Time Series - Intro

Time Series Analysis

- A sub-field of econometrics with an emphasis in forecasting.
- Variables distributed over time.
- Can include variables distributed over both time and space (panel data analysis), such as phenomena spanning multiple countries over multiple years.
- Initially, time series analysis was primarily focused on forecasting, bearing similarities to machine learning.
- Nowadays, it also encompasses causality analysis.
- While most models are linear in terms of their parameters, there are also numerous non-linear models available.

Data preparation

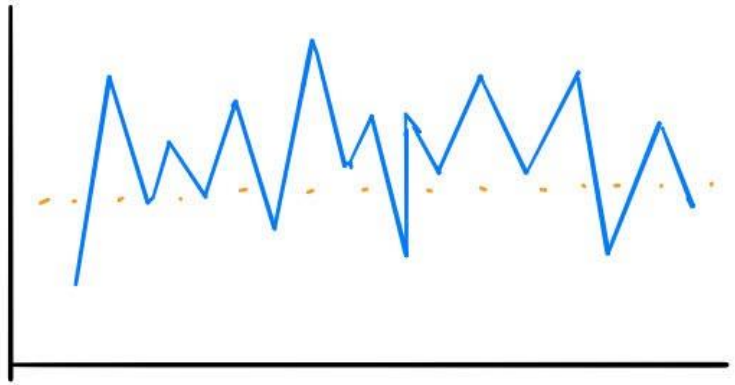
- We will focus on modeling data, whether for forecasting or structural analysis.
- Before we proceed with data modeling, we engage in data pre-processing.
- Pre-processing steps vary depending on the type of model used.
- For example, in neural networks, standardizing the data is common practice, while time series models do not require such standardization.

Data preparation cont.

- We will be working with data that is more or less 'ready for analysis.' We assume you already know how to perform the following steps:

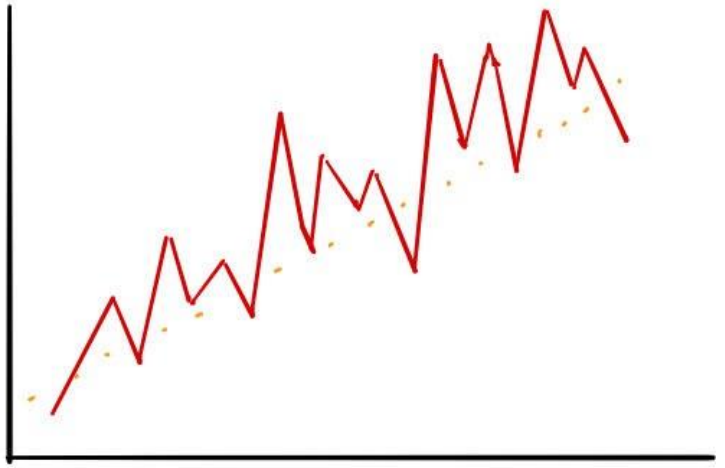
a) Drop lines with missing data or impute missing values with predictions.
b) Detect and either drop or trim outliers (extreme data points that appear to originate from a different data generating process).
c) Detect and remove duplicate data.
d) Identify and address inconsistencies (e.g., multiple addresses for one person).
e) Smooth volatile data or extract features.

