Master Seminar, JLU Gießen SS 2023

TOPIC:

Business and Economic Forecasting - Corner stones in a data-driven economy

Lecturer:
Prof. Dr. Frauke Schleer-van Gellecom

Honorprofessorin – Decision Intelligence, Justus-Liebig University Gießen
Director – Predictive Excellence, PricewaterhouseCoopers GmbH WPG

Elena Tönjes

Chair of Statistics & Econometrics, Justus-Liebig University Gießen

What is Machine Learning? And what is AI? Automated processes, robots and artificial intelligence will remain and become more and more important. **Nerds' and data specialists are the new heroes of our days.** To make you part of the play and to enable you to shape the future of data-driven decision making in companies and across society, the seminar will deal with **business and economic forecasting** as one central element in **digital transformation**.

We will examine the relevance of **forecasting using advanced analytics** – e.g., statistics, machine learning and AI - for firms and the economy. You - as a participant - will present your own (empirical) work.

The aim of the seminar is to enable the participants to

- gain insights into the broad topic of business and economic forecasting as basis for data driven decision-making and economies
- deal with applications from the field of predictive analytics such as financial forecasting, business cycle forecasting, financial stress indices, customer churn prediction, credit scoring (…)
- train presentation of Data and Analytics exercises for management communication

Therefore, we will also have **training sessions with R** at the beginning. Please note that is not necessary to do an empirical work in the seminar paper, but by giving you guidance and training, we encourage you to do so.

This seminar intends to **enable you with digital skills** for your future career, i.e., not necessarily "becoming a data scientist", but e.g., understanding the difference between business intelligence/reporting and advanced analytics as a potential future (digital) leader.

1. Organizational information

Important Dates:

- Kick-off – **18.04.2023 10:15 – 11:45.** Topic Presentation & Allocation
  Location: On-site campus
- Hands-on R-training sessions will be announced during kick-off
  Location: to be announced
- Presentation of students' work **– 30.06.2023 / 01.07.2023, exact time to be announced**
  Location: On-site campus
- Final deadline for seminar paper submission **– 31.07.2023**

Organization & Grading:

- Topics see following slides, topics will be allocated to the students during the kick-off session.
- Students will be graded based on these four parts of the coursework:
  1. a written seminar paper (70%)
  2. an oral presentation of the written paper, the presentation itself incl. the design and explanation of 5 Multiple Choice (MC) questions for the presented work (30%).
     - Based on the MC question, we will have a MC Quiz.

Guide for written work:

- Language: English, German
- There are word or LaTex templates available. (Please find them here)
- It is recommended to use a citation manager, such as Mendeley, Citavi, Zotero, etc.
- The paper should have at least 10, but no more than 15 pages.
- Please note that you should hand in your preliminary paper one week before the presentation and will be shared with the other participants.
- Revising the paper after the presentation is allowed and encouraged. However, it must be handed in at the day of the final deadline.
- When handing in your work, include a pdf-Version of the written paper and the R, xlsx (…) files (if applicable).
- You should hand in your paper via Mail to Frauke Schleer-van Gellecom (see contact details below).

Guide for the presentation of the written paper:

- For your presentation, you have 15 – 20 min. The MC part can last from 10 to 15 minutes. The discussion may take 5 to 10 mins.
- The presentation must be either in English or German.
- Before the presentation date, please send your slides to Frauke Schleer-van Gellecom.

Contact details:

- For questions, please refer to Frauke Schleer-van Gellecom (frauke.schleer@wirtschaft.uni-giessen.de) or Elena Tönjes, (Elena.Toenjes@wirtschaft.uni-giessen.de)

2. Topics

This chapter contains a list of topics from which you can choose. You find a short introduction to the **topics and corresponding paper and book recommendations below.**

Literature recommendation (generic):

