

The dangers of using Seasonal Adjustment and other filters in Econometrics

Some economic and environmental examples

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2 Traditional approach

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

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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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3 Small empirical exercise

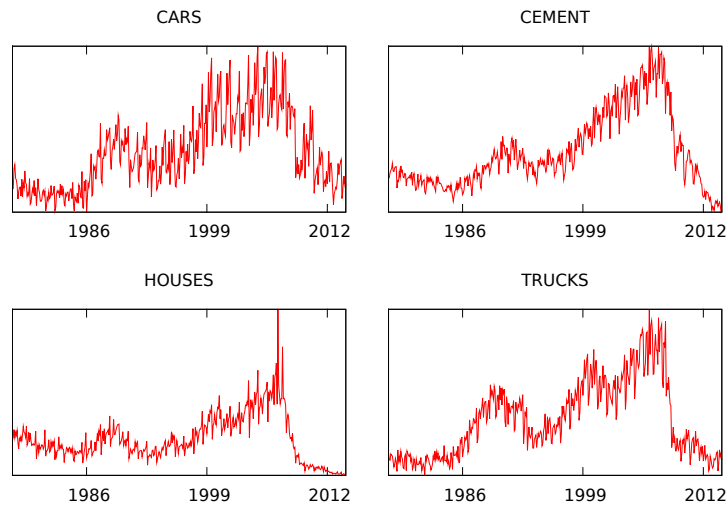
Four monthly time series pertaining to the Spanish economic CLI used in: <http://uam-ucm-economic-indicators.es/>

- CAR REGISTRATIONS
- HOUSING STARTS
- CEMENT CONSUMPTION
- TRUCKS

From 1978M01 to 2013M12

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4 Small empirical exercise



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5 Several signal extraction methodologies

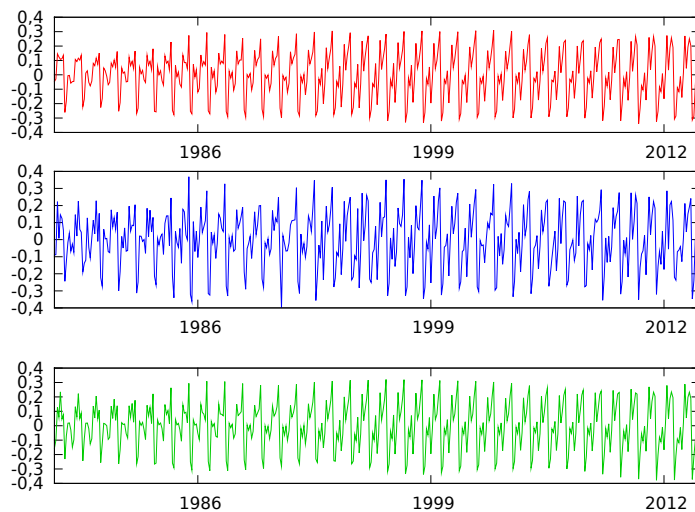
Using several model-based signal extraction methodologies, namely

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

Disclaimer and explanation of the posterior empirical results

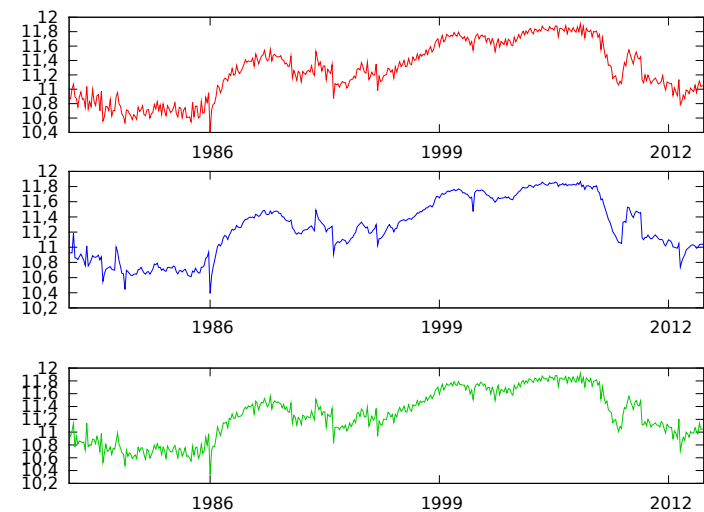
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6 Car registrations Seasonal Factors: DHR, ST, X12



