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Performance of asymmetric filters for trend-cycle extraction Application to the COVID-19 crisis

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Introduction

Moving averages (or *linear filters*) are ubiquitous in trend-cycle extraction and seasonal adjustment (e.g.: X-13-ARIMA):

$$M_\theta(X_t) = \sum_{k=-p}^{+f} \theta_k X_{t+k}$$

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- In general, *symmetric* moving averages ($p = f$ et $\theta_{-i} = \theta_i$)

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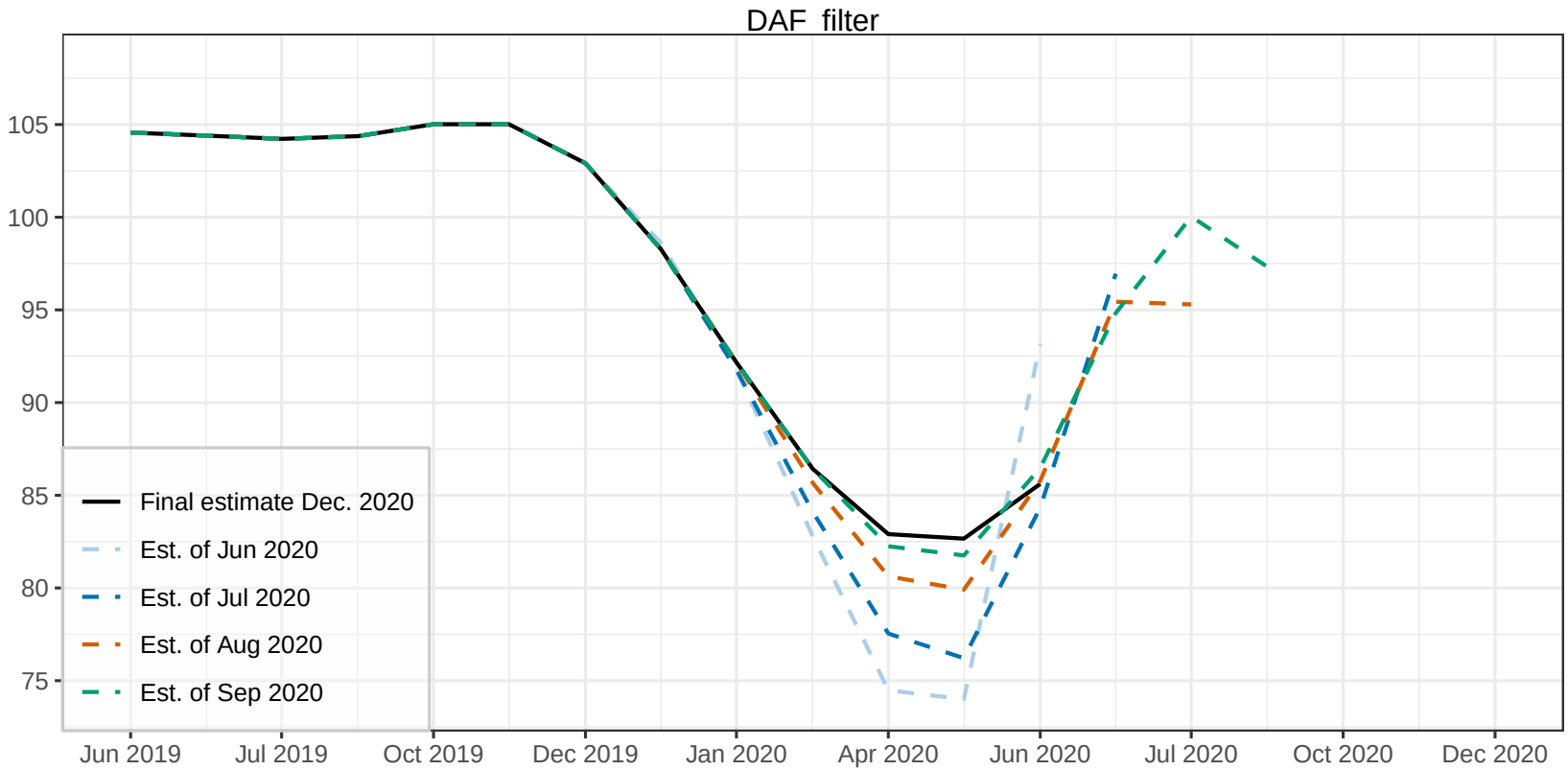
- In general, *symmetric* moving averages ($p = f$ et $\theta_{-i} = \theta_i$)
- For **real-time estimates**, we must rely on *asymmetric* filters ($p > f$): revisions and delay in turning points detections (*phase-shift*)
- Comparison of 5 non-parametric methods that could be included in X-13-ARIMA

