**ENERGY FORECASTS
WESTERN AUSTRALIA
1992 - 2010**

by

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and
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Department of Economics
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DISCUSSION PAPER 92.01
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Introduction

In the three decades from 1961 to 1991, total energy consumption in Western Australia rose from 99.6 PJ¹ to 467.8 PJ - an overall increase of 370 percent at a rate of growth of 5.3 percent per year. The general upward trend in energy consumption was accompanied by large short-run fluctuations. After expanding strongly from the mid-1960s to the late 1970s, energy consumption leveled off in the wake of the second oil crisis in 1979, and then fell by about 10 percent during the economic downturn in the early 1980s. In the second half of the 1980s, energy consumption rebounded vigorously. A notable feature of energy consumption in Western Australia is that it was unaffected by the first oil crisis in 1973/74. Figure 1 shows total energy consumption in Western Australia since 1961.

The discovery of natural gas in the remote northwestern part of the State in the 1970s has transformed Western Australia's energy sector. Natural gas now accounts for close to 40 percent of State energy consumption and its share is predicted to approach 50 percent by the end of the century. Both the rise in the price of oil and the discovery of natural gas induced large-scale substitution among fuels in the 1980s. Figure 2 shows the consumption of natural gas, petroleum products and black coal during the past three decades.

This report provides estimates of energy consumption in Western Australia to the year 2010. Four multivariate time series models are developed that capture

¹One petajoule (PJ) equals 10^{15} joules.

Total Energy Consumption

Figure 1.

Consumption of Primary Fuel Components

Figure 2.

the interactions between energy consumption, energy prices and economic activity. In the second section forecasts of energy consumption and its main components are presented. In the next section the models are compared in terms of common economic variables. In the fourth section conditional energy forecasts are generated, in which the time paths of real GDP and the price of oil are preset. Included in the appendices are data series, a discussion of the use of vector autoregressions in energy forecasting, and estimated regression equations, variance decompositions and impulse responses for all models.

Unconditional Forecasts

Four models are presented that deal with energy consumption and its principal components. The first model is concerned with total energy consumption. In the second model energy consumption is split into consumption of natural gas, black coal and petroleum products, and in the third model the consumption of petroleum products is further disaggregated into automotive gasoline and automotive distillate. The fourth model focuses on the consumption of electricity.

Multivariate time series models exploit dynamic patterns in groups of economic variables. The models in this report generate energy forecasts to the year 2010, using data on energy consumption, energy prices and aggregate output from 1961 to 1991. All data apply to the financial year ending in June. Forecasting is based upon a "business-as-usual" scenario. In particular, it is assumed that neither fundamental changes in federal and state energy policy nor major technological breakthroughs will occur during the forecast period. However, the models do incorporate secular technological improvements by considering the long-run relationship between aggregate output and energy consumption. Note that forecasts predict energy demand without constraints on fuel availability.

Model 1: Total Energy Consumption

Total energy consumption is defined as the total quantity of primary and derived fuels consumed less the quantity of derived fuels produced. Petroleum products that are used in a non-fuel capacity are included in total energy consumption.

The first model captures the relationships between total energy consumption (TOTE), the real price of oil (PRIC) and Australian real gross domestic product (RGDP). The estimated model is shown in Appendix 3.

Total energy demand is predicted to rise from 467.8 PJ in 1991 to 619.2 PJ in 2010. This amounts to an overall increase of about one-third or a rate of growth of 1.5 percent per year. Following the historical pattern, the predicted rate of growth in total energy consumption displays large fluctuations in the short-run. It will fall from 3.9 percent in 1992 to a low of 0.15 percent by 1998, and then rebound and peak at 2 percent in 2006/07. For a complete range of annual estimates refer to Figure 3, and Tables 1 and 2.

These estimates show that total energy consumption will grow by less than the historical average of 5.3 percent for the past three decades. It should be noted, however, that there was a break in the trend in the early 1980s.

Total Energy Consumption

Forecast 1992 to 2010

Figure 3.

Table 1.
Forecasts 1992 to 2010

	TOTE	PRIC	RGDP
1991	467.8	4.045	256.8
1992	486.1	4.402	260.1
1993	502.2	4.978	263.1
1994	513.2	5.612	266.2
1995	519.2	6.164	269.2
1996	521.8	6.625	271.9
1997	522.9	6.933	274.9
1998	523.7	7.137	278.1
1999	524.9	7.242	281.7
2000	527.2	7.249	285.5
2001	531.0	7.179	289.5
2002	536.7	7.052	293.7
2003	544.3	6.898	297.9
2004	553.4	6.740	302.0
2005	563.9	6.599	306.0
2006	575.2	6.488	309.9
2007	586.8	6.419	313.4
2008	598.3	6.394	316.7
2009	609.2	6.413	319.7
2010	619.1	6.469	322.4

Table 2.
Growth rates (in percent)

	TOTE	PRIC	RGDP
1992	3.91	8.81	1.27
1993	3.31	13.07	1.18
1994	2.18	2.74	1.16
1995	1.17	9.83	1.12
1996	.50	7.47	1.01
1997	.20	4.65	1.07
1998	.15	2.94	1.17
1999	.23	1.46	1.28
2000	.43	.10	1.36
2001	.73	-.97	1.41
2002	1.07	-1.75	1.43
2003	1.40	-2.18	1.42
2004	1.68	-2.28	1.39
2005	1.88	-2.10	1.33
2006	2.00	-1.67	1.24
2007	2.02	-1.07	1.14
2008	1.95	-.38	1.04
2009	1.81	.29	.94
2010	1.63	.88	.84

Model 2: Primary Fuel Components

In recent years, three primary fuel types have dominated total energy consumption. In 1991, natural gas, black coal and petroleum products accounted for 38, 20 and 39 percent, respectively, of all energy consumed in Western Australia. The remaining 3 percent of energy was gained from fuels such as wood, thermal electricity and solar energy.

The second model considers the relationships between natural gas (NGAS), black coal (COAL) and petroleum products (PETR), the real price of oil and real GDP. The estimated model is shown in Appendix 4.