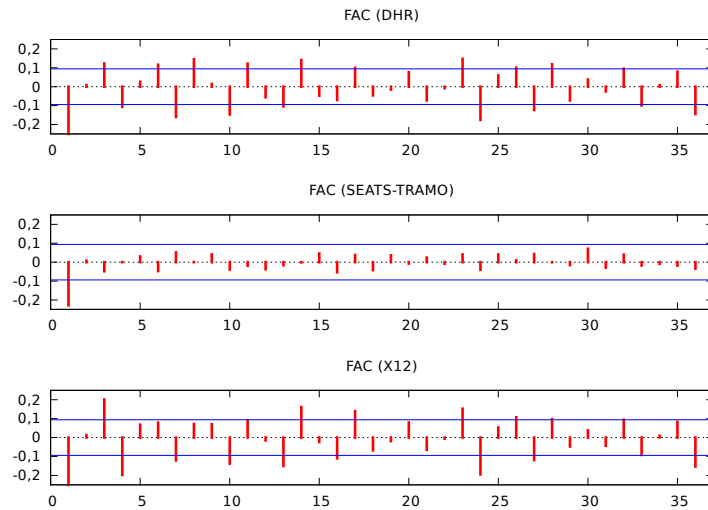
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7 Seasonally adjusted Car registrations: DHR, ST, X12



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8 FAC – First Difference of Seasonally adjusted Car registrations



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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%

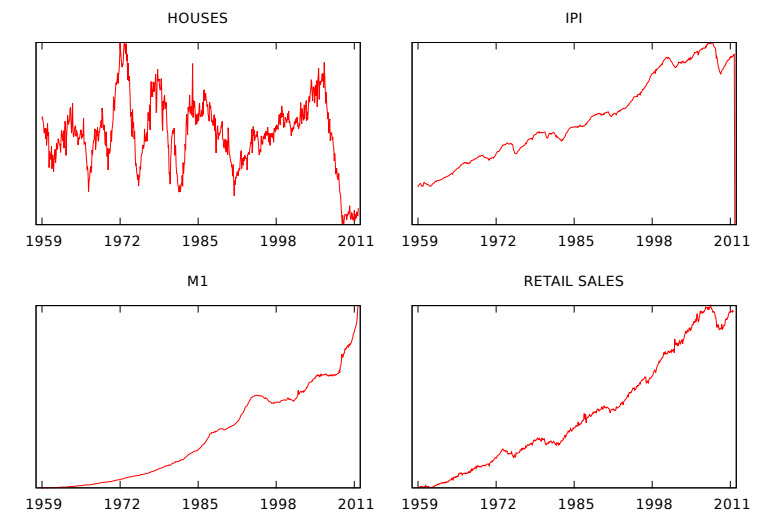
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10 Results from a Stock & Watson data base

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

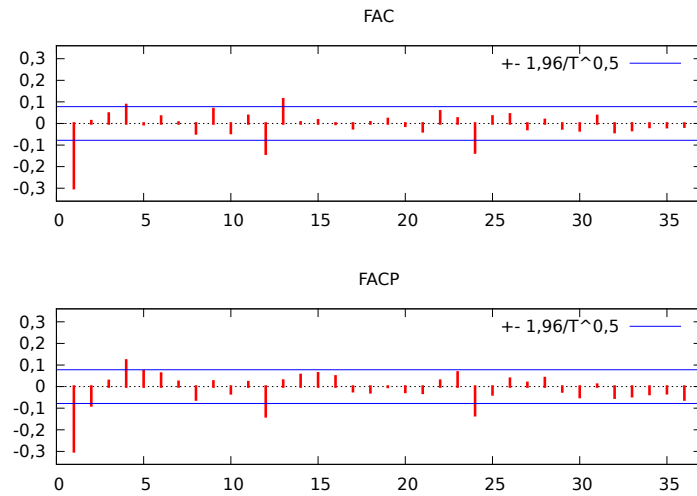
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11 Results from a Stock & Watson data base