Some examples



STATIONARY

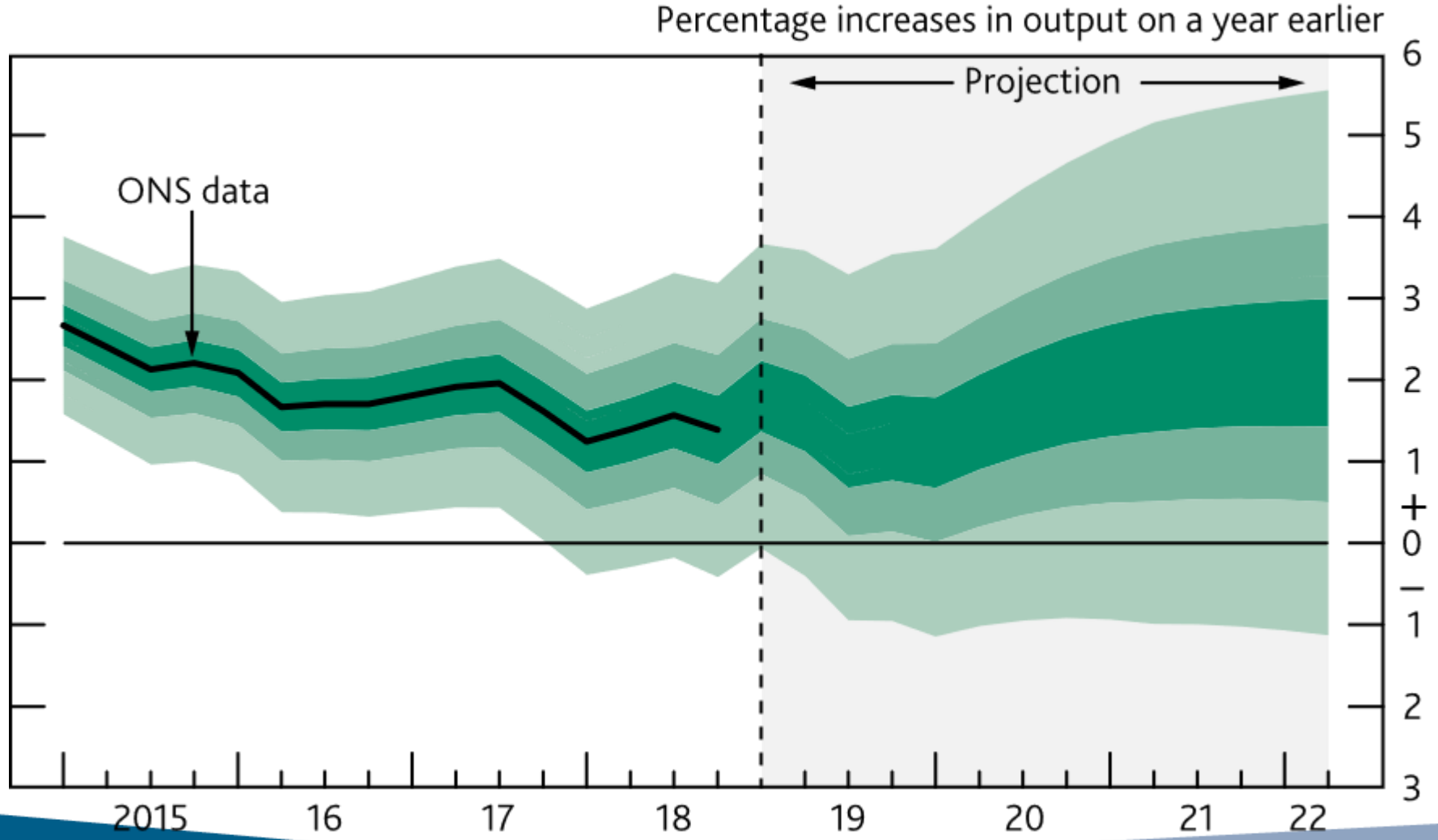
TREND



SEASONAL

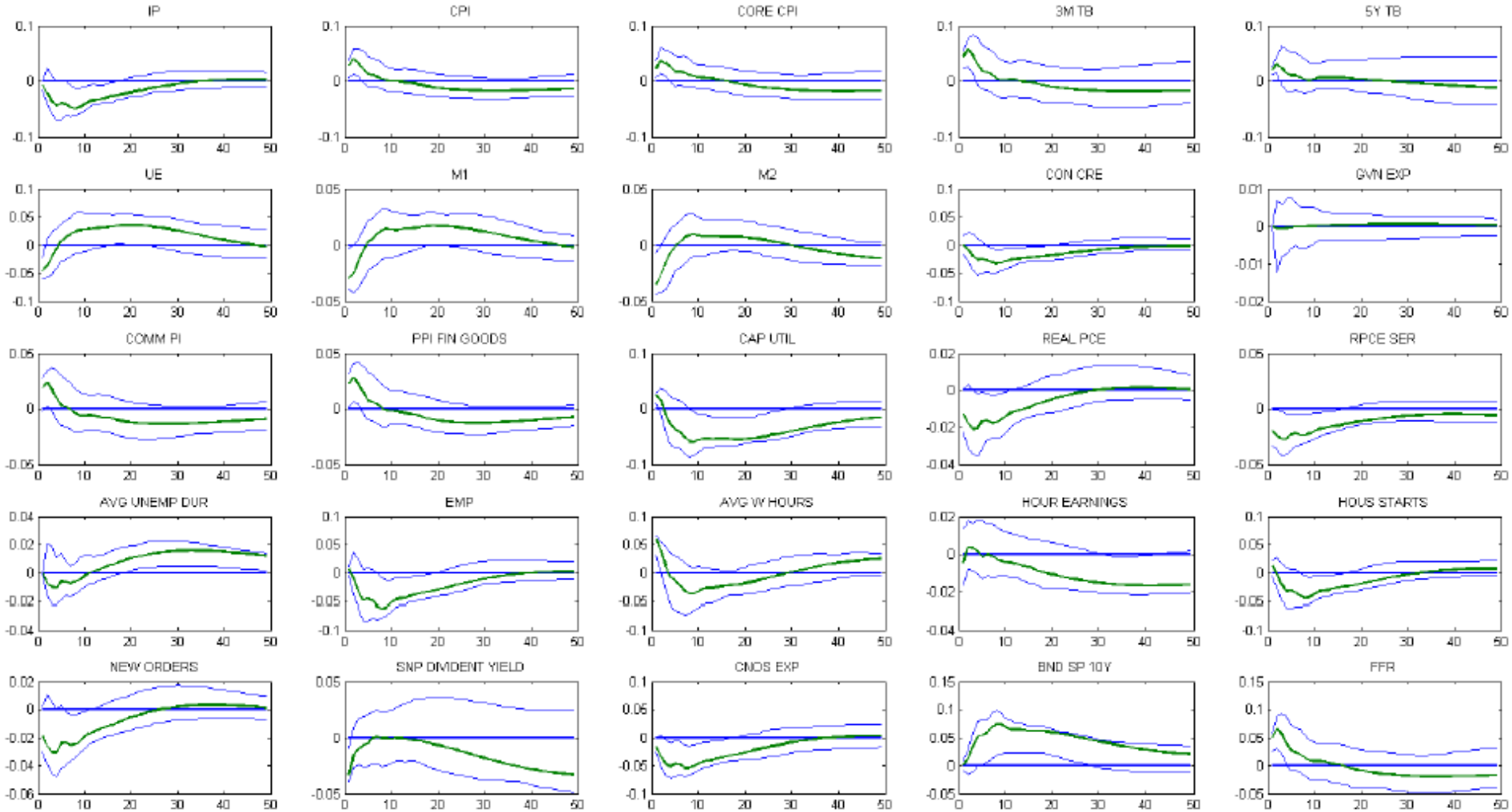
Source: medium.com

GDP projection based on market interest rate expectations, other policy measures as announced



