

The dangers of using Seasonal Adjustment and other filters in Econometrics

Some economic and environmental examples

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1 Introduction

- When using seasonally unadjusted data, how can we decide what is the optimal seasonal adjustment to use?
 - Not theoretical point of view
- Do we have sensible statistical tools to discriminate among the different available alternatives?
- Knowing that the *estimated* components are not *observable*, is it enough to pay attention to just the component of interest and forget about the remaining ones?
- Is the ideal property of *orthogonality* among the different component reasonably fulfilled?
- How potential *outliers* and other variants of *intervention* analysis affect final estimated components?

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2 Traditional approach

$$y_t = T_t + C_t + S_t + \varepsilon_t$$

3 Small empirical exercise

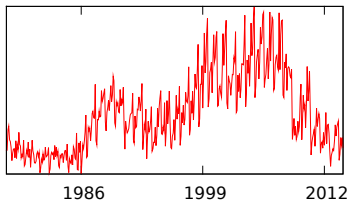
Four monthly time series pertaining to the Spanish economic CLI used in: <http://uam-ucm-economic-indicators.es/>

- CAR REGISTRATIONS
- HOUSING STARTS
- CEMENT CONSUMPTION
- TRUCKS

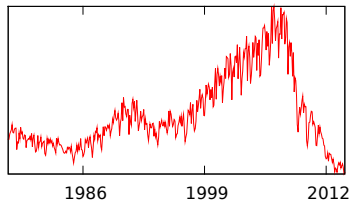
From 1978M01 to 2013M12

4 Small empirical exercise

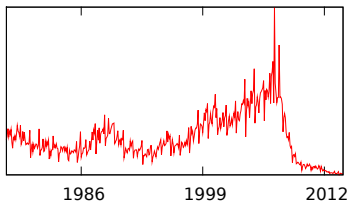
CARS



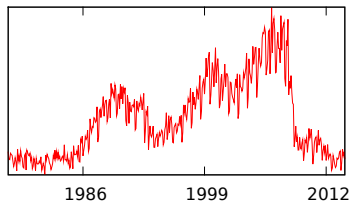
CEMENT



HOUSES



TRUCKS



5

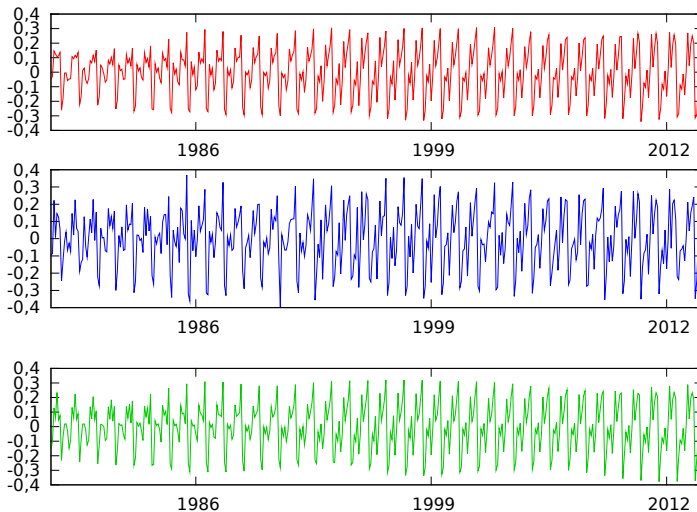
Several signal extraction methodologies

Using several model-based signal extraction methodologies, namely

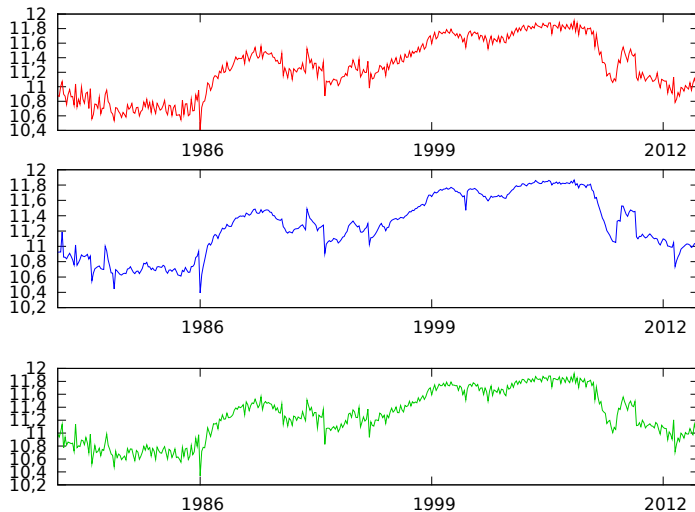
- SEATS-TRAMO
- X-12 ARIMA
- Linear Dynamic Harmonic Regression ([Bujosa et al., 2007](#))