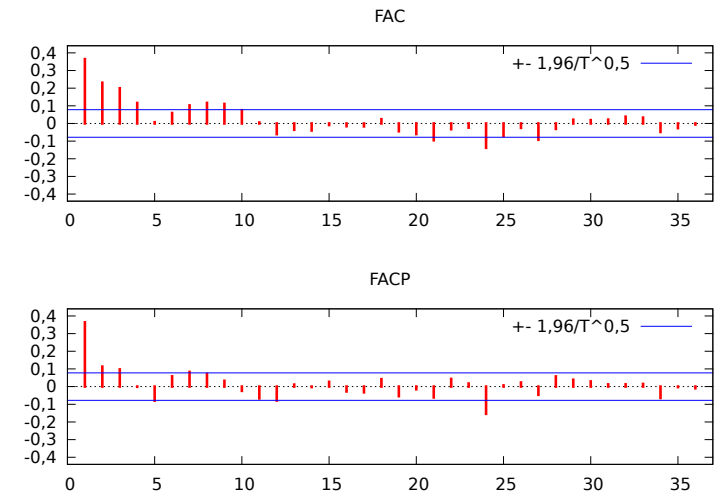
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12 Results from a Stock & Watson data base: Housing starts



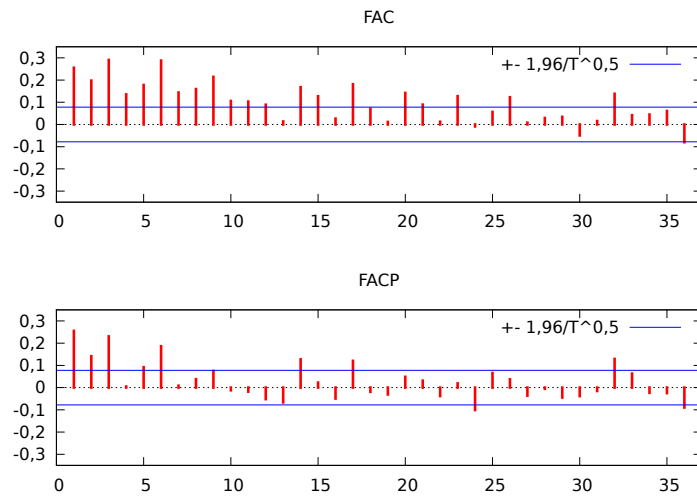
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13 Results from a Stock & Watson data base: IPI



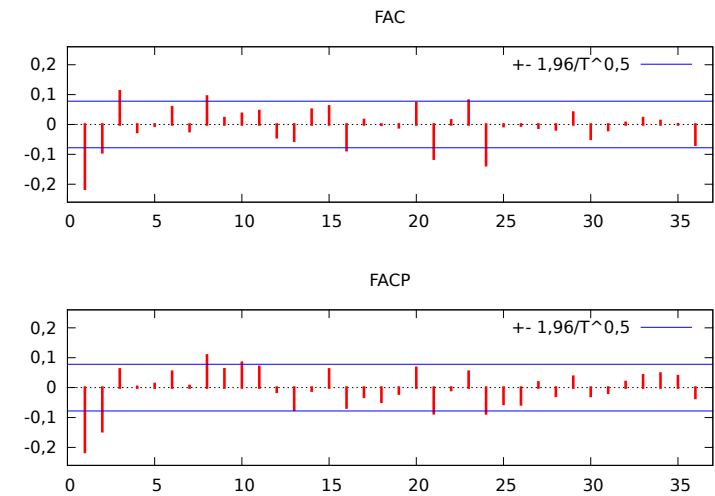
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14 Results from a Stock & Watson data base: Money supply



