

## The SAS System

### The VARMAX Procedure

Number of Observations	132
Number of Pairwise Missing	0

Simple Summary Statistics						
Variable	Type	N	Mean	Standard Deviation	Min	Max
Gasoline_Gallons	Dependent	132	376804937.74	34812609.531	218414414.00	476873743.00
Diesel_Gallons	Dependent	132	80003756.470	9364707.9800	64939973.000	111638305.00
Kerosene_Gallons	Dependent	132	299988.92424	368176.38610	2214.00000	1725070.0000
Alternative_Fuels_Gallons	Dependent	132	482229.06818	509431.11286	53077.00000	2372859.0000

Dickey-Fuller Unit Root Tests						
Variable	Type	Rho	Pr < Rho	Tau	Pr < Tau	
Gasoline_Gallons	Zero Mean	0.16	0.7187	0.29	0.7677	
	Single Mean	-36.69	0.0011	-5.29	<.0001	
	Trend	-53.35	0.0004	-7.01	<.0001	
Diesel_Gallons	Zero Mean	-0.16	0.6458	-0.24	0.5986	
	Single Mean	-21.73	0.0058	-3.30	0.0169	
	Trend	-68.66	0.0004	-6.33	<.0001	
Kerosene_Gallons	Zero Mean	-41.45	<.0001	-4.52	<.0001	
	Single Mean	-85.06	0.0011	-6.45	<.0001	
	Trend	-88.50	0.0004	-6.51	<.0001	
Alternative_Fuels_Gallons	Zero Mean	-17.77	0.0027	-3.22	0.0015	
	Single Mean	-40.29	0.0011	-4.60	0.0003	
	Trend	-283.42	0.0001	-11.79	<.0001	

Eigenvalues for Cointegration Rank Test for I(2)					
r\rs	0	1	2	3	Eigenvalue of I(1)
0	0.804361	0.780805	0.738233	0.397163	0.5216
1	0.784882	0.726037	0.397790		0.3788
2	0.780674	0.411851			0.2423
3	0.762957				0.0559

Cointegration Rank Test for I(2)						
r\k-r-s	4	3	2	1	Trace of I(1)	Pr > Trace of I(1)
0	649.4396	437.3465	240.0331	65.7940	201.2586	<.0001
Pr > Trace of I(2)	0.0000	0.0000	0.0000	0.0000		
1		434.0025	234.2487	65.9294	105.4205	<.0001
Pr > Trace of I(2)		0.0000	0.0000	0.0000		

<b>2</b>			266.2361	69.0008	43.5368	<.0001
<b>Pr &gt; Trace of I(2)</b>			0.0000	0.0000		
<b>3</b>				187.1367	7.4719	0.0061
<b>Pr &gt; Trace of I(2)</b>				0.0000		

<b>Long-Run Parameter Beta Estimates</b>				
<b>Variable</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Gasoline_Gallons</b>	1.00000	1.00000	1.00000	1.00000
<b>Diesel_Gallons</b>	31.54464	-3.99191	-5.46456	318.50340
<b>Kerosene_Gallons</b>	244.35098	12.66943	-183.71038	1694.36073
<b>Alternative_Fuels_Gallons</b>	-677.27574	26.08116	21.62836	3045.31271

<b>Adjustment Coefficient Alpha Estimates</b>				
<b>Variable</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Gasoline_Gallons</b>	-0.05719	-0.32554	-0.10272	-0.00093
<b>Diesel_Gallons</b>	-0.01275	0.08578	-0.00829	-0.00036
<b>Kerosene_Gallons</b>	0.00003	-0.00406	0.00193	0.00000
<b>Alternative_Fuels_Gallons</b>	0.00120	-0.00387	-0.00000	-0.00002

<b>Parameter Eta Estimates</b>				
<b>Variable</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Gasoline_Gallons</b>	0.00000	-0.00000	0.00000	-0.00000
<b>Diesel_Gallons</b>	0.00000	0.00000	-0.00000	0.00000
<b>Kerosene_Gallons</b>	0.00000	0.00000	0.00000	0.00000
<b>Alternative_Fuels_Gallons</b>	-0.00000	0.00000	0.00000	-0.00000

