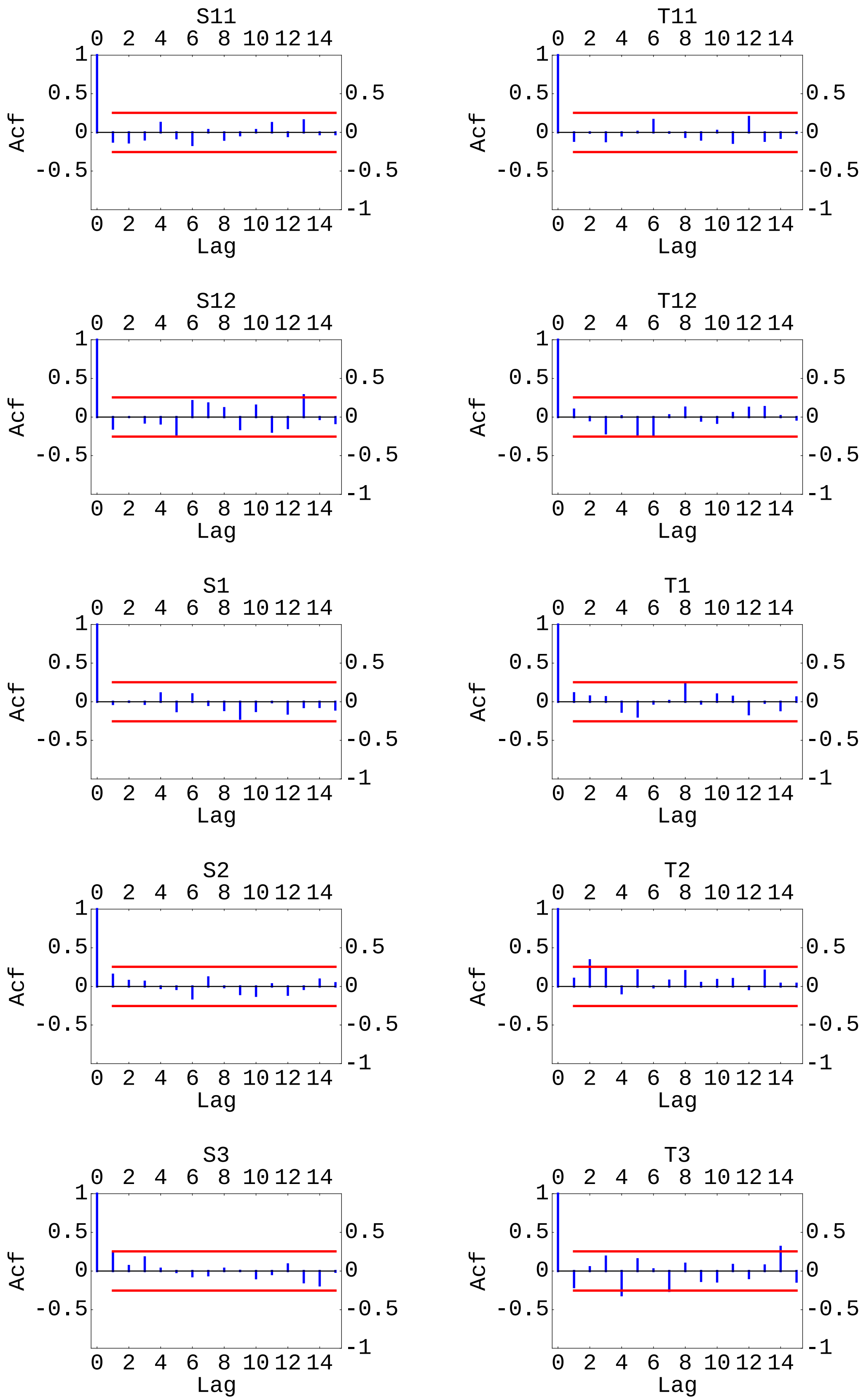
WPS Assaults

Introduction

The WPS assault time series are comprised of $n = 60$ monthly observations beginning January 1994 and ending December 1998. Ten time series were created corresponding the two weekgroup variables SunWed and ThuSat and the five hour one hour periods beginning at 11PM, 12AM, 1AM, 2AM and 3AM. For brevity we will refer to these time series using the codes S11, S12, S1, S2, S3, T11, T12, T1, T2 and T3. We are primarily interested in testing to see if a change occurred starting effective with May 1996, the 29th observation.

