

# Simple Macroeconomic Forecast Distributions

Friederike Becker, Fabian Krüger, Melanie Schienle | July 30, 2024

# Overview

## 1. Setting

## 2. Methods

## 3. Results

## 4. Outlook

Setting  
○○○

Methods  
○○○

Results  
○○○○○

Outlook  
○○○○○

# An economist's favorite pastime

- various institutions issue forecasts for annual macroeconomic targets
  - most prominent targets: (real) GDP growth and inflation
  - for Germany, sources are (among others) the Bundesbank, the ifo institute, the OECD
  - fixed-event forecasts: target date is fixed, forecast date is not
- forecasts are often disseminated widely
  - extensive media coverage, influence on political discussions
  - relevant for real-world outcomes (public budget planning, collective bargaining)

# Can we really be that sure?

- usual practice: issue point forecasts only
  - uncertainty is at best acknowledged, rarely quantified
- forecasts of different horizons are often left uncontextualized
- distributional forecasts supposedly would require extra modeling effort

Prognose der EU

## Deutschland vermeidet 2023 Rezession

Stand: 13.02.2023 12:56 Uhr

Nach Einschätzung der EU-Kommission dürfte sich die konjunkturelle Lage in Deutschland besser entwickeln als gedacht. Das Wachstum wird den Prognosen zufolge aber sehr gering ausfallen.

In ihrem aktuellen konjunkturellen Ausblick vertritt die EU-Kommission die Einschätzung, dass Deutschland im Jahr 2023 nicht in eine Rezession fallen wird. Die Brüsseler Behörde erwartet beim Bruttoinlandsprodukt (BIP) ein kleines Plus von 0,2 Prozent. Damit hat sich die Prognose deutlich gebessert, nachdem sie im November noch ein Minus von 0,6 Prozent veranschlagt hatte.

Figure: Source: tagesschau.de

# Contributions of this work

- show that attaching prediction intervals to an existing base of point forecasts can be
  - simple
  - cheap
  - transparent
- provide competitively performing distributional forecasts for
  - GDP growth and inflation
  - all G7 countries
  - current and next year targets

# Data Source: IMF World Economic Outlook

- survey by the IMF staff, published bi-annually
  - contains forecasts with up to 6 years horizon and historic truth values
  - publication in April (horizon for current year  $\approx$  8 months) and in October ( $\approx$  2 months)
- publicly available<sup>1</sup> in an accessible format
- targets: real GDP growth, CPI inflation, current account balance
- time range: available since 1990, giving  $>30$  years of forecast-truth pairs
- target locations: forecasts are issued for 196 countries in total

---

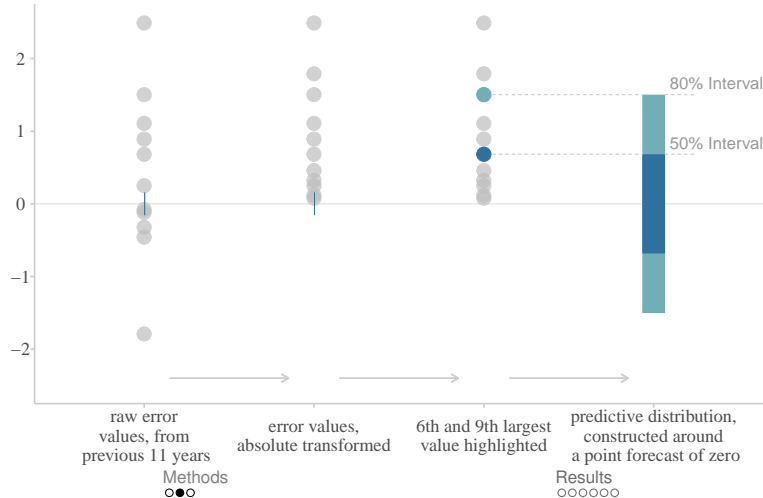
<sup>1</sup>International Monetary Fund. 2024. *World Economic Outlook Database*, available at <https://www.imf.org/en/Publications/WEO/weo-database/2024/April>

# Methods

We apply an attractively simple and cheap method. For a given country and target:

