") in a panel data regression, showing false positive rates of up to 50Spatial econometric models, in particular the spatial error model (SEM), solve the problem by modelling the spatial dependence. The "true" spatial data generating process, nevertheless, is rarely known. Panel data allow for a number of robust estimation techniques to alleviate the issue without assuming a known pattern for the spatial dependence. We assess how far these tools can go in controlling the empirical size of the significance test. We also evaluate the empirical performance of parametric solutions to the problem, including estimating spatial econometric models with a misspecified spatial weights matrix. We illustrate and employ open source tools from the R Project.

References.

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Keywords. Spatial dependence, Panel data, Spurious significance, Robust covariances, Spatial regression.

5:35
Complexity economics. A critical assessment of the Santa Fe Institute's perspective.

Fabrizio Li Vigni (Centre Internet et Société (UPR 2000), CNRS, Paris, France).

Abstract. 'Complexity economics,' as formulated and introduced by the Santa Fe Institute in the 1990s, refers to an interdisciplinary approach to economic analysis that self-represents as heterodox. Its specificity is that it treats economies as complex adaptive systems, focusing on micro-interactions, feedback loops, and non-linear dynamics and integrating insights from fields such as physics, biology, computer science, and quantitative social sciences. However, rather than supporting a progressive departure from neoliberalism as they may say, complexity economists tend to sustain it with some modifications. In this paper I assert four key points. Firstly, I contend that while critiquing and suggesting an alternative to neoclassical economics may be considered heterodox in the realm of scientific economics, it is not necessarily so within political economy. Secondly, complexity economists employ a positivistic approach that draws from natural, engineering, and bio-inspired social sciences, not in order to transcend neoliberal capitalism, but rather to naturalize it. Thirdly, their sometimes stated goal of surpassing the current economic order lacks a progressive agenda, and their normative proposals seemingly seek instead to assimilate and defuse criticism. The conclusion shows that not all complexity economists endorse neoliberalism, since there exist Veblenian and Marxist scholars within the field that I briefly describe for reasons of pluralism and nuance.