Kiel Trade Indicator

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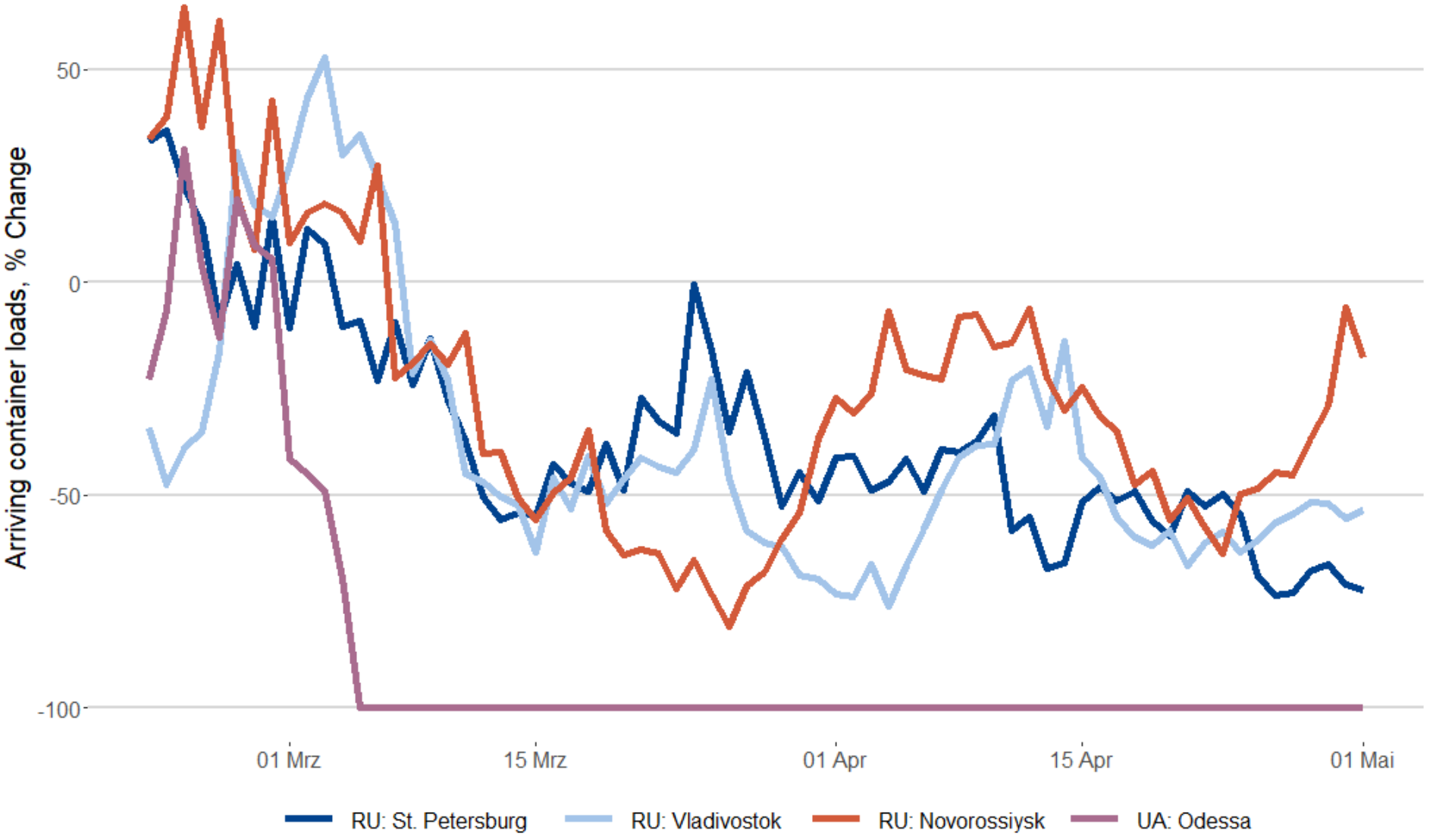
Motivation: Predict Trade Flows in Real Time