<b>Parameter Xi Estimates</b>				
<b>Variable</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Gasoline_Gallons</b>	-34439764.08	-2606073.319	-24639381.42	10305369.849
<b>Diesel_Gallons</b>	-11113331.54	-6360545.808	469956.07272	1928288.0134
<b>Kerosene_Gallons</b>	-15748.26816	-36126.30088	-90889.75327	-205649.8180
<b>Alternative_Fuels_Gallons</b>	355522.24047	-739986.1399	-280439.6195	10990.49206

## The SAS System

### The VARMAX Procedure

Type of Model	VECM(2)
Estimation Method	Maximum Likelihood Estimation
Cointegrated Rank	1

Long-Run Parameter Beta Estimates When RANK=1	
Variable	1
Gasoline_Gallons	1.00000
Diesel_Gallons	31.54464
Kerosene_Gallons	244.35098
Alternative_Fuels_Gallons	-677.27574

Adjustment Coefficient Alpha Estimates When RANK=1	
Variable	1
Gasoline_Gallons	-0.05719
Diesel_Gallons	-0.01275
Kerosene_Gallons	0.00003
Alternative_Fuels_Gallons	0.00120

Coefficient of Granger Representation				
Variable	Gasoline_Gallons	Diesel_Gallons	Kerosene_Gallons	Alternative_Fuels_Gallons
Gasoline_Gallons	0.71893	-1.22860	-12.13761	21.49647
Diesel_Gallons	0.01561	0.38518	-4.72939	4.94116
Kerosene_Gallons	-0.00236	0.00523	1.24253	-0.08291
Alternative_Fuels_Gallons	0.00094	0.01801	0.21009	0.23196

Constant Estimates	
Variable	Constant
Gasoline_Gallons	152994939.23
Diesel_Gallons	33795937.157
Kerosene_Gallons	-64468.93142
Alternative_Fuels_Gallons	-3189957.396

Parameter Alpha * Beta' Estimates				
Variable	Gasoline_Gallons	Diesel_Gallons	Kerosene_Gallons	Alternative_Fuels_Gallons
Gasoline_Gallons	-0.05719	-1.80392	-13.97349	38.73079
Diesel_Gallons	-0.01275	-0.40205	-3.11439	8.63226
Kerosene_Gallons	0.00003	0.00079	0.00612	-0.01697
Alternative_Fuels_Gallons	0.00120	0.03780	0.29279	-0.81153

AR Coefficients of Differenced Lag					
DIF Lag	Variable	Gasoline_Gallons	Diesel_Gallons	Kerosene_Gallons	Alternative_Fuels_Gallons
1	Gasoline_Gallons	-0.33198	0.21828	-4.85137	-14.56983
	Diesel_Gallons	0.03675	-0.47673	-3.73448	-2.61958
	Kerosene_Gallons	-0.00269	0.00334	0.18861	-0.05406
	Alternative_Fuels_Gallons	0.00069	-0.02403	0.00028	-0.10544

Schematic Representation of Parameter Estimates			
Variable/Lag	C	AR1	AR2
Gasoline_Gallons	*	---+	..-
Diesel_Gallons	*	---+	....
Kerosene_Gallons	*	....	....
Alternative_Fuels_Gallons	*	....	....
+ is > 2*std error, - is < -2*std error, . is between, * is N/A			