Example with the French IPI: DAF filters

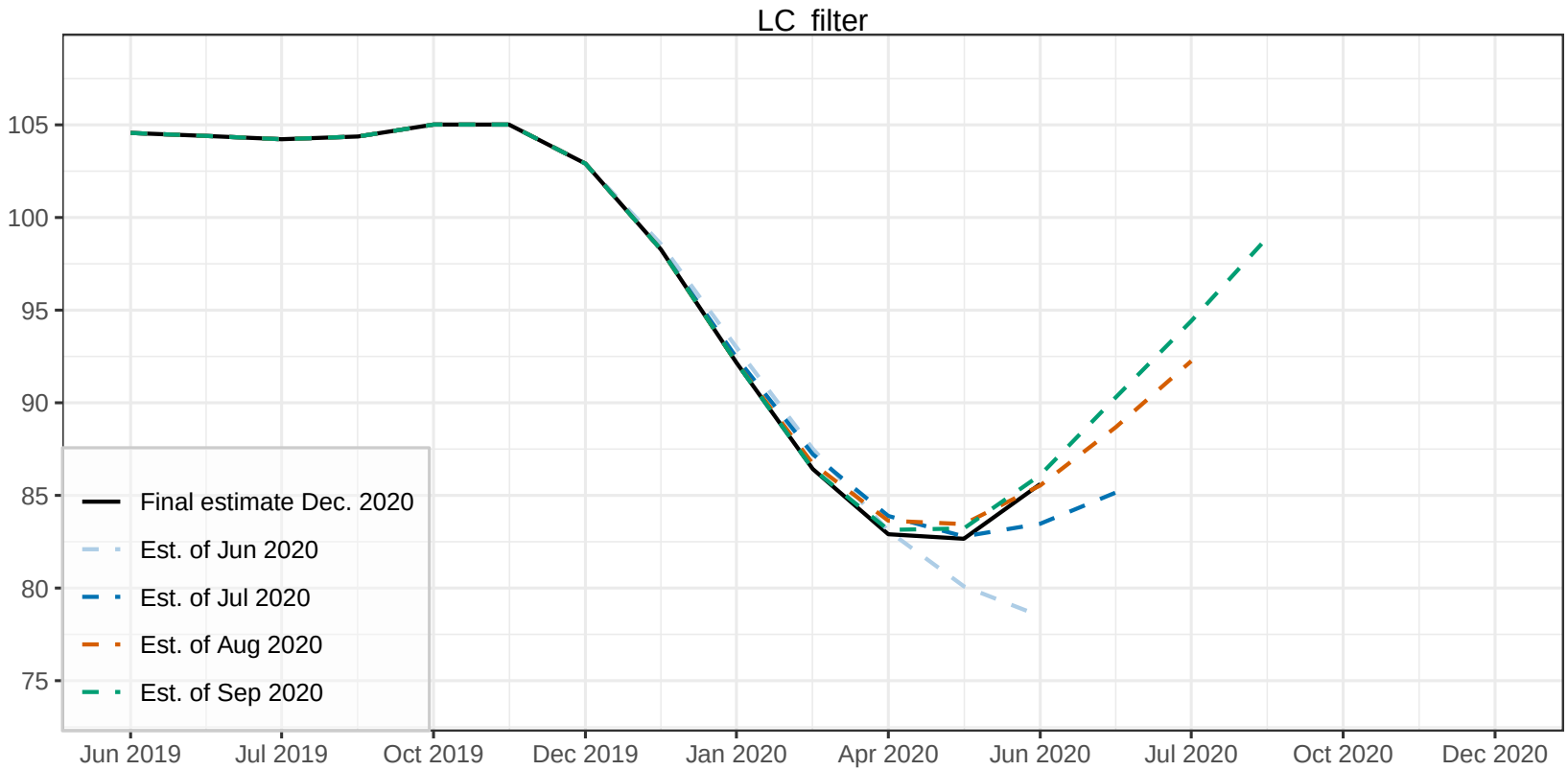
1. Local polynomial filters by Proietti and Luati (2008)
   i. Direct asymmetric filter (**DAF**) local polynomial of degree 3 (as for symmetric filters) ➔ used in SA method STL



