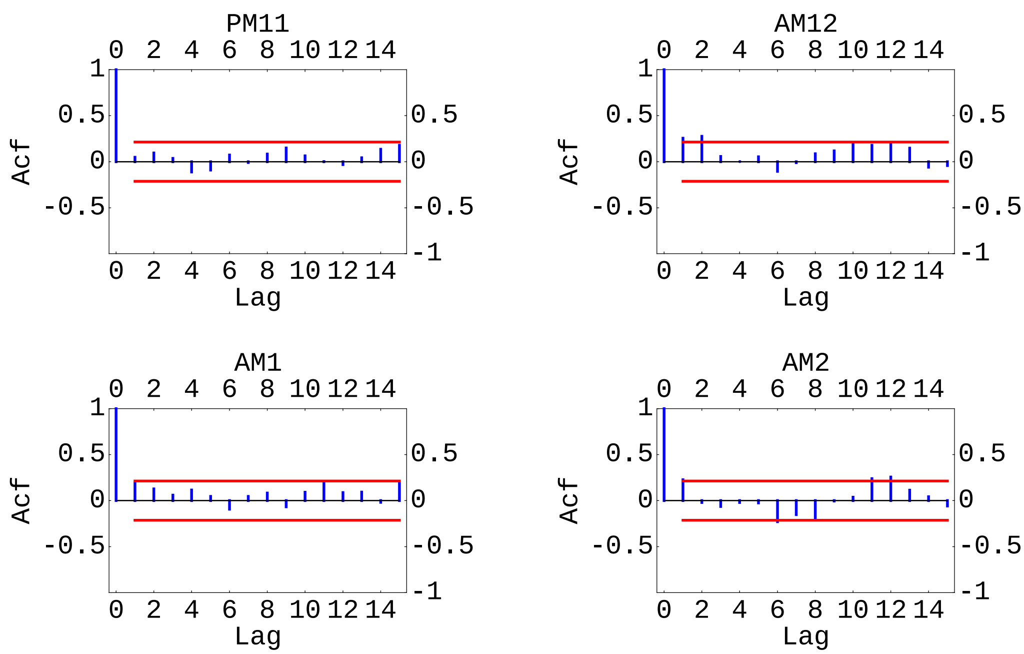
OTR

Autocorrelation Function

Based on the autocorrelation function, the following models were tenatively identified.

Data	ARMA Model
PM11	(0, 0, 0)
AM12	(0, 0, 2) $(0, 0, 1)_{12}$
AM1	(0, 0, 1)
AM2	(0, 0, 1) $(0, 0, 1)_{12}$



Intervention Analysis

May 1996 corresponds to observation #49 in this series. A step intervention model defined by,

$$z_t = \mu + \delta\ \xi_t + N_t \tag{1}$$

where N_t is the error term. Based on the pre-intervention data we assume initially that N_t is normal and independent, so ordinary multiple linear regression can be used. The intervention series are defined by,

$$\xi_t^{(1)} = \begin{cases} 0 & t < 49 \\ 1 & t \geq 49 \end{cases}$$

For each series the ARMA component has been tentatively identifed as follows. For PM11,

$$N_t = a_t \tag{2}$$

For AM12,

$$N_t = (1 - \theta_1 \mathcal{B} - \theta_2 \mathcal{B}^2)(1 - \Theta_1 \mathcal{B}^{12}) \tag{3}$$

For AM1,

$$N_t = a_t - \theta_1 a_{t-1} \tag{4}$$

and for AM2

$$N_t = (1 - \theta_1 \mathcal{B})(1 - \Theta_1 \mathcal{B}^{12}) \tag{5}$$

where $a_t \sim \text{NID}(0, \sigma_a^2)$ and $\mathcal{B}$ denotes the backshift operator on t, $\mathcal{B} a_t = a_{t-1}$. After fitting my exact maximum likelihood the parameter estimates are shown in the tables below. The intervention parameter δ is statistically significant on a two-sided test for PM11 at 9.4% and for AM1 at 4.7%. No departures from model assumptions were indicated in the residual analysis.

- **PM11**

	Estimate	SE	P-Value
μ	6.312	0.314	0
δ	**-1.062**	**0.635**	**0.094**

- **AM12**

	Estimate	SE	P-Value
μ	4.455	0.443	0
"δ	0.271	0.783	0.729
θ_1	-0.175	0.103	0.091
θ_2	-0.323	0.103	0.002
Θ_1	-0.238	0.106	0.025

- **AM1**

	Estimate	SE	P-Value
μ	7.599	0.379	0
"δ	**-1.513**	**0.762**	**0.047**
θ_1	-0.12	0.108	0.266

- **AM2**

	Estimate	SE	P-Value
μ	5.574	0.464	0
"δ	0.532	0.828	0.521
θ_1	-0.179	0.107	0.096
Θ_1	-0.282	0.105	0.007

■ Intervention Visualizations

The effect of the intervention is visualized graphically.