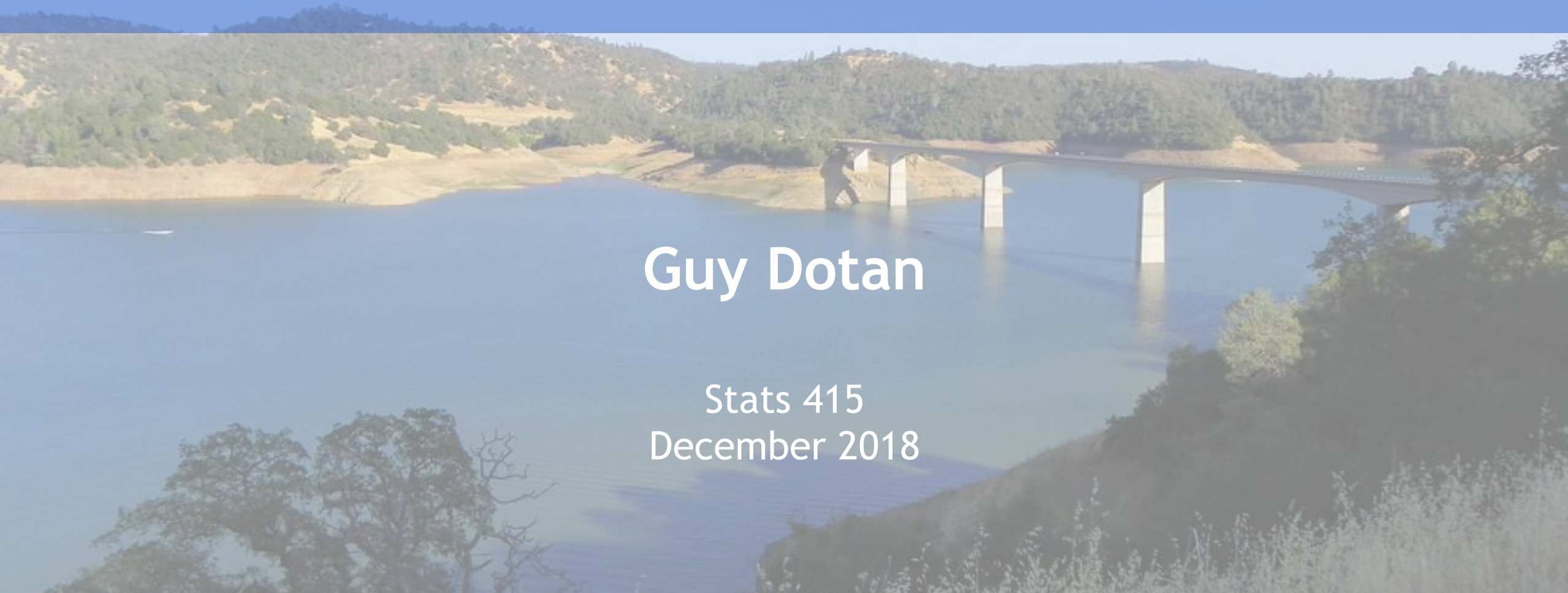
Forecasting Reservoir Storage



Guy Dotan

Stats 415
December 2018

Background

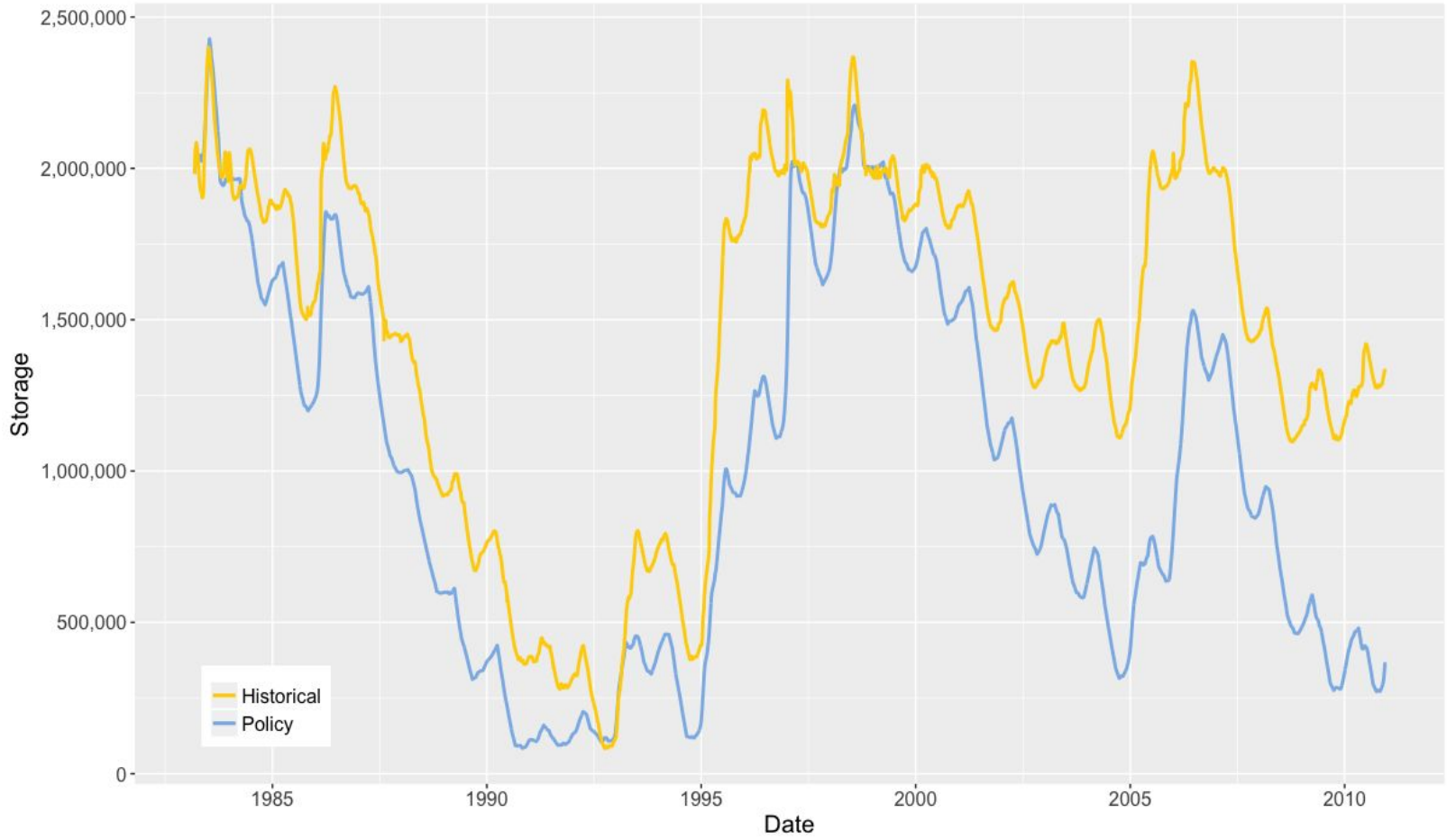
San Joaquin River System - New Melones is the largest reservoir in the system ~ 2.4M acre-feet

- Inflow from the San Joaquin River cascades first through the **New Melones Reservoir.**
- Reservoir outflow dictates how much water goes downstream for agricultural / municipal needs
- **Problem:** New state policy requires 40% of the springtime inflow into New Melones to be released.

  Farmers and cities fear ramifications as result of reduction in water storage during drought conditions.