Final estimate: Henderson filter of order 13 ($p = f = 6$)

Example with the French IPI: LC filters

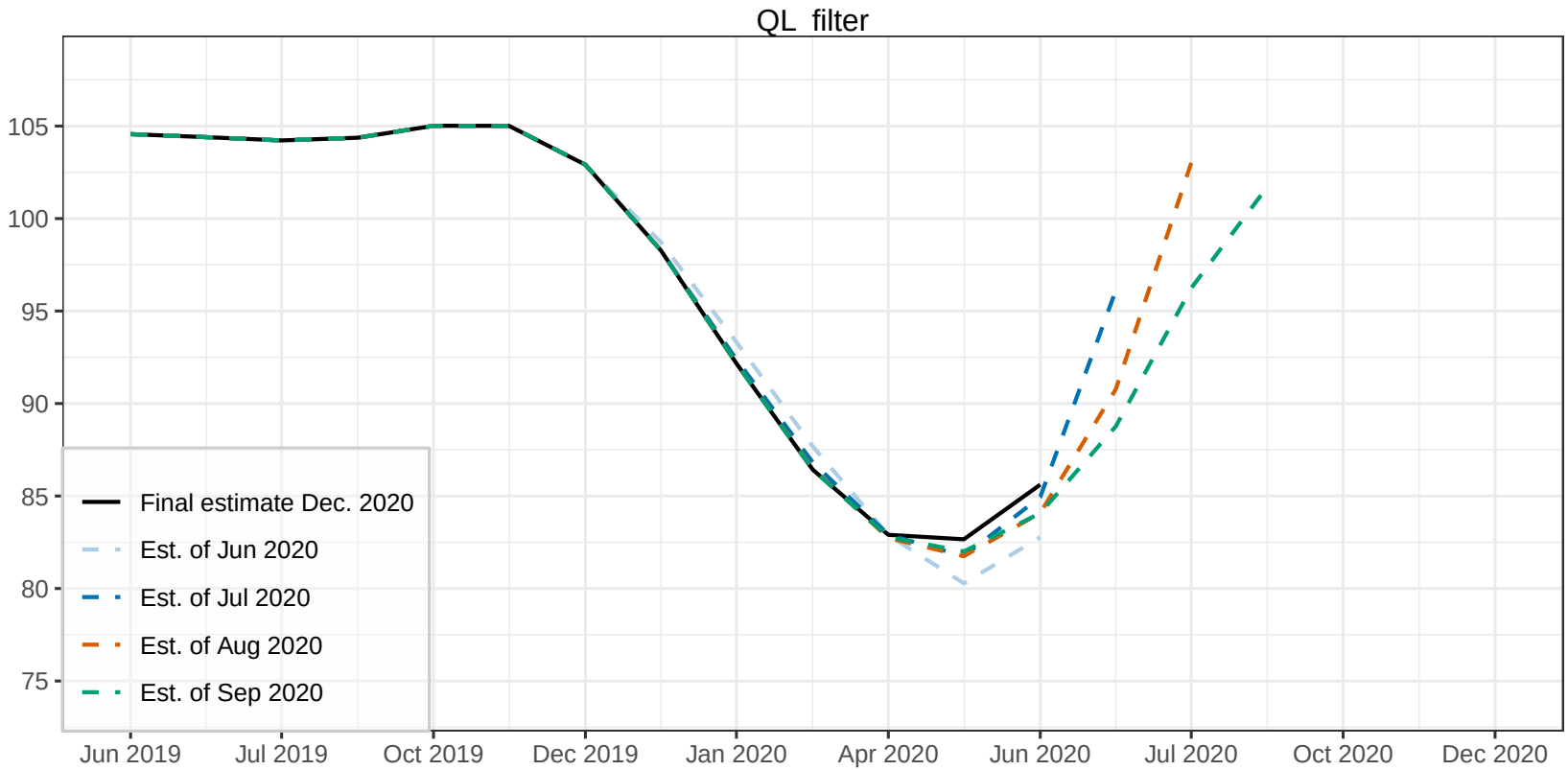
1. Local polynomial filters by Proietti and Luati (2008)
   ii. Linear-Constant (**LC**) filter: trend is of degree 1 and asymmetric filter preserves of degree 0 (constant) ➔ Musgrave filters



