nowcast

Bridge-equation nowcasting and real-time evaluation in R

Charles Coverdale

London, United Kingdom

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The question

How do we nowcast quarterly GDP from monthly indicators in a single reproducible R workflow?

Alignment, bridge estimation, real-time backtesting, one consistent interface.

Why it matters

- **Central banks** run GDP nowcasts as a core monthly deliverable
- **Sovereign fiscal offices** pre-position budget forecasts before the official print
- **Macro hedge funds** trade the gap between consensus and real-time data flow
- **International organisations** (IMF, OECD) publish current-quarter estimates for surveillance

What is already out there

- **`bridgr`**: bridge equations inside tidyverse, no evaluation pipeline[1]
- **`midasr`**: mixed-data-sampling regressions, different modelling family[2]
- **`dfms`**: dynamic factor models in C++, scales to large panels[3]
- **Central-bank scripts**: bespoke code per institution, not reusable

The gap: **no single package unifies alignment, bridge estimation, pseudo-real-time backtesting, and Diebold-Mariano testing**.

[1] Dahlhaus (2021), *bridgr: Bridge Equations in R*, R package.

[2] Ghysels, Kvedaras & Zemlys (2016), *Mixed Frequency Data Sampling Regression Models: the R Package midasr*, Journal of Statistical Software 72(4).

[3] Krantz & Bagdziunas (2023), *dfms: Dynamic Factor Models*, R package.

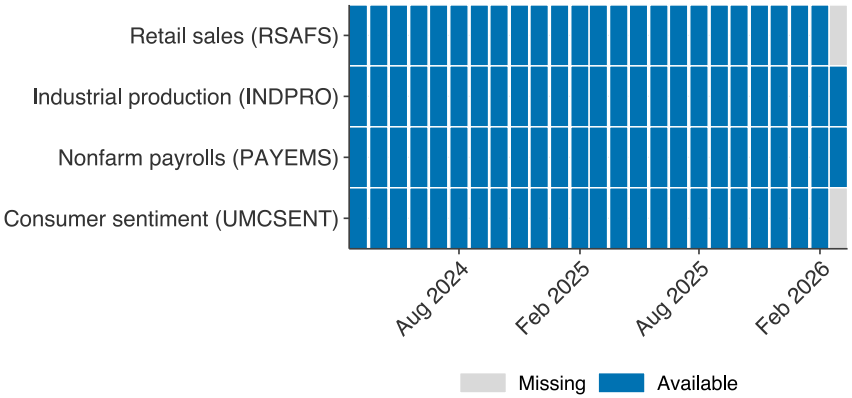
What nowcast offers

1. **Coverage**: alignment, bridge estimation, pseudo-real-time backtest, HLN-corrected DM test, all in one place
2. **Interface**: ten exported functions share the `nc_` prefix, accept plain data frames, return S3 objects with `print()`, `summary()`, `plot()`
3. **Provenance**: pure R, `cli` as only non-base import, deterministic outputs, 153 unit tests, no bundled data

On CRAN since March 2026. Follows Giannone et al. (2008) and Harvey-Leybourne-Newbold (1997) conventions[4].

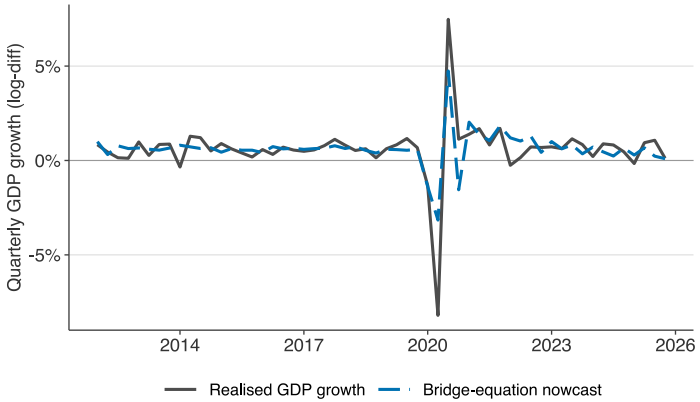
[4] Giannone, Reichlin & Small (2008), *Nowcasting: The real-time informational content of macroeconomic data*, Journal of Monetary Economics 55(4).

