



FoReco and FoRecoML

Unified Forecast Reconciliation in R

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Joint work with Jeroen Rombouts, Ines Wilms and Yangzhuoran Fin Yang

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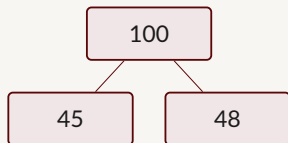


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Why forecast reconciliation?

From incoherent to coherent

✗ Base (incoherent)



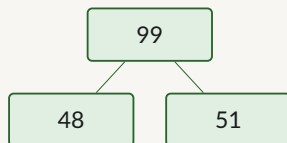
$$45 + 48 = 93 \neq 100$$

The national team plans for 100
The regional teams plan for 93

Same company, **two different numbers**:
inventory, staffing and budgets **diverge**

No one is “wrong” (*a priori*)

✓ Reconciled (coherent)



$$48 + 51 = 99 \checkmark$$



Reconciliation (Athanasopoulos *et al.*, 2024) is the general fix:
it **revises every level** so everyone can plan with **one coherent set of forecasts**

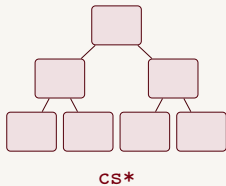


The FoReco ecosystem

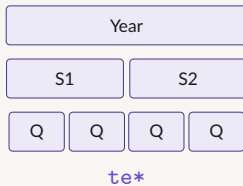
FoReco (Girolimetto and Di Fonzo, 2025) and FoRecoML (Girolimetto *et al.*, 2025)

Frameworks

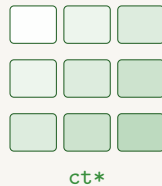
Cross-sectional
variables



Temporal
frequencies



Cross-temporal
both variables & frequencies



Methods

- ⦿ *Classical reconciliation*: top-down `*td()`, bottom-up `*bu()` and middle-out `*mo()`
- ⦿ *Regression-based reconciliation*: least squares `*rec()` and level conditional coherent `*lcc()`
- ⦿ *Probabilistic reconciliation*: Gaussian-based `*mvn()` and sample-based `*smp()`
- ⦿ *ML-based reconciliation* `*rml()`



One consistent interface

One verb to rule them all, one verb to find them, one verb to bring them all and in the coding bind them

Regression

```
rec <- ctrec(  
  base = fc,  
  agg_mat = A,  
  agg_order = c(4,2,1),  
  comb = "shr", res = res # Regression args  
)
```

Machine learning

```
rec <- ctrml(  
  base = fc,  
  agg_mat = A,  
  agg_order = c(4,2,1),  
  hat = vbf, obs = vobs # ML args  
)
```

Sensible defaults for newcomers, full control for experts

One line to get started

Minimal effort, sensible defaults.

```
rf <- csrec(base, agg_mat)
```

Full control when you need it

Covariance, non-negativity, immutables...

```
rf <- csrec(base, agg_mat,  
            res = res, comb = "shr",  
            nn = TRUE, immutable = fixed)
```

Why R users should care

Girolimetto *et al.* (2026)

- ⦿ **Unified toolbox**: the *only* R package covering **all three** frameworks (cs / te / ct)
- ⦿ **Almost every method**: classical, MinT, level-conditional, probabilistic *and* ML
- ⦿ **More features**: non-negative & immutable reconciliation, smart **defaults** + full **expert control**
- ⦿ **Open source**, on **CRAN**, actively developed on GitHub

	cs	te	ct	
hts	✓	-	-	
thief	-	✓	-	
fable	✓	-	-	
bayesRecon	✓	✓	-	
FoReco	✓	✓	✓	+ much more
FoRecoML	✓	✓	✓	

```
install.packages(c("FoReco", "FoRecoML"))
```

3

frameworks
cs · te · ct

8

method
families

1

consistent
interface

**OPEN
SOURCE**

on CRAN
& GitHub





Thank you!

Any questions?

 <https://arxiv.org/abs/2604.27696>

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 [danigiuro/FoReco](https://github.com/danigiuro/FoReco)

 danigiuro.github.io/FoReco

 CRAN/package=FoReco

 [danigiuro/FoRecoML](https://github.com/danigiuro/FoRecoML)

 danigiuro.github.io/FoRecoML

 CRAN/package=FoRecoML



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References

- Athanasopoulos, G., Hyndman, R. J., Kourentzes, N. and Panagiotelis, A. (2024) Forecast reconciliation: A review. *International Journal of Forecasting* **40**(2), 430–456. **doi:** <http://dx.doi.org/10.1016/j.ijforecast.2023.10.010>
- Girolimetto, D. and Di Fonzo, T. (2025) FoReco: Forecast reconciliation. *R package version 1.4.0*
URL: <https://CRAN.R-project.org/package=FoReco>
- Girolimetto, D., Rombouts, J., Wilms, I. and Yang, Y. F. (2025) FoRecoML: Forecast reconciliation with machine learning. *R package version 0.2.0*
URL: <https://CRAN.R-project.org/package=FoRecoML>
- Girolimetto, D., Rombouts, J., Wilms, I. and Yang, Y. F. (2026) FoReco and FoRecoML: A unified toolbox for forecast reconciliation in R. *arXiv* **doi:** <http://dx.doi.org/10.48550/arXiv.2604.27696>