Source:
www.bankofengland.co.uk

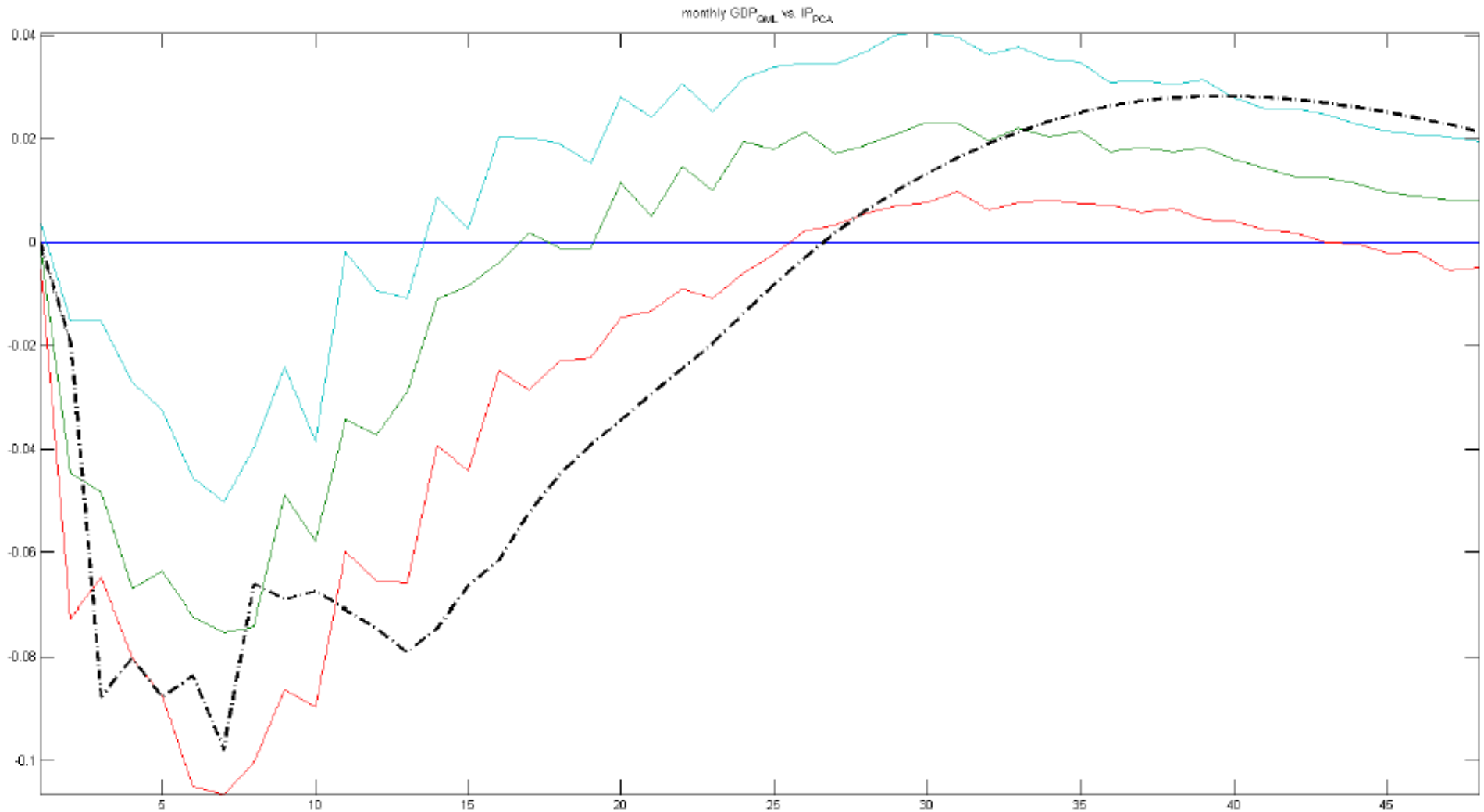
Figure 14: MF-S-FAVAR, IRs to a monetary polcy shock



Source: Marcellino&Sivec (2016)

IRs of selected variables to a monetary policy shock. IRs are estimated using the Boivin et al. (2013) dataset. Blue lines are the 95% confidence bands estimated using 500 bootstrap replications.