Autocorrelation Function

There does not seem to be any strong autocorrelations at either lag one or lag twelve across the entire series, $n = 60$. So we can model the intervention using regression and check that there is no autocorrelation remaining in the residuals.


S11
T11
S12
T12
S1
T1
S2
T2
S3
T3
Acf
Lag

Intervention Analysis

May 1996 corresponds to observation #29 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,

$$\xi_t = \begin{cases} 0 & t < 29 \\ 1 & t \geq 29 \end{cases}$$

The term N_t represents the disturbance or error term and it has been tentatively identified as Gaussian white noise, that is $N_t = a_t$, where $a_t \sim \text{NID}(0,\ \sigma^2)$.

■ Parameter Estimates

		Estimate	SE	TStat	PValue
S11	1	3.42857	0.567344	6.0432	1.15666×10^{-7}
	ξ	-0.491071	0.776868	-0.632117	0.529794

		Estimate	SE	TStat	PValue
S12	1	2.85714	0.400813	7.12837	1.78397×10^{-9}
	ξ	-0.638393	0.548836	-1.16318	0.249521

		Estimate	SE	TStat	PValue
S1	1	2.39286	0.361005	6.62832	1.23055×10^{-8}
	ξ	-0.361607	0.494327	-0.731515	0.46741

		Estimate	SE	TStat	PValue
S2	1	1.46429	0.294064	4.97948	6.05137×10^{-6}
	ξ	**0.754464**	**0.402664**	**1.87368**	**0.0660148**

		Estimate	SE	TStat	PValue
S3	1	0.714286	0.209407	3.411	0.00118467
	ξ	**0.410714**	**0.286742**	**1.43235**	**0.157412**

		Estimate	SE	TStat	PValue
T11	1	3.10714	0.42323	7.34149	7.81845×10^{-10}
	ξ	-0.263393	0.579532	-0.454492	0.651171

		Estimate	SE	TStat	PValue
T12	1	3.21429	0.439494	7.31361	8.70954×10^{-10}
	ξ	-0.245536	0.601801	-0.408001	0.684775

		Estimate	SE	TStat	PValue
T1	1	5.	0.555408	9.00239	1.31406×10^{-12}
	ξ	-0.96875	0.760524	-1.27379	0.207818