- given forecasts  $\hat{y}_{t,h}$  and the realized true values  $y_t$  ...
  - for target year  $t$ , horizon  $h$
- ... construct sets  $\mathcal{E}_{t,h} = \{\hat{e}_{t^*,h}^{abs} | t - R \leq t^* < t\}$ , containing the last  $R = 11$  forecast errors
  - based on *absolute* errors  $\hat{e}_{t,h}^{abs} = |y_t - \hat{y}_{t,h}|$
- for  $\tau \in \{0.5, 0.8\}$ , compute  $q_{t,h}^\tau = Q(\mathcal{E}_{t,h}, \tau)$ 
  - with  $R = 11$ , quantiles can be taken directly from the order statistics
- and compute the upper and lower endpoints of a central prediction interval as
  - $u_{t,h}^\tau = \hat{y}_{t,h} + q_{t,h}^\tau$
  - $l_{t,h}^\tau = \hat{y}_{t,h} - q_{t,h}^\tau$
- assess central interval coverage, score via the interval score

# Methods - Visualized





# Benchmarks

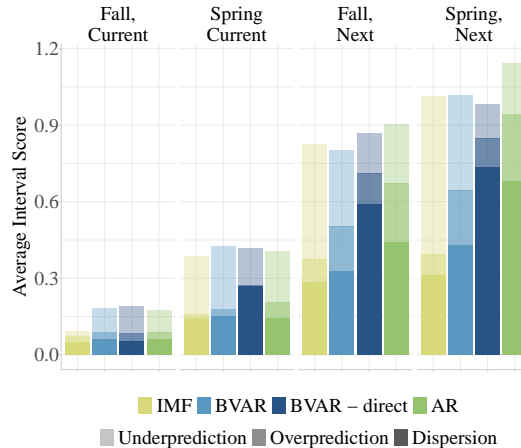
We compare with benchmarks:

- ① same methodology, alternative point forecasts
  - autoregressive model ("AR")
  - Primiceri Bayesian vector autoregressive model<sup>2</sup> ("BVAR")
- ② directly generated distributional forecasts
  - obtained from the BVAR model ("BVAR - direct")
- trained on quarterly data

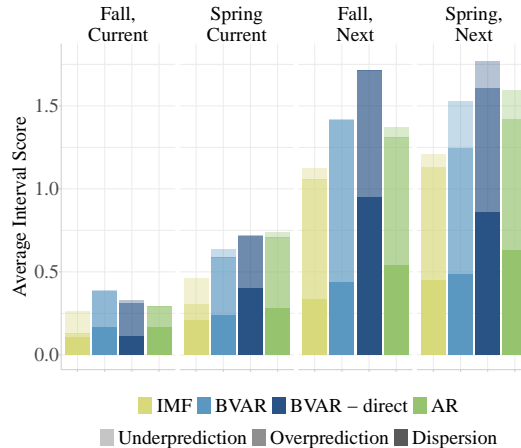
---

<sup>2</sup>Primiceri, G. 2005. *Time Varying Structural Vector Autoregressions and Monetary Policy*. Review of Economic Studies 72.

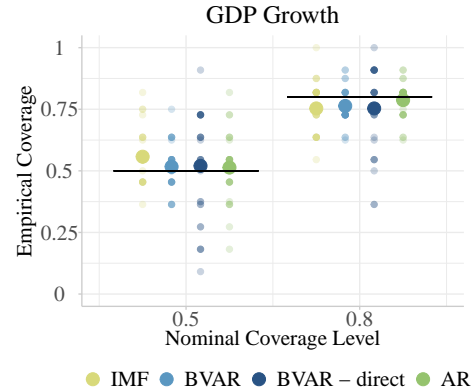
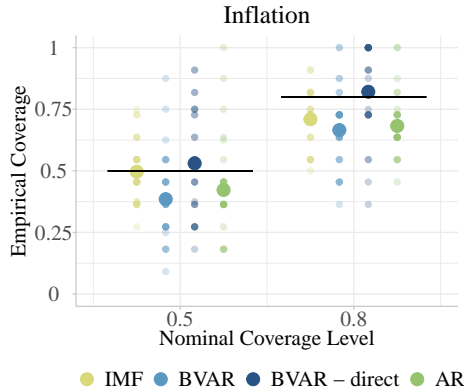
# Scores on holdout data 2013-2023 - Inflation