- Gilliland M., L. Tahsman and U. Sglavo (2021), Business Forecasting – the Emerging Role of Artifical Intelligence and Machine Learning, Wiley.
- Gilliland M., L. Tahsman and U. Sglavo (2015), Business Forecasting: Practical Problems and Solutions, Wiley.
- Gillialnd, The Business Forecasting Deal, Wiley, 2010.
- Hyndman R. J and Athanasopoulos G., Forecasting: Principles and Practice (2nd ed), can be accessed via https://otexts.com/fpp2/
- Mertens, P. und S. Rässler, 2012, „Prognoserechnung“, Physica-Verlag (ebook)
- Morlidge, Steve (2010), Future Ready: How to Master Business Forecasting, Wiley.
- Petropoulos et al (2021), Forecasting: theory and practice, can be accessed via https://arxiv.org/abs/2012.03854.
- Winker, Peter (2017): Empirische Wirtschaftsforschung und Ökonometrie. Springer, Gabler, Berlin, 4.

Topic 1: Quantitative Forecasting Model: Statistical/econometric methods, Bayesian forecasting and Machine Learning

There are numerous methods for making quantitative forecasts. First, classical time series econometric methods such as AR, ARIMA and VAR models should be presented. Second, you should also outline further approaches from Bayesian forecasting and machine learning / neural network based forecasting. In addition, own forecasts could be carried out empirically and discussed.

Literature:

- Lütkepohl, Helmut (2009): Univariate Time Series Analysis. In: Helmut Lütkepohl und Markus Krätzig (Hg.): Applied time series econometrics. Transferred to digital printing. Cambridge: Cambridge Univ. Press (Themes in modern econometrics).
- Lütkepohl, Helmut (2009): Vector Autoregressive and Vector Error Correction Models. In: Helmut Lütkepohl und Markus Krätzig (Hg.): Applied time series econometrics. Transferred to digital printing. Cambridge: Cambridge Univ. Press (Themes in modern econometrics).
- Petropoulos et al (2021), Forecasting: theory and practice, can be accessed via https://arxiv.org/abs/2012.03854.

Potential Data Source:

- https://data.oecd.org/

Topic 2: Predictive Analytics in the forecasting and planning process

The forecasting and planning process plays an important role in corporate planning. Up to now, the planning process is mainly driven by human intelligence using qualitative analysis and expert knowledge. Due to the progress of digitalization, data-driven methods and models, namely predictive analytics, are emerging.
The importance of the forecasting and planning process should be described and the KPIs that

managers pay particular attention to should be highlighted and discussed. Importantly, benefits and status quo of using predictive analytics in the forecasting and planning process should be presented. Moreover, you can also apply predictive analytics and create your own revenue forecast using statistical or machine learning algorithms.

Literature:

- Abbott, D. (2014). Applied Predictive Analytics, Principles and Techniques for the professional Data Analyst.
- Burow, L., Gerads, Y., & Demmer, M. (2017). Effektiv und effizient steuern mit Predictive Analytics. Controlling & Management Review, 48-56.
- Behringer, S. (2018). Controlling.
- Große Kamphake, A. (2020). Digitization in Controlling: Forecasting Processes through Automation.
- Heupel, T., & Lange, V. (2019). Wird der Controller zum Data Scientist? Herausforderungen und Chancen in Zeiten von Big Data, Predictive Analytics und Echtzeitverfügbarkeit. In Arbeitswelten der Zukunft Wie die Digitalisierung unsere Arbeitsplätze und Arbeitsweisen verändert (pp. 202-218).
- KPIs für Unternehmenssteuerung (ab S.19) (Schönbohm & Egle, 2016): https://www.controllerakademie.de/pdf/2016/controllermagazin_112016.pdf
- Controller Magazin, https://www.haufe.de/download/cm-special-491056.pdf (pp. 20)

Potential Data Source:

- Provided by lecturer (P&L quarterly historical data)

Topic 3: Time Series Forecasting with Covariates

Time series models often include only information from past observations of the time series, but the inclusion of other information may also be relevant. For example, the effects of holidays, marketing events, competitor activity, changes in the law, the wider economy, or other external variables, may explain some of the historical variation and may lead to more accurate forecasts. You should evaluate methods which are able to include exogenous regressors (e.g. ARIMAX) and compare their forecast accuracy against pure univariate methods without such additional information (e.g. ARIMA).