The energy equivalent of the combined consumption of natural gas, black coal and petroleum products is predicted to reach 623.0 PJ by the year 2010. This projection is very close to the total energy consumption forecast in model 1.

Consumption of natural gas, black coal and petroleum products will rise to 294, 151 and 177 PJ, respectively, by the year 2010. The overall changes for each of those fuels are 65.5, 62 and -4 percent. In 2010, the three fuel components will account for 47.3, 24.3 and 28.4 percent of total energy consumption. This demonstrates the increasing importance of natural gas as a fuel in Western Australia and the declining importance of petroleum. Despite the presence of gas as a strong competitor, coal will remain a major fuel type and its predicted share

in total energy consumption will rise slightly. The annual forecasts for model 2 are presented in Figure 4, and Tables 3 and 4.

The consumption of natural gas is predicted to decline over the first three years of the forecast period. However, a turnaround occurs in 1995. The rate of growth will peak at 7.3 percent in 1999, after which growth continues at a decreasing rate.

The growth rate of coal consumption is predicted to peak at 5.1 percent in 1994. The long-term growth rate will then settle at a fairly constant rate of 2 percent per year.

The consumption of petroleum products is predicted to increase somewhat over the first three years of the forecast period and then decline. The years after 2000 show a flattening of petroleum consumption.

Consumption of Primary Fuel Components

Forecast 1992 to 2010

Figure 4.

Table 3.
Forecasts 1992 to 2010

	NGAS	COAL	PETR
1991	178.0	93.4	184.0
1992	170.2	96.6	188.5
1993	162.6	101.3	192.3
1994	158.4	106.5	194.0
1995	158.7	110.6	193.2
1996	163.4	113.4	190.6
1997	171.9	115.6	187.4
1998	183.3	117.8	184.1
1999	196.6	120.1	181.1
2000	210.7	122.4	178.7
2001	224.6	124.8	176.9
2002	237.3	127.4	175.9
2003	248.5	130.2	175.4
2004	257.9	133.1	175.4
2005	265.8	136.2	175.8
2006	272.5	139.3	176.2
2007	278.3	142.4	176.6
2008	283.8	145.4	176.9
2009	289.1	148.4	177.1
2010	294.6	151.2	177.0

	PRIC	RGDP
1991	4.045	256.8
1992	4.348	260.1
1993	4.738	263.9
1994	5.199	268.4
1995	5.595	273.0
1996	5.898	277.5
1997	6.049	282.2
1998	6.074	287.4
1999	6.004	292.8
2000	5.869	298.3
2001	5.701	303.8
2002	5.529	309.2
2003	5.376	314.4
2004	5.259	319.4
2005	5.185	324.1
2006	5.154	328.6
2007	5.157	332.9
2008	5.186	337.1
2009	5.231	341.2
2010	5.280	345.1

Table 4.
Growth rates (in percent)

	NGAS	PETR	COAL
1992	-4.33	2.45	1.73
1993	-4.45	2.05	2.40
1994	-2.63	.84	2.52
1995	.19	-.38	1.91
1996	2.98	-1.33	1.25
1997	5.19	-1.71	.97
1998	6.63	-1.75	.94
1999	7.26	-1.60	.95
2000	7.17	-1.33	.96
2001	6.56	-.98	.97
2002	5.66	-.60	1.02
2003	4.69	-.25	1.07
2004	3.80	.01	1.12
2005	3.06	.17	1.14
2006	2.51	.24	1.13
2007	2.14	.24	1.10
2008	1.94	.17	1.06
2009	1.88	.08	1.00
2010	1.89	-.02	.94

	PRIC	RGDP
1992	7.47	1.29
1993	8.98	1.48
1994	9.71	1.69
1995	7.62	1.70
1996	5.41	1.64
1997	2.56	1.71
1998	.40	1.81
1999	-1.14	1.88
2000	-2.24	1.88
2001	-2.86	1.84
2002	-3.02	1.76
2003	-2.76	1.67
2004	-2.16	1.58
2005	-1.40	1.48
2006	-.61	1.39
2007	.06	1.31
2008	.56	1.25
2009	.85	1.20
2010	.95	1.16

Model 3: Automotive Gasoline and Distillate

This model considers the transport industry's use of petroleum products. In 1991, automotive gasoline and automotive distillate accounted for 56.3 and 77.3 PJ of total State petroleum consumption of 184.0 PJ. Combined, the two products made up 72.6% of petroleum consumed in 1991.

This model focuses on the relationships between consumption of leaded and unleaded gasoline (AGAS), automotive distillate (ADIS), the real price of oil and real GDP. The estimated model is presented in Appendix 5.

The forecasts indicate a continued increase in the consumption of automotive gasoline and distillates. This implies that the proportion of automotive fuels in petroleum-derived products will expand because the overall consumption of petroleum products is predicted to remain almost unchanged for the forecast period (model 2). By 2010, the two types of automotive fuel will account for 93.3 percent of the total petroleum consumption. Annual estimates for automotive gasoline and distillate are shown in Figure 5, and Tables 5 and 6.

The growth rate of automotive gasoline consumption is predicted to peak at 1.9 percent in 1994, after which it progressively falls to only 0.5 percent by the year 2010. The growth rate of automotive distillate consumption peaks at 1.8 percent in 1998, and subsequently falls as well. The ratio of automotive gasoline to distillate will fluctuate slightly around 0.7 during the forecast period.

Consumption of Petroleum Components

Forecast 1992 to 2010

Figure 5.