Disclaimer and explanation of the posterior empirical results

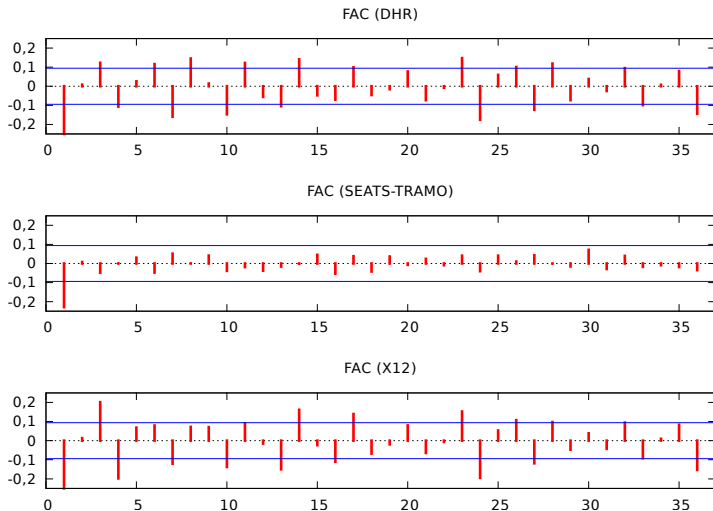
6 Car registrations Seasonal Factors: DHR, ST, X12



7 Seasonally adjusted Car registrations: DHR, ST, X12



8 FAC – First Difference of Seasonally adjusted Car registrations



9 Summary of tentative results of the four series

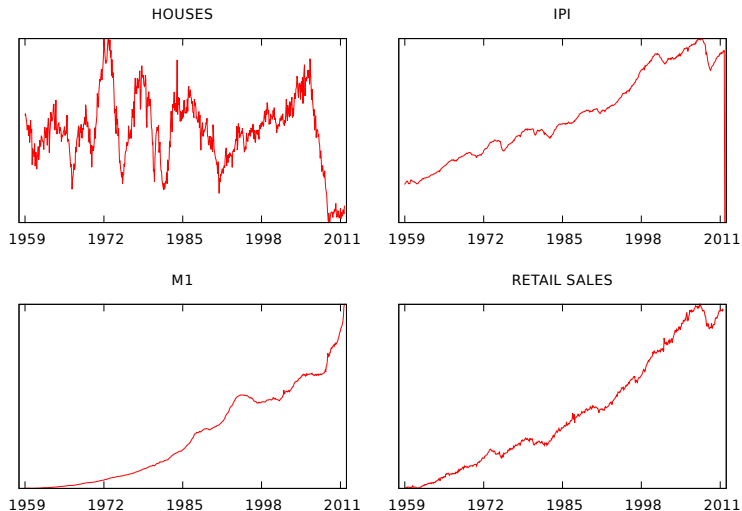
- Outlier detection plus other interventions as easter effects and calendar effects are crucial in the estimation of unobserved components models
- As a matter of fact when you don't use this option in SEATS-TRAMO there is evidence of seasonality in the SA series
- Using outlier detection plus easter and calendar effects produce considerable reduction in the estimated residual variances ranging from 21% to 31%

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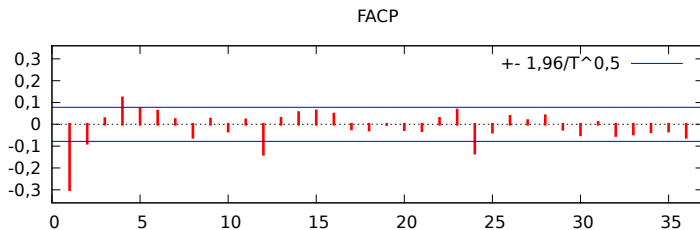
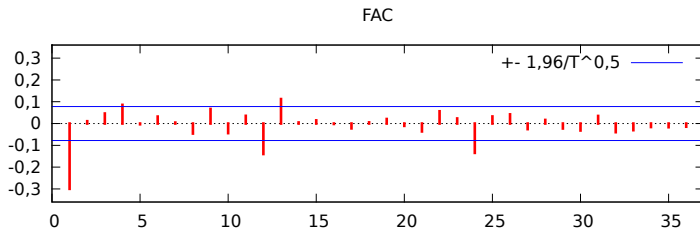
Results from a Stock & Watson data base

