

ROBUST ESTIMATION OF STANDARD ERRORS

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log: Z:\LDA\DataLDA\sitka_Lab8.log
log type: text
opened on: 18 Feb 2004, 11:29:17
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```
. ****The observed mean responses in each of the 4 chambers; for 1988 and 1989
. egen mean1=mean(logs) if ch==1&days<300, by(days)
(892 missing values generated)

. egen mean2=mean(logs) if ch==2&days<300, by(days)
(892 missing values generated)

. egen mean3=mean(logs) if ch==3&days<300, by(days)
(967 missing values generated)

. egen mean4=mean(logs) if ch==4&days<300, by(days)
(962 missing values generated)

. egen mean5=mean(logs) if ch==1&days>300, by(days)
(811 missing values generated)

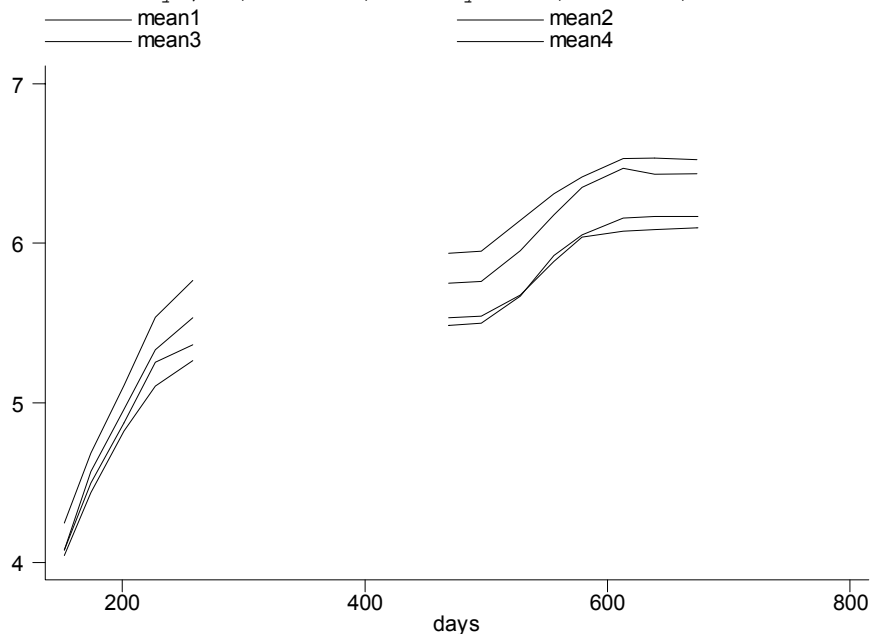
. egen mean6=mean(logs) if ch==2&days>300, by(days)
(811 missing values generated)

. egen mean7=mean(logs) if ch==3&days>300, by(days)
(931 missing values generated)

. egen mean8=mean(logs) if ch==4&days>300, by(days)
(923 missing values generated)

. sort days

. graph7 mean* days, c(11111111) xlab ylab s(iiiiiiii)
```



```
. ****The observed mean responses in each of the two treatment groups
. egen meanc1=mean(logs) if o3==0&days<300, by(days)
(902 missing values generated)
```

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. egen meanc2=mean(logs) if o3==0&days>300, by(days)
(827 missing values generated)

. egen meant1=mean(logs) if o3==1&days<300, by(days)
(757 missing values generated)

. egen meant2=mean(logs) if o3==1&days>300, by(days)
(595 missing values generated)

. label var meanc1 "control-1988"

. label var meanc2 "control-1989"

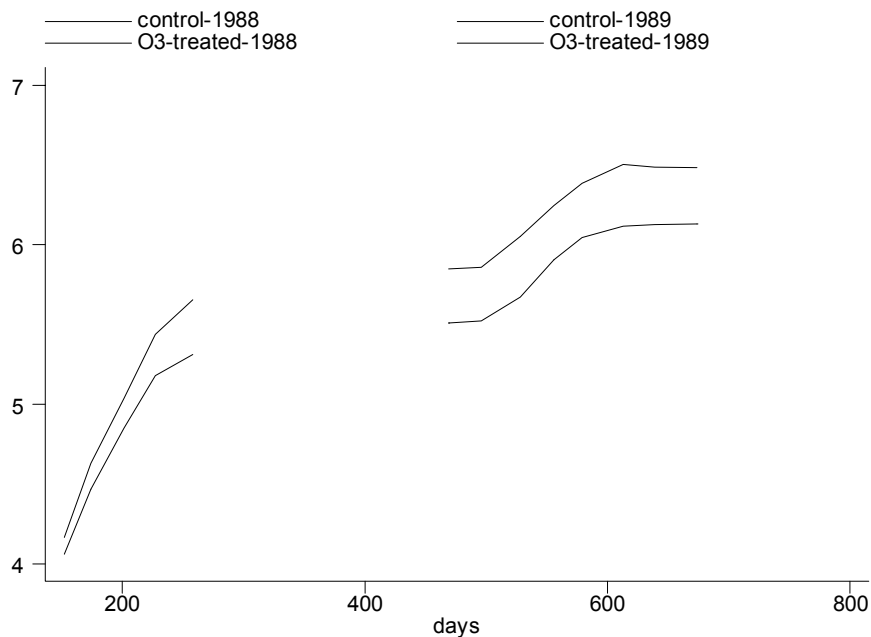
. label var meant1 "O3-treated-1988"

. label var meant2 "O3-treated-1989"

. sort days

. graph7 meanc* meant* days, c(l1l1l) xlab ylab s(iiii)