Table 5.
Forecasts 1992 to 2010

	AGAS	ADIS	PRIC	RGDP
1991	56.30	77.30	4.045	256.8
1992	56.74	78.27	4.441	259.0
1993	57.78	78.91	4.758	261.9
1994	58.88	79.45	4.946	265.7
1995	59.80	80.41	5.025	269.9
1996	60.58	81.66	5.056	273.8
1997	61.31	83.06	5.041	277.7
1998	61.99	84.55	5.025	281.5
1999	62.61	86.04	5.023	285.1
2000	63.19	87.45	5.035	288.5
2001	63.72	88.79	5.059	291.8
2002	64.22	90.02	5.089	294.9
2003	64.70	91.18	5.122	297.9
2004	65.15	92.26	5.154	300.7
2005	65.58	93.28	5.183	303.5
2006	65.99	94.25	5.207	306.1
2007	66.38	95.18	5.226	308.7
2008	66.75	96.06	5.240	311.2
2009	67.11	96.92	5.250	313.6
2010	67.44	97.74	5.256	315.9

Table 6.
Growth rates (in percent)

	AGAS	ADIS	PRIC	RGDP
1992	.79	1.26	9.77	.87
1993	1.82	.81	7.14	1.09
1994	1.90	.68	3.94	1.45
1995	1.56	1.21	1.60	1.58
1996	1.30	1.55	.62	1.47
1997	1.20	1.70	-.30	1.41
1998	1.10	1.79	-.31	1.35
1999	1.00	1.75	-.04	1.28
2000	.91	1.64	.24	1.20
2001	.84	1.52	.47	1.13
2002	.78	1.39	.59	1.06
2003	.74	1.28	.64	1.00
2004	.70	1.18	.62	.95
2005	.66	1.10	.56	.91
2006	.62	1.03	.46	.87
2007	.59	.98	.36	.84
2008	.55	.93	.26	.80
2009	.52	.89	.18	.77
2010	.49	.85	.11	.74

Model 4: Electricity

Electricity is a derived energy source that is generated from oil, gas, coal and, to a limited extent, wind. In Western Australia coal is currently the predominant fuel converted to electricity. Electricity data refer to all sectors which use electricity including industrial, commercial and residential. The industrial sector is the largest consumer of electricity. The electricity data do not include electricity generated and co-generated in the industrial sector.

The fourth model examines the relationships between electricity consumption (ELEC) and real GDP. The estimated model is presented in Appendix 6.

In 1991, the energy equivalent of consumed electricity was 47.0 PJ. By 2010, the predicted electricity consumption will reach 74.3 PJ - an increase of 58 percent. The annual growth peaks at 3.6 percent in 1993; thereafter, it progressively slows to 1.5 percent by the end of the forecast period. The mean growth is 2.5 percent. Annual estimates are shown in Figure 6, and Tables 7 and 8.

Electricity Consumption

Forecast 1992 to 2010

Figure 6.

Table 7.
Forecasts 1992 to 2010

	ELEC	RGDP
1991	47.00	256.8
1992	48.58	261.4
1993	50.36	266.1
1994	52.04	270.6
1995	53.65	275.1
1996	55.25	279.4
1997	56.86	283.6
1998	58.43	287.6
1999	59.97	291.6
2000	61.46	295.4
2001	62.91	299.1
2002	64.32	302.7
2003	65.70	306.2
2004	67.04	309.6
2005	68.34	312.8
2006	69.60	316.0
2007	70.83	319.0
2008	72.02	322.0
2009	73.18	324.8
2010	74.30	327.5

Table 8.
Growth rate (in percent)

	ELEC	RGDP
1992	3.36	1.82
1993	3.68	1.77
1994	3.33	1.71
1995	3.08	1.63
1996	2.98	1.55
1997	2.91	1.49
1998	2.76	1.43
1999	2.62	1.37
2000	2.48	1.31
2001	2.36	1.25
2002	2.24	1.20
2003	2.13	1.14
2004	2.03	1.10
2005	1.93	1.05
2006	1.84	1.00
2007	1.76	.96
2008	1.68	.92
2009	1.60	.88
2010	1.53	.84

Real Output and Petroleum Price

Since all variables are jointly determined in vector autoregressions, the models in this report can also be used to generate forecasts of the real price of oil and real GDP. The forecast of those variables are shown in Tables 1,3, 5 and 7, and Figures 7 and 8.

It should be noted, however, that the models are primarily designed to forecast energy consumption. The real price of oil and real GDP are included because variance decompositions and impulse responses show that these variables are suitable to predict energy consumption. On the other hand, the models are much less capable of predicting the real price of oil and real GDP. Energy consumption in Western Australia does not affect the real price of oil - which is determined in world markets - and energy consumption has also only a minor impact on Australian real GDP. For this reason, it is not surprising that the energy forecasts of the four models are consistent in the sense that the subaggregates in models 2 and 3 add up to the aggregate figures in models 1 and 2, whereas there is some variation in the forecast on the real price of oil and real GDP across models.

The forecasts of the real price of oil and real GDP do provide useful information. The first model, for example, predicts that the real price of oil will increase until the year 2000 and then fall, and that real output will expand slowly in the 1990s and at a faster rate at the turn of the century. High energy prices

Australian Real GDP

Forecast 1992 to 2010

Figure 7.

Real Petroleum Price

Forecast 1992 to 2010

Figure 8.

and low real GDP growth thus explain why the rate of growth of total energy consumption will remain depressed in the 1990s. After 1998, the two effects are reversed and energy consumption grows at an increasing rate.

Similarly, price and income effects explain why, in the second model, consumption of natural gas and black coal are predicted to increase rapidly, whereas consumption of petroleum products will remain almost constant. Both the high price of oil and the continuous expansion in real output feed the consumption of natural gas and black coal, whereas price and income effects offset each other in the case of petroleum products. For the third and fourth models, it is necessary to review the variance decompositions and impulse responses in Appendix 2 in order to determine the relative importance of price and income effects on energy consumption.

Conditional Forecasts

VAR models are systems of dynamic equations that determine the time paths of a group of variables. In conditional forecasts the time paths of some variables are set in advance for the forecast period. In this section it is assumed that the real price of oil is constant and real GDP will grow at 3 percent per year until the year 2010.