Alignment: ragged-edge data availability



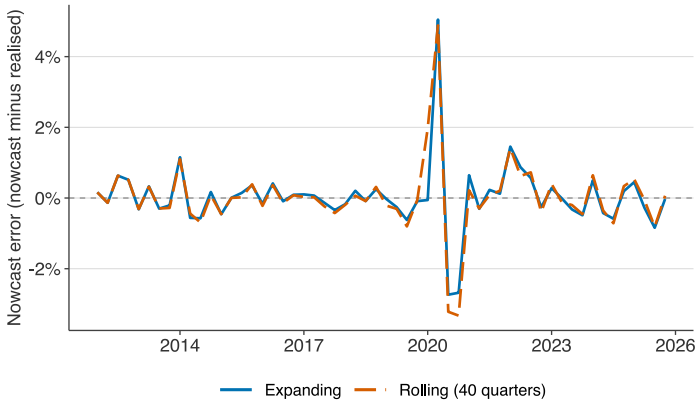
Ragged-edge availability of monthly indicators at nowcast time. Exports: `nc_align()`, `nc_ragged_edge()`, `nc_aggregate()`, `nc_transform()`.

Bridge: pseudo-real-time GDP nowcast



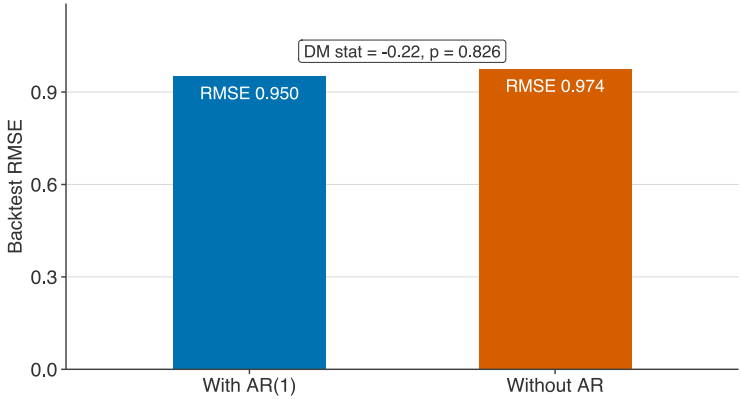
Pseudo-real-time bridge nowcast of quarterly GDP growth against the realised series. Exports: `nc_bridge()` *with optional AR term.*

Backtest: expanding vs rolling window



Expanding-window and rolling-window backtest errors across the sample. Exports: `nc_backtest()`, `nc_evaluate()`.

DM test: HLN-corrected specification comparison



Diebold-Mariano loss-differential test with the Harvey-Leybourne-Newbold small-sample correction. Exports: `nc_dm_test()`.

Central formulas

Bridge equation with AR(p) (quarterly target, monthly aggregates):

$$y_t = \alpha + \sum_{j=1}^{J} \beta_j x_{j,t}^{\text{agg}} + \sum_{k=1}^{p} \rho_k y_{t-k} + \varepsilon_t \tag{1}$$

Diebold-Mariano statistic with loss differential d_t:

$$\text{DM} = \bar{d} / \sqrt{V_n} \tag{2}$$

Harvey-Leybourne-Newbold correction (horizon h, sample n):

$$\text{DM}^* = \text{DM} \cdot \sqrt{\frac{n + 1 - 2h + h(h-1)/n}{n}} \tag{3}$$

Package at a glance

Function families:

- **Alignment**: `nc_align()`, `nc_ragged_edge()`, `nc_aggregate()`, `nc_transform()`
- **Estimation**: `nc_bridge()` with optional AR term
- **Backtesting**: `nc_backtest()` expanding or rolling window
- **Evaluation**: `nc_evaluate()` RMSE, MAE, bias
- **Testing**: `nc_dm_test()` HLN-corrected
- **Dispatchers**: `nc_compute()`, `nc_available()`

Deps: `cli`, `grDevices`, `graphics`, `stats`. R $\geq$ 4.1.0.

Uniform output

Every modelling call returns S3 objects: `nowcast_result` | `nowcast_backtest` | `nowcast_dm` with `print()`, `summary()`, `plot()`.

Minimal working example

```r
library(nowcast)

# Align quarterly GDP with four monthly indicators
aligned  <- nc_align(gdp, retail = retail_df, indpro = indpro_df,
                     payrolls = payrolls_df, sentiment = sent_df)

# Fit a bridge equation, then backtest it pseudo-real-time
fit      <- nc_bridge(target ~ retail + indpro + payrolls + sentiment,
                      data = aligned)
backtest <- nc_backtest(target ~ retail + indpro + payrolls + sentiment,
                        data = aligned, start = 40)
backtest$metrics  # RMSE, MAE, bias
```

Four calls: align, fit, backtest, read metrics. Same data frame flows through each step; no reshaping, no column juggling.