```



```

. *** Compute the REML estimates of the covariance matrix
. tsset id days
    panel variable: id, 1 to 79
    time variable: days, 152 to 674, but with gaps

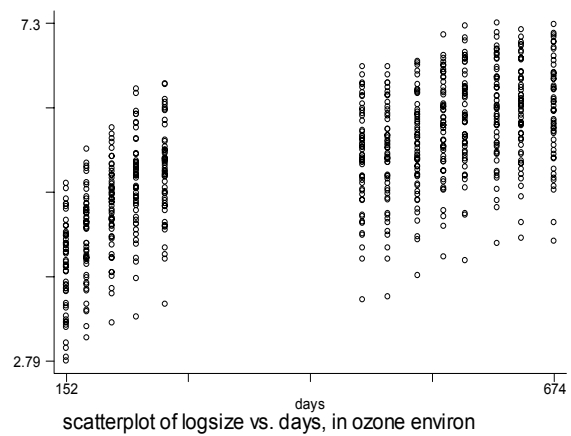
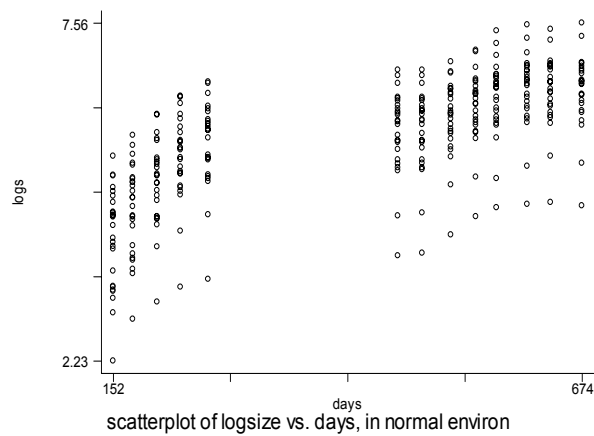
. ** Plotting logsize over time, across chambers ;

. ** two scatterplots;
. graph7 logs days if o3==0, ti("scatterplot of logsize vs. days, in normal environ")

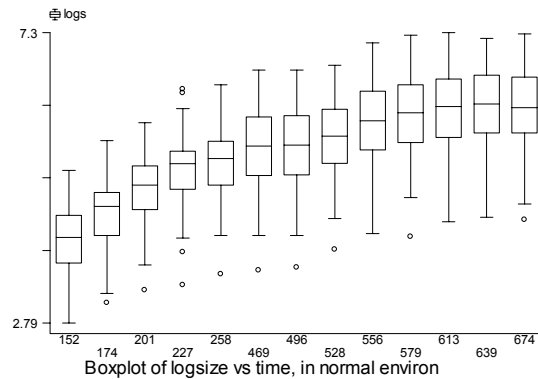
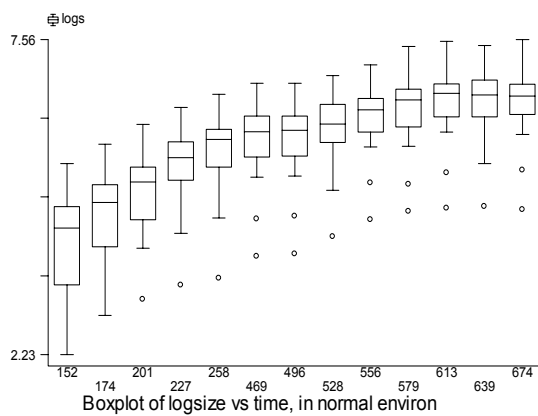
. graph7 logs days if o3==1, ti("scatterplot of logsize vs. days, in ozone environ")

.

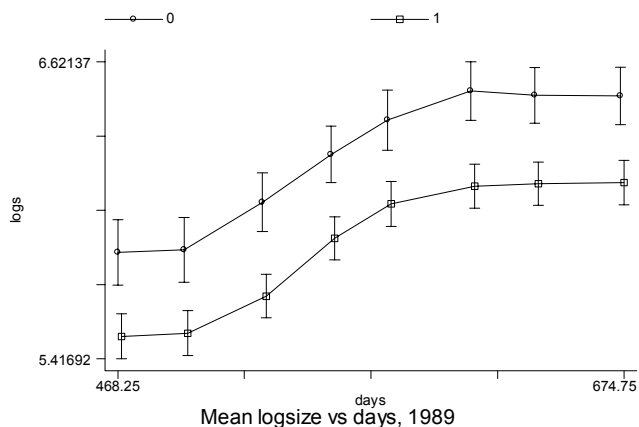
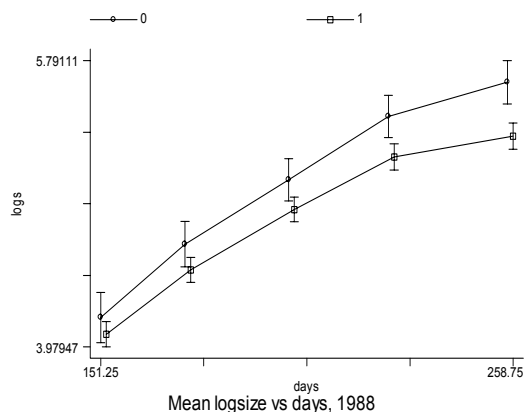
```



```
. ** two box plots;
. sort days
. graph7 logs if o3==0, box by(days) ti("Boxplot of logsize vs time, in normal envi
ron")
. graph7 logs if o3==1, box by(days) ti("Boxplot of logsize vs time, in normal envi
> ron")
```



```
. ** Mean trend plot***;
. xtgraph logs if (days<300) , group(o3) ti("Mean logsize vs days, 1988") bar(se)
> offset(1.5)
. xtgraph logs if (days>300) , group(o3) ti("Mean logsize vs days, 1989") bar(se)
> offset(1.5)
```