The conditional energy forecasts are shown in Figures 9 to 12 and Tables 8 to 11. The conditional forecasts exceed the unconditional ones because the internally generated projection of real GDP growth is less than three percent per year. Most of the difference between unconditional and conditional forecasts arises after the year 2000. A comparison of conditional and unconditional forecasts shows:

Model 1: The conditional forecast of total energy demand exceeds the unconditional forecast by 11.9 percent in the year 2000 and by 57.7 percent in 2010. The revised forecast for the year 2005 is now very close to that of the *Australian Bureau of Agricultural and Resource Economics* (Table D6).

Model 2: Higher real GDP growth primarily leads to a rise in the demand for natural gas, whereas the demand for petrol and coal does not change much. This is in keeping with the variance decompositions, which show

that natural gas depends on real GDP, whereas petroleum and coal are largely independent of GDP (pp. 59-60).

Model 3: The conditional forecast for the demand for automotive distillate exceeds the unconditional forecast by 10.5 percent in the year 2000 and by 30.3 percent in the year 2010. The difference among forecasts is much smaller for automotive gasoline. The variance decompositions again show that the demand for automotive distillate is more responsive to real GDP than the demand for gasoline (p. 71).

Model 4. The conditional forecast for electricity demand exceeds the unconditional forecast by 17.9 percent in the year 2000 and 58.5 percent in the year 2010.

An important finding of this report is that State energy consumption strongly depends on real GDP. Therefore, energy forecasts would benefit from improved GDP forecasts. Time and funding prevented further research into the determinants of real GDP.

Total Energy Consumption

Conditional Forecast 1992 to 2010

Figure 9.

Consumption of Primary Fuel Component

Conditional Forecast 1992 to 2010

Figure 10.

Consumption of Petroleum Components

Conditional Forecast 1992 to 2010

Figure 11.

Electricity Consumption

Conditional Forecast 1992 to 2010

Figure 12.

Table 8.
Total Energy Consumption

	TOTE	PRIC	RGDP
1992	475.5	4.045	264.5
1993	486.1	4.045	272.4
1994	497.3	4.045	280.6
1995	509.4	4.045	289.0
1996	522.7	4.045	297.7
1997	537.5	4.045	306.6
1998	553.7	4.045	315.8
1999	571.2	4.045	325.3
2000	590.1	4.045	335.1
2001	610.4	4.045	345.1
2002	632.3	4.045	355.5
2003	656.3	4.045	366.1
2004	683.0	4.045	377.1
2005	713.2	4.045	388.4
2006	747.7	4.045	400.1
2007	787.7	4.045	412.1
2008	833.6	4.045	424.4
2009	884.9	4.045	437.2
2010	939.0	4.045	450.3

Table 9.
Primary Fuel Components

	NGAS	COAL	PETR
1992	179.2	93.7	182.5
1993	182.7	96.1	181.4
1994	189.6	100.1	180.2
1995	200.8	104.6	178.6
1996	215.7	108.6	177.1
1997	232.7	112.8	175.7
1998	250.5	117.4	174.8
1999	267.8	122.4	174.4
2000	284.2	127.4	174.4
2001	299.2	132.4	175.0
2002	313.0	137.3	176.0
2003	326.3	142.2	177.3
2004	340.0	147.1	178.9
2005	355.4	151.6	180.6
2006	373.3	155.6	182.2
2007	394.0	158.9	184.0
2008	417.4	162.6	185.7
2009	442.8	167.2	187.5
2010	467.4	172.6	189.6

	PRIC	RGDP
1992	4.045	264.5
1993	4.045	272.4
1994	4.045	280.6
1995	4.045	289.0
1996	4.045	297.7
1997	4.045	306.6
1998	4.045	315.8
1999	4.045	325.3
2000	4.045	335.1
2001	4.045	345.1
2002	4.045	355.5
2003	4.045	366.1
2004	4.045	377.1
2005	4.045	388.4
2006	4.045	400.1
2007	4.045	412.1
2008	4.045	424.4
2009	4.045	437.2
2010	4.045	450.3

Table 10.
Petroleum Products

	AGAS	ADIS	PRIC	RGDP
1992	57.17	77.3	4.045	264.5
1993	58.75	78.2	4.045	272.4
1994	60.30	79.7	4.045	280.6
1995	61.61	82.2	4.045	289.0
1996	62.82	85.0	4.045	297.7
1997	64.03	88.0	4.045	306.6
1998	65.25	90.9	4.045	315.8
1999	66.46	93.8	4.045	325.3
2000	67.67	96.6	4.045	335.1
2001	68.87	99.5	4.045	345.1
2002	70.04	102.5	4.045	355.5
2003	71.17	105.5	4.045	366.1
2004	72.24	108.3	4.045	377.1
2005	73.23	111.1	4.045	388.4
2006	74.15	113.8	4.045	400.1
2007	75.04	116.6	4.045	412.1
2008	75.89	119.8	4.045	424.4
2009	76.73	123.4	4.045	437.2
2010	77.58	127.3	4.045	450.3

Table 11.
Electricity

	ELEC	RGDP
1992	49.1	264.5
1993	51.6	272.4
1994	54.2	280.6
1995	56.8	289.0
1996	59.6	297.7
1997	62.6	306.6
1998	65.7	315.8
1999	69.0	325.3
2000	72.5	335.1
2001	76.1	345.1
2002	79.9	355.5
2003	83.9	366.1
2004	88.1	377.1
2005	92.4	388.4
2006	97.0	400.1
2007	101.8	412.1
2008	106.9	424.4
2009	112.2	437.2
2010	117.7	450.3

Appendix 1.

Data Series

ADIS

Consumption of automotive distillate in Western Australia.

Units: PJ

Source: Energy Policy and Planning Bureau

AGAS

Consumption of automotive gasoline, leaded and unleaded, in Western Australia.

Units: PJ

Source: Energy Policy and Planning Bureau

COAL

Consumption of black coal in Western Australia.

Units: PJ

Source: Energy Policy and Planning Bureau

ELEC

Consumption of electricity in Western Australia.

Electricity series were spliced by multiplying data prior to 1974 by a factor of 1.88.

Units: PJ

Source: Energy Policy and Planning Bureau

NGAS

Consumption of natural gas in Western Australia.