Literature:

- Preez, du J. and Witt, Stephen F. (2003): Univariate versus multivariate time series forecasting: an application to international tourism demand, International Journal of Forecasting 19 (3), p. 435 - 451
- Anggraeni, W. et al. (2017): The Performance of ARIMAX Model and Vector Autoregressive (VAR) Model in Forecasting Strategic Commodity Price in Indonesia, Procedia Computer Science 124, p. 189 - 196
- Ziel, F. and Weron, R. (2018): Day-ahead electricity price forecasting with high-dimensional structures: Univariate vs. Multivariate modeling frameworks, Energy Economics 70, p. 396 - 420
- Laurent, S., Rombouts, J. V. K., Violante, F. (2011): On the forecasting accuracy of multivariate GARCH models, Journal of Applied Econometrics 27, p. 934 – 955

Potential Data Source:

- M5 Competition; https://www.kaggle.com/c/m5-forecasting-accuracy/data

Topic 4: Hierarchical forecasting: Literature overview. Application and Consistency measures

Time Series can often be characterized by different dimensions such as regions or products. Because of different hierarchy levels, accurate forecasting can become a challenge, as small changes may have large effects on other hierarchy levels. You should discuss different methods for hierarchical forecasting and evaluate them regarding the consistency of these models. This should include a comprehensive analysis of similarities, differences, implications and research gaps. In addition, you are encouraged to conduct your own empirical analysis based on forecasting profit and loss data.

Literature:

- Hyndman, Rob J. and Athanasopoulos, George: Forecasting: Principles and Practice. Available online: https://otexts.com/fpp2/hts.html
- Hyndman, Rob J.; Ahmed, Roman A.; Athanasopoulos, George; Shang, Han Lin (2011): Optimal combination forecasts for hierarchical time series. In: Computational Statistics and Data Analysis, 55(9): p. 2579-2589. Online available: https://robjhyndman.com/publications/hierarchical/.
- Wickramasuriya, Shanika L.; Athanasopoulos, G; Hyndman, Rob J. (2019): Optimal forecast reconciliation for hierarchical and grouped time series through trace minimization. In: American Statistical Association, 114(526), p. 804 - 819. Online available: https://robjhyndman.com/publications/mint/.
- Timmermann, A. (2006): Forecast combinations. In: Handbook of Economic Forecasting vol. 1, pp 135-196. Elsevier. Online available: https://econweb.ucsd.edu/~atimmerm/combine.pdf.
- van Erven, Tim; Cugliari, Jairo (2014): Game-Theoretically optimal reconciliation of contemporaneous hierarchical time series forecasts. In: Modeling and Stochastic Learning for Forecasting in High Dimensions, Lecture Notes in Statistics, pp. 297–317. Springer International Publishing.
- Hyndman, Rob J.; Lee, Alan J.; Wang, Earo; Wickramasuriya, Shanika (2018): hts. Hierarchical and Grouped Time Series. R package version 5.1.5. Online available: https://CRAN.R-project.org/package=hts.

Potential Data Source:

- Provided by lecturer (P&L quarterly historical data)

Topic 5: Customer Churn Prediction

Forecasting customer churn rates is one of the most popular applications of Business Forecasting. You should describe potential application of customer churn predictions and furthermore, introduce and discuss available machine learning techniques.

Literature:

- Ahmad et. al (2019), Customer Churn prediction in telecom using machine learning in a big data platform, Journal of Big Data, 6 (28).

