Econometrics and Data Science

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Topic: **Lessons Learned in Data Science**

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VU VRIJE UNIVERSITEIT AMSTERDAM

aceda

Lessons Learned in Data Science: Elsewhere

8 september 2021

Outline

1 Introduction

2 The Case

3 Mixed, Messy and Noisy Data

4 Econometric Modelling: Causality

5 Conclusion

Econometrics and Data Science: EDS - Department at VU-SBE ACEDA - Data Science Services

EDS Department

- **EDS** stands for

  Department of Econometrics and Data Science
  School of Business and Economics, VU Amsterdam

- **EDS** consists of 30+ fte
  - 15 fte research staff (senior, junior, tenure-track)
  - 3 fte part-time research
  - 3 fte post-docs (external funding)
  - 9 PhD students

ACEDA: Data Science Services

- **Data Science**:
  - Multivariate Statistical Methods
  - Network structures
  - Classification
  - Regression
  - Unsupervised Statistical Learning (k-means, principal components)
  - Random Forests

- **Econometrics**
  - Time Series and Dynamic Econometrics
  - Prediction and Forecasting
  - Causal Structural Modelling
  - Mixed-Frequency, Messy and Noisy Data

Marketing: Correlation and Causality

ACEDA: The Case

- **Marketing Consultancy**:
  - Large Companies, Huge Data Sets
  - Huge Number of Products
  - Many Divisions (and Bosses!)
  - Organized along Different Lines
  - Countries, Products, Channels
  - History of Mergers
  - Communication is Surprisingly Poor

- **Doing Data Science**
  - Challenge in Getting the Data
  - Much Data is Hidden in Systems and Locked
  - Promises Promises in Unlocking
  - Noisy Data with Many Messy Features

Mixed, Messy and Noisy Data

Signal and Noise

Key challenge: from noisy indicators towards SIGNAL EXTRACTION

We focus on **SIGNAL EXTRACTION**:

- Building predictive models from data with
- different frequencies, different features, missing entries, outliers, etc.
- Using Data-Driven frameworks:

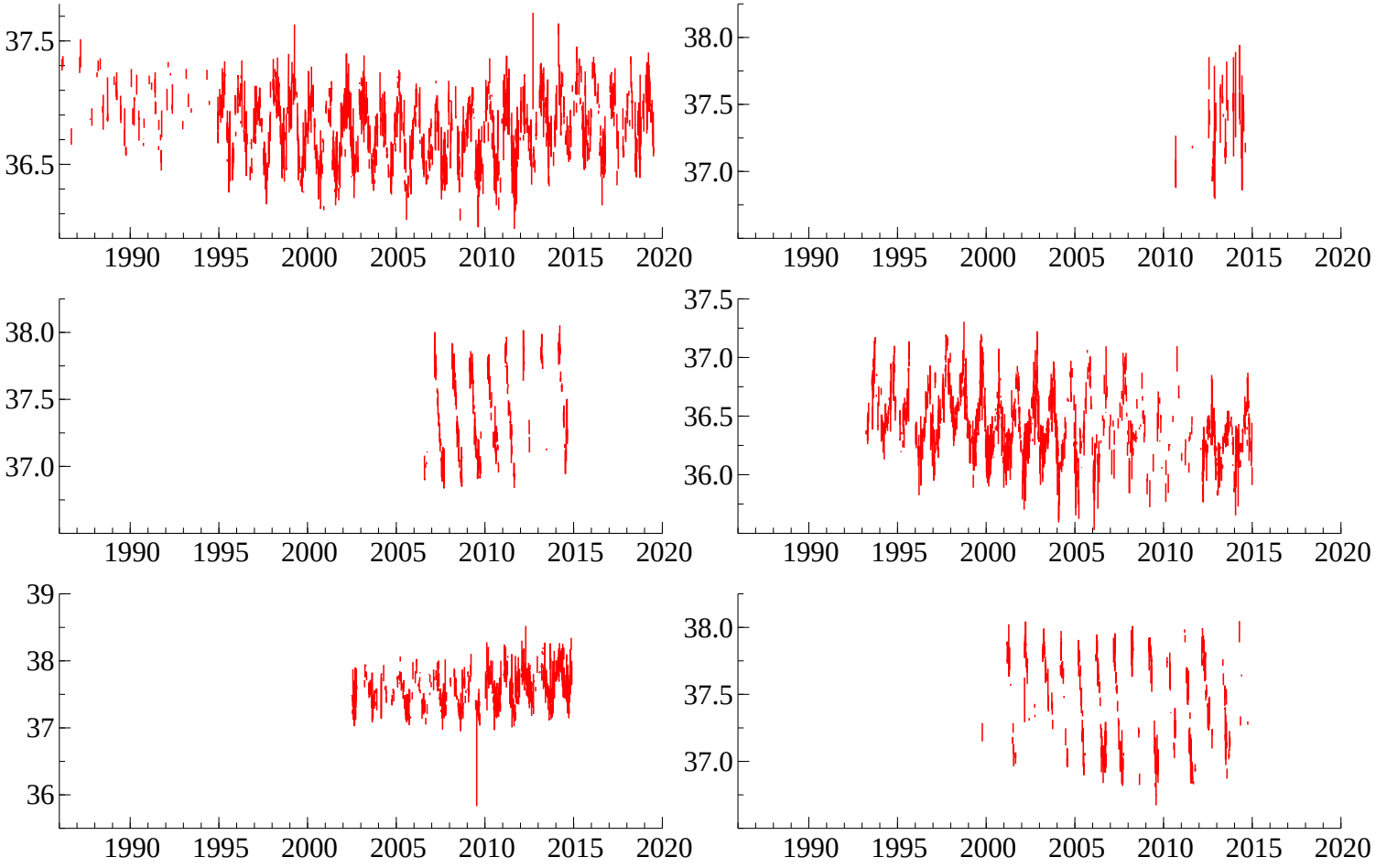
$$y_{it} \sim p_i(y_{it}|\mathcal{F}_{t-1}, \theta_t; \psi), \qquad \theta_t = Z_t \alpha_t$$