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



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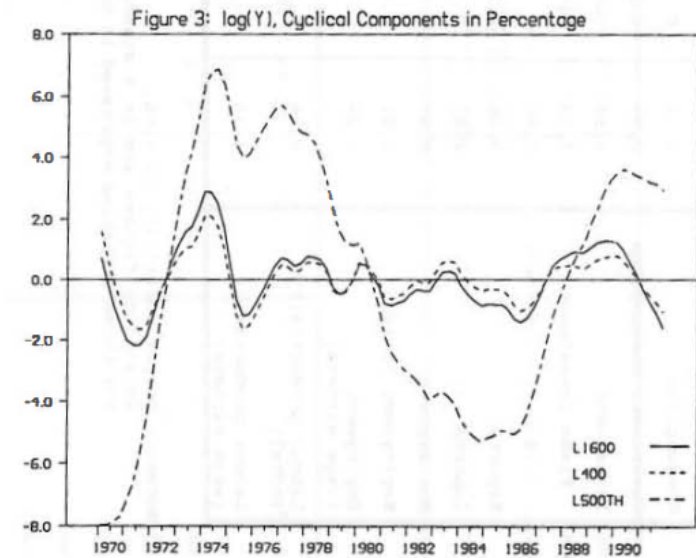
16 Hodrick–Prescott filter

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

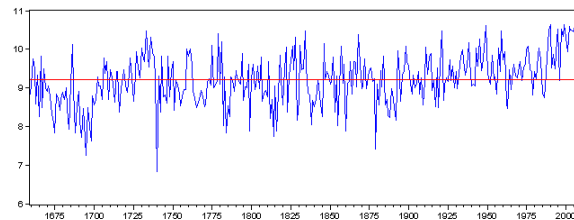
Given a positive λ , there is a trend component τ that solves

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

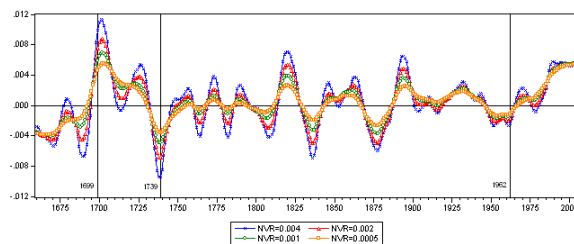
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17 Hodrick–Prescott filter

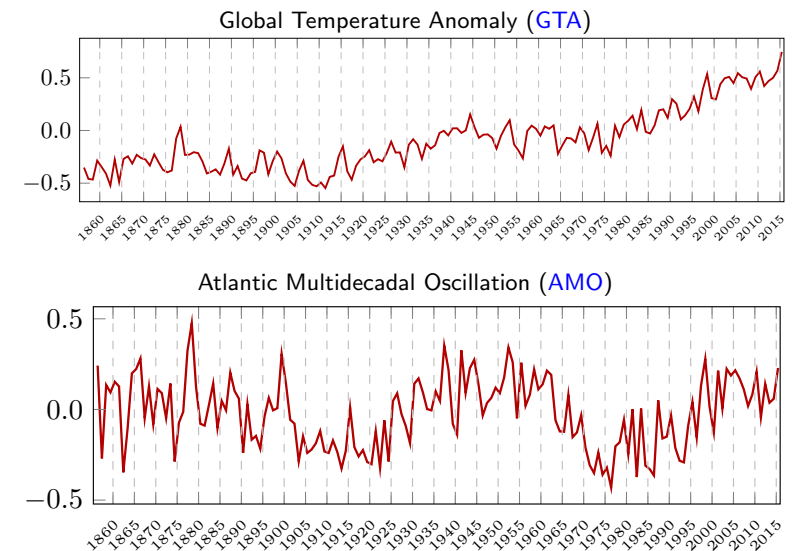
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18 The Central England Temperature (CET)