- Housing starts
- IPI
- Money supply – M1
- Retail sales

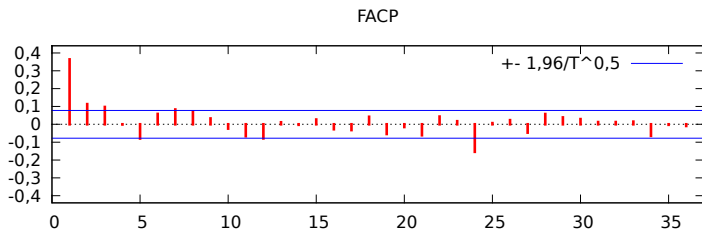
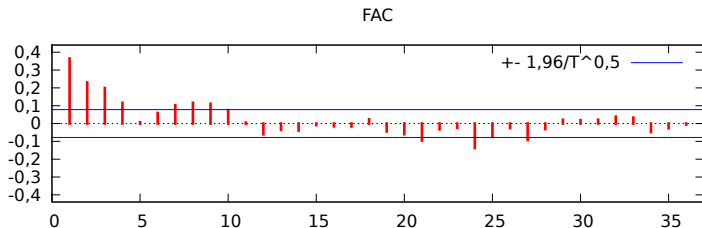
11 Results from a Stock & Watson data base



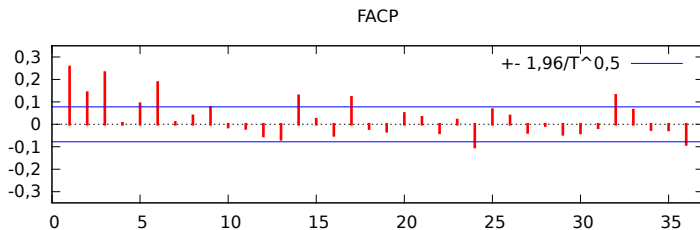
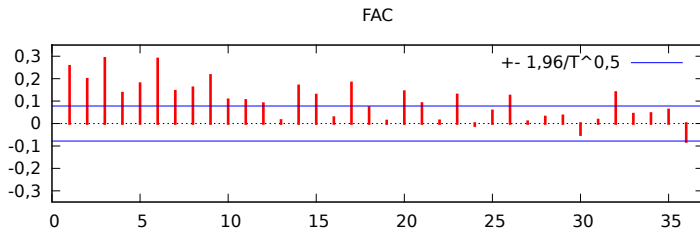
12 Results from a Stock & Watson data base: Housing starts