- with data y_{it}, model / distribution $p(y_{it}; \cdot)$, past data $\mathcal{F}_{t-1}$, signal θ_t, fixed parameter vector ψ and time-varying parameter vector α_t with dynamic updating

$$\alpha_{t+1} = \omega + \beta \alpha_t + \delta \nabla_t$$

where ∇_t is the innovation (score function) and ω, β, δ are coefficients.

Noisy Data Features



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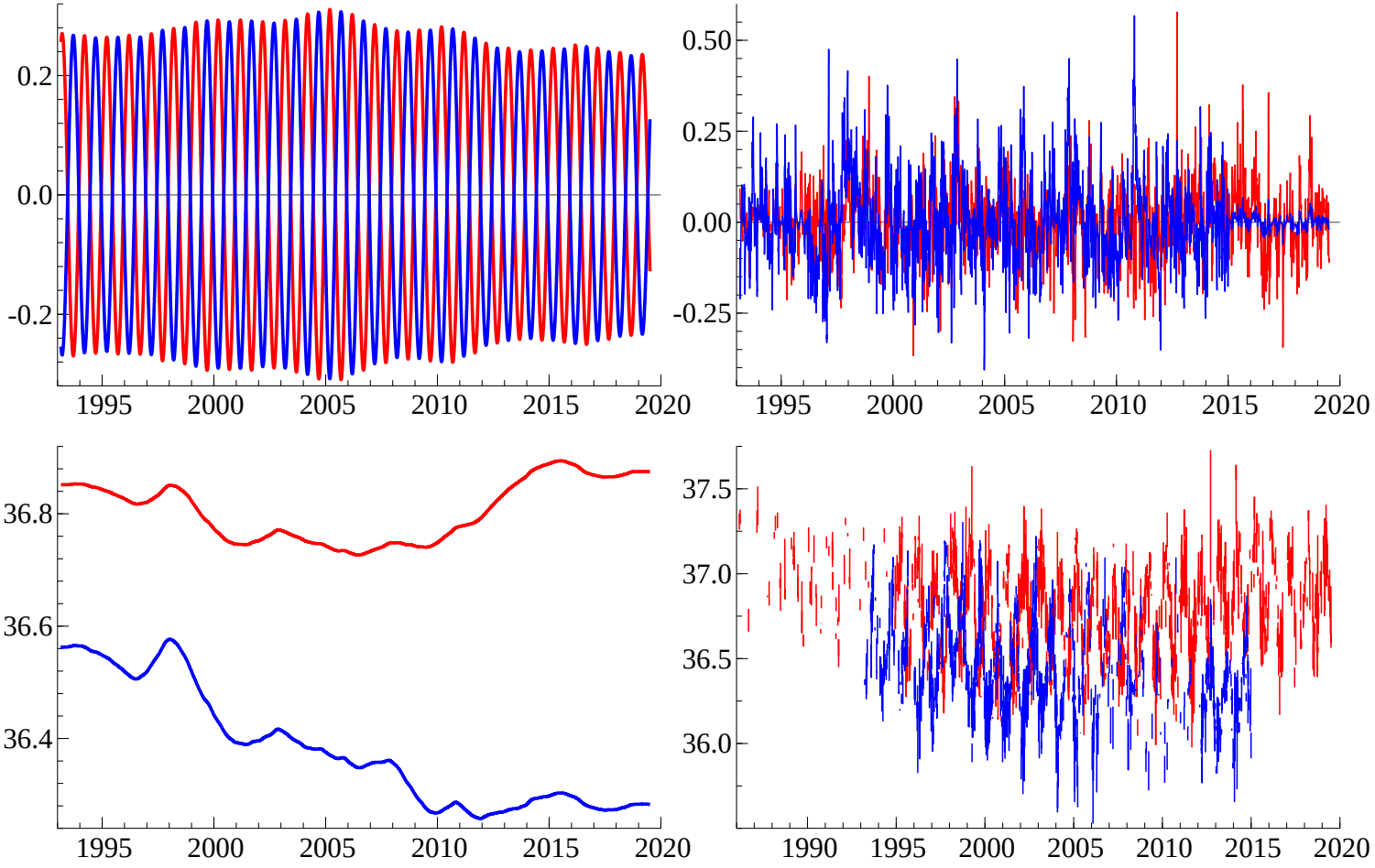
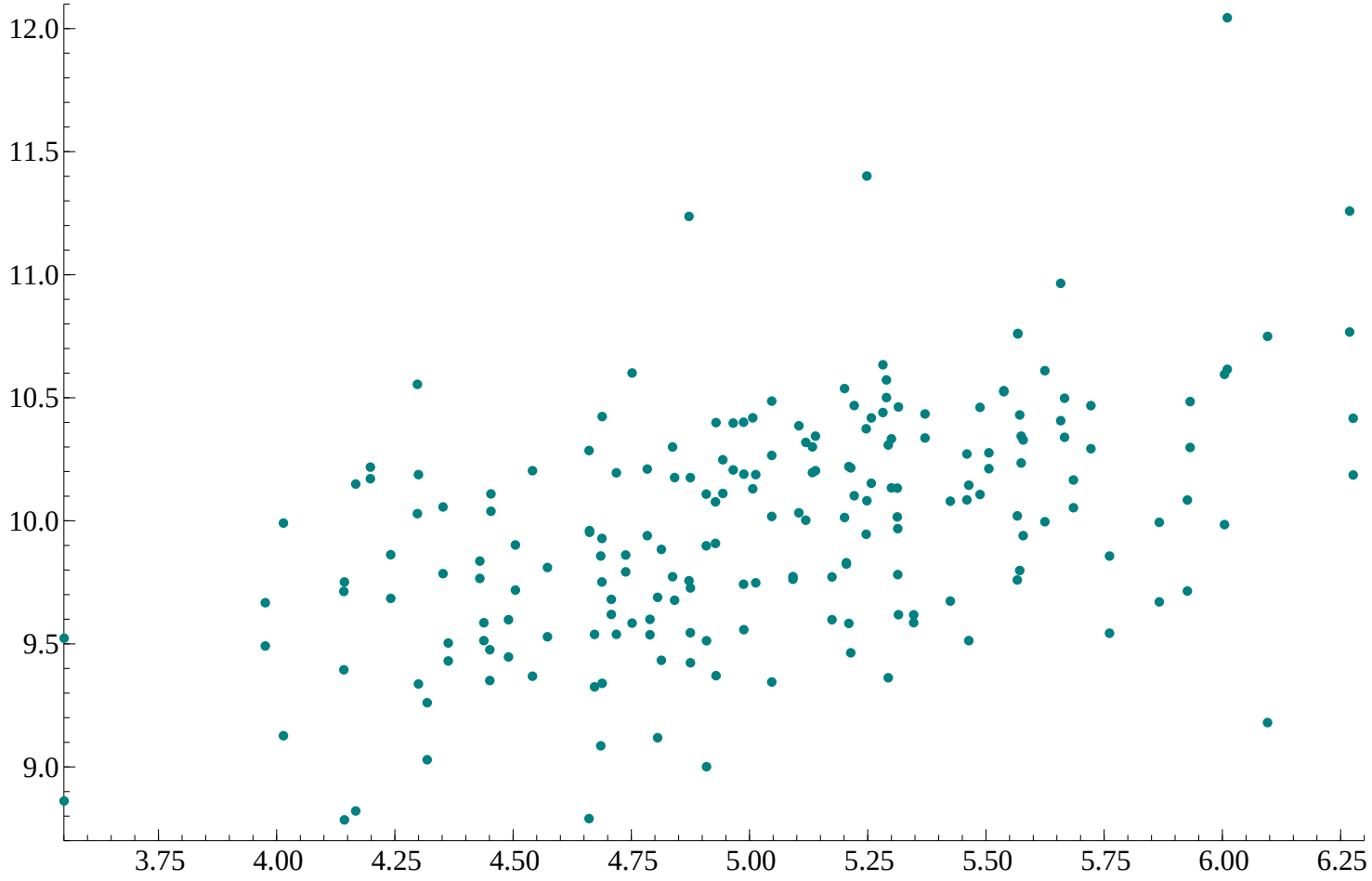