Units: PJ

Source: Energy Policy and Planning Bureau

PETR

Consumption of petroleum products in Western Australia.

Units: PJ

Source: Energy Policy and Planning Bureau

PRIC

Real price of crude oil.

Units: Nominal price divided by GDP deflator

Source: International Financial Statistics, IMF

RGDP

Real Australian gross domestic product.

Units: Millions of dollars (1984/85)

Source: ABS

TOTE

Total energy consumption in Western Australia.

Units: PJ

Source: Energy Policy and Planning Bureau

	TOTE	PRIC	RGDP
1961	99.6000	2.51524	83023.0
1962	99.1000	2.01232	84363.0
1963	103.900	1.70189	89711.0
1964	110.800	1.64096	95992.0
1965	115.900	1.59867	102743.
1966	124.600	1.75983	105870.
1967	136.200	2.00323	112138.
1968	157.100	1.95904	117475.
1969	169.400	1.80921	126742.
1970	189.800	1.63361	134823.
1971	209.100	1.69265	141222.
1972	221.700	1.82987	147679.
1973	239.100	1.61587	153936.
1974	272.600	3.07152	160649.
1975	279.500	3.89558	162981.
1976	296.500	4.01311	167045.
1977	321.800	4.17399	172330.
1978	328.200	4.24252	173882.
1979	335.800	4.28133	182758.
1980	334.100	6.55048	186611.
1981	322.000	8.20238	193043.
1982	300.100	8.01207	197200.
1983	304.600	7.95572	193835.
1984	313.900	6.91154	205546.
1985	343.100	7.72141	216266.
1986	344.200	7.70937	225087.
1987	358.400	4.30345	231264.
1988	391.000	3.64221	241676.
1989	427.600	3.19295	251203.
1990	471.600	3.20287	259436.
1991	467.800	4.04577	256820.

	NGAS	COAL	PETR
1961	0.000000	16.7000	64.1000
1962	0.000000	19.5000	61.5000
1963	0.000000	20.4000	66.1000
1964	0.000000	19.7000	74.4000
1965	0.000000	20.0000	79.8000
1966	0.000000	22.3000	86.8000
1967	0.000000	22.3000	99.0000
1968	0.000000	22.5000	120.200
1969	0.100000	21.7000	133.700
1970	0.300000	22.9000	153.300
1971	0.600000	23.3000	172.300
1972	11.4000	23.7000	174.100
1973	32.5000	23.2000	171.300
1974	31.2000	23.0000	194.600
1975	31.5000	36.1000	187.900
1976	31.9000	42.5000	194.900
1977	32.8000	45.1000	220.400
1978	31.3000	46.1000	226.000
1979	32.2000	47.6000	228.100
1980	33.1000	57.6000	218.800
1981	33.6000	62.5000	206.600
1982	31.9000	64.4000	194.900
1983	38.3000	67.9000	189.100
1984	38.6000	71.1000	194.900
1985	73.9000	82.4000	177.100
1986	115.300	63.7000	156.500
1987	132.900	60.6000	155.600
1988	153.000	61.1000	166.800
1989	158.500	78.8000	178.900
1990	183.300	92.2000	184.100
1991	178.000	93.4000	184.000

	AGAS	ADIS	ELEC
1961	14.3982	4.82500	5.29723
1962	15.4242	6.06020	5.30900
1963	16.7922	6.98660	5.87845
1964	18.2628	7.48840	6.30996
1965	19.7676	8.87800	7.07408
1966	21.5118	11.4256	7.85363
1967	22.9140	12.8152	8.92248
1968	25.0344	16.1734	10.0214
1969	27.8388	18.6438	11.4445
1970	30.4038	21.6160	12.9936
1971	32.2848	25.1672	14.5660
1972	34.0290	28.4482	16.0958
1973	35.5680	30.9572	17.6794
1974	38.4066	36.6314	19.5000
1975	39.8772	40.5686	21.5000
1976	42.1344	40.8388	23.4000
1977	45.6570	45.6638	25.1000
1978	47.3670	45.7024	26.0000
1979	49.3848	46.7060	26.8000
1980	48.4272	52.2644	27.6000
1981	48.4614	54.6962	28.2000
1982	49.6242	54.9664	29.5000
1983	49.7610	55.8156	30.1000
1984	50.3082	56.2016	31.1000
1985	51.6078	54.8120	35.0000
1986	52.0866	52.4188	37.1000
1987	53.3178	55.6612	39.2000
1988	55.4382	62.1460	41.2000
1989	60.1920	71.0240	46.3000
1990	58.6188	78.3580	51.2000
1991	56.3000	77.3000	47.0000

Appendix 2.

Modelling with Vector Autoregressions

Modelling with Vector Autoregressions

In univariate time series analysis, a time series, such as total energy consumption, is viewed as a series of random variables. If those random variables are correlated, future values of the series can then be forecast. Unlike structural econometric models, time series models are purely statistical, taking advantage of inherent patterns in variables. Table 2.1 shows the serial correlation in total energy consumption, using data from 1961 to 1991. The correlation coefficients start at 0.9 for the first lag and fall to 0.36 for the sixth lag.

Recent advances in econometrics have lead to multivariate time series models which take account of the interactions between two or more variables.² In multivariate time series models, a group of variables is considered to be generated by a vector stochastic process. Table 2.2 shows the joint serial correlation among the variables in model 1. For example, the correlation between total energy consumption in period t and real GDP in period $(t-2)$ equals 0.77.

A vector autoregression (VAR) model consists of a set of equations in which each variable is regressed on its own lagged values and on the lagged values of all other variables in the model. The model can be written as:

²See the seminal paper by Sims, C.A., *Macroeconomics and Reality*, *Econometrica* 48, January 1980. Reprinted in C.W.J. Granger, ed., *Modelling Economic Series*, Clarendon Press, Oxford, 1990.