- De Caigny, A., Coussement, K., & De Bock, K. W. (2018). A new hybrid classification algorithm for customer churn prediction based on logistic regression and decision trees. European Journal of Operational Research, 269(2), 760-772.
- Kumar V., and A. Petersen (2012), Statistical methods in customer relationship management, Wiley.
- Mahajan, V., Misra, R., & Mahajan, R. (2015). Review of data mining techniques for churn prediction in telecom. Journal of Information and Organizational Sciences, 39(2), 183-197.
- Vafeiadis, T., Diamantaras, K. I., Sarigiannidis, G., & Chatzisavvas, K. C. (2015). A comparison of machine learning techniques for customer churn prediction. Simulation Modelling Practice and Theory, 55, 1-9.
- Verbeke, W., Martens, D., & Baesens, B. (2014). Social network analysis for customer churn prediction. Applied Soft Computing, 14, 431-446
- "Customer Churn Prediction Using Machine Learning: Main Approaches and Models", available online: https://www.kdnuggets.com/2019/05/churn-prediction-machine-learning.html

Potential Data Source:

- https://www.kaggle.com/c/kkbox-churn-prediction-challenge/overview
- https://github.com/srees1988/predict-churn-py/blob/main/customer_churn_data.csv ?

Topic 6: Decision trees (Random Forests, Gradient Boosting) and Neural Networks: The application of credit scoring

The rise of Machine Learning can change the process of lending money and is already about to change it. You should discuss decision tree algorithms and neural network both from a technical perspective and in terms of how they transform the process of determining credit scores. Furthermore, you should emphasize challenges and potential research gaps.

Literature:

- Abellán, J., & Castellano, J. G. (2017). A comparative study on base classifiers in ensemble methods for credit scoring. Expert Systems with Applications, 73, 1-10.
- Bhatia, S., Sharma, P., Burman, R., Hazari, S., & Hande, R. (2017). Credit scoring using machine learning techniques. International Journal of Computer Applications, 161(11), 1-4.
- Dahiya, S., Handa, S. S., & Singh, N. P. (2015). Credit scoring using ensemble of various classifiers on reduced feature set. Industrija, 43(4), 163-174.
- Fernández-Delgado, M.; Cernadas, E.; Barro, S. (2014): Do we Need Hundreds of Classifers to Solve Real World Classifcation Problems? In: Journal of Machine Learning Research, volume 15, pp. 3133-3181.
- Flores, J. A., Malca, J. L., Saldarriaga, L. R., & Román, C. S. (2017). Analysis and Comparison of Machine Learning Classification Models Applied to Credit Approval. In SIMBig (pp. 225-226).
- Ghatasheh, N. (2014). Business analytics using random forest trees for credit risk prediction: A comparison study. International Journal of Advanced Science and Technology, 72(2014), 19-30.

- Hand, D. J., & Henley, W. E. (1997). Statistical classification methods in consumer credit scoring: a review. Journal of the Royal Statistical Society: Series A (Statistics in Society), 160(3), 523-541.
- Kennedy, K. (2013). Credit scoring using machine learning, Dublin Institute of Technology.
- Korn, M. (2019). Potenziale künstlicher Intelligenz und maschinellen Lernens im Risikomanagement von Banken. Controlling, 31(3), 42-45.
- Yap, B. W., Ong, S. H., & Husain, N. H. M. (2011). Using data mining to improve assessment of credit worthiness via credit scoring models. Expert Systems with Applications, 38(10), 13274-13283.

Potential Data Source:

- Lending club data from Kaggle: https://www.kaggle.com/wordsforthewise/lending-club

Topic 7: Cash Flow Forecasting and Predictive Analytics

Cash Flow Forecasting has always played a crucial role in corporate management. Especially, during the C19 crisis cash flow and liquidity was one of the most important and critical KPIs to be managed. The high volatility and risks emphasized the importance of accurate and efficient cash flow forecast even more. In recent years, predictive analytics, big data and machine learning techniques have emerged. You should identify and discuss the ways these factors or techniques (may) change traditional cash flow forecasting methods. Furthermore, you should discuss methods for cash flow forecasting and create your own cash flow forecast using, for instance, classical time series prediction models.