The Data

- **Dataset:**
  Provided by my father from...
  California State Water Resources Control Board
- **Dates:**
  Jan. 1 1984 → Dec. 12, 2010
- **Sample size:**
  9,841 total observations
- **Forecasting variable:**
  Historical Storage (acre-ft)
  Policy Storage (acre-ft)

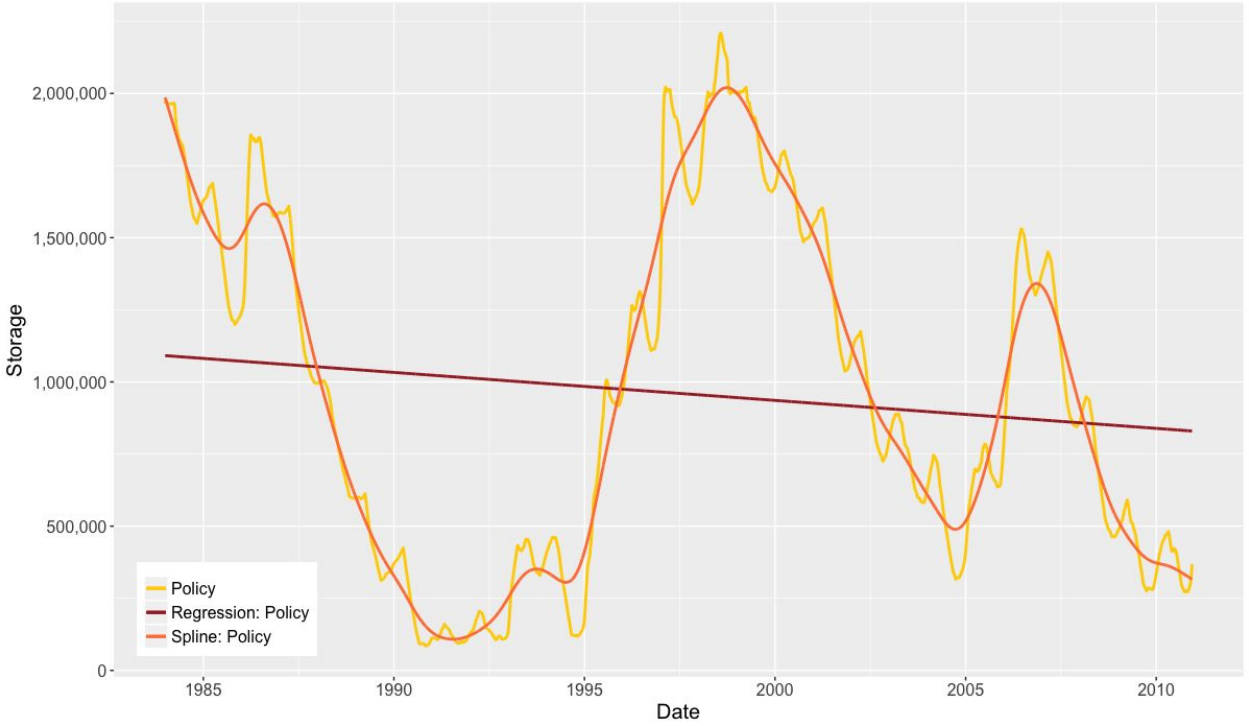


Removing the Trend

Policy

Coefficients

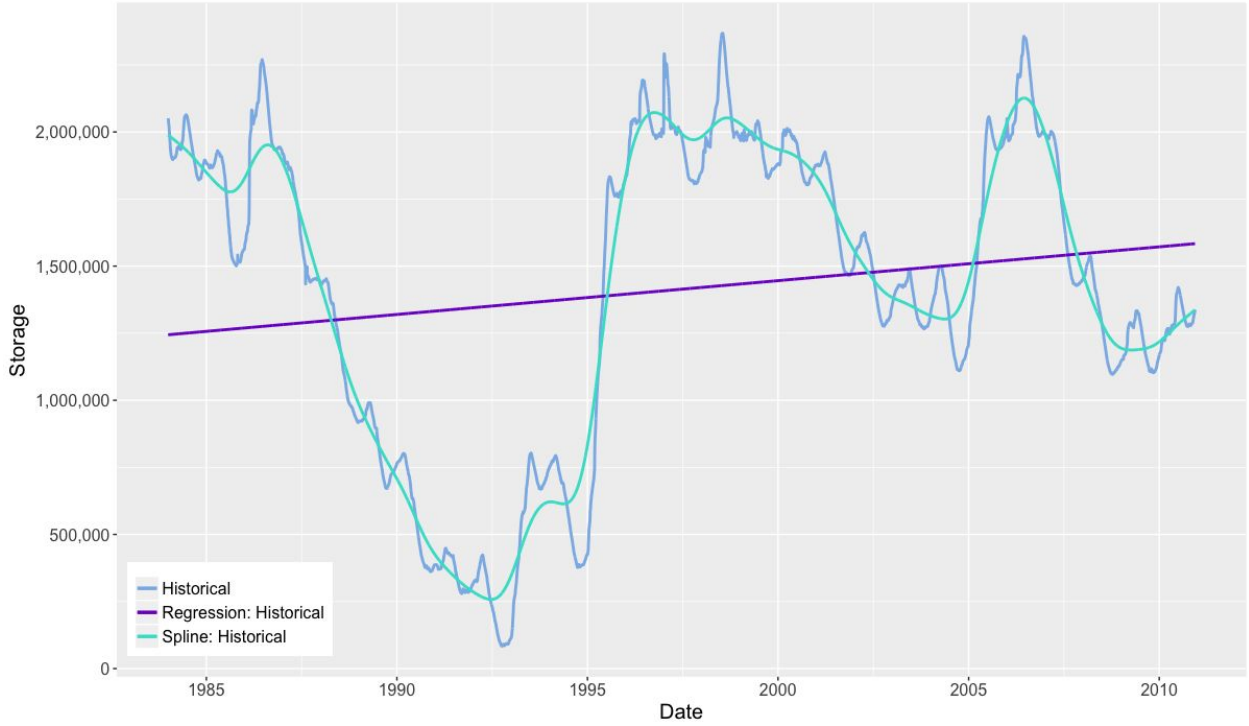