Model Parameter Estimates						
Equation	Parameter	Estimate	Standard Error	t Value	Pr >  t	Variable
D_Gasoline_Gallons	CONST1	152994939.23	0.00000			1
	AR1_1_1	-0.05719	0.00077	-74.37	<.0001	Gasoline_Gallons(t-1)
	AR1_1_2	-1.80392	0.02426	-74.37	<.0001	Diesel_Gallons(t-1)
	AR1_1_3	-13.97349	0.18790	-74.37	<.0001	Kerosene_Gallons(t-1)
	AR1_1_4	38.73079	0.52081	74.37	<.0001	Alternative_Fuels_Gallons(t-1)
	AR2_1_1	-0.33198	0.09749	-3.41	0.0009	D_Gasoline_Gallons(t-1)
	AR2_1_2	0.21828	0.35240	0.62	0.5368	D_Diesel_Gallons(t-1)
	AR2_1_3	-4.85137	7.67756	-0.63	0.5287	D_Kerosene_Gallons(t-1)
D_Diesel_Gallons	AR2_1_4	-14.56983	3.72313	-3.91	0.0002	D_Alternative_Fuels_Gallons(t-1)
	CONST2	33795937.157	0.00000			1
	AR1_2_1	-0.01275	0.00021	-60.32	<.0001	Gasoline_Gallons(t-1)
	AR1_2_2	-0.40205	0.00667	-60.32	<.0001	Diesel_Gallons(t-1)
	AR1_2_3	-3.11439	0.05163	-60.32	<.0001	Kerosene_Gallons(t-1)
	AR1_2_4	8.63226	0.14311	60.32	<.0001	Alternative_Fuels_Gallons(t-1)
	AR2_2_1	0.03675	0.02679	1.37	0.1727	D_Gasoline_Gallons(t-1)
	AR2_2_2	-0.47673	0.09684	-4.92	<.0001	D_Diesel_Gallons(t-1)
D_Kerosene_Gallons	AR2_2_3	-3.73448	2.10973	-1.77	0.0792	D_Kerosene_Gallons(t-1)
	AR2_2_4	-2.61958	1.02309	-2.56	0.0117	D_Alternative_Fuels_Gallons(t-1)
	CONST3	-64468.93142	0.00000			1
	AR1_3_1	0.00003	0.00001	2.92	0.0042	Gasoline_Gallons(t-1)
	AR1_3_2	0.00079	0.00027	2.92	0.0042	Diesel_Gallons(t-1)
	AR1_3_3	0.00612	0.00210	2.92	0.0042	Kerosene_Gallons(t-1)

	AR1_3_4	-0.01697	0.00582	-2.92	0.0042	Alternative_Fuels_Gallons(t-1)
	AR2_3_1	-0.00269	0.00109	-2.47	0.0148	D_Gasoline_Gallons(t-1)
	AR2_3_2	0.00334	0.00393	0.85	0.3980	D_Diesel_Gallons(t-1)
	AR2_3_3	0.18861	0.08573	2.20	0.0297	D_Kerosene_Gallons(t-1)
	AR2_3_4	-0.05406	0.04157	-1.30	0.1959	D_Alternative_Fuels_Gallons(t-1)
D_Alternative_Fuels_Gallons	CONST4	-3189957.396	0.00000			1
	AR1_4_1	0.00120	0.00001	91.36	<.0001	Gasoline_Gallons(t-1)
	AR1_4_2	0.03780	0.00041	91.36	<.0001	Diesel_Gallons(t-1)
	AR1_4_3	0.29279	0.00320	91.36	<.0001	Kerosene_Gallons(t-1)
	AR1_4_4	-0.81153	0.00888	-91.36	<.0001	Alternative_Fuels_Gallons(t-1)
	AR2_4_1	0.00069	0.00166	0.42	0.6773	D_Gasoline_Gallons(t-1)
	AR2_4_2	-0.02403	0.00601	-4.00	0.0001	D_Diesel_Gallons(t-1)
	AR2_4_3	0.00028	0.13094	0.00	0.9983	D_Kerosene_Gallons(t-1)
	AR2_4_4	-0.10544	0.06350	-1.66	0.0994	D_Alternative_Fuels_Gallons(t-1)