Econometric Causal Modeling

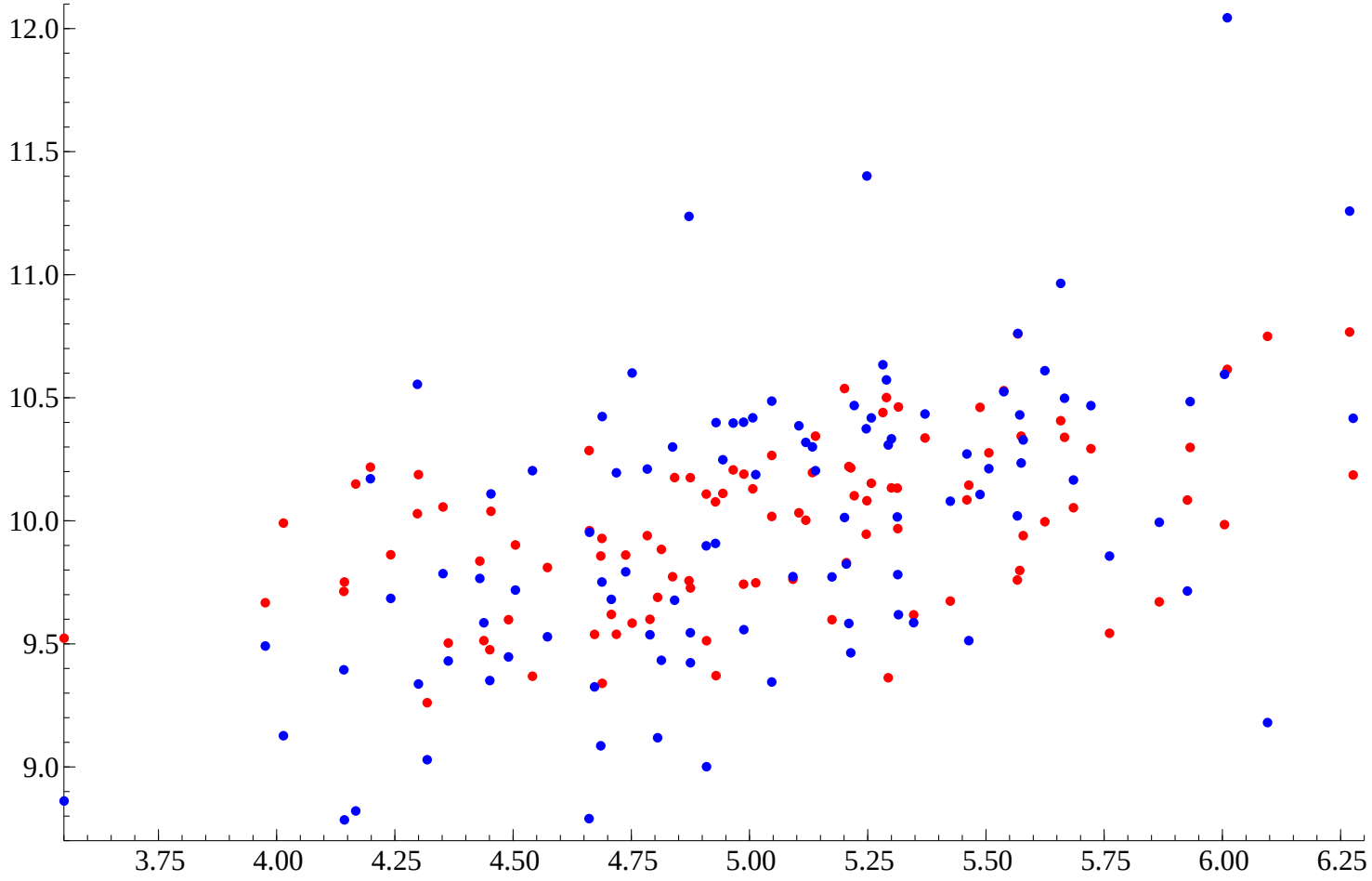
Econometrics and Causality

- Data Science Methods are highly effective in Data Exploration, Visualisation, Correlations
- Correlation versus Causality: structural econometric models
- Classic example is sales/consumption versus price/inflation