	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	1425867.52	21200.50	67.26	<0.00 ***
dat$DATE	-43.67	2.06	-21.23	<0.00 ***



Historical

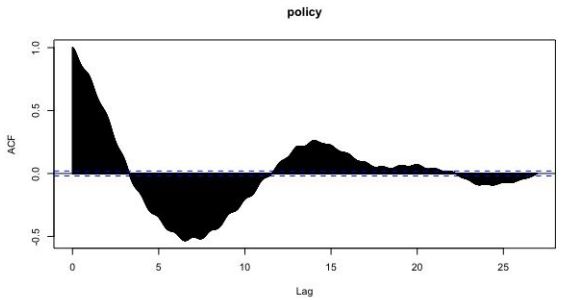
Coefficients

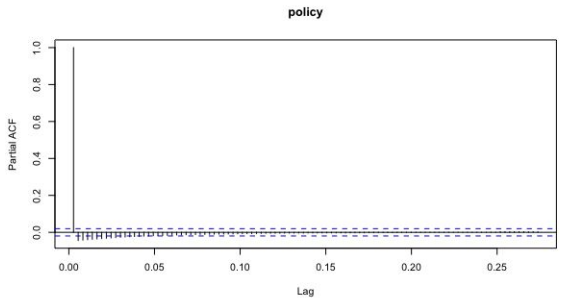
	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	1234530.56	20274.13	60.89	<0.00 ***
dat$DATE	20.15	1.97	10.25	<0.00 ***