Alpha and Beta Parameter Estimates						
Equation	Parameter	Estimate	Standard Error	t Value	Pr >  t	Variable
D_Gasoline_Gallons	ALPHA1_1	-0.05719	0.00077	-74.37	<.0001	Beta[,1]*_DEP_(t-1)
	BETA1_1	1.00000				Gasoline_Gallons(t-1)
D_Diesel_Gallons	ALPHA2_1	-0.01275	0.00021	-60.32	<.0001	Beta[,1]*_DEP_(t-1)
	BETA2_1	31.54464				Diesel_Gallons(t-1)
D_Kerosene_Gallons	ALPHA3_1	0.00003	0.00001	2.92	0.0042	Beta[,1]*_DEP_(t-1)
	BETA3_1	244.35098				Kerosene_Gallons(t-1)
D_Alternative_Fuels_Gallons	ALPHA4_1	0.00120	0.00001	91.36	<.0001	Beta[,1]*_DEP_(t-1)
	BETA4_1	-677.27574				Alternative_Fuels_Gallons(t-1)

Covariance Parameter Estimates				
Parameter	Estimate	Standard Error	t Value	Pr >  t
COV1_1	5.416147E14	0.00000		
COV1_2	9.5886899E13	0.00000		
COV2_2	4.0897485E13	0.00000		
COV1_3	-2.209507E12	0.00000		
COV2_3	-4.977547E11	0.00000		
COV3_3	67524994120	0.00000		
COV1_4	2.8096359E12	0.00000		
COV2_4	930653289298	0.00000		
COV3_4	10600857897	0.00000		
COV4_4	157547687107	0.00000		

Covariances of Innovations				

Variable	Gasoline_Gallons	Diesel_Gallons	Kerosene_Gallons	Alternative_Fuels_Gallons
Gasoline_Gallons	5.416147E14	9.5886899E13	-2.209507E12	2.8096359E12
Diesel_Gallons	9.5886899E13	4.0897485E13	-4.977547E11	930653289298
Kerosene_Gallons	-2.209507E12	-4.977547E11	67524994120	10600857897
Alternative_Fuels_Gallons	2.8096359E12	930653289298	10600857897	157547687107

Log-likelihood	-7739.48
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Information Criteria	
AICC	15579.61
HQC	15592.91
AIC	15550.96
SBC	15654.2
FPEC	1.362E50

Cross Covariances of Residuals					
Lag	Variable	Gasoline_Gallons	Diesel_Gallons	Kerosene_Gallons	Alternative_Fuels_Gallons
0	Gasoline_Gallons	5.416147E14	9.5886899E13	-2.209507E12	2.8096359E12
	Diesel_Gallons	9.5886899E13	4.0897485E13	-4.977547E11	930653289298
	Kerosene_Gallons	-2.209507E12	-4.977547E11	67524994120	10600857897
	Alternative_Fuels_Gallons	2.8096359E12	930653289298	10600857897	157547687107
1	Gasoline_Gallons	-3.086574E13	-1.249346E13	-4.245633E11	-1.257113E12
	Diesel_Gallons	-1.389878E13	-7.175118E12	-1.223041E11	-6.609442E11
	Kerosene_Gallons	38968417024	95581394105	-1562085595	-3249237240
	Alternative_Fuels_Gallons	-7.484097E11	-1.007453E11	-6180969687	-42056917717
2	Gasoline_Gallons	1.3354446E13	1.284406E13	-4.784957E11	-1.152E12
	Diesel_Gallons	-3.893214E12	-4.633671E12	-1.396346E11	-7.68072E11
	Kerosene_Gallons	-6.460029E11	-4.313771E11	1696637246.5	-6758114093
	Alternative_Fuels_Gallons	-8.148178E11	-2.667602E11	-11441408478	-39744593977
3	Gasoline_Gallons	5.1442998E13	7.8072962E12	397849640498	1.8989777E12
	Diesel_Gallons	1.5071628E13	36753234826	393444954865	749581196077
	Kerosene_Gallons	580367448336	431629480269	-18358691623	14343947433
	Alternative_Fuels_Gallons	2.1963806E12	423768388741	12720131517	93229832621
4	Gasoline_Gallons	-9.534681E13	-4.055846E13	965643524930	-8.461539E11
	Diesel_Gallons	-2.190133E13	-1.065177E13	182096483974	-4.604291E11
	Kerosene_Gallons	-76766215099	240351114102	-2623082057	11341515473
	Alternative_Fuels_Gallons	-7.680387E11	-1.156484E11	-8584087783	-43770057277
5	Gasoline_Gallons	-4.665894E13	-1.765005E13	1.1168159E12	-1.063589E12
	Diesel_Gallons	1.8815665E12	-1.584528E12	-94751658610	-2.43159E11
	Kerosene_Gallons	291656725764	-9169561202	-9277848093	-9783004391
	Alternative_Fuels_Gallons	-1.607919E12	-8.887092E11	3250742710.0	-28834752449