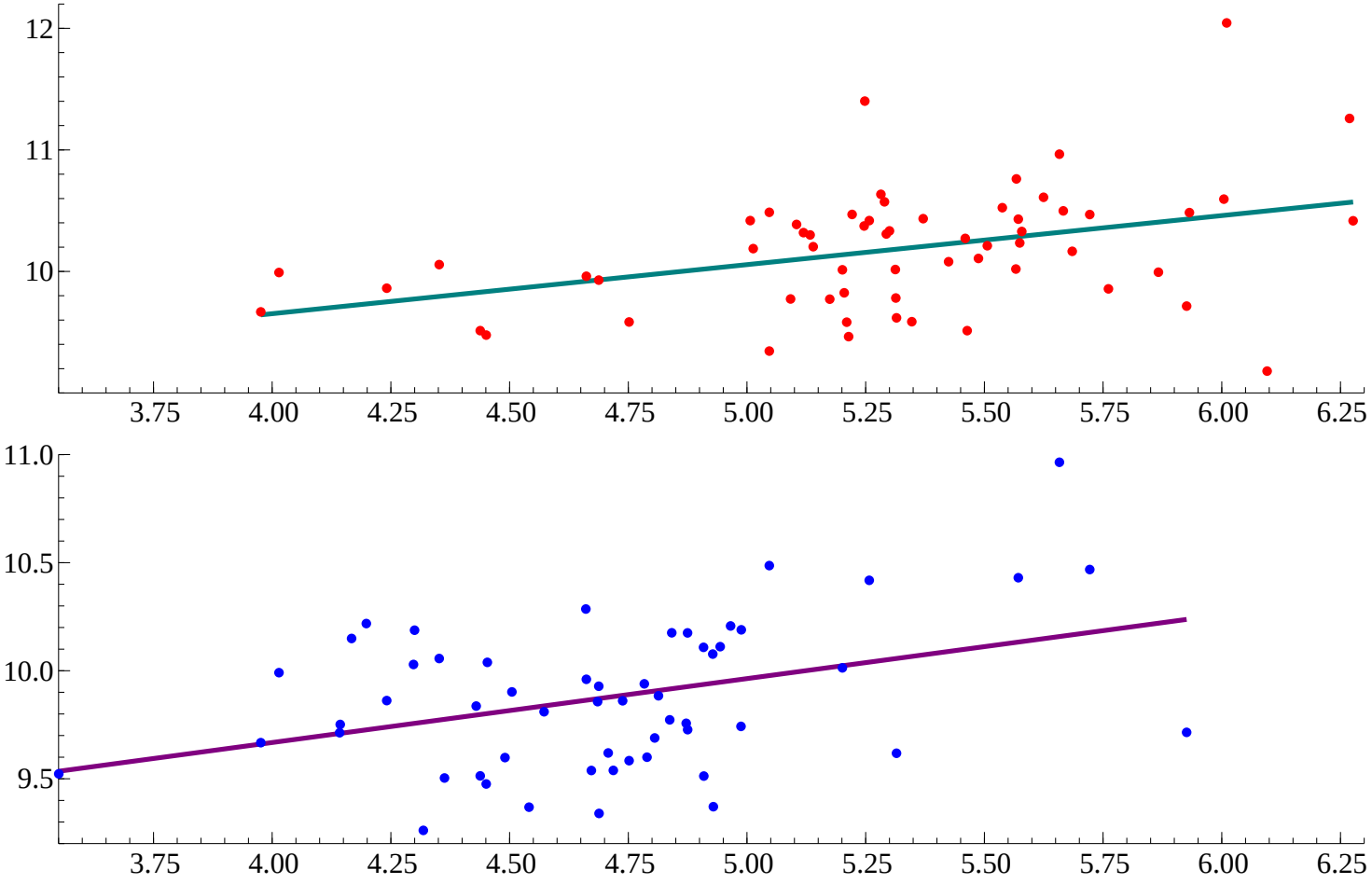
Sales and Discounts



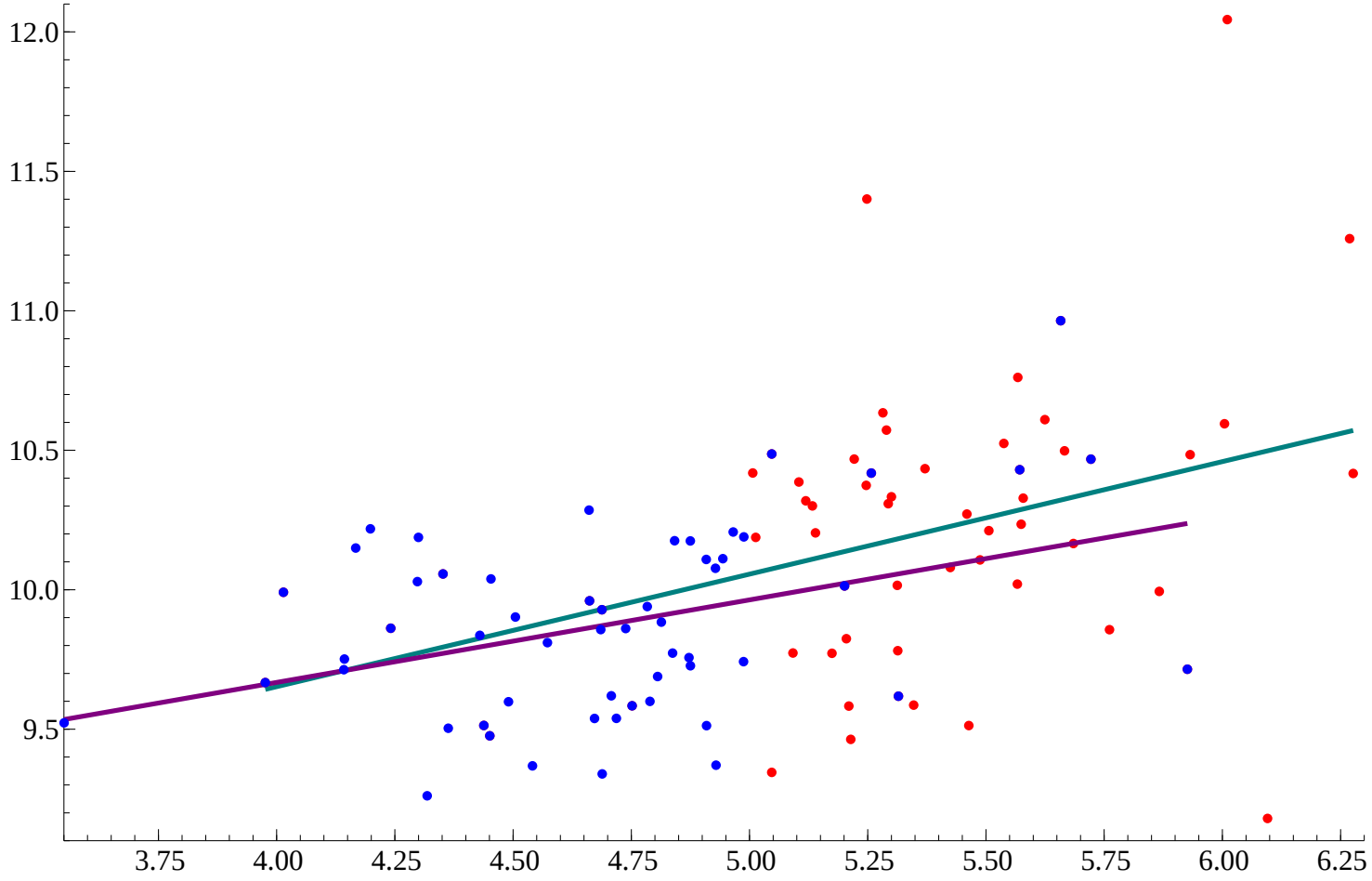
Sales and Discounts: from TWO Divisions