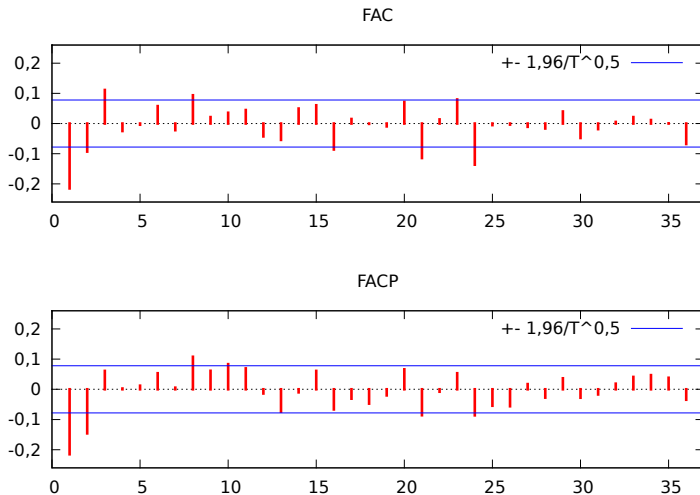


13 Results from a Stock & Watson data base: IPI



14 Results from a Stock & Watson data base: Money supply



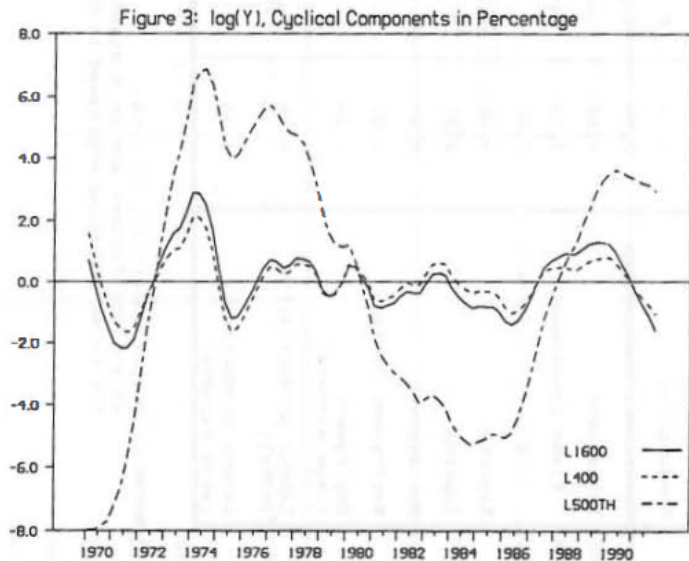
15 Results from a Stock & Watson data base: Retail sales

16 Hodrick–Prescott filter

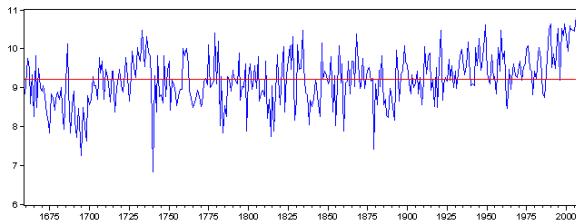
$$y_t = \tau_t + c_t + \epsilon_t$$

Given a positive λ , there is a trend component τ that solves

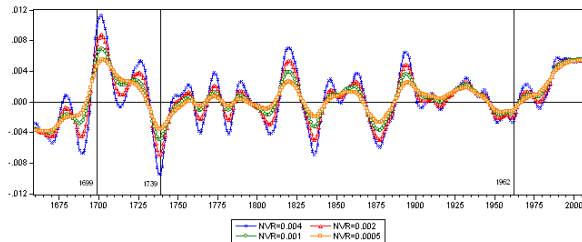
$$\min_{\tau} \left(\sum_{t=1}^T (y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \right)$$

17 Hodrick–Prescott filter

18 The Central England Temperature (CET)

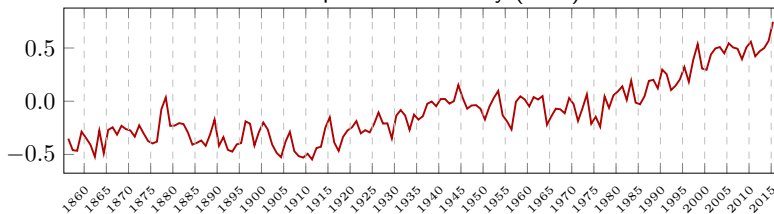


Alternative Temperature Cycles and Bayesian Turning Points

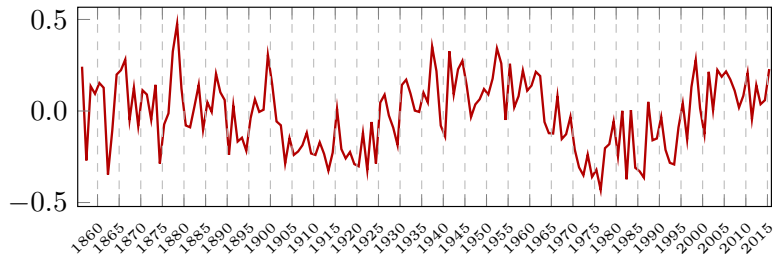


19 Modelling of Global Climate Change

Global Temperature Anomaly (GTA)