6	Gasoline_Gallons	-1.380134E14	2.1873239E12	1.0427317E12	2.028631E12
	Diesel_Gallons	-6.755913E11	1.0896304E13	5857514393.1	849025001265
	Kerosene_Gallons	1.1552549E12	-1.230292E11	-5561752695	1769098269.8
	Alternative_Fuels_Gallons	2.5987133E12	910765347385	-5935343728	82380905129

Cross Correlations of Residuals					
Lag	Variable	Gasoline_Gallons	Diesel_Gallons	Kerosene_Gallons	Alternative_Fuels_Gallons
0	Gasoline_Gallons	1.00000	0.64427	-0.36536	0.30416
	Diesel_Gallons	0.64427	1.00000	-0.29953	0.36663
	Kerosene_Gallons	-0.36536	-0.29953	1.00000	0.10278
	Alternative_Fuels_Gallons	0.30416	0.36663	0.10278	1.00000
1	Gasoline_Gallons	-0.05699	-0.08394	-0.07020	-0.13609
	Diesel_Gallons	-0.09339	-0.17544	-0.07360	-0.26038
	Kerosene_Gallons	0.00644	0.05752	-0.02313	-0.03150
	Alternative_Fuels_Gallons	-0.08102	-0.03969	-0.05993	-0.26695
2	Gasoline_Gallons	0.02466	0.08630	-0.07912	-0.12471
	Diesel_Gallons	-0.02616	-0.11330	-0.08403	-0.30259
	Kerosene_Gallons	-0.10682	-0.25958	0.02513	-0.06552
	Alternative_Fuels_Gallons	-0.08821	-0.10509	-0.11093	-0.25227
3	Gasoline_Gallons	0.09498	0.05246	0.06579	0.20557
	Diesel_Gallons	0.10127	0.00090	0.23676	0.29530
	Kerosene_Gallons	0.09597	0.25974	-0.27188	0.13907
	Alternative_Fuels_Gallons	0.23777	0.16695	0.12333	0.59176
4	Gasoline_Gallons	-0.17604	-0.27251	0.15968	-0.09160
	Diesel_Gallons	-0.14716	-0.26045	0.10958	-0.18139
	Kerosene_Gallons	-0.01269	0.14463	-0.03885	0.10996
	Alternative_Fuels_Gallons	-0.08314	-0.04556	-0.08323	-0.27782
5	Gasoline_Gallons	-0.08615	-0.11859	0.18467	-0.11514
	Diesel_Gallons	0.01264	-0.03874	-0.05702	-0.09579
	Kerosene_Gallons	0.04823	-0.00552	-0.13740	-0.09485
	Alternative_Fuels_Gallons	-0.17407	-0.35011	0.03152	-0.18302
6	Gasoline_Gallons	-0.25482	0.01470	0.17242	0.21961
	Diesel_Gallons	-0.00454	0.26643	0.00352	0.33448
	Kerosene_Gallons	0.19103	-0.07403	-0.08237	0.01715
	Alternative_Fuels_Gallons	0.28132	0.35880	-0.05754	0.52290

Schematic Representation of Cross Correlations of Residuals							
Variable/Lag	0	1	2	3	4	5	6
Gasoline_Gallons	++-+	....	....	...+	--..	...+	-...+
Diesel_Gallons	++-+	.-.-	...-	..++	.-.-	....	.+..+
Kerosene_Gallons	--+.	....	.-..	.+-.	....	....	+...+