Container loads in Russia. Comparison to last year

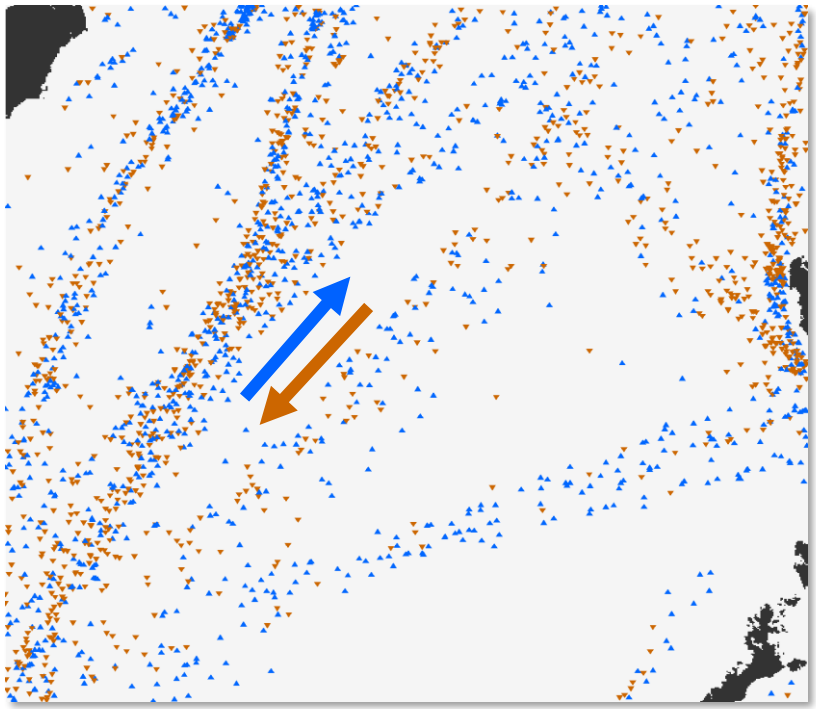


Motivation: Predict Trade Flows in Real Time

- COVID-19 lockdowns and the war in Ukraine show need for **real time information** on trade flows
- Official statistics are published with a **delay of over a month** in Germany
- IfW receives **2 M. daily container ship positions** and port calls per year including draught and heading information
- **Machine learning tools** make predicitons for monthly trade flows based on ships‘ movement profiles

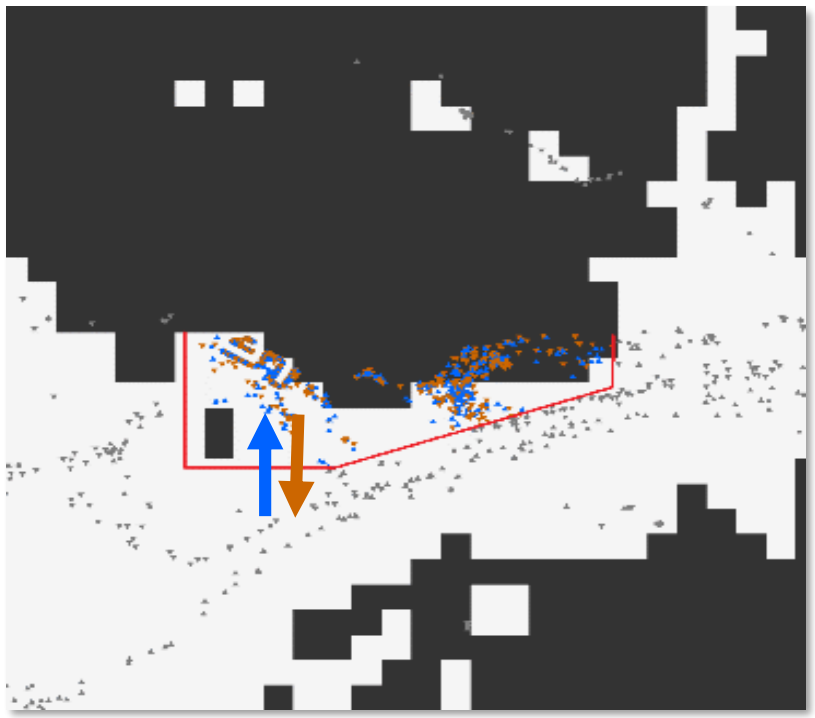
Data: Aggregate Raw Data to Monthly Time Series

Ship Movements at Sea



- Divide world into **10 x 10 degree cells** and retain 100 busiest areas
- Determine two main headings using **k-means clustering** algorithm

Ships Entering and Departing Ports



- Assign ships arriving/departing **to 500 major ports**
- **Gross load** derived from net-draught and size of ship

Methodology: Data Aggregation

- Approximate **cargo load** in Twenty-foot Equivalent Units (TEU) for every ship observation i at time t

$$TEUload_{it} = TEU_i, max \times \frac{draught_{it} - draught_{i,min}}{draught_{i,max} - draught_{i,min}}$$