Alternative Temperature Cycles and Bayesian Turning Points



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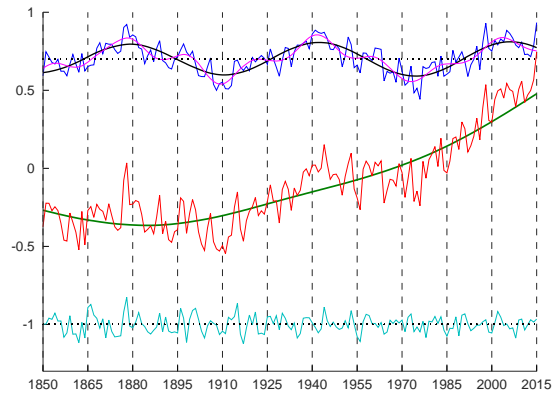
19 Modelling of Global Climate Change

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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



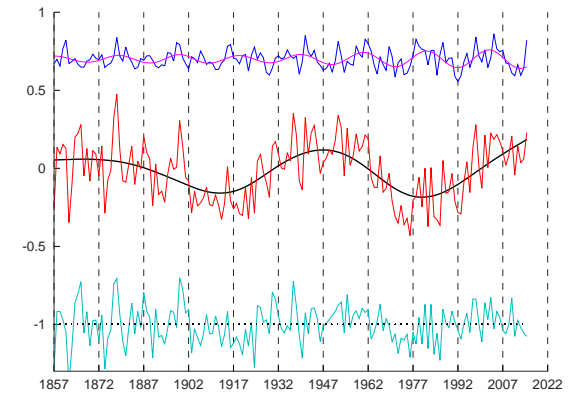
$$GTA = T + S^{63} + S^{21} + \sum(\text{other harmonics}) + Irreg$$

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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



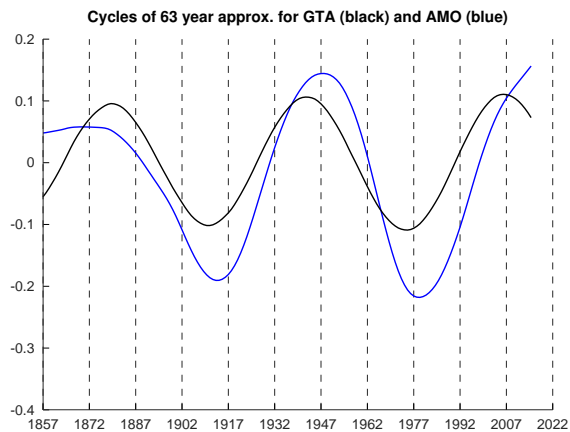
$$AMO = T + S^{21} + \sum(\text{other harmonics}) + Irreg$$

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

Not clear

GTA has a periodic cycle, but not AMO

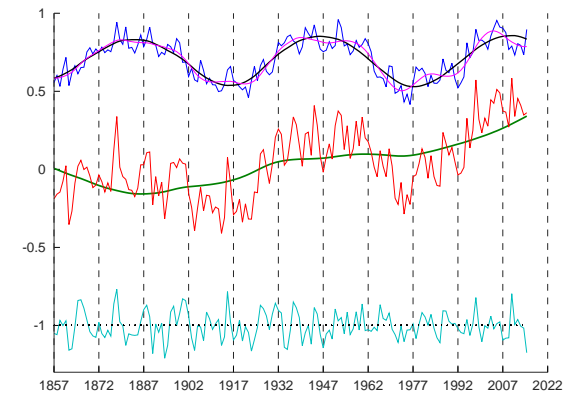


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23 Have original AMO and GTA a common 63-years cycle?

DHR components for "original" AMO data

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

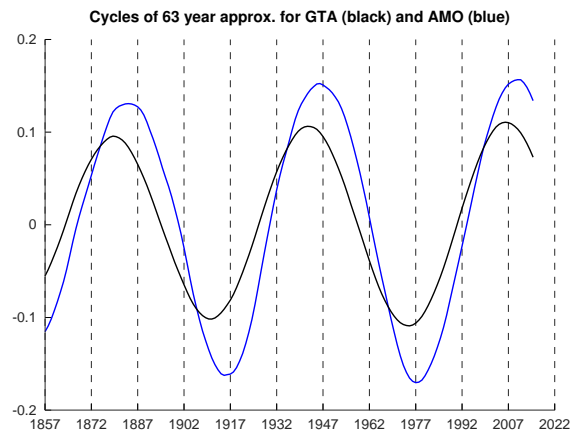


$$AMO_{\text{with trend}} = T + S^{63} + S^{21} + \sum(\text{other harmonics}) + Irreg$$

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24 Have the "original" AMO and GTA a common cycle?

