Volkswirtschaftliches Seminar (MW86/MQV10)

Summer Term 2025

Prof. Dr. Jannis Kück

Machine Learning in Applied Microeconomics

Content: In the most recent past, a rapidly growing literature is tackling the problem of using machine learning (ML) methods for causal inference to answer policy relevant questions in different fields of economic research. This literature takes many of the strengths and innovations of ML methods and, thus, can help to overcome issue from traditional causal inference methods by, e.g., improving covariance balancing or reducing the omitted variable bias. In this seminar, we will discuss selected empirical studies on applied machine learning in different economic research fields. We will focus on how ML methods are used in state-of-the-art research to improve both the estimation of treatment effects and the prediction of outcomes in the areas of industrial organization, competition policy, labor economics as well as public and environmental economics.

Organization: At the beginning of the semester, each student will choose one of the academic papers listed on the next page. Suggestions for alternative papers that are related to the topic of the seminar are welcome. This paper should serve as a starting point for the student's term paper. Of course, it is expected that students cite and evaluate additional literature for their term papers. At the end of the semester, every student is supposed to present this term paper during a block seminar.

Target group: M.Sc. VWL / M.Sc. BWL / M.Sc. Economics

Prerequisite: Basic knowledge in statistics

Maximum number of students: 15

Examination: Term paper 10-12 pages, presentation and discussion

Language: English, German

Dates:

- Kick-off: 14 April (9-10 a.m., seminar room 5 at Oeconomicum)
- Submission deadline for term papers: 6 July
- Presentations (block seminar): 11 July

Main Reading

- Huber, M. (2023). *Causal analysis: Impact evaluation and Causal Machine Learning with applications in R.* MIT Press.
- Athey, S. (2018). The impact of machine learning on economics. *The economics of artificial intelligence: An agenda*, 507-547.
- Hastie, T., Tibshirani, R., & Friedman, J. (2017). *The elements of statistical learning: data mining, inference, and prediction.*

Topics for Seminar Papers

1. **Industrial Organization**

   1.1. **Demand Estimation**

   - Bajari, P., Nekipelov, D., Ryan, S. P., & Yang, M. (2015). Machine learning methods for demand estimation. *American Economic Review*, 105(5), 481-485.
   - Adam, H., He, P., & Zheng, F. (2024). Machine learning for demand estimation in long tail markets. *Management Science*, 70(8), 5040-5065.
   - Zhao, S., Lai, Y., Ye, C., & Lee, K. (2024). Machine learning applications in household-level demand prediction. *Applied Economics Letters*, 31(1), 5-11.

   1.2. **Digital Markets**

   - Decarolis, F., & Rovigatti, G. (2021). From mad men to maths men: Concentration and buyer power in online advertising. *American Economic Review*, 111(10), 3299-3327.
   - Athey, S., Blei, D., Donnelly, R., Ruiz, F., & Schmidt, T. (2018, May). Estimating heterogeneous consumer preferences for restaurants and travel time using mobile location data. *AEA Papers and Proceedings*, 108, 64-67.

2. **Competition Policy**

   2.1. **Machine Learning Methods**

   - Rodríguez, M. J. G., Rodríguez-Montequín, V., Ballesteros-Pérez, P., Love, P. E., & Signor, R. (2022). Collusion detection in public procurement auctions with machine learning algorithms. Automation in Construction, 133, 104047.
   - Tas, B. K. O. (2024). A machine learning approach to detect collusion in public procurement with limited information. Journal of Computational Social Science, 1-23.
   - Silveira, D., Vasconcelos, S., Resende, M., & Cajueiro, D. O. (2022). Won't get fooled again: A supervised machine learning approach for screening gasoline cartels. Energy Economics, 105, 105711.
   - Huber, M., & Imhof, D. (2019). Machine learning with screens for detecting bid-rigging cartels. International Journal of Industrial Organization, 65, 277-301.

- Wallimann, H., Emmenegger, S., Pouly, M., & Wegelin, P. (2025). Where is the Limit? Assessing the Potential of Algorithm-Based Cartel Detection. Journal of Competition Law & Economics, nhae023.

2.2. **Deep Learning Methods**

- Huber, M., & Imhof, D. (2023). Flagging cartel participants with deep learning based on convolutional neural networks. International Journal of Industrial Organization, 89, 102946.
- Gomes, L., Kueck, J., Mattes, M., Spindler, M., & Zaytsev, A. (2024). Collusion Detection with Graph Neural Networks. arXiv preprint arXiv:2410.07091.

2.3. **Other Competition Policy Topics**

- Bernhardt, L., & Dewenter, R. (2022). The impact of the more economic approach on EU merger decisions (No. 195). Discussion Paper.
- März, O. (2022). Estimating cartel damages using machine learning. European Competition Journal, 18(2), 406-423.

3. **Labor Economics**

- Knaus, M. C., Lechner, M., & Strittmatter, A. (2022). Heterogeneous employment effects of job search programs: A machine learning approach. Journal of Human Resources, 57(2), 597-636.
- Cockx, B., Lechner, M., & Bollens, J. (2023). Priority to unemployed immigrants? A causal machine learning evaluation of training in Belgium. Labour Economics, 80, 102306.
- Lechner, M. (2018). Modified causal forests for estimating heterogeneous causal effects. arXiv preprint arXiv:1812.09487.
- Bach, P., Chernozhukov, V., & Spindler, M. (2024). Heterogeneity in the US gender wage gap. Journal of the Royal Statistical Society Series A: Statistics in Society, 187(1), 209-230.

4. **Public Economics**

- Gavrilova, E., Langørgen, A., & Zoutman, F. (2023). Dynamic causal forests, with an application to payroll tax incidence in norway.

- Kleinberg, J., Ludwig, J., Mullainathan, S., & Obermeyer, Z. (2015). Prediction policy problems. American Economic Review, 105(5), 491-495.

5. **Environmental Economics**

- Miller, S. (2020). Causal forest estimation of heterogeneous and time-varying environmental policy effects. Journal of Environmental Economics and Management, 103, 102337.
- Ho, J. (2016). Machine learning for causal inference: An application to air quality impacts on house prices. arXiv: 1808.02547 v1.
- Deryugina, T., Heutel, G., Miller, N. H., Molitor, D., & Reif, J. (2019). The mortality and medical costs of air pollution: Evidence from changes in wind direction. American Economic Review, 109(12), 4178-4219.
- Koch, N., Ritter, N., Rohlf, A., & Thies, B. (2023). Machine learning from big gps data about the heterogeneous costs of congestion. Available at SSRN 4526796.

6. **Causal Machine Learning Methods**

- Athey, S. (2018). The impact of machine learning on economics. The economics of artificial intelligence: An agenda, 507-547.
- Chernozhukov, V., Chetverikov, D., Demirer, M., Duflo, E., Hansen, C., Newey, W., & Robins, J. (2018). Double/debiased machine learning for treatment and structural parameters

Contact: If you have any further questions, just send an e-mail to klotz@dice.hhu.de.