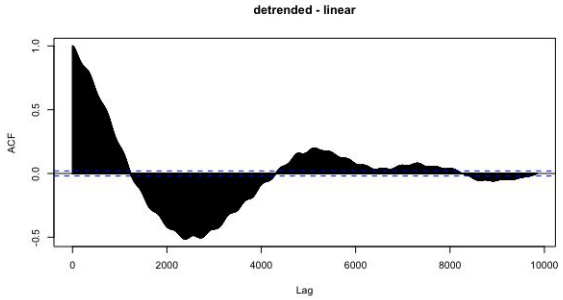
ACF / PACF

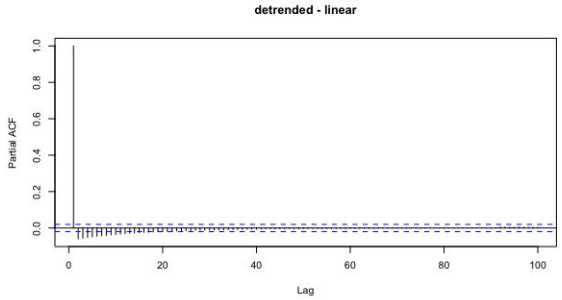
Policy



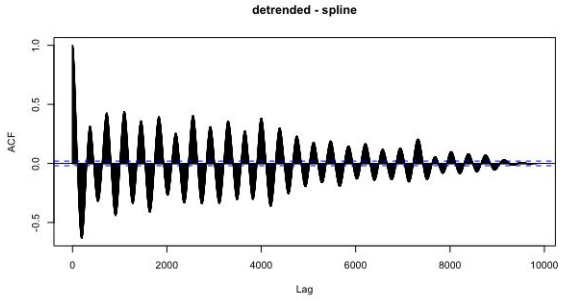


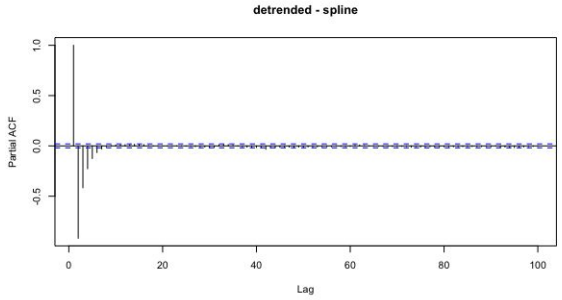
original





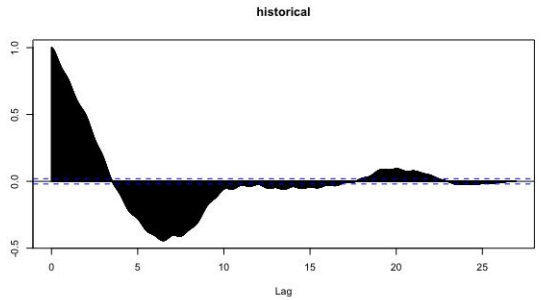
linear

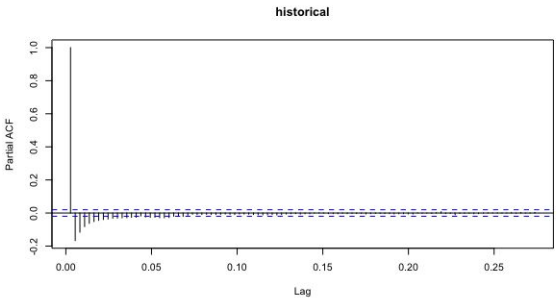