Table 2.1
Autocorrelation of total energy consumption

Lags	Correlation coefficient
1	0.9046
2	0.7918
3	0.6800
4	0.5717
5	0.4658
6	0.3629

Table 2.2
Cross correlation between
total energy consumption and real GDP

Lags	Correlation coefficient
1	0.8818
2	0.7699
3	0.6668
4	0.5742
5	0.4931
6	0.4121

$$y_{(t)} = \sum_{s=1}^L \beta_{(s)} \cdot y_{(t-s)} + \mu_{(t)} \quad (1)$$

where y is a n -vector of variables and $\beta(s)$ is a $n \times n$ matrix of coefficients. L indicates the number of lags used and μ is a vector of error terms. Appendices 3 to 6 present the estimated energy models.

VARs may be regarded as reduced forms of (unspecified) structural econometric models. For this reason, the regression coefficients do not have any meaning. The moving average representation, however, provides variance decompositions and impulse responses that highlight the relationships among the variables in the model. Variance decompositions and impulse responses are included in Appendices 3 to 6 following the estimated models.

A variable is statistically exogenous if most of the variance of its forecast error is due to its own innovations, rather than to innovations in the other variables in the model. Consider, for example, the first model. The real price of oil is an exogenous variable because most of its forecast error is due to its own innovations. Independent shocks to the price of oil account for 96.4 percent of the four-year forecast error and for 83.8 percent of the eight-year forecast error. Similarly, real GDP is an exogenous variable. On the other hand, local energy consumption depends on the real price of oil and real GDP. Shocks to the price of oil account for 28.1 percent of the four-year forecast error and shocks to real GDP account for 9.3 percent. On a longer horizon, the contribution of real GDP

shocks to the forecast error in total energy consumption approaches one third. The impulse responses show that the price effect on energy consumption is negative and the income effect is positive.

Impulse responses must be viewed in conjunction with variance decompositions. For example, the impulse responses of model 1 also show that an increase in total energy consumption in Western Australia has a negative effect on Australian real GDP. There is no obvious theoretical justification for this effect, and the variance decompositions confirm that it is unimportant. Shocks to energy consumption account for only 1.4 percent of the four-year forecast error in real GDP.

Variance decompositions and impulse responses require orthogonalized innovations. The forecast error of a variable cannot be split into the contributions of shocks to specific variables if those shocks are correlated. Similarly, it would not be possible to assign impulse responses to shocks in specific variables. In this study, the so-called Choleski factorization is employed to orthogonalize the contemporaneous covariance matrix of residuals. As a consequence, variance decompositions depend upon the ordering of variables because, within a single time period, variables that are listed first may influence the following variables - but without feedback. In model 1 it is assumed that there is a contemporaneous influence from the real price of oil - to real GDP - to total energy consumption. This assumption is justified by the fact that the price of oil is determined in world

markets and real GDP is an economy-wide variable, whereas total energy consumption applies to Western Australia.

Vector autoregressions generally suffer from over-parametrization because each variable is regressed on its own lags and on the lags of all other variables. As a consequence, standard errors are large and forecasts are uncertain, except in very small models. Model 1 requires the estimation of 57 coefficients. The degrees of freedom problem can be overcome by a Bayesian approach that imposes normal prior distributions on the coefficients with specified means and standard deviations that decline with growing lag length. In this report, the "Minnesota prior" is adopted, which assumes that all variables follow a random walk process.³ The prior is implemented by setting the means of the first own lags equal to one and the means of all other lags equal to zero in each equation. Theil's mixed estimation technique can then be used to estimate the models.

An important issue in time series analysis concerns stationarity. Stationarity can often be achieved by differencing a series. This poses a problem when, in multivariate models, some series are stationary and others are not. Bayesian VARs provide an alternative to differencing either all series or none. By imposing prior distributions on first own lags that centre around one, the "Minnesota prior" assumes that all series are nonstationary. If this prior is

³Bayesian VARs are discussed in Todd, R.M., *Improving Economic Forecasting with Bayesian Vector Autoregressions*, Federal Reserve Bank of Minneapolis *Quarterly Review*, Fall 1984. Reprinted in C.W.J. Granger, ed., *Modelling Economic Series*, Clarendon Press, Oxford, 1990.

inappropriate, it can easily be overridden by the data because the prior standard deviation of first lags are large.

The prior distributions of the regression coefficients are specified as independent normal distributions with the following means and standard deviations

$$\begin{aligned}
 E(\beta(ijs)) &= \begin{aligned} &1 \text{ if } i=j, s=1 \\ &0 \text{ otherwise} \end{aligned} \\
 \sigma(\beta(ijs)) &= \{\gamma g(s) f(i,j)\} \sigma(i)/\sigma(j)
 \end{aligned} \tag{2}$$

Here, $\beta(i,j,s)$ is the coefficient of lag s of variables j in equation i . The quantities γ , $g(s)$ and $f(i,j)$ determine the tightness of the prior distributions of the β coefficients. γ controls the prior standard deviation of the first own lag since $f(i,i) = g(1) = 1.0$. The decay function, $g(s)$, determines the tightness of lag s relative to lag 1. The function $f(i,j)$ sets the tightness of variables j in equation i relative to variable i . $\sigma(i)$ is the standard error of a univariate autoregression on equation i . The ratio $\sigma(i)/\sigma(j)$ scales the different magnitudes of the variables i and j .

All models use six lags. In model 1, the overall tightness parameter γ equals 0.4. The lag decay function $g(s)$ is harmonic with a decay parameter of 1, and the function $f(i,j)$ is symmetric with $f(i,j) = 0.5$ for $i \neq j$. Each model's prior is fully described in Appendices 3 to 6.

The software package **Regression Analysis of Time Series (RATS)** by
VAR Econometrics⁴ was used for the econometric work.

⁴VAR Econometrics, Inc., 1800 Sherman Ave., Suite 612, Evanston, Illinois,
USA.

Appendix 3.

Model 1: Total Energy

The variables in this model include total energy consumption, the real price of oil and real GDP. Total energy consumption and real GDP were converted to logarithms. The following tables show the prior distribution imposed upon the regression coefficients, the estimated regression equations, and variance decompositions and impulse responses.