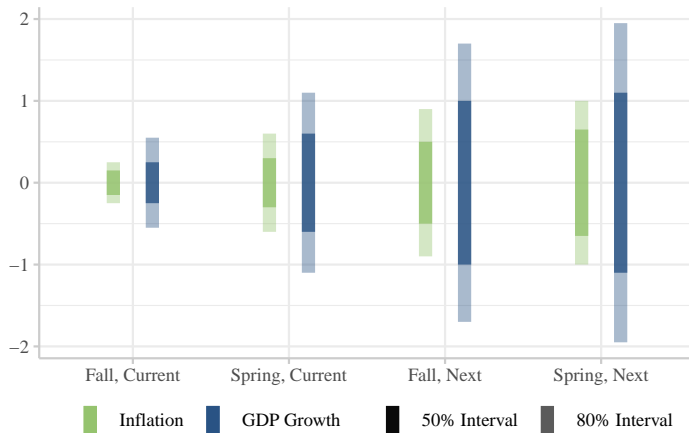
# Scores on holdout data 2013-2023 - GDP Growth



# Calibration - on holdout data 2013-2023



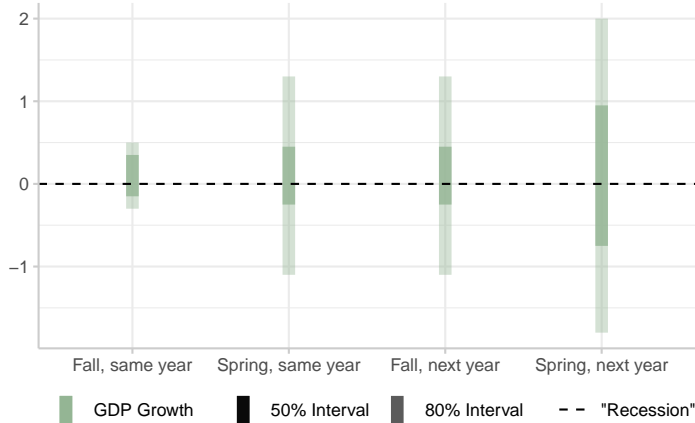
# Increasing Uncertainty



## Average length of intervals

	50%	80%
<b>GDP Growth</b>		
Fall, SY	0.5	1.1
Spring, SY	1.0	2.1
Fall, NY	1.7	3.3
Spring, NY	2.1	4.0
<b>Inflation</b>		
Fall, SY	0.3	0.5
Spring, SY	0.6	1.2
Fall, NY	1.2	2.0
Spring, NY	1.4	2.2

# Will Germany avoid recession?



# Robustness Checks / Alternative Methods

- error extraction method: absolute vs. directional errors
  - similar scores, worse calibration [link](#)
- window method: rolling vs. expanding window
  - slightly improved coverage and scores, at the cost of interpretability [link](#)
- alternative truth values from the OECD
  - influences evaluation results at the shortest horizon [link](#)
- alternative BVAR specification
  - similar scores and calibration [link](#)

# Summing up

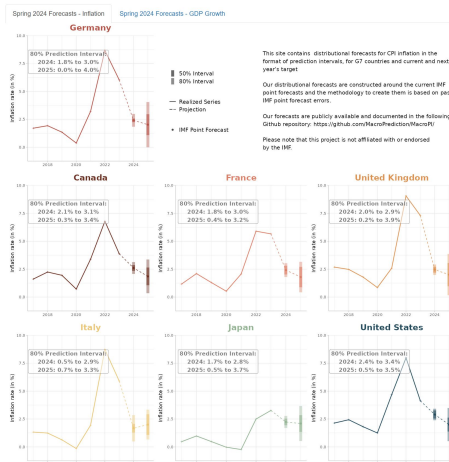
- Attaching distributional forecasts via past forecast errors to an existing base of point forecasts is
  - cheap
  - transparent
  - competitive
- IMF forecasts are valuable source for distributional forecasts
- Uncertainty around point forecasts is often substantial, making its communication necessary
- Potential Extensions / Outlook
  - scale to more countries
  - make forecasts easily and publicly accessible via shiny app
  - preregistration of real-time forecasts