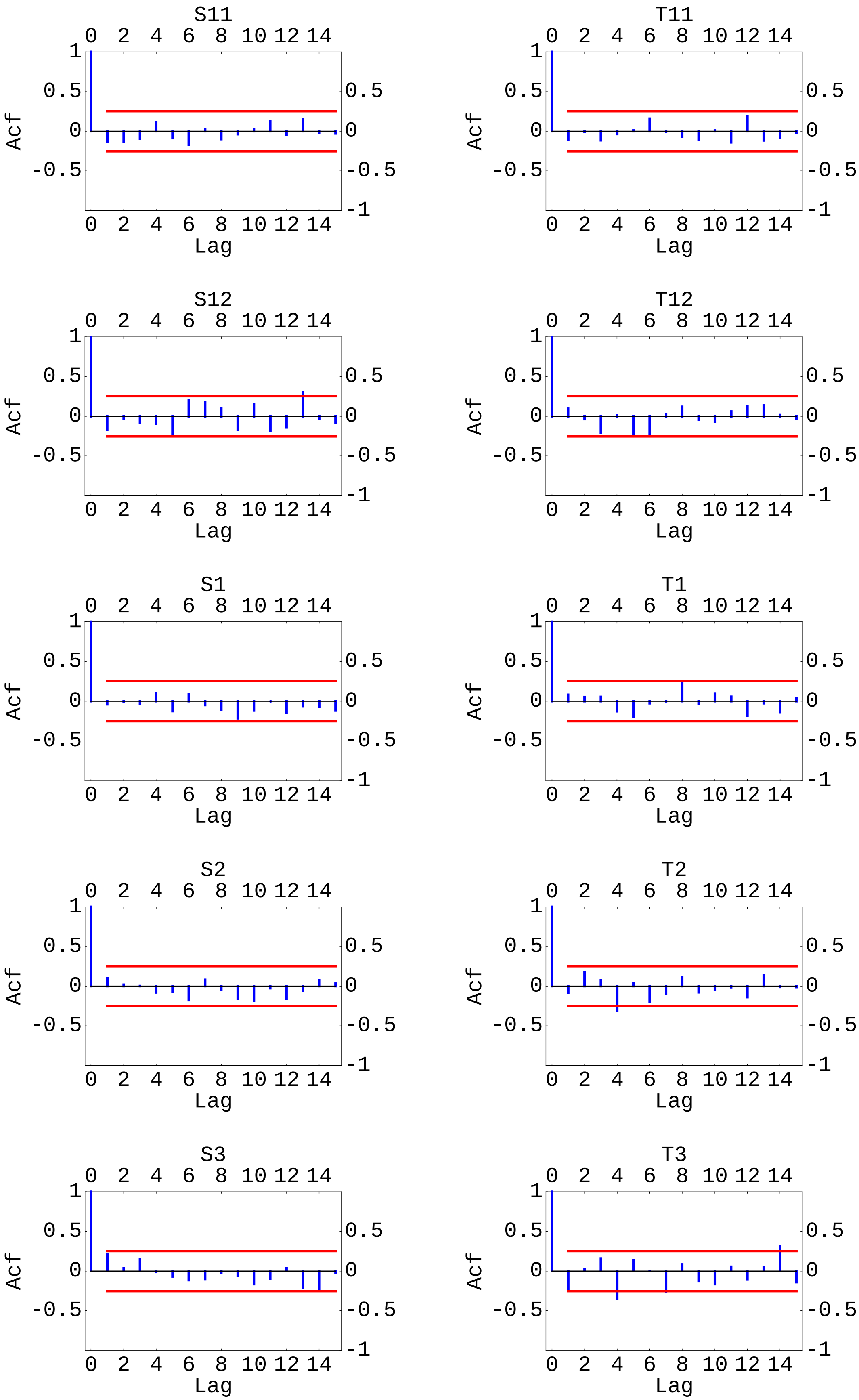
		Estimate	SE	TStat	PValue
T2	1	2.35714	0.47856	4.92549	7.35334×10^{-6}
	ξ	**2.26786**	**0.655296**	**3.46081**	**0.0010171**

		Estimate	SE	TStat	PValue
T3	1	1.75	0.283745	6.16751	7.20387×10^{-8}
	ξ	**0.625**	**0.388534**	**1.60861**	**0.113131**

