



Supplement of

First and second derivative atmospheric CO₂, global surface temperature and ENSO

L. M. W. Leggett and D. A. Ball

Correspondence to: L. M. W. Leggett (mleggett.globalriskprogress@gmail.com)

Detailed results from time series analyses

Table S1: OLS dynamic regression between first-derivative atmospheric CO₂ and global surface temperature for period 1959-2012, with autocorrelation taken into account (see text for details)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	0.00418791	0.00311006	1.3466	0.17860	
Led2m2x13mma1s tDerivCO ₂	0.0973641	0.0206949	4.7047	<0.00001	***
Led1mHad4Glob	0.564726	0.0377431	14.9623	<0.00001	***
Led2mHad4Glob	0.306035	0.0374109	8.1804	<0.00001	***
Mean dependent var	-0.030850	S.D. dependent var		0.195400	
Sum squared resid	3.368592	S.E. of regression		0.072777	
R-squared	0.861930	Adjusted R-squared		0.861279	
F(3, 636)	1323.454	P-value(F)		6.7e-273	
Log-likelihood	770.9108	Akaike criterion		-1533.822	
Schwarz criterion	-1515.976	Hannan-Quinn		-1526.895	
rho	-0.011403	Durbin-Watson		2.022743	

LMF test statistic for autocorrelation up to order 12

Null hypothesis: no autocorrelation

Test statistic: LMF = 1.43686

with p-value = $P(F(12,624) > 1.43686) = 0.144257$.

Table S2: OLS dynamic regression between second-derivative atmospheric CO₂ and reversed Southern Oscillation Index for period 1959-2012, with autocorrelation taken into account (see text for details)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	0.000138006	0.0286976	0.0048	0.99616	
Led3mZ2x13mma 2ndDerivCO ₂	0.0769493	0.0300172	2.5635	0.01059	**
Led1mZReverseLo ngPaddockSOI	0.455636	0.0383604	11.8777	<0.00001	***
Led2mZReverseLo ngPaddockSOI	0.271723	0.038144	7.1236	<0.00001	***
Mean dependent var	0.000400	S.D. dependent var		1.002060	
Sum squared resid	332.0730	S.E. of regression		0.724294	
R-squared	0.480017	Adjusted R-squared		0.477552	
F(3, 633)	194.7823	P-value(F)		1.80e-89	
Log-likelihood	-696.3882	Akaike criterion		1400.776	
Schwarz criterion	1418.604	Hannan-Quinn		1407.697	
rho	-0.035159	Durbin-Watson		2.067890	

LMF test for autocorrelation up to order 12 -
 Null hypothesis: no autocorrelation
 Test statistic: LMF = 1.2991
 with p-value = $P(F(12,621) > 1.2991) = 0.214213$

Table S3: OLS dynamic regression between first derivative global surface temperature and reversed Southern Oscillation Index for period 1877 to 2012, with autocorrelation taken into account (see text for details)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	0.0011349	0.0181196	0.0626	0.95007	
led3mZ13mma_fir	0.140219	0.0193107	7.2612	<0.00001	***
st_derivhad4Glob					
Led1mZReverseLo	0.465077	0.0241683	19.2432	<0.00001	***
ngPaddockSOI					
Led2mZReverseLo	0.209942	0.0239305	8.7730	<0.00001	***
ngPaddockSOI					
Mean dependent var	0.002218	S.D. dependent var		1.000403	
Sum squared resid	869.0817	S.E. of regression		0.731314	
R-squared	0.466596	Adjusted R-squared		0.465612	
F(3, 1625)	473.8245	P-value(F)		3.8e-221	
Log-likelihood	-1799.713	Akaike criterion		3607.426	
Schwarz criterion	3629.009	Hannan-Quinn		3615.434	
rho	-0.022337	Durbin-Watson		2.044496	

Breusch-Gordon LM test for autocorrelation up to order 3 -
 Null hypothesis: no autocorrelation
 Test statistic: LMF = 1.54212
 with p-value = $P(F(3,1627) > 1.54212) = 0.201729$

Table S4: OLS dynamic regression between NDVI and the difference between Z-scored level of atmospheric CO₂ and Z-scored global surface temperature for period 1980 to 2012, with autocorrelation taken into account (see text for details)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	0.099632	0.0312679	3.1864	0.00156	***
led4mNDVI_GI MMS_to2005_92_ then	0.0462155	0.0273817	1.6878	0.09228	*
led1mGap__CO ₂ _ minus_Had4Glob_	0.506724	0.0502139	10.0913	<0.00001	***
led2mGap__CO ₂ _ minus_Had4Glob_	0.260036	0.0501829	5.1818	<0.00001	***
Mean dependent var	0.442499	S.D. dependent var		0.739363	
Sum squared resid	96.65885	S.E. of regression		0.509741	
R-squared	0.528486	Adjusted R-squared		0.524683	
F(3, 372)	138.9825	P-value(F)		2.09e-60	
Log-likelihood	-278.1414	Akaike criterion		564.2829	
Schwarz criterion	580.0012	Hannan-Quinn		570.5225	
rho	-0.004581	Durbin-Watson		1.982026	

LM test for autocorrelation up to order 6 -

Null hypothesis: no autocorrelation

Test statistic: LMF = 1.97307

with p-value = $P(F(6,366) > 1.97307) = 0.0686534$

Table S5. OLS dynamic regression between (unreversed) Southern Oscillation Index and NDVI for 1980 to 2012, with autocorrelation taken into account (see text for details)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	0.071	0.036	1.973	0.049	**
Led7mLongPaddockSOI	0.120	0.034	3.495	0.001	***
Led1mNDVI	0.688	0.037	18.808	<0.00001	***
Mean dependent var	0.175	S.D. dependent var		0.986	
Sum squared resid	170.385	S.E. of regression		0.678	
R-squared	0.530	Adjusted R-squared		0.527	
F(2, 371)	209.042	P-value(F)		1.590E-61	
Log-likelihood	-383.664	Akaike criterion		773.328	
Schwarz criterion	785.101	Hannan-Quinn		778.002	
rho	0.066	Durbin-Watson		1.866	

LM test for autocorrelation up to order 2 -
 Null hypothesis: no autocorrelation
 Test statistic: LMF = 2.976
 with p-value = $P(F(2,369) > 2.976) = 0.0522221$