<b>Alternative_Fuels_Gallons</b>	++.	...	...	++.	...	...	++.
+ is > 2*std error, - is < -2*std error, . is between							

Portmanteau Test for Cross Correlations of Residuals			
Up To Lag	DF	Chi-Square	Pr > ChiSq
3	16	132.45	<.0001
4	32	165.09	<.0001
5	48	201.56	<.0001
6	64	284.83	<.0001

Univariate Model ANOVA Diagnostics				
Variable	R-Square	Standard Deviation	F Value	Pr > F
<b>Gasoline_Gallons</b>	0.3763	23272616.951	9.13	<.0001
<b>Diesel_Gallons</b>	0.4160	6395114.1804	10.77	<.0001
<b>Kerosene_Gallons</b>	0.1055	259855.71789	1.78	0.0868
<b>Alternative_Fuels_Gallons</b>	0.4850	396922.77222	14.25	<.0001

Univariate Model White Noise Diagnostics					
Variable	Durbin Watson	Normality		ARCH	
		Chi-Square	Pr > ChiSq	F Value	Pr > F
<b>Gasoline_Gallons</b>	2.10921	30.85	<.0001	7.28	0.0079
<b>Diesel_Gallons</b>	2.33361	214.92	<.0001	7.79	0.0061
<b>Kerosene_Gallons</b>	2.04623	48.88	<.0001	3.18	0.0768
<b>Alternative_Fuels_Gallons</b>	2.50625	18.41	0.0001	7.94	0.0056

Univariate Model AR Diagnostics								
Variable	AR1		AR2		AR3		AR4	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
<b>Gasoline_Gallons</b>	0.42	0.5203	0.31	0.7319	0.87	0.4610	1.58	0.1828
<b>Diesel_Gallons</b>	4.10	0.0449	3.52	0.0326	2.25	0.0858	5.12	0.0008
<b>Kerosene_Gallons</b>	0.07	0.7947	0.08	0.9270	3.47	0.0183	2.68	0.0347
<b>Alternative_Fuels_Gallons</b>	10.05	0.0019	16.22	<.0001	31.88	<.0001	24.53	<.0001

Infinite Order AR Representation					
Lag	Variable	Gasoline_Gallons	Diesel_Gallons	Kerosene_Gallons	Alternative_Fuels_Gallons
1	<b>Gasoline_Gallons</b>	0.61084	-1.58564	-18.82486	24.16096
	<b>Diesel_Gallons</b>	0.02400	0.12122	-6.84887	6.01268
	<b>Kerosene_Gallons</b>	-0.00267	0.00413	1.19474	-0.07102
	<b>Alternative_Fuels_Gallons</b>	0.00189	0.01377	0.29306	0.08303
2	<b>Gasoline_Gallons</b>	0.33198	-0.21828	4.85137	14.56983
	<b>Diesel_Gallons</b>	-0.03675	0.47673	3.73448	2.61958



	<b>Kerosene_Gallons</b>	0.00269	-0.00334	-0.18861	0.05406
	<b>Alternative_Fuels_Gallons</b>	-0.00069	0.02403	-0.00028	0.10544
<b>3</b>	<b>Gasoline_Gallons</b>	0.00000	0.00000	0.00000	0.00000
	<b>Diesel_Gallons</b>	0.00000	0.00000	0.00000	0.00000
	<b>Kerosene_Gallons</b>	0.00000	0.00000	0.00000	0.00000
	<b>Alternative_Fuels_Gallons</b>	0.00000	0.00000	0.00000	0.00000

<b>Testing Weak Exogeneity of Each Variable</b>			
<b>Variable</b>	<b>DF</b>	<b>Chi-Square</b>	<b>Pr &gt; ChiSq</b>
<b>Gasoline_Gallons</b>	1	17.71	<.0001
<b>Diesel_Gallons</b>	1	13.99	0.0002
<b>Kerosene_Gallons</b>	1	0.03	0.8630
<b>Alternative_Fuels_Gallons</b>	1	27.16	<.0001