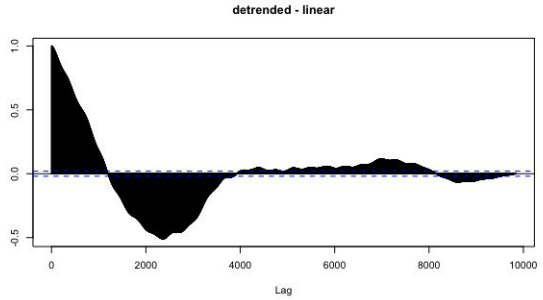


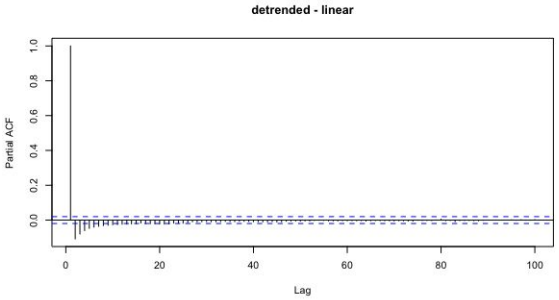
spline

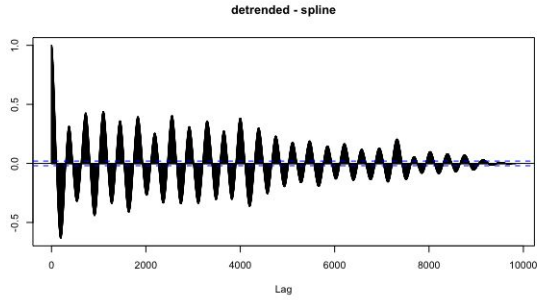
Historical

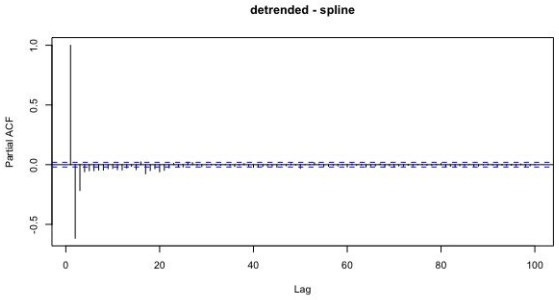








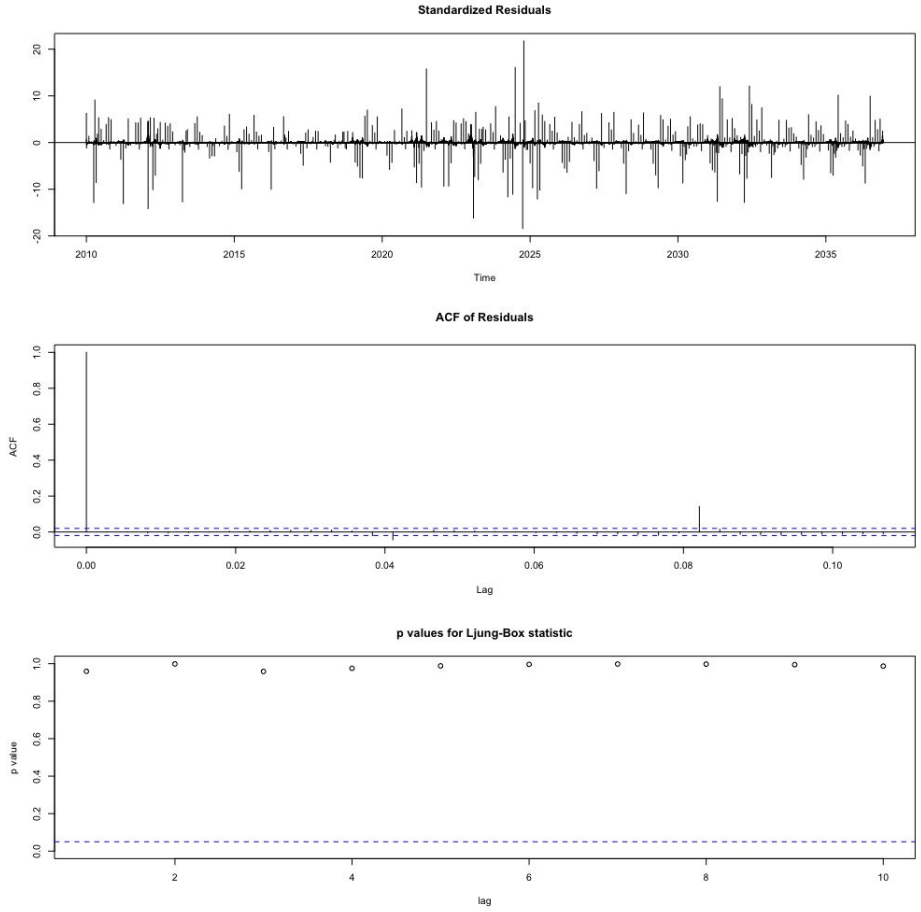




Model Fitting

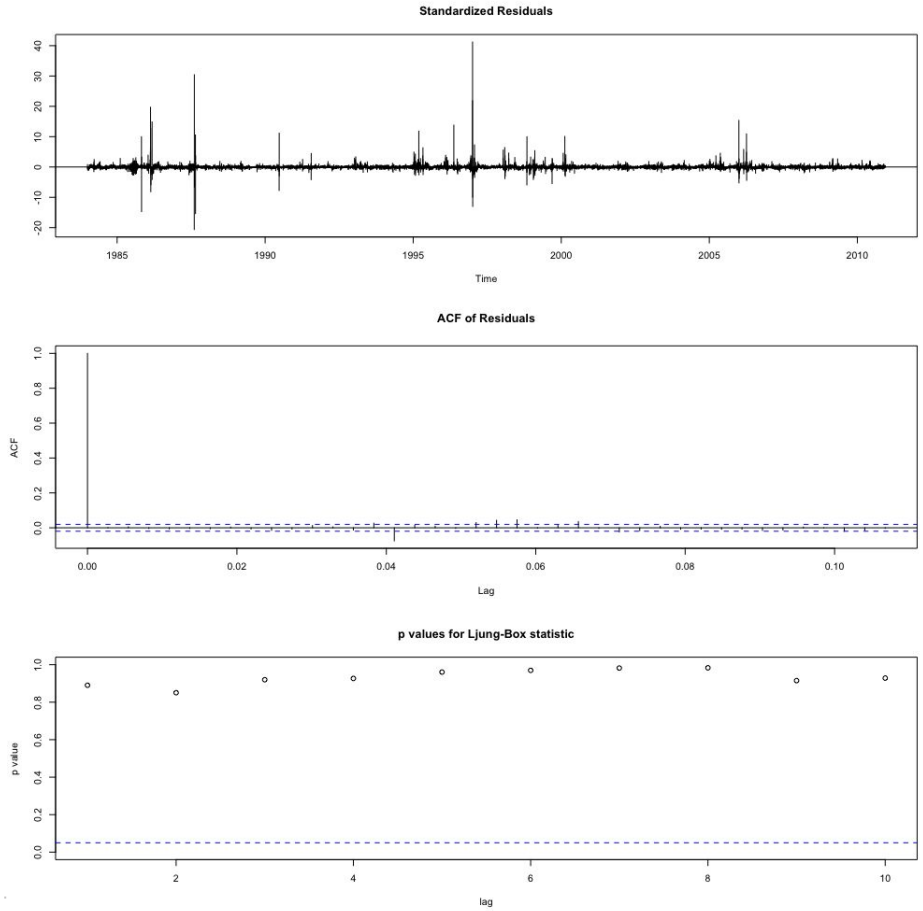
Policy