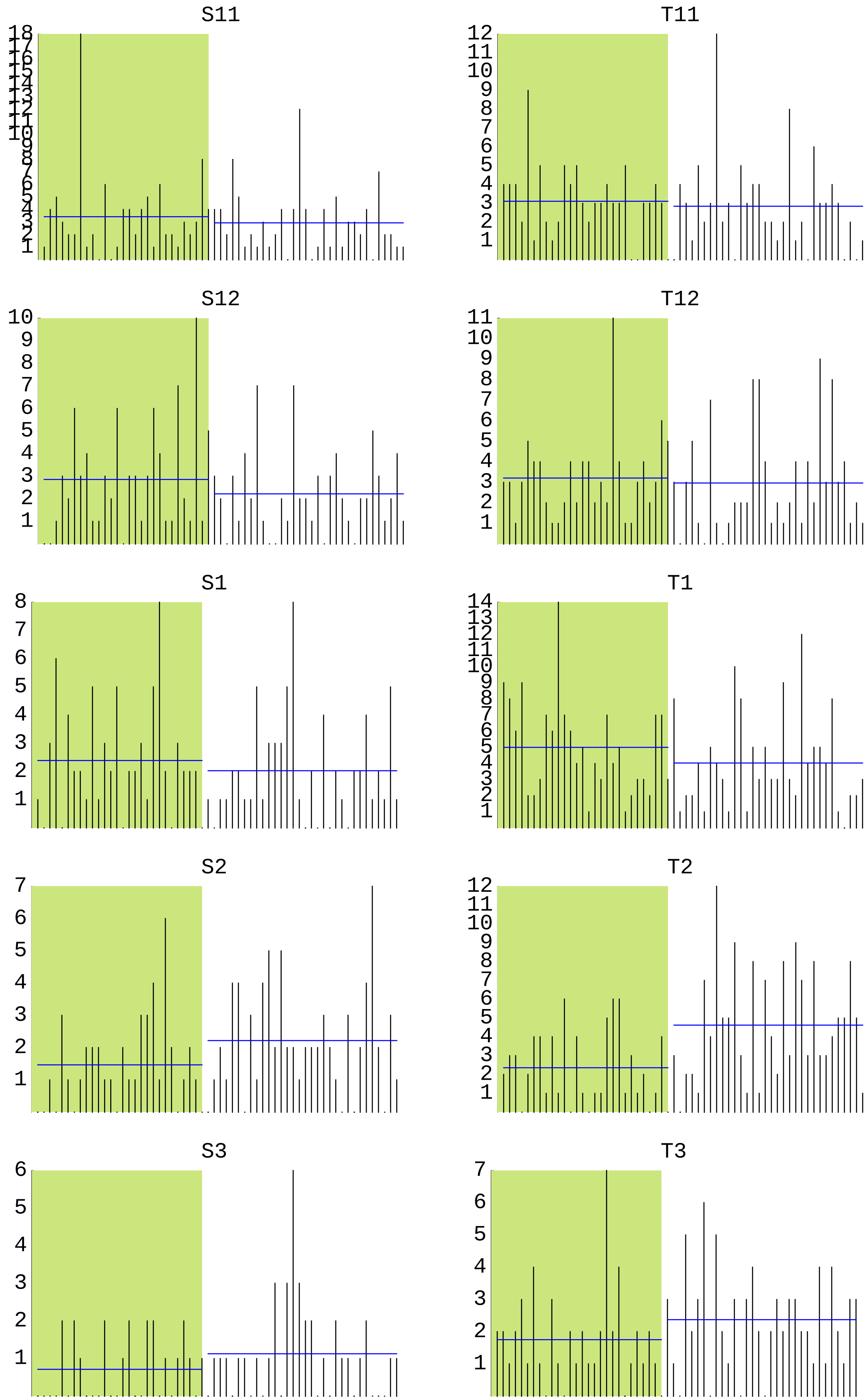
Using a one-sided test, the intervention parameter is significant at 10% for S3 and T3 and it is significant at 5% for S2 and T2. The intervention is especially strong for T2.

■ Residual Autocorrelation Analysis

The autocorrelation in the residuals is examined particularly at lag one and lag twelve. Everything looks reasonable except perhaps for S3 and T3 which have rather large autocorrelations at lag one.


S11
T11
S12
T12
S1
T1
S2
T2
S3
T3
Acf
Lag

■ Visualization of Intervention


S11
T11
S12
T12
S1
T1
S2
T2
S3
T3

Additional Fitting

The residual autocorrelations suggested that for the S3 and T3 series we should consider a model of the form $N_t \sim \text{ARIMA}(0, 0, 1)$ for the disturbance term.

S3 (0, 0, 1)

	Estimate	SE	P-Value
μ	0.725	0.168	0
δ	0.385	0.333	0.248
θ_1	-0.225	0.126	0.074

As expected the statistical significance of the intervention effect is reduced due to the positive autocorrelation.

T3 (0, 0, 1)

	Estimate	SE	P-Value
μ	1.763	0.14	0
δ	**0.594**	**0.285**	**0.037**
θ_1	0.24	0.125	0.055

As expected the statistical significance of the intervention effect is increased due to the negative autocorrelation.