- For every area or port, **aggregate** to monthly time series X_t, seasonally adjust and derive month-over-month time series

$$X_t = \frac{\sum_i TEUload_{i,t}}{\sum_i TEUload_{i,t-1}}$$

Methodology: Partial Least Squares Model

- The **Partial Least Squares Model** goes back to Wold (1975) and several handbooks such as Garthwaite (1994) describe the procedure in detail
- Well published examples of **applications** include Fuentes et al. (2015) and Eickmeier and Ng (2011)
- Let (>1,000) time series X_t be a function of a smaller number (<10) of factors F_t

$$\mathbf{X_t} = \phi \mathbf{F_t} + \epsilon_\mathbf{t}$$

- Estimated factors F_t are used to model specific **target time series** y_{t+h}, such as imports of Germany (month-on-month growth, seasonally adjusted), with specific time horizon

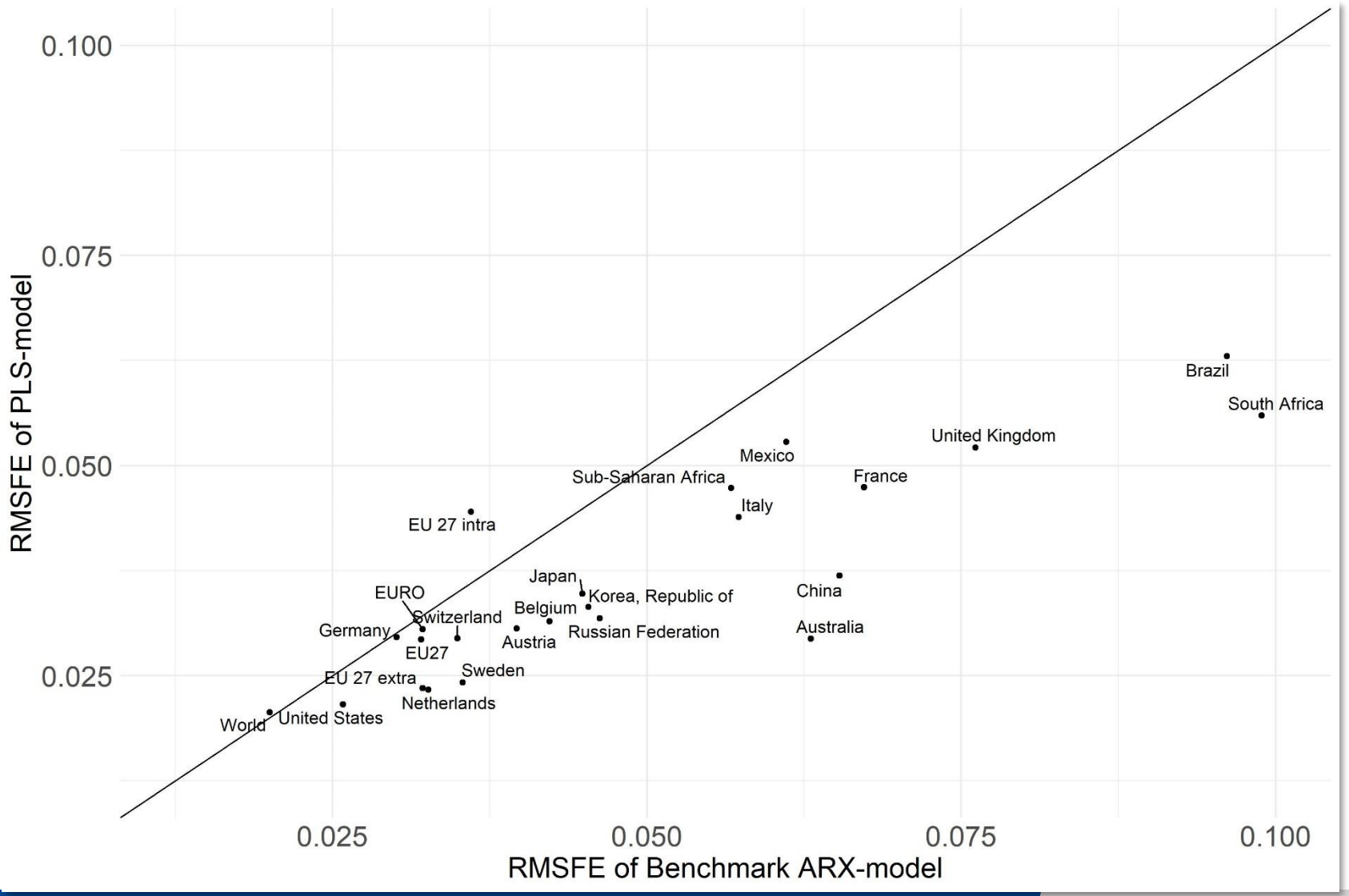
$$y_{t+h} = \beta \mathbf{F_t} + \nu_\mathbf{t}$$

