# Computational Social Science for First-Year Research Immersion Students

Binghamton University Interview

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## Introduction: my Research

- **Topics**
  - Ecological Macroeconomics
  - Structural Change and Socio-Economic Development
- **Methods**
  - Dynamical Systems
  - Input-Output Analysis
  - Machine Learning
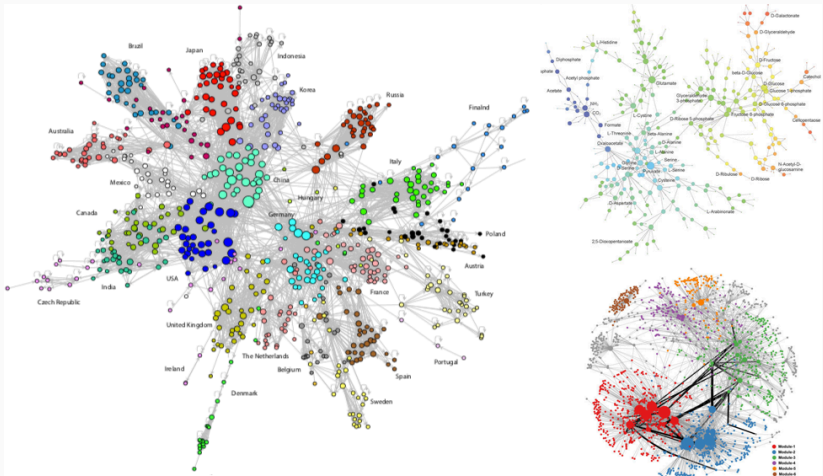- **Language**
  - open-source R

**Figure 1:** Networks: economic, protein, genetic

## Research Projects

- computing carbon footprints
- ecological impacts of economic activities
- analysis, visualization of networks of intermediate production and trade
- analysis of ecological and labor flows
- supply chain bottle-necks
- life cycle assessment of economic production
- citation networks, literature reviews
- financial stability, banking networks

## Licensing Datasets

- Many are open-source (EXIOBASE, WIOD, ICIO, TiVA, USEEIO)
- Others are not:
    - GTAP
    - UN COMTRADE
    - full EORA
    - environmental World Input-Output Database
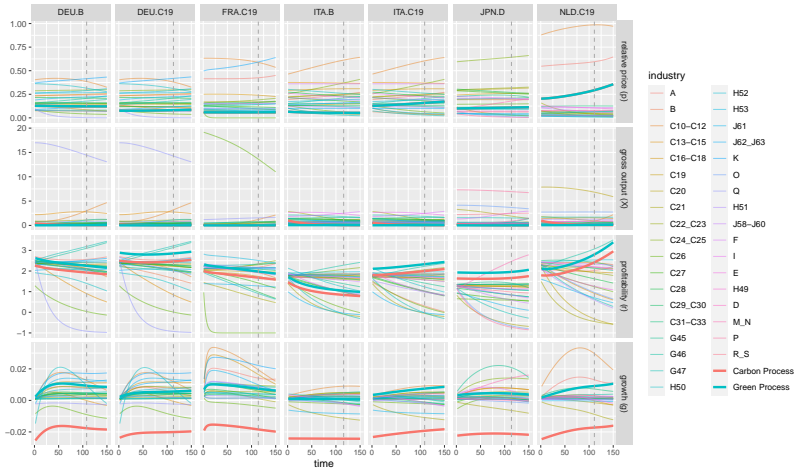    - LCA datasets

# Data-Driven Dynamical Systems



**Figure 2:** State-driven decarbonization of five carbon-intensive industries

## Research Projects

| Lotka-Volterra | Prey | Predator |
| --- | --- | --- |
| Goodwin | Workers/Wages | Employers/Employment |
| Flaschel-Semmler | Profits/Prices | Investment/Quantities |

- Ricardian **logistic growth** under limited natural resources
- **replicator equation** in autocatalytic networks
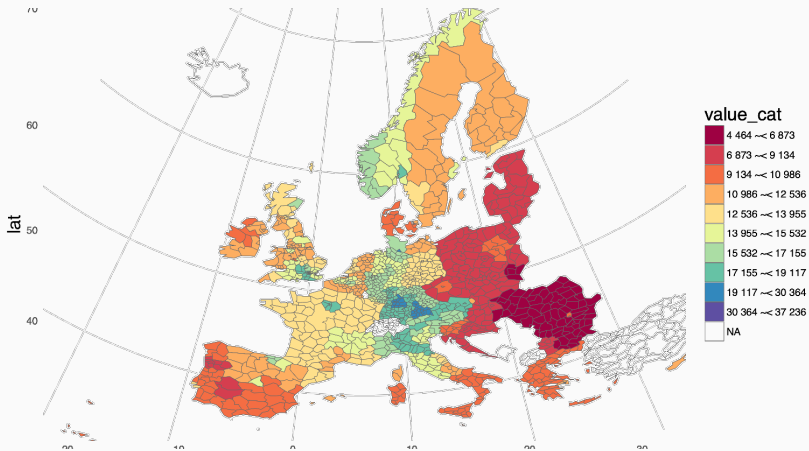- **agent-based simulations** Conway's game, cellular automata, Schelling's segregation model
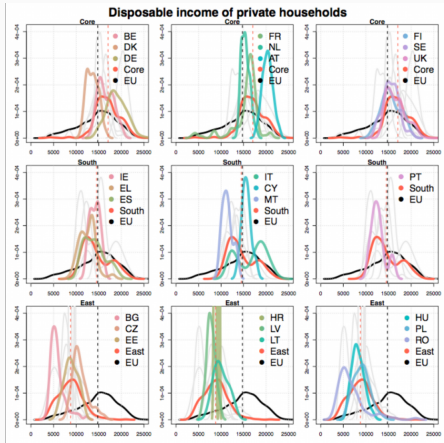
**Figure 3:** Three European macro-regions

**Figure 4:** Three European macro-regions

## Statistical Research Projects

- principal component analysis, hierarchical clustering to detect macro-regions
- patterns in social and economic well-being: clusters, correlations in demographic and social statistics like US Census Bureau, CDC, or Eurostat
- singular value decomposition to categorize input-output networks
- environmental impact on economic activity using hierarchical linear regression
- how does air pollution affect economic productivity?
- spatial analysis: mapping police violence vs crime datasets; socio-economic factors
- impact on health, inequality by economic activity

## Statistical Research Projects

- economic mobility analysis with census data
- predicting housing prices
- climate change impact on agricultural yields
- text mining: sentiment analysis of political and financial news
- relationship between deportations and inflation

## Thank You!

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