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



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25 Number of confirmed cases at 3/22/2020

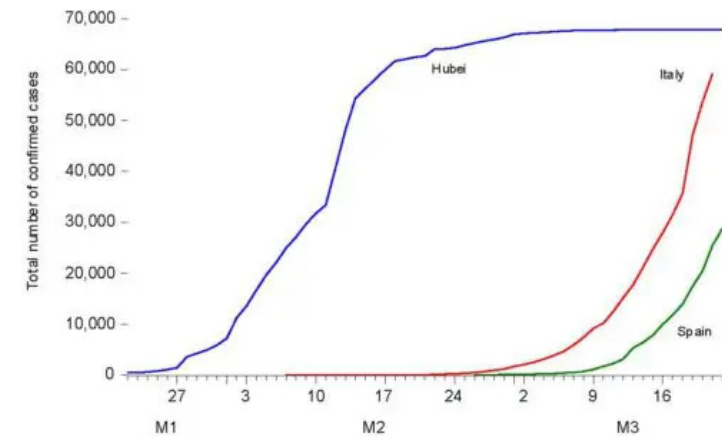


Figure 1: Number of confirmed cases at 3/22/2020

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26 Observed contagions and forecasts in Spain

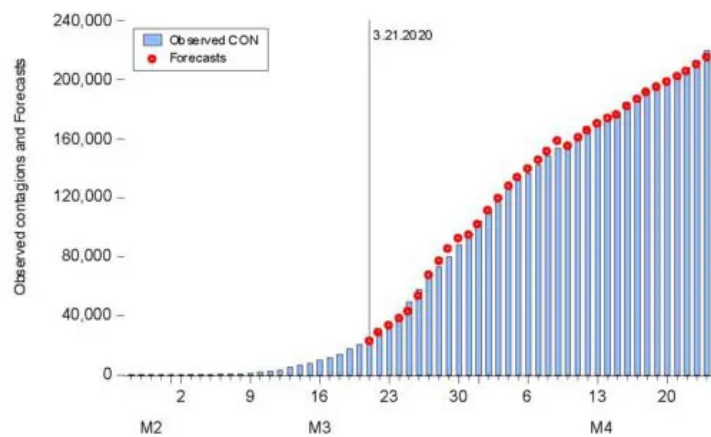


Figure 2: Observed contagions and Forecasts in Spain

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27 Observed deaths and forecasts in Spain

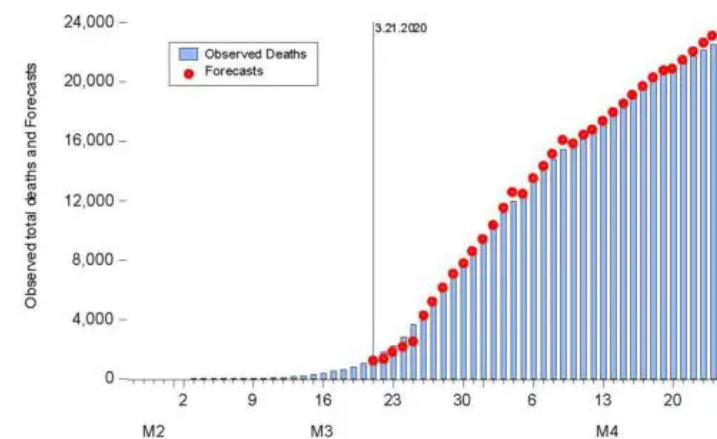


Figure 3: Observed Deaths and Forecasts in Spain

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28 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.