Results: Indicators predict trade flows for 75 countries

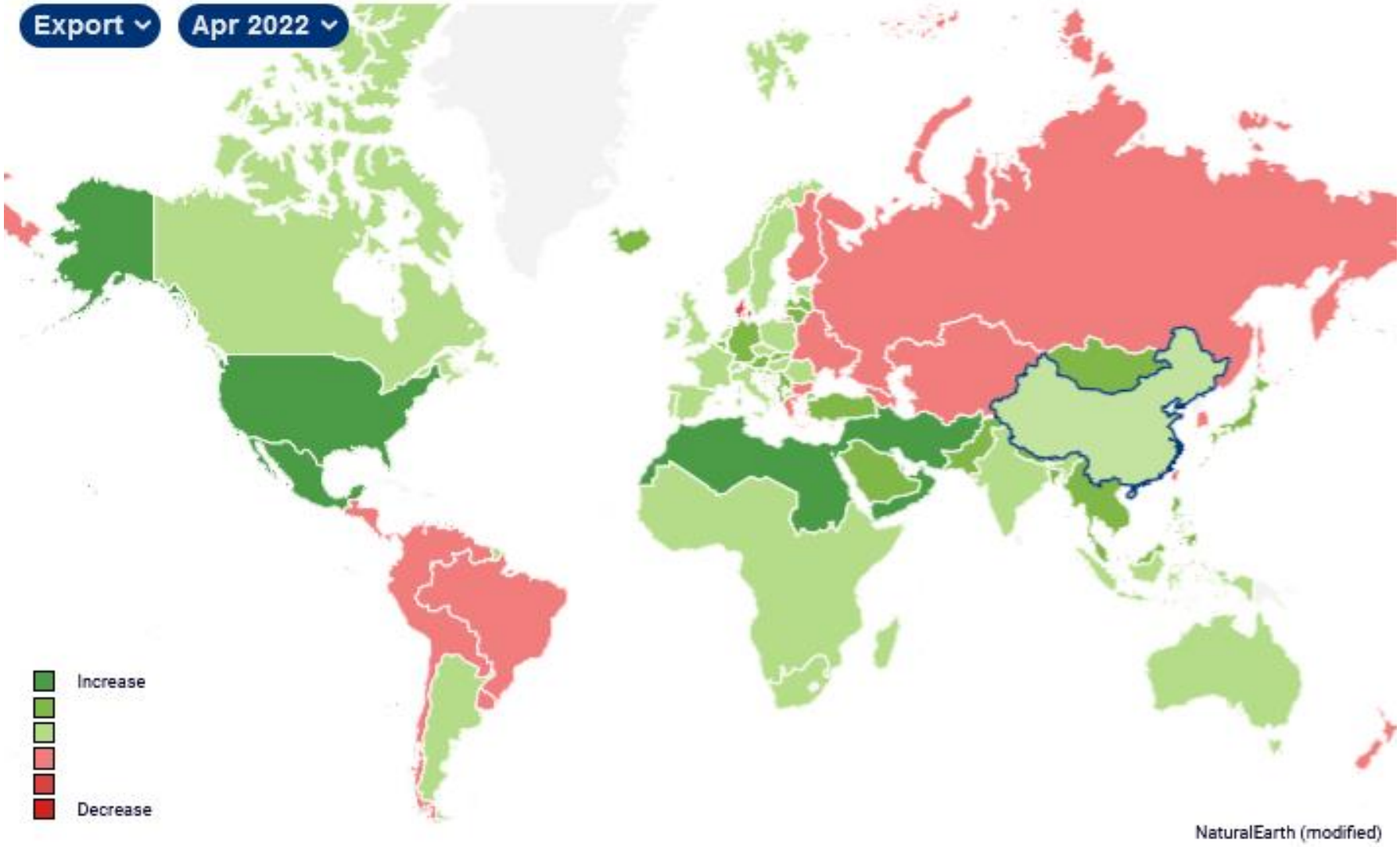
- Estimated time series include all real imports and exports reported by CPB Netherlands for **75 countries**, regions and the world in total
- Out-of-sample tests show that forecasts frequently **outperform benchmarks** or at least add new information
- The forecasts can be used as **leading indicators** and capture what the level of shipped goods imply for trade figures