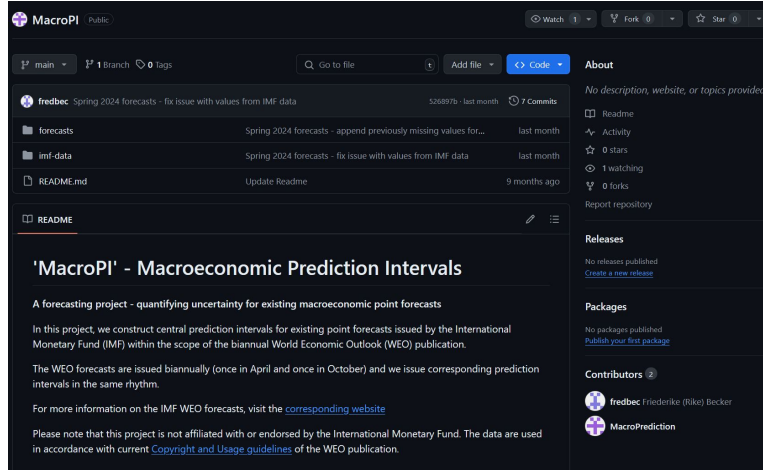
# Making it public

Shiny App:  
<https://probability-forecasting.shinyapps.io/macropi/>

GitHub repo with our forecasts:  
<https://github.com/MacroPrediction/MacroPI>



# Making it public - Timestamped Forecast Publication I



The screenshot shows a GitHub repository page for 'MacroPI' (Public). The repository has 1 Watch, 0 Forks, and 0 Stars. It is on the 'main' branch with 1 Branch and 0 tags. The repository contains three files: 'forecasts' (Spring 2024 forecasts - append previously missing values for...), 'imf-data' (Spring 2024 forecasts - fix issue with values from IMF data), and 'README.md' (Update Readme). The README file is selected and shows the following content:

## 'MacroPI' - Macroeconomic Prediction Intervals

A forecasting project - quantifying uncertainty for existing macroeconomic point forecasts

In this project, we construct central prediction intervals for existing point forecasts issued by the International Monetary Fund (IMF) within the scope of the biannual World Economic Outlook (WEO) publication.


The WEO forecasts are issued biannually (once in April and once in October) and we issue corresponding prediction intervals in the same rhythm.


For more information on the IMF WEO forecasts, visit the [corresponding website](#)


Please note that this project is not affiliated with or endorsed by the International Monetary Fund. The data are used in accordance with current [Copyright and Usage guidelines](#) of the WEO publication.

The right sidebar shows the 'About' section with no description, website, or topics provided. It also lists 'Releases' (No releases published), 'Packages' (No packages published), and 'Contributors' (2 contributors: fredbec and MacroPrediction).

# Making it public - Timestamped Forecast Publication II

MacroPI / forecasts / forecasts\_Spring2024.csv 

 fredbec Spring 2024 forecasts - append previously missing values for Japan

[Preview](#)
[Code](#)
[Blame](#)
113 lines (113 loc) · 5.35 KB
 Code 55% faster with GitHub Copilot

🔍 Search this file

	country	target	forecast_year	forecast_season	target_year	quantile	prediction
1							
2	CAN	gdp_growth	2024	S	2024	0.1	0.24114360300708
3	CAN	gdp_growth	2024	S	2024	0.25	0.66909486974327
4	CAN	gdp_growth	2024	S	2024	0.75	1.63924033544263
5	CAN	gdp_growth	2024	S	2024	0.9	2.06719160217882

Setting  
○○○○

Methods  
○○○

Results  
○○○○○

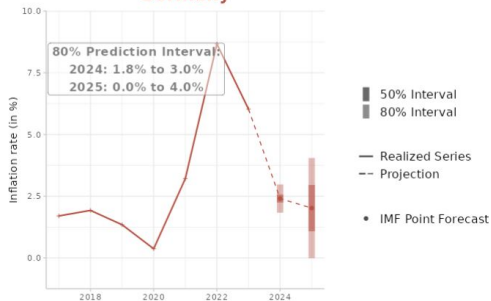
Outlook  
○○○●○

# Making it public - Visualization

Spring 2024 Forecasts - Inflation

Spring 2024 Forecasts - GDP Growth

**Germany**



This site contains distributional forecasts for CPI inflation in the format of prediction intervals, for G7 countries and current and next year's target

Our distributional forecasts are constructed around the current IMF point forecasts and the methodology to create them is based on past IMF point forecast errors.