The variance decompositions indicate that total energy consumption is influenced by the real price of oil and real GDP, whereas the price of oil and real GDP are both statistically exogenous. The impulse responses show that the price effect on total energy consumption is negative for eight years and the income effect is positive. The Q-values of the regression equations confirm that serial correlation is not a problem. Appendix 2 contains a more detailed discussion of the output of model 1.

Several additional variables were tested in model 1. For example, the State labour force was used to proxy for State real GDP. It was hypothesised that the inclusion of a State variable would account for local effects on energy consumption in Western Australia. The variance decompositions of the expanded model showed, however, that total energy consumption is independent of the State labour force if Australian real GDP is also included in the model. In fact, the variables in the expanded model explain movements in the State labour force but there is no feedback to energy consumption. For this reason, the labour force series was dropped from the model.

THE PRIOR IS.....

TIGHTNESS PARAMETER 0.40000

HARMONIC LAG DECAY WITH PARAMETER 1.00000

MEANS AND STANDARD DEVIATIONS AS PERCENTAGE OF OWN LAG
LISTED UNDER THE DEPENDENT VARIABLE

	RGDP	TOTE	PRIC
RGDP	1.00000000	0.50000000	0.50000000
TOTE	0.50000000	1.00000000	0.50000000
PRIC	0.50000000	0.50000000	1.00000000
MEAN	1.00000000	1.00000000	1.00000000

EQUATION 1
 DEPENDENT VARIABLE 5 RGDP
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 0.99605773 RBAR**2 0.99605773
 SSR 0.55528126E-02 SEE 0.15210759E-01
 DURBIN-WATSON 2.32357114

Q(12)= 10.7773 SIGNIFICANCE LEVEL 0.54809761

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	5	1	0.9143620	0.1347870	6.783753
2	RGDP	5	2	0.1890377E-01	0.1283305	0.1473053
3	RGDP	5	3	0.1121618E-01	0.9602910E-01	0.1167998
4	RGDP	5	4	0.2651945E-01	0.7557441E-01	0.3509052
5	RGDP	5	5	0.3622352E-01	0.6289056E-01	0.5759770
6	RGDP	5	6	0.4975366E-02	0.5260239E-01	0.9458441E-01
7	TOTE	4	1	-0.1822620E-01	0.4689834E-01	-0.3886321
8	TOTE	4	2	-0.2029442E-01	0.3311406E-01	-0.6128642
9	TOTE	4	3	-0.1066486E-01	0.2326901E-01	-0.4583290
10	TOTE	4	4	-0.5038460E-02	0.1794242E-01	-0.2808128
11	TOTE	4	5	0.3577852E-03	0.1461494E-01	0.2448078E-01
12	TOTE	4	6	-0.1186186E-02	0.1225854E-01	-0.9676407E-01
13	PRIC	6	1	-0.1634489E-02	0.2291754E-02	-0.7132045
14	PRIC	6	2	0.6440960E-03	0.1781157E-02	0.3616167
15	PRIC	6	3	0.1164132E-02	0.1256043E-02	0.9268249
16	PRIC	6	4	0.1012527E-02	0.9762559E-03	1.037153
17	PRIC	6	5	0.2591452E-03	0.8003293E-03	0.3237983
18	PRIC	6	6	0.2961832E-04	0.6709202E-03	0.4414581E-01
19	CONSTANT	0	0	0.1991531	0.5170055	0.3852051

EQUATION 2
 DEPENDENT VARIABLE 4 TOTE
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 0.99132622 RBAR**2 0.99132622
 SSR 0.21962530E-01 SEE 0.30250709E-01
 DURBIN-WATSON 1.99221404
 Q(12)= 8.84411 SIGNIFICANCE LEVEL 0.71618431

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	5	1	0.1366760	0.1797713	0.7602771
2	RGDP	5	2	0.2375315E-01	0.1474580	0.1610842
3	RGDP	5	3	0.7644756E-01	0.1055640	0.7241820
4	RGDP	5	4	0.4326039E-01	0.8132688E-01	0.5319323
5	RGDP	5	5	0.1404983E-01	0.6598182E-01	0.2129349
6	RGDP	5	6	-0.3723474E-03	0.5515339E-01	-0.6751125E-02
7	TOTE	4	1	0.8434472	0.1323838	6.371229
8	TOTE	4	2	-0.3483629E-01	0.1170293	-0.2976716
9	TOTE	4	3	-0.2650166E-01	0.8422495E-01	-0.3146533
10	TOTE	4	4	-0.1111733E-01	0.6597531E-01	-0.1685074
11	TOTE	4	5	-0.8078464E-02	0.5440594E-01	-0.1484849
12	TOTE	4	6	-0.1094766E-01	0.4570615E-01	-0.2395228
13	PRIC	6	1	-0.1273830E-01	0.4900405E-02	-2.599438
14	PRIC	6	2	0.2122645E-02	0.3577380E-02	0.5933519
15	PRIC	6	3	0.1378940E-02	0.2507317E-02	0.5499665
16	PRIC	6	4	0.7533473E-03	0.1944283E-02	0.3874679
17	PRIC	6	5	-0.3428084E-03	0.1591589E-02	-0.2153874
18	PRIC	6	6	-0.3719616E-03	0.1334150E-02	-0.2788005
19	CONSTANT	0	0	-2.058628	1.055682	-1.950046

EQUATION 3
 DEPENDENT VARIABLE 6 PRIC
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 0.88671669 RBAR**2 0.88671669
 SSR 14.325843 SEE 0.77259958