Literature:

- Dadteev, K., Shchukin, B., & Nemeshaev, S. (2020). Using artificial intelligence technologies to predict cash flow. Procedia Computer Science, 264-268.
- Glaum, M., Schmidt, P. and Schnürer, K. (2018), Processes and Accuracy of Cash Flow Forecasting: A Case Study of a Multinational Corporation. Journal of Applied Corporate Finance, 30: 65-82. doi:10.1111/jacf.12301
- Hongjiu, L., Rieg, R., & Yanrong, H. (2012). Performance comparison of artificial intelligence methods for predicting cash flow. Neural Network World, 22(6), 549.
- Salas-Molina, F., Martin, F. J., Rodriguez-Aguilar, J. A., Serra, J., & Arcos, J. L. (2017). Empowering cash managers to achieve cost savings by improving predictive accuracy. International Journal of Forecasting, 33(2), 403-415.
- Salas Molina, Francisco & Rodríguez-Aguilar, Juan & Serrà, Joan & Martin, Francisco. (2016). Empirical analysis on daily cash flow time series and its implications for forecasting. SORT. 42. 10.2436/20.8080.02.70.

Potential Data Source:

- https://www.iiia.csic.es/~jar/54datasets3.csv

Topic 8: Classification and Forecasting of Intermittent Demand

Intermittent demand appears when demand events occur only sporadically. Typically, such time series have few observations making (intermittent) demand forecasting challenging. Forecast errors can be costly in terms of unmet demand or obsolescent stock- a very relevant topic for companies when doing demand forecasting and planning in the context of S&OP. You should evaluate methods for the classification of intermittent demand patterns and compare different methods for forecasting. This is a highly relevant topic that was also tackled by the M5 Kaggle competition. The data provided there can also be used for an empirical exercise.

Literature:

- Boylan, J. and Croston, D. (2005): On the categorization of demand patterns, Journal of the Operations Research Society 56 (5), p. 495 – 503
- Boylan J. and Syntetos A. (2021), Intermittent Demand Forecasting: Context, methods and applications, Wiley.
- Hasni, M. et al. (2019): On the performance of adjusted bootstrapping methods for intermittent demand forecasting, International Journal of Production Economics 216, p. 145 – 153
- Hyndman, R. (2006): Another look at forecast-accuracy metrics for intermittent demand, Foresight 4, p. 43-46
- Hyndman, R. J. and Athanasopoulos, G. (2018), Forecasting: principles and practice, OTexts, can be accessed online: https://otexts.com/fpp2/
- Petropoulos, F., Kourentzes, N., Nikolopoulos, K. (2016): Another look at estimators for intermittent demand, International Journal of Production Economics 181 A, p. 154 - 161
- Syntetos, A. and Boylan, J. (2005): The accuracy of intermittent demand estimates, International Journal of Forecasting 21 (2), p. 303-314

Potential Data Source:

- M5 Competition; https://www.kaggle.com/c/m5-forecasting-accuracy/data (at item level)

Topic 9: Economy situation and business cycle

Business cycle assessments are a very relevant topic to understand and apply time series features and provide a crucial basis for forecasting (concepts). Different methods for measuring the cyclical, component i.e. business cycle, should be discussed. Different methodologies can also be empirically applied and compared.

Literature:

- Baxter, Marianne; King, Robert G. (1999): Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series. In: *The Review of Economics and Statistics* 81 (4), S. p 575-593.
- Canova, Fabio (1998): Detrending and business cycle facts. In: *Journal of Monetary Economics* 41 (3), S. 475–512. DOI: 10.1016/S0304-3932(98)00006-3.
- Harvey, A. C.; Jaeger, A. (1993): Detrending, Stylized Facts and the Business Cycle. In: *Journal of Applied Econometrics* 8 (3), S. p 231-247
- Hodrick, Robert J.; Prescott, Edward C. (1997): Postwar U.S. Business Cycles. An Empirical Investigation. In: *Journal of Money, Credit and Banking* 29 (1), S. 1. DOI: 10.2307/2953682.

- Thorsrud (2018), Word are the new numbers: A newsy coincident index of business cycle, https://cepr.org/sites/default/files/1895_Thorsrud_NF_Main.pdf
- Winker, Peter (2017): Empirische Wirtschaftsforschung und Ökonometrie. Springer, Gabler, Berlin, 4. Aufl. Kapitel 10.