Our forecasts are publicly available and documented in the following Github repository: <https://github.com/MacroPrediction/MacroPI/>

Please note that this project is not affiliated with or endorsed by the IMF.

Setting  
○○○○

Methods  
○○○

Results  
○○○○○

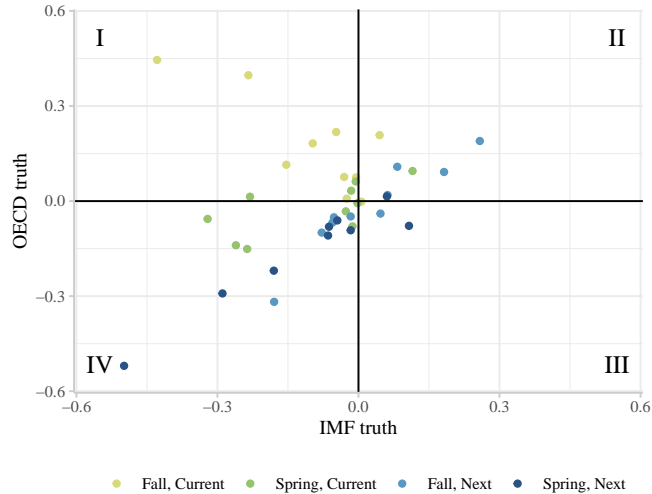
Outlook  
○○○○●

# Directional Errors - Scores on years 2001-2012

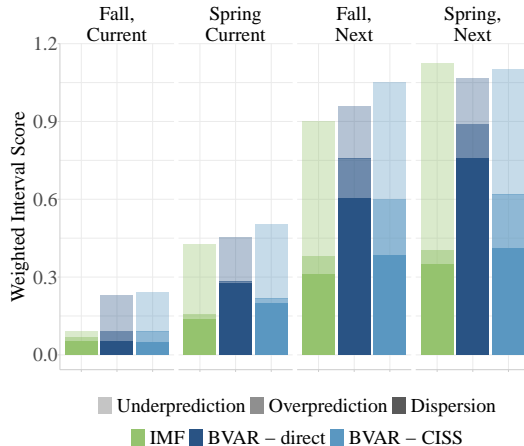
	Horizon	Interval Score		50% Cvg.		80% Cvg.	
		absolute	directional	absolute	directional	absolute	directional
GDP Growth	Fall, Current	<b>0.23</b>	0.24	<b>0.49</b>	0.43	<b>0.76</b>	0.65
	Spring, Current	0.41	<b>0.41</b>	0.56	<b>0.54</b>	<b>0.76</b>	0.67
	Fall, Next	0.91	<b>0.88</b>	<b>0.49</b>	0.42	<b>0.73</b>	0.70
	Spring, Next	<b>1.14</b>	1.15	<b>0.50</b>	0.40	<b>0.64</b>	0.55
Inflation	Fall, Current	<b>0.12</b>	0.12	<b>0.52</b>	0.44	<b>0.76</b>	0.64
	Spring, Current	0.26	<b>0.25</b>	<b>0.43</b>	0.39	<b>0.75</b>	0.65
	Fall, Next	<b>0.47</b>	0.50	<b>0.40</b>	0.31	<b>0.67</b>	0.54
	Spring, Next	<b>0.52</b>	0.55	<b>0.42</b>	0.38	<b>0.67</b>	0.54

# Expanding Window - Scores

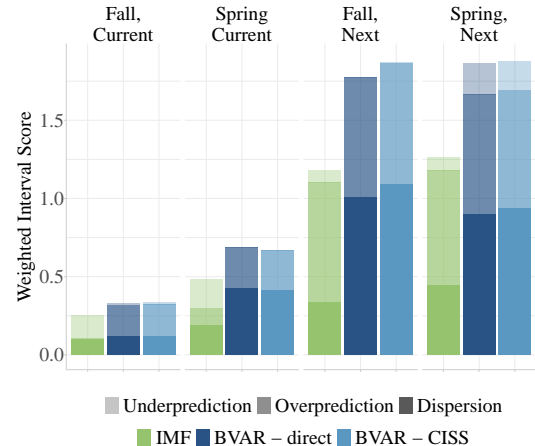
# Alternative truth value - Scores



# Alternative BVAR specification - Scores



(a) Inflation



(b) GDP Growth