Final estimate: Henderson filter of order 13 ($p = f = 6$)

Example with the French IPI: QL filters

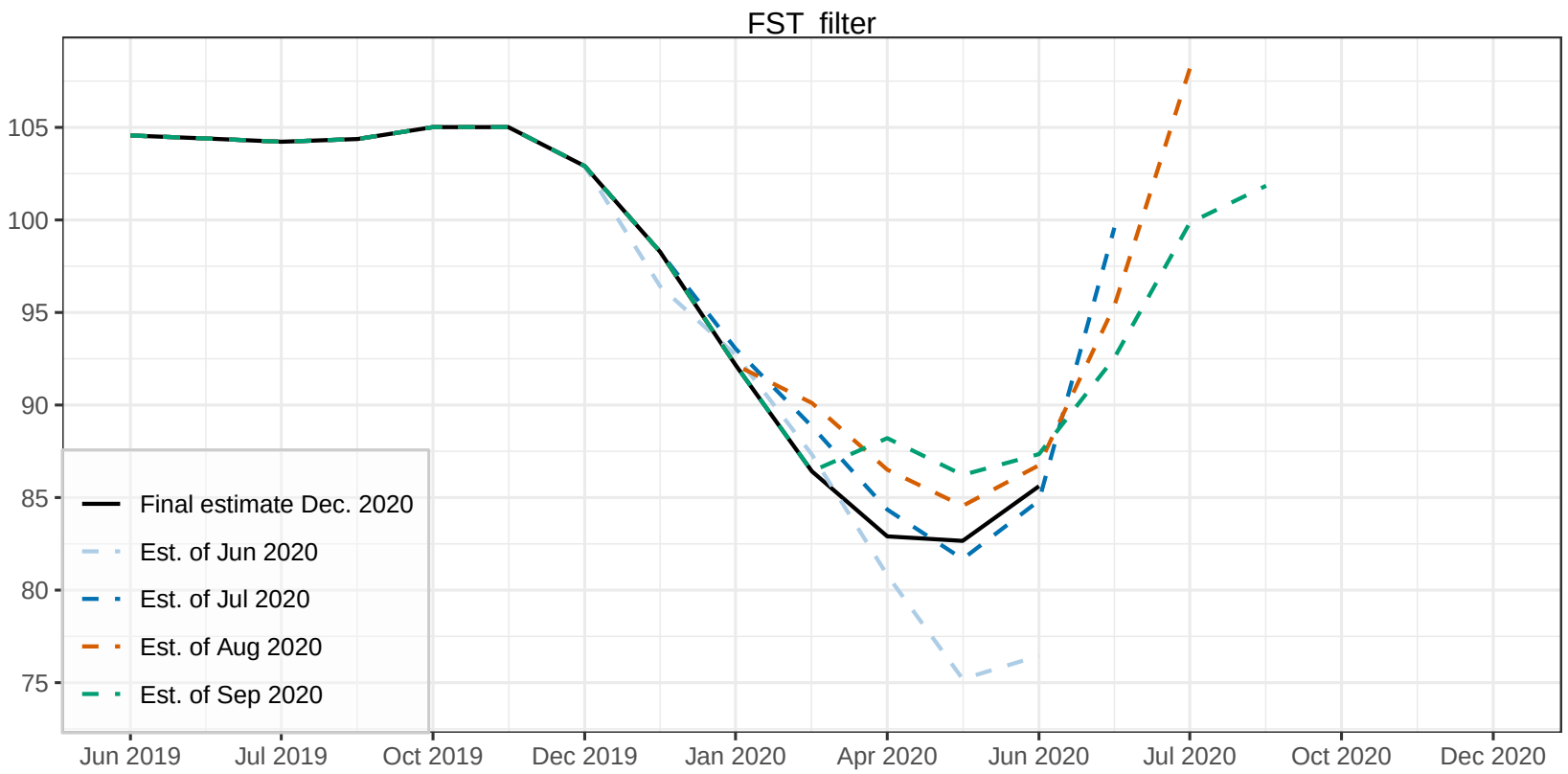
1. Local polynomial filters by Proietti and Luati (2008)
   iii. Quadratic-Linear (**QL**) filter: trend is of degree 2 and asymmetric filter preserves trends of degree 1