****Saturated model for the mean response, ignore chamber effect

```
.
. keep if days<300
(632 observations deleted)
. anova logs days o3
```

```
Number of obs =      395      R-squared      = 0.3871
Root MSE      = .628909      Adj R-squared = 0.3792
```

Source	Partial SS	df	MS	F	Prob > F
Model	97.1719809	5	19.4343962	49.14	0.0000
days	93.3623074	4	23.3405769	59.01	0.0000
o3	3.80967344	1	3.80967344	9.63	0.0021
Residual	153.859874	389	.395526667		
Total	251.031854	394	.637136687		

```
. predict logsres, resid

. ***The corresponding fitted means
. predict yhat
(option xb assumed; fitted values)

. keep id logsres days

. reshape group days 152 174 201 227 258

. reshape var logsres

. reshape cons id

. reshape wide
. matrix accum Cov=logsres152 logsres174 logsres201 logsres227 logsres258, deviatio
> ns noconstant
(obs=79)

. scalar adj=1/(_result(1)-4)

. matrix Cov=adj*Cov

. *REML estimate of covariance for 1988, P72
. matrix list Cov

symmetric Cov[5,5]
```

```

      logsres152  logsres174  logsres201  logsres227  logsres258
logsres152      .4500164
logsres174      .40754288   .39916499
logsres201      .37601123   .37498865   .37307495
logsres227      .37273896   .37764627   .37626807   .40840599
logsres258      .37131931   .37765755   .37499285   .4087105   .42080266

```

```
. **Now get the GLS beta(hatW)
```

```
. use "Z:\LDA\DataLDA\sitka.dta", clear
```

```
. keep if days<300
(632 observations deleted)
```

```
. tab days, gen(t)
```

days	Freq.	Percent	Cum.
152	79	20.00	20.00
174	79	20.00	40.00
201	79	20.00	60.00
227	79	20.00	80.00
258	79	20.00	100.00
Total	395	100.00	

```
. gen eta=1-o3
```

```
. *covariate of time
. gen gamma=days/100*eta
```

```
.
. *We fit GEE marginal model with robust estimates of standard error
. xtgee logs t1 t2 t3 t4 t5 eta gamma, noconst i(id) corr(exc) robust
```

```
Iteration 1: tolerance = 6.450e-13
```

```

GEE population-averaged model
Group variable:          id      Number of obs      =      395
Link:                  identity  Number of groups   =      79
Family:                Gaussian  Obs per group: min =      5
Correlation:           exchangeable      avg =      5.0
                                      max =      5
                                      Wald chi2(6)      =    6651.46
Scale parameter:        .3881248      Prob > chi2        =    0.0000