Potential Data Source:

- https://data.oecd.org/

Topic 10: Qualitative Forecasting & Early Warning Systems: Economic indicators and (composite) leading indicators

Economic indicators, especially leading indicators are central determinants to accurately estimate and forecast economic performance. You should describe and discuss potential leading indicators as well as their application in the context of forecasting, in particular for the use and construction of composite leading indicators. The OECD offers a detailed description on how to construct composite leading indicators providing the basis to present and evaluate the approach of composite leading indicators. You can also draw your attention to best practices and principles on how to construct an economic tendency survey.

Literature:

- CBS (2005), "The Statistics Netherlands' Business Cycle Tracer", available online: https://www.cbs.nl/en-gb/visualisations/business-cycle-tracer-dashboar.
- El Gibari, S., Gómez, T., & Ruiz, F. (2019). Building composite indicators using multicriteria methods: a review. Journal of Business Economics, 89(1), 1-24.
- Marcellino, Massimiliano (2006): Leading Indicators. In: Graham Elliott, Clive Granger und Allan Timmermann (Hg.): Handbook of Economic Forecasting: Elsevier (Handbook of Economic Forecasting).
- OECD (2008), "Handbook on Constructing Composite Indicators", Methodology and User Guide.
- OECD (2016), Handbook on Economic Tendency Survey, https://www.un-ilibrary.org/content/books/9789210577199
- Paap, Richard; Segers, Rene; van Dijk, Dick (2009): Do Leading Indicators Lead Peaks More Than Troughs? In: Journal of Business & Economic Statistics 27 (4), S. p 528-543. Online available: http://www.jstor.org/stable/27799104.
- Schlösser, A. (2020). Forecasting industrial production in Germany: The predictive power of leading indicators (No. 838). Ruhr Economic Papers.

Potential Data Sources:

- Data can be found here
  - https://data.oecd.org/leadind/composite-leading-indicator-cli.htm
  - https://www.oecd-ilibrary.org/economics/data/main-economic-indicators/business-tendency-and-consumer-opinion-surveys_data-00041-en
  - https://www.oecd-ilibrary.org/economics/data/oecd-stat/data-warehouse_data-00900-en

Topic 11: Financial market stress indices

Financial market stress indices have gained more and more attention after the great financial crisis. You should give an overview of indices measuring financial market stress and analyze them according to similarities and differences. In particular, the literature shows various approaches to construct such an index. Different statistical and econometric approaches should be discussed and evaluated. You are also encouraged to construct your own financial stress index. This can be done by using R or xlsx, for instance.

Literature:

- Cardarelli, Roberto; Elekdag, Selim; Lall, Subir (2011): Financial stress and economic contractions. In: *Journal of Financial Stability* 7 (2), S. 78–97. DOI: 10.1016/j.jfs.2010.01.005.
- Hakkio, Craig S.; Keeton, William R. (2009): Financial stress: what is it, how can it be measured, and why does it matter? In: *Economic Review* (Q II), S. 5–50. Online available: http://ideas.repec.org/a/fip/fedker/y2009iqiip5-50nv.94no.2.html.
- Kliesen, Kevin L.; Owyang, Michael T.; Vermann, E. Katarina (2012): Disentangling diverse measures: a survey of financial stress indexes. In: *Review* (Sep), S. 369–398. Online available: http://ideas.repec.org/a/fip/fedlrv/y2012iseptemberp369-398nv.94no.5.html.
- Kremer, M. (2016). Financial stress indices: An introduction. The Spanish Review of Financial Economics, 14(1), 1-4.
- Vašíček, B., Žigraiová, D., Hoeberichts, M., Vermeulen, R., Šmídková, K., & de Haan, J. (2017). Leading indicators of financial stress: New evidence. Journal of Financial Stability, 28, 240-257.