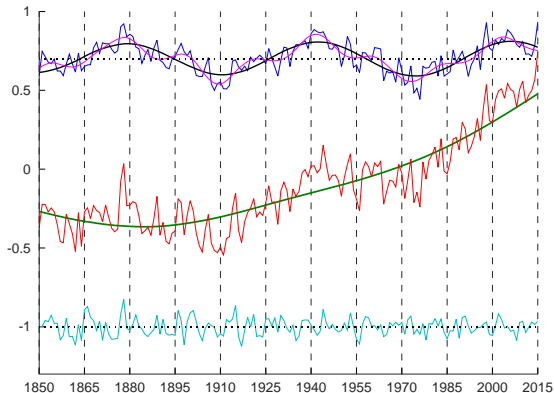
Atlantic Multidecadal Oscillation (AMO)



20 Have AMO and GTA a common 63-years cycle?

DHR components for GTA

Trend, Cycle (shifted +0.7 units) and irregular (shifted -1 units) DHR components

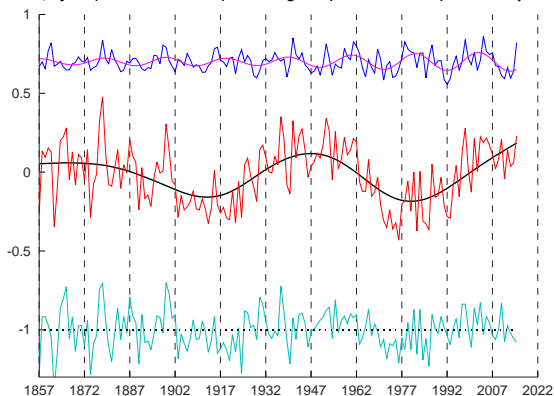


$$GTA = T + S^{63} + S^{21} + \sum(\text{other harmonics}) + Irreg$$

21 Have AMO and GTA a common 63-years cycle?

DHR Trend-cycle component for AMO

Trend, cycle (shifted +0.7 units) and irregular (shifted -1 units) DHR components

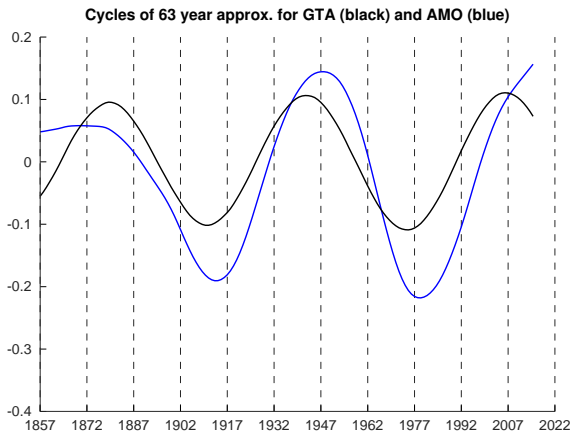


$$AMO = T + S^{21} + \sum(\text{other harmonics}) + Irreg$$

22 Have AMO and GTA a common 63-years cycle?

Not clear

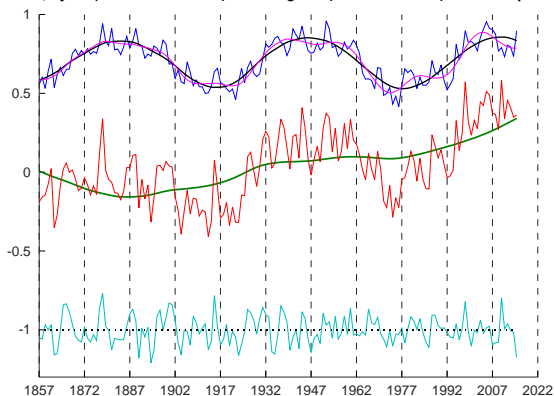
GTA has a periodic cycle, but not AMO



23 Have original AMO and GTA a common 63-years cycle?

DHR components for “original” AMO data

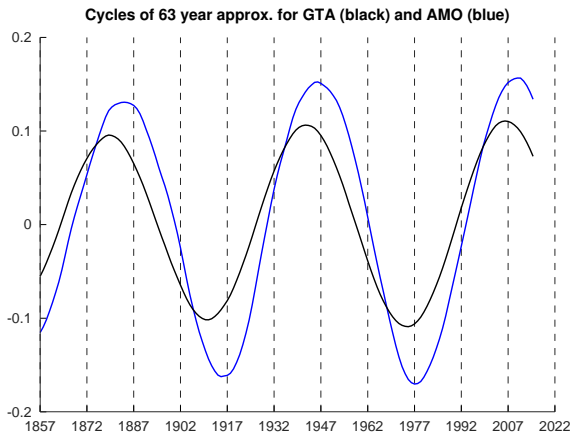
Trend, cycle (shifted +0.7 units) and irregular (shifted -1 units) DHR components



$$AMO_{\text{with trend}} = T + S^{63} + S^{21} + \sum(\text{other harmonics}) + Irreg$$