Tests and documention available in working paper „Thinking Outside the Container: A Sparse Partial Least Squares Approach to Forecasting Trade Flows“

Results: Comparison against benchmark ARX-model

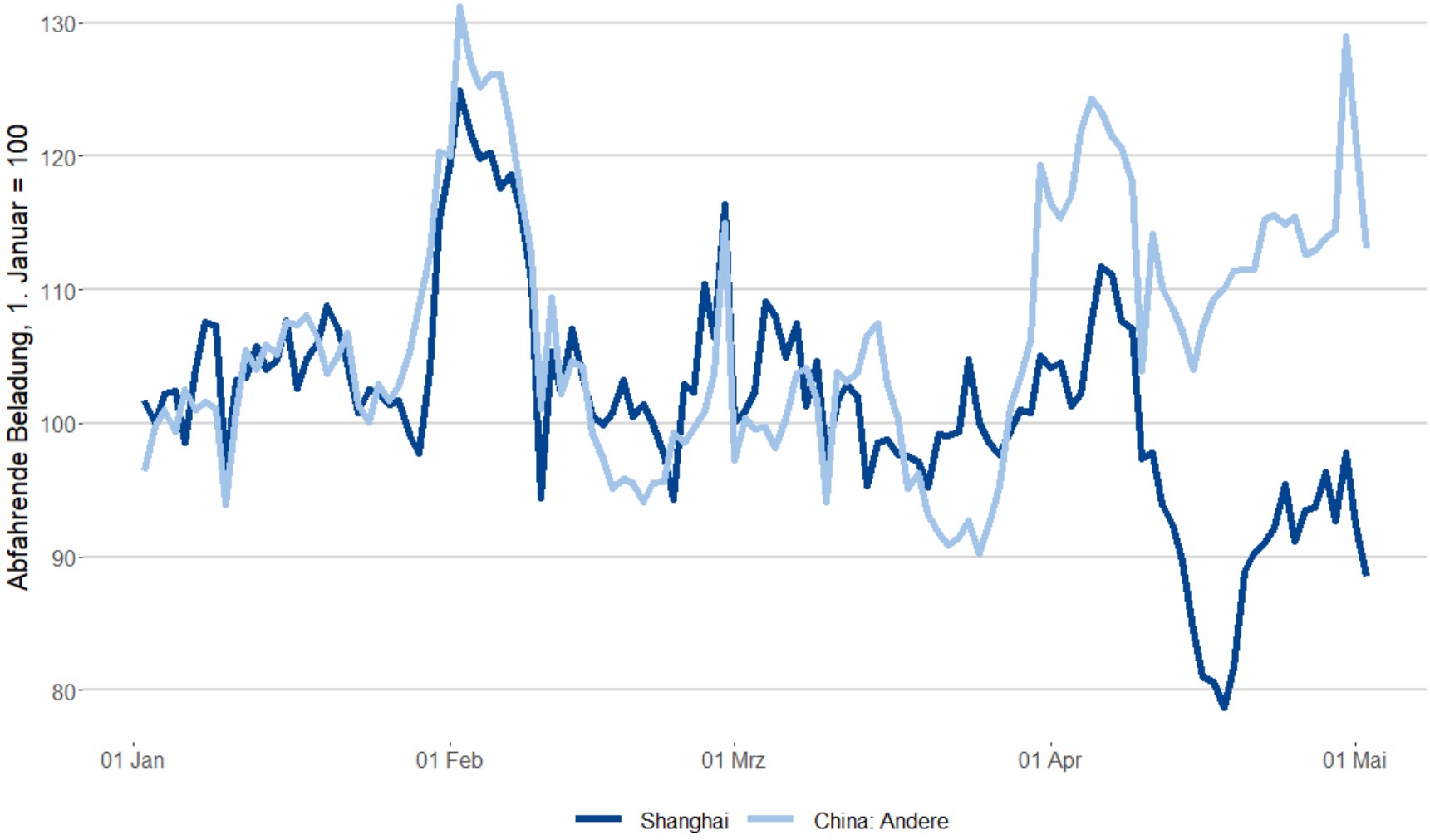


Results: Update indicates stagnation in China



Result: Impact of Shanghai lockdown on local exports

Departing container loads. Comparison to Jan. 1st.



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Referenes

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