Making Useful Forecasts

Aaron Smith
Agricultural and Resource Economics
UC Berkeley
https://asmith.ucdavis.edu

Summary
1. Forecast intervals not points
2. Trends dominate long-run forecasts
3. Correlations matter

1. Forecast Intervals Not Points

Everyone wants to know **THE** number

- Forecast should reflect what we know

ERS food outlook now does this. **Excellent!**

- State the probability associated with interval
- FPO currently reports 95% intervals (I think)
- Consider 90% (9 years out of 10)

Consumer Price Index item	Prediction Interval 2024[2]			Prediction Interval 2025[2]		
	Percent change			*Percent change*		
	Lower	Mid	Upper	Lower	Mid	Upper
All food	1.5	2.2	2.9	-3.7	2.0	8.0
Food away from home	3.8	4.3	4.7	0.0	3.0	6.1
Food at home	-0.1	1.0	2.1	-7.6	0.7	9.8


USDA Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Economic Research Service

Technical Bulletin Number 1957

August 2022

Time-Series Methods for Forecasting and Modeling Uncertainty in the Food Price Outlook

Matthew J. MacLachlan, Carolyn A. Chelius, and Gianna Short

1. Forecast Intervals Not Points

Consider formalizing interval forecasting using **conformal prediction**

- guarantees coverage probability

Convert point forecasts from **any prediction algorithm** into an interval

All you need is a sample of n predictions ($\hat{y}_t$) and outcomes (y_t)

- $R_t = |y_t - \hat{y}_t|$ is absolute prediction error
- Assume exchangeability of R_t
- Define q_{n+1} as 0.1 quantile of $\{R_1, R_2, \ldots, R_n\}$
- 90% forecast interval is $[\hat{y}_{n+1} - q_{n+1}, \hat{y}_{n+1} + q_{n+1}]$

Can allow interval width to vary using studentization of R_t or quantile regression

Anastasios N. Angelopoulos and Stephen Bates. A gentle introduction to conformal prediction and distribution-free uncertainty quantification. Foundations and Trends in Machine Learning, 16(4):494–591, 2023.

2. Trends Dominate Long-Run Forecasts

Consider predicting average inflation over the next *n* years

Old: fit a times series model and project

- trend assumptions dominate

New: regress inflation on cosine functions

- asymptotically normal from central limit theorem
- Müller and Watson

Review of Economic Studies (2016) **83**, 1711–1740 doi:10.1093/restud/rdw003

Advance access publication 21 January 2016

Measuring Uncertainty about Long-Run Predictions

ULRICH K. MÜLLER
Princeton University, Department of Economics
and
MARK W. WATSON
Princeton University, Department of Economics

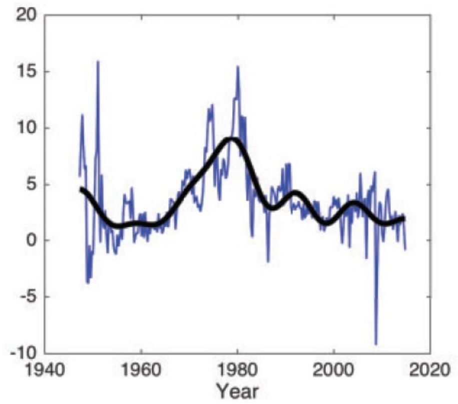
First version received September 2013; final version accepted December 2015 (Eds.)

Long-run forecasts of economic variables play an important role in policy, planning, and portfolio decisions. We consider forecasts of the long-horizon average of a scalar variable, typically the growth rate of an economic variable. The main contribution is the construction of prediction sets with asymptotic coverage over a wide range of data generating processes, allowing for stochastically trending mean growth, slow mean reversion, and other types of long-run dependencies. We illustrate the method by computing prediction sets for 10- to 75-year average growth rates of U.S. real per capita GDP and consumption, productivity, price level, stock prices, and population.

Key words: Prediction interval, Low frequency, Spectral analysis, Least favourable distribution

JEL Codes: C22, C53, E17

(i) Series and low-frequency component



3. Correlations Matter

Handbook of Macroeconomics, 2016

CHAPTER 8

Dynamic Factor Models, Factor-Augmented Vector Autoregressions, and Structural Vector Autoregressions in Macroeconomics☆

J.H. Stock*[,‡], M.W. Watson[†,‡]

Better models

- most of the variation in large datasets can be captured by a small number of factors
- dimension reduction reduces noise

Better decisions

- to what extent do food price increases coincide with energy price increases?
- do grain price increases tend to coincide with livestock price increases?
- correlation between price and quantity drives revenue insurance payouts

Summary

1. Forecast intervals not points
2. Trends dominate long-run forecasts
3. Correlations matter

Aaron Smith
Rausser Chair of Ag and Resource Economics
UC Berkeley

https://asmith.ucdavis.edu
https://agdatanews.substack.com
aaronsmith@berkeley.edu