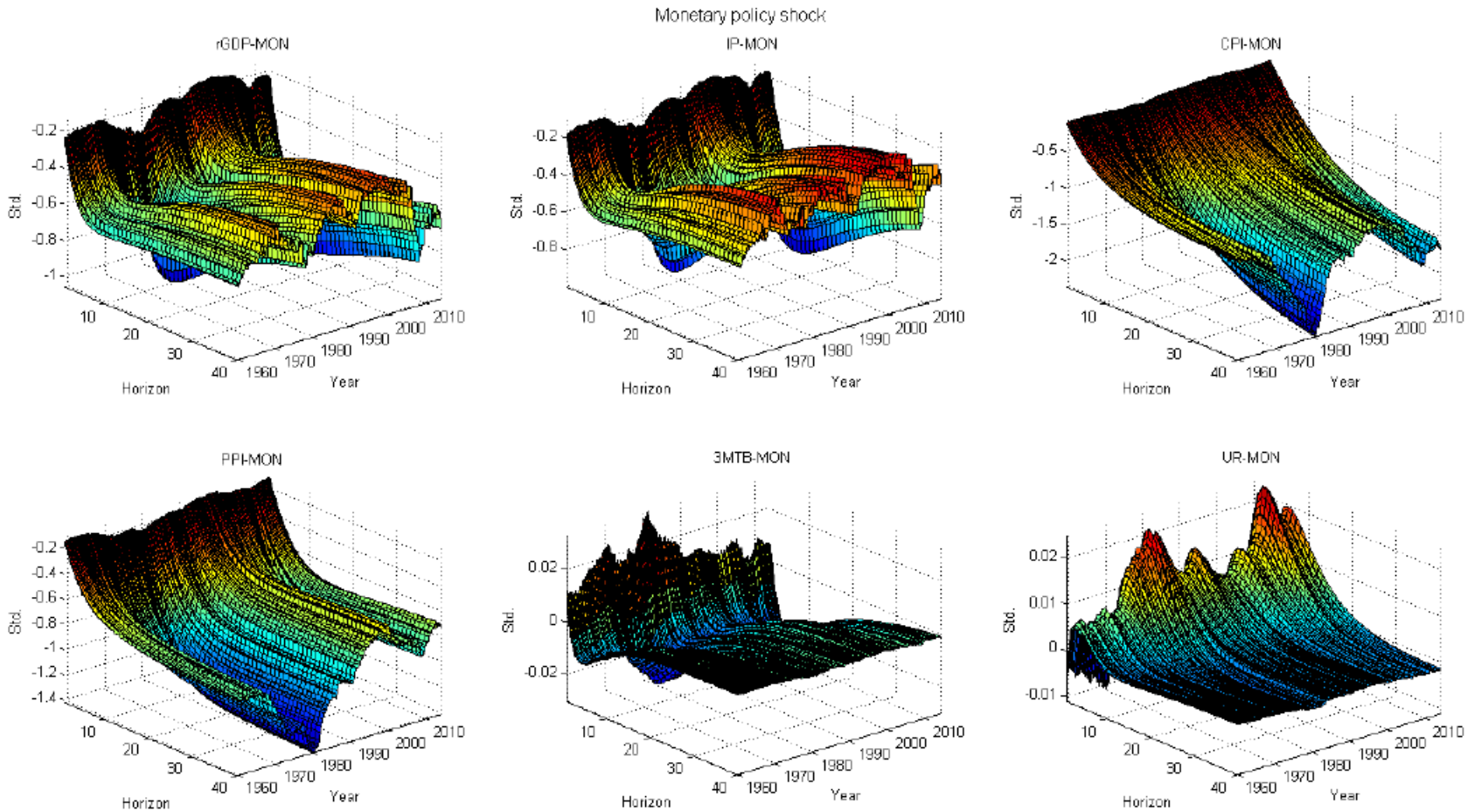
Figure 8: IRs of the industrial production index and monthly GDP to a monetary policy shock



Source: Marcellino&Sivec (2016)

Figure displays the IR of the industrial production index (solid line), calculated using the PCA approach, and of the latent monthly GDP (dashed black line), estimated with MF-S-FAVAR. The IRs were estimated on the Bernanke et al. (2005) dataset

Figure 7: IRs of selected aggregate variables to a monetary policy shock



Sivec (2015)

Comparison of models for nowcasting Lux quarterly rGDP grwoth

	RMSE					
Model	**pre-crisis**	**fin-crisis**	**svn-crisis**	**post-crisis**	**covid**	**full period**
AR	0.39	3.16	1.26	1.04	8.88	2.21
ARX	0.50	6.13	2.24	1.10	8.81	2.20
MIDAS	0.51	3.48	1.36	1.09	8.90	2.22
DFM	0.40	2.50	1.16	1.09	8.62	2.07
MFDFM	0.39	2.40	1.12	1.14	7.90	1.96
3PRF	0.48	2.70	1.17	1.05	8.51	2.08
NN	0.38	2.73	1.07	1.04	8.23	2.03
RANFOR	1.00	2.79	1.40	1.16	8.44	2.16
TOP5 ARX	0.34	2.23	1.02	0.99	7.19	1.93
TOP5 MIDAS	0.35	2.40	1.01	0.99	7.57	2.00
AVERAGE	0.51	3.24	1.35	1.09	8.54	2.12

Source: Massimiliano & Sivec (2021)