```

(standard errors adjusted for clustering on id)

logs	Coef.	Semi-robust Std. Err.	z	P> z	[95% Conf. Interval]
t1	4.060577	.0790991	51.34	0.000	3.905546 4.215609
t2	4.470879	.0776508	57.58	0.000	4.318686 4.623071
t3	4.842733	.0773668	62.59	0.000	4.691097 4.994369
t4	5.178935	.0820593	63.11	0.000	5.018102 5.339769
t5	5.31669	.0838617	63.40	0.000	5.152325 5.481056
eta	-.2216775	.2429765	-0.91	0.362	-.6979027 .2545478
gamma	.213851	.0789394	2.71	0.007	.0591327 .3685694

```
. *Incorrect standard error using OLS
. reg logs t1 t2 t3 t4 t5 eta gamma, noconst
```

Source	SS	df	MS	Number of obs =
-----+-----				395
				F(7, 388) = 3381.85

Model		9353.83562	7	1336.26223	Prob > F	=	0.0000
Residual		153.309291	388	.395127038	R-squared	=	0.9839
-----+-----							
Total		9507.14491	395	24.0687213	Adj R-squared	=	0.9836
					Root MSE	=	.62859

logs		Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-----+-----							
t1		4.060577	.07937	51.16	0.000	3.904528 4.216626	
t2		4.470879	.0756955	59.06	0.000	4.322054 4.619703	
t3		4.842733	.0739281	65.51	0.000	4.697383 4.988083	
t4		5.178935	.075257	68.82	0.000	5.030973 5.326898	
t5		5.31669	.0805032	66.04	0.000	5.158413 5.474967	
eta		-.2216775	.3729256	-0.59	0.553	-.9548853 .5115304	
gamma		.213851	.1811625	1.18	0.239	-.1423321 .5700341	

. *Now create design matrix for 1988 data X

. set matsize 400

. *Now create design matrix for 1988 data X

. mkmat t1 t2 t3 t4 t5 eta gamma, matrix(X)

. *Now create response matrix of Y for 1988 data

. mkmat logs, matrix(Y)

. *OLS estimate of beta (4.3.4) pg. 60

. matrix beta=syminv(X'*X)*X'*Y

. matrix list beta

beta[7,1]

	logs
t1	4.0605772
t2	4.4708787
t3	4.8427332
t4	5.1789353
t5	5.3166904
eta	-.22167746
gamma	.21385103

. *Calculate the robust estimate of standard error of beta (4.6.1)

. matrix diag=I(79)

. matrix V=diag#Cov

. ***Get the estimated variance matrix (4.6.2) pg. 70

. matrix RW=syminv(X'*X)*X'*V*X*syminv(X'*X)

. *Robust estimate of covariance matrix for the coefficients

. matrix list RW

symmetric RW[7,7]

	t1	t2	t3	t4	t5	eta
t1	.00815331					
t2	.00753765	.00738623				
t3	.00704276	.00702453	.00699381			
t4	.00690913	.00700455	.00702797	.00747413		
t5	.00678122	.00694076	.00700437	.00752491	.00778973	
eta	-.00946726	-.00850778	-.00733024	-.00619631	-.00484431	.0508646
gamma	.00112069	.00065165	.00007602	-.00047829	-.00113919	-.01378161

	gamma
gamma	.006737

*** Calculate the robust standard error**

. matrix var=vecdiag(RW)

. matrix var=var'

. svmat var, name(varbeta)

. keep varbeta1

. drop in 8/395

(388 observations deleted)

. gen se=sqrt(varbeta1)

. svmat beta, name(beta)

. mkmat beta1 se, matrix(Coef)

. matrix Coef=Coef'

. matrix list Coef

Coef[2,7]

	r1	r2	r3	r4	r5	r6
beta1	4.0605774	4.4708786	4.8427334	5.1789355	5.3166904	-.22167745
se	.0902957	.08594321	.08362897	.08645306	.08825944	.2255318

	r7
beta1	.21385103
se	.08207925

. matrix colnames Coef= beta1 beta2 beta3 beta4 beta5 tao gamma

. *Table4.3 for 1988 P75

. matrix list Coef

Coef[2,7]

	beta1	beta2	beta3	beta4	beta5	tao
beta1	4.0605774	4.4708786	4.8427334	5.1789355	5.3166904	-.22167745
se	.0902957	.08594321	.08362897	.08645306	.08825944	.2255318

	gamma
beta1	.21385103
se	.08207925

. log close

log: Z:\LDA\DataLDA\sitka_Lab8.log

log type: text

closed on: 18 Feb 2004, 12:14:51