ARIMA (2, 1, 3)
AIC = 14,1013.7
BIC = 14,1056.9



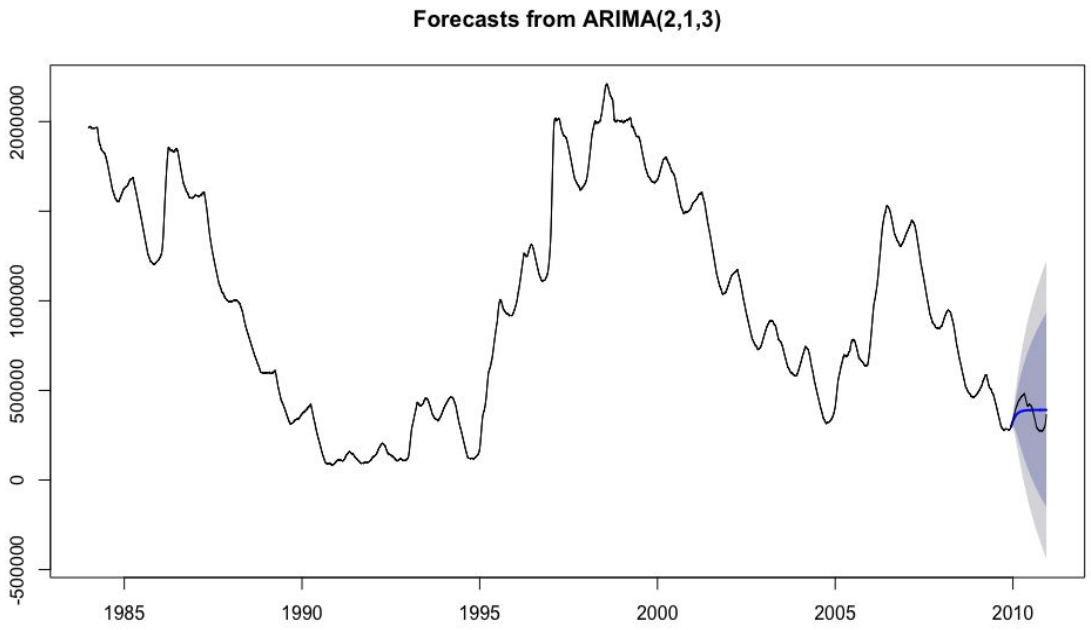
Historical

ARIMA (3, 1, 1)
AIC = 18,3051.6
BIC = 18,3087.6

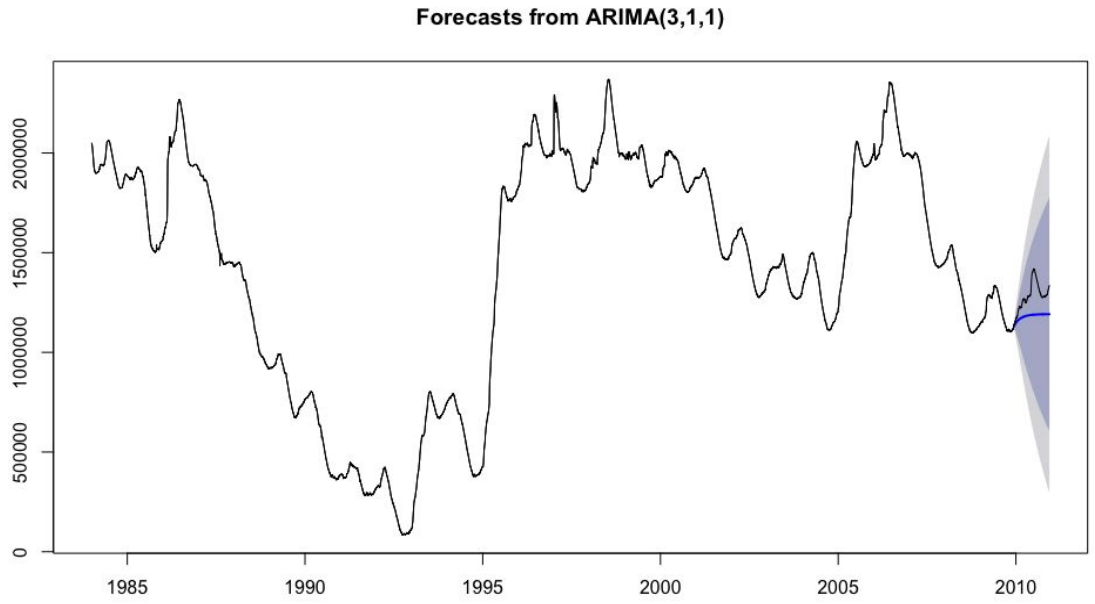


Model Forecasting

Policy



Historical



Further Analysis

Aggregate

Consider grouping data into larger increments (week/month/year)

Seasonality

Deeper dive into seasons since we know policy is contingent on it

Forecast

With a more robust model goal would be to forecast 5-10+ years down the road

Analyze

Compare historical vs. policy to determine impact of water availability from policy