Final estimate: Henderson filter of order 13 ($p = f = 6$)

Example with the French IPI: FST filters

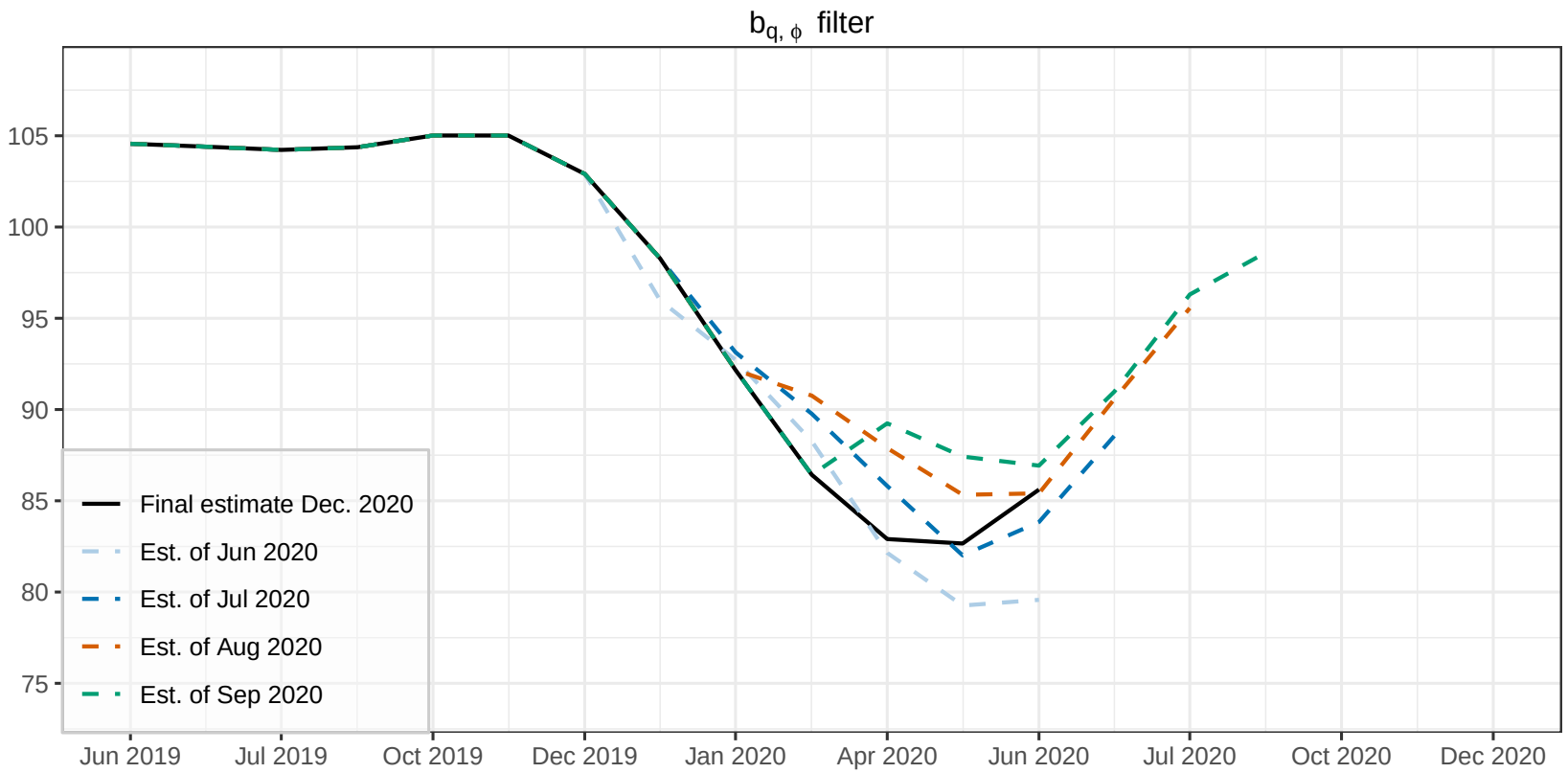
2. Fidelity-Smoothness-Timeliness (**FST**) minimization approach of Grun-Rehomme, Guggemos, and Ladiray (2018) ➔ FST = filter that preserves linear trends and minimizes the *Timeliness* (= measure of phase-shift)



Final estimate: Henderson filter of order 13 ($p = f = 6$)

Example with the French IPI: RKHS filters

3. Filters based on Reproducing Kernel Hilbert Space (RKHS) methodology by Dagum and Bianconcini (2008) ➔ $b_{q,\phi}$ = filters with a "bandwidth" that minimizes *Timeliness* (= measure of phase-shift)



Final estimate: Henderson filter of order 13 ($p = f = 6$)

Conclusion and improvements

- Different methods can lead to very different trend-cycle estimates
-  Seasonal adjustment process already uses asymmetric filters: methods should also be compared in the seasonal adjustment process.
-  More series should be studied and more investigations on the different parameters (especially with FST)
-  Outliers impact on extraction methods: during the COVID-19 crisis several AO ➔ study of asymmetric filters based on robust methods 

Thank you for your attention...

R package: palatej/rjdfilters


Click here for a more detailed study

About me: @AlainQlt
AQLT

Bibliography:

Dagum, Estela Bee, and Silvia Bianconcini. 2008. "The Henderson Smoother in Reproducing Kernel Hilbert Space." *Journal of Business & Economic Statistics* 26: 536–45. https://ideas.repec.org/a/bes/jnlbes/v26y2008p536-545.html.

Grun-Rehomme, Michel, Fabien Guggemos, and Dominique Ladiray. 2018. "Asymmetric Moving Averages Minimizing Phase Shift." *Handbook on Seasonal Adjustment*. ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-18-001.

Proietti, Tommaso, and Alessandra Luati. 2008. "Real Time Estimation in Local Polynomial Regression, with Application to Trend-Cycle Analysis." *Ann. Appl. Stat.* 2 (4): 1523–53.