24 Have the “original” AMO and GTA a common cycle?

They seem to have a common cycle
(as suggested in Professor Young’s article)



25 Number of confirmed cases at 3/22/2020

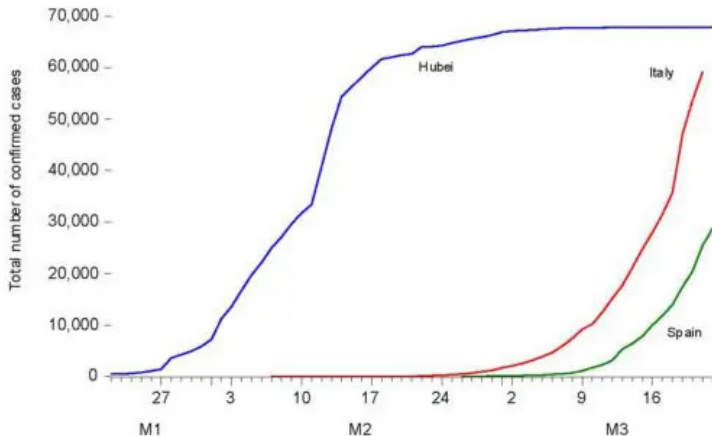


Figure 1: Number of confirmed cases at 3/22/2020

26 Observed contagions and forecasts in Spain

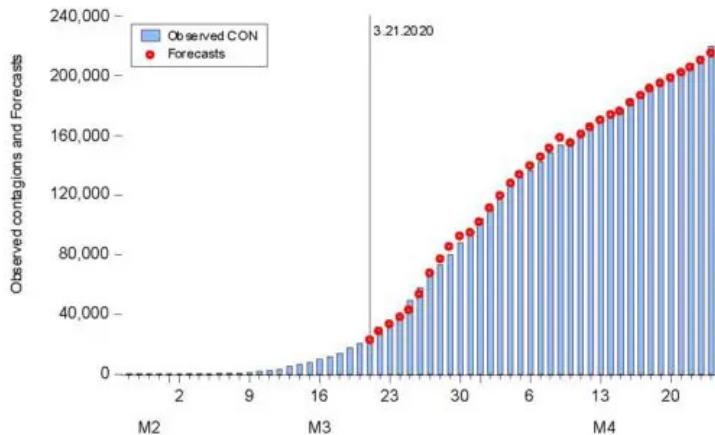


Figure 2: Observed contagions and Forecasts in Spain

27 Observed deaths and forecasts in Spain

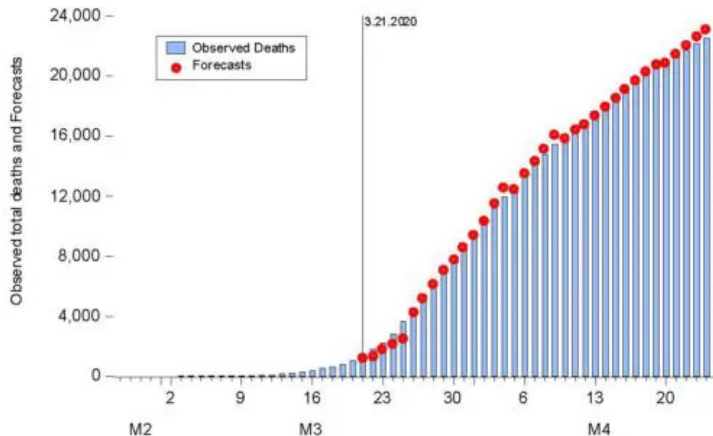


Figure 3: Observed Deaths and Forecasts in Spain

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Mean Central England Temperature (Degrees Celsius)

Decidir qué meter aquí

Bujosa, M., García-Ferrer, A., and Young, P. C. (2007). Linear dynamic harmonic regression. *Comput. Stat. Data Anal.*, **52**(2), 999–1024. ISSN 0167-9473.