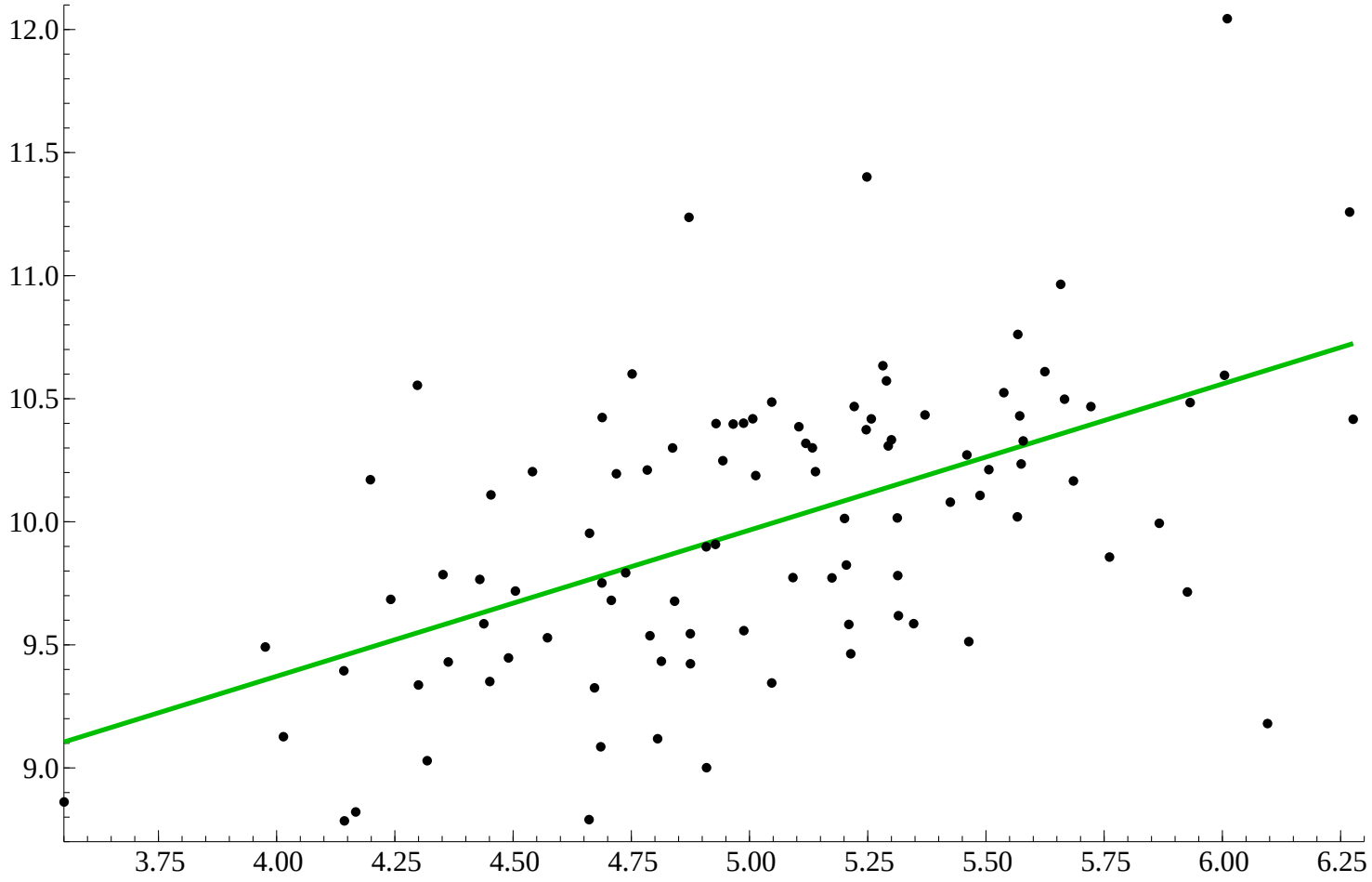
Separate Analysis



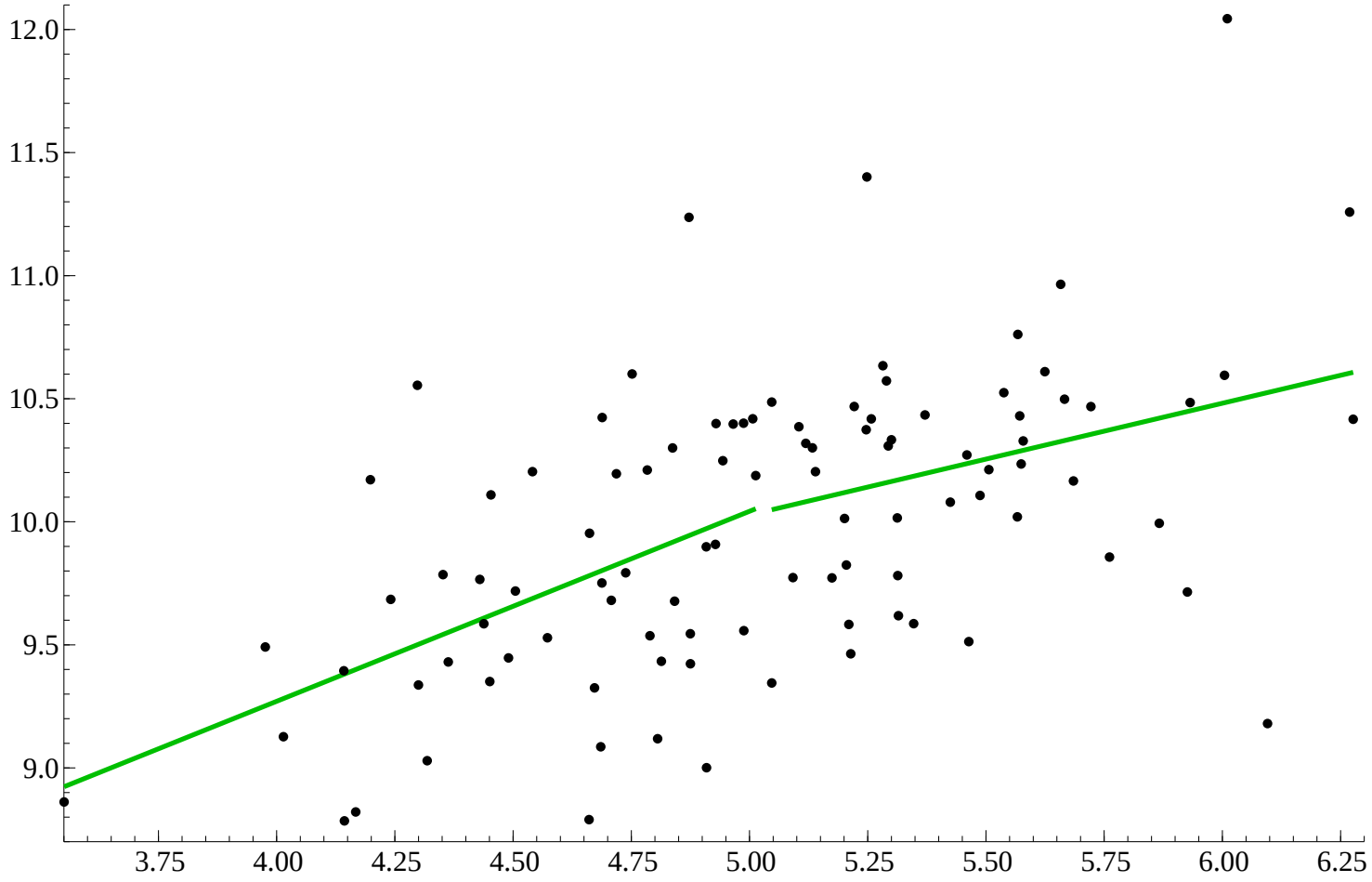
Separate Analysis



Joint Analysis



Joint Analysis



Econometric Analysis

- First: Separate Analyses are Done for the TWO Divisions
- Second: Simultaneous Analyses are Done
- Results are Different
- Relevant Fit Improvements and Policy Ramifications

Conclusion

- EDS and ACEDA
- Broad scope on Econometrics and Data Science Methods
- Structural view on Data Analysis, Modelling and Prediction