Potential Data Source:

- Financial data can be collected and downloaded online via yahoo finance. Inspiration for data sources and data can be found in papers mentioned above. Additionally, the university also offers access to financial data sources. Please get in touch with us if you need access to additional data.

Topic 12: Impact of data revisions on forecasts and the use of real-time data

The quality of forecasts is centrally influenced by the underlying data. However, data revisions can distort the evaluation result in an ex-post analysis. Both the influence of data revisions on forecasts and the use of a real-time data set for forecasting should be discussed using the example of oil price forecasts or inflation/output growth.

Literature:

- Baumeister, Christiane; Kilian, Lutz (2011): Real-Time Forecasts of the Real Price of Oil. In: Journal of Business & Economic Statistics 30 (2), S. 326–336.
- Baumeister, Christiane; Kilian, Lutz; Lee, Thomas K. (2014): Are there gains from pooling real-time oil price forecasts? In: Energy Economics 46, S. S33-S43.
- Clements, M. P., Galvao, A. B., 2019. Data revisions and real-time forecasting. The Oxford Research Encyclopedia of Economics and Finance.
- Clements, M. P., Galvao, A. B., 2013b. Real-time forecasting of inflation and output growth with autoregressive models in the presence of data revisions. Journal of Applied Econometrics 28 (3), 458–477.

- Croushore, Dean (2006): Forecasting with Real-Time Macroeconomic Data. In: Graham Elliott, Clive Granger und Allan Timmermann (Hg.): Handbook of Economic Forecasting: Elsevier (Handbook of Economic Forecasting),
- Croushore, D., 2011a. Forecasting with real-time data vintages, chapter 9. In: Clements, M. P., Hendry, D. F. (Eds.), The Oxford
- Diebold, Francis X.; Rudebusch, Glenn D. (1991): Forecasting Output With the Composite Leading Index. A Real-Time Analysis. In: Journal of the American Statistical Association 86 (415), S. 603. DOI: 10.2307/2290388.
- Garratt et al (2018), Real-time combination for the oil-price, Journal of Applied Econometrics, Vol. 31 Issue 3.

Potential Data Source:

- http://www.bundesbank.de/Navigation/DE/Statistiken/Zeitreihen_Datenbanken/Echtzeitdatenbank/realtime_zeitreihen_node.html
- https://www.philadelphiafed.org/research-and-data/real-time-center/real-time-data/

Topic 13: Judgmental Forecasts and Judgmental Adjustments

Is it forecasting by human OR machine or by human AND machine? Forecasting processes in companies are getting more and more impacted by advanced analytics. However, algorithms do typically not capture “expert knowledge” and events or measures that are not represented in data. Judgmental forecast or adjustments exists for a long time. You should review the literature about judgmental forecasts and adjustments and put them also in the context of more recent application in business forecasting.

Literature:

- Gilliland M., L. Tahsman and U. Sglavo (2021), Business Forecasting – the Emerging Role of Artifical Intelligence and Machine Learning, Wiley. (Chapter 3 and “The Future of Forecasting is Artifical Intelligence combined with Human Forecasters”
- Harvey, N., 2007. Use of heuristics: Insights from forecasting research. Thinking & Reasoning 13 (1), 5–24.
- Lawrence et al. (2006), Judgmental forecasting: A review of progress over the last 25 years, International Journal of Forecasting Vol 22. Issue 3.
- Petropoulos, F., Fildes, R., Goodwin, P., 2016. Do ‘big losses’ in judgmental adjustments to statistical forecasts affect experts’ behaviour? European Journal of Operational Research 249 (3), 842–852.
- Petropoulos, F., Kourentzes, N., Nikolopoulos, K., and Siemsen, E. (2018). Judgmental selection of forecasting models. Journal of Operations Management 60, 34–46.
- Tetlock P.E., and D. Gardner (2015), Superforecasting: the art and science of prediction, ,2015. Print.
- Webby R. and O’Connor M. (1996), Judgmental and statistical time series forecasting: a review of the literature, International Journal of Forecasting Vol 12. Issue 1.