US GDP nowcasting, 2012 to present

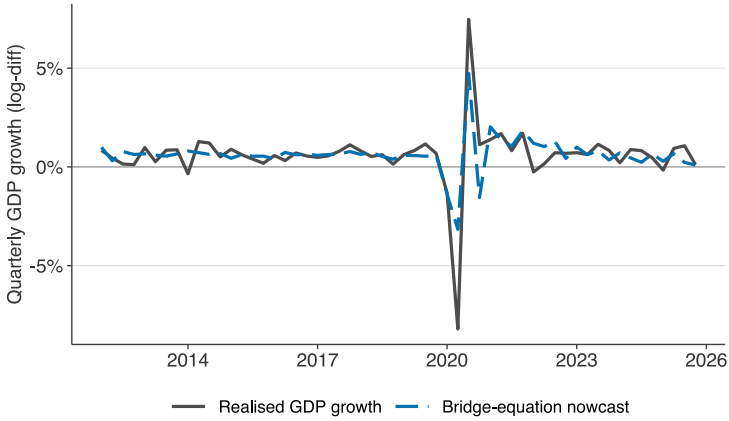
Data. Quarterly US real GDP from FRED series `GDPC1`. Four monthly indicators: retail sales (`RSAFS`), industrial production (`INDPRO`), nonfarm payrolls (`PAYEMS`), Michigan consumer sentiment (`UMCSENT`). Fourteen years, 56 quarters.

Question. *Can a four-indicator bridge equation track US GDP growth through the 2020 pandemic shock and the post-2022 recovery?*

Why this case. Canonical US nowcast setup. Includes the largest peacetime real-GDP contraction in US history. Reproducible with public FRED data and five function calls[5].

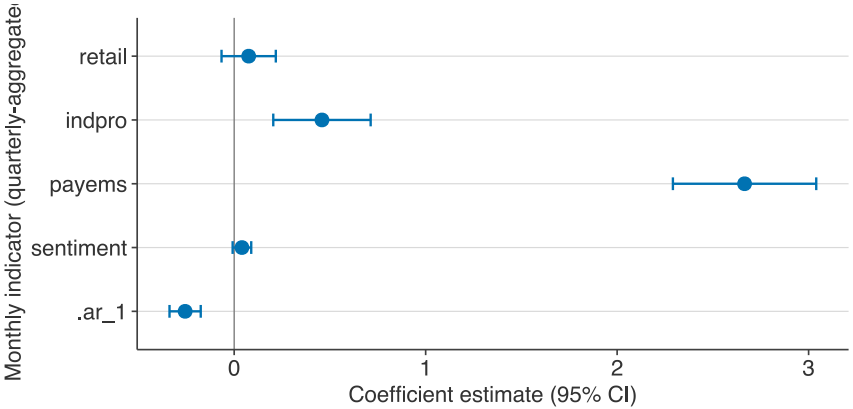
[5] Bok, Caratelli, Giannone, Sbordone & Tambalotti (2018), *Macroeconomic nowcasting and forecasting with big data*, Annual Review of Economics 10.

US GDP nowcast, 2012 to 2024



One-step-ahead expanding-window bridge nowcast of US real GDP against FRED `GDPC1`. RMSE 0.95 *pp, MAE* 0.51*, bias* 0.03*.*

Deep dive: which indicators carry the signal?



Bridge-equation coefficients with 95 per cent confidence intervals, full-sample fit on US real GDP. Retail and industrial production dominate; payrolls and sentiment contribute marginally.

What nowcast does not yet do

- **Bridge equations only**: no MIDAS regressions, no dynamic factor models
- **No data fetching**: users supply data frames from FRED, ONS, Eurostat, ECB themselves
- **Final-vintage data**: no real-time revision tracking; users needing vintages must construct them upstream
- **Monthly alignment only**: flash-estimate and intra-month releases require manual handling

v0.2.0 roadmap: `nc_midas()`, `nc_dfm()`, `nc_combine()` for model averaging, `nc_compare()` for side-by-side specification tables, `nc_fill()` for ragged-edge completion.

Contact, code, paper

Charles Coverdale

charles.f.coverdale@gmail.com
github.com/charlescoverdale/nowcast
charlescoverdale.github.io/publications

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