DURBIN-WATSON 2.04571827

Q(12)= 10.3879

SIGNIFICANCE LEVEL 0.58196746

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	5	1	-2.619602	4.781976	-0.5478073
2	RGDP	5	2	-2.978607	3.765193	-0.7910902
3	RGDP	5	3	-0.2419075	2.685090	-0.9009288E-01
4	RGDP	5	4	0.8942530	2.066524	0.4327330
5	RGDP	5	5	0.6061432E-01	1.681484	0.3604811E-01
6	RGDP	5	6	0.2581892	1.408806	0.1832681
7	TOTE	4	1	1.208125	2.449363	0.4932406
8	TOTE	4	2	0.2735165	1.697496	0.1611293
9	TOTE	4	3	0.8808934	1.184011	0.7439912
10	TOTE	4	4	0.6803552	0.9108346	0.7469580
11	TOTE	4	5	0.5177495	0.7414372	0.6983053
12	TOTE	4	6	0.4010792	0.6231492	0.6436327
13	PRIC	6	1	0.8742783	0.1462599	5.977566
14	PRIC	6	2	-0.1392269	0.1484106	-0.9381195
15	PRIC	6	3	0.2032456E-02	0.1108360	0.1833750E-01
16	PRIC	6	4	-0.2350506E-01	0.8983048E-01	-0.2616602
17	PRIC	6	5	0.1353998E-01	0.7663691E-01	0.1766771
18	PRIC	6	6	-0.2747113E-01	0.6509663E-01	-0.4220054
19	CONSTANT	0	0	35.40182	31.03997	1.140524

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN PRIC

ENTRY	PRIC	RGDP	TOTE
1	0.756990	-0.128365E-02	-0.405403E-02
2	0.660285	-0.233712E-02	-0.132376E-01
3	0.464724	-0.242935E-02	-0.181780E-01
4	0.300390	-0.108975E-02	-0.187236E-01
5	0.148968	0.111265E-02	-0.165633E-01
6	0.305923E-01	0.315774E-02	-0.132163E-01
7	-0.879681E-01	0.466875E-02	-0.930045E-02
8	-0.180304	0.571153E-02	-0.451508E-02
9	-0.234752	0.635043E-02	0.555688E-03
10	-0.253269	0.659275E-02	0.521791E-02
11	-0.240969	0.643569E-02	0.897442E-02
12	-0.205939	0.592941E-02	0.115673E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN RGDP

ENTRY	PRIC	RGDP	TOTE
1	0.000000	0.148481E-01	0.626320E-02
2	-0.313293E-01	0.134623E-01	0.731205E-02
3	-0.963360E-01	0.123810E-01	0.854089E-02
4	-0.138151	0.115081E-01	0.110908E-01
5	-0.138000	0.109437E-01	0.138441E-01
6	-0.118378	0.106474E-01	0.157470E-01
7	-0.855842E-01	0.100654E-01	0.165598E-01
8	-0.506226E-01	0.925476E-02	0.165008E-01
9	-0.147608E-01	0.837133E-02	0.158139E-01
10	0.204390E-01	0.752324E-02	0.146318E-01
11	0.511217E-01	0.676699E-02	0.130716E-01
12	0.744171E-01	0.612235E-02	0.112952E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN TOTE

ENTRY	PRIC	RGDP	TOTE
1	0.000000	0.000000	0.286852E-01
2	0.346553E-01	-0.522821E-03	0.241944E-01
3	0.687437E-01	-0.155781E-02	0.188945E-01
4	0.115627	-0.266564E-02	0.133060E-01
5	0.165412	-0.360557E-02	0.788414E-02
6	0.206258	-0.418618E-02	0.274633E-02
7	0.231393	-0.447592E-02	-0.204367E-02
8	0.227403	-0.445034E-02	-0.594862E-02
9	0.199525	-0.412054E-02	-0.871011E-02
10	0.155285	-0.353756E-02	-0.102510E-01
11	0.101871	-0.278965E-02	-0.106425E-01
12	0.461433E-01	-0.198183E-02	-0.100477E-01

DECOMPOSITION OF VARIANCE, SERIES

6

PRIC

STEP	STAN ERR	PRIC	RGDP	TOTE
1	0.756990	100.0000000	0.0000000	0.0000000
2	1.00558	99.7841647	0.0970659	0.1187695
3	1.11408	98.6956759	0.8268151	0.4775090
4	1.16784	96.4333296	2.1518306	1.4148398
5	1.19685	93.3645860	3.3782459	3.2571681
6	1.22063	89.8248033	4.1884138	5.9867829
7	1.24842	86.3673069	4.4740098	9.1586833
8	1.28271	83.7876743	4.3937781	11.8185476
9	1.31927	82.3740185	4.1661267	13.4598548
10	1.35246	81.8873956	3.9869932	14.1256112
11	1.37848	81.8810365	3.9754354	14.1435280
12	1.39652	81.9531525	4.1573117	13.8895358

DECOMPOSITION OF VARIANCE, SERIES

5

RGDP

STEP	STAN ERR	PRIC	RGDP	TOTE
1	0.149034E-01	0.7418525	99.2581475	0.0000000
2	0.202258E-01	1.7380042	98.1951774	0.0668183
3	0.238893E-01	2.2799399	97.2469350	0.4731251
4	0.266726E-01	1.9958608	96.6258237	1.3783154
5	0.290763E-01	1.8259463	95.4765100	2.6975437
6	0.314053E-01	2.5761550	93.3347989	4.0890461
7	0.336071E-01	4.1795732	90.4758266	5.3446003
8	0.356022E-01	6.2979291	87.3771375	6.3249334
9	0.373484E-01	8.6138842	84.4215845	6.9645313
10	0.388263E-01	10.8538529	81.8715758	7.2745713
11	0.400309E-01	12.7950896	79.8759322	7.3289782
12	0.409761E-01	14.3055266	78.4657940	7.2286794

DECOMPOSITION OF VARIANCE, SERIES

4

TOTE

STEP	STAN ERR	PRIC	RGDP	TOTE
1	0.296395E-01	1.8708140	4.4652973	93.6638887
2	0.411409E-01	11.3240905	5.4765113	83.1993981
3	0.495273E-01	21.2847635	6.7526888	71.9625477
4	0.557099E-01	28.1184427	9.3004019	62.5811554
5	0.602640E-01	31.5832370	13.2251961	55.1915669
6	0.637333E-01	32.5385781	17.9292451	49.5321768
7	0.665345E-01	31.8103926	22.6459970	45.5436103
8	0.689557E-01	30.0444801	26.8098302	43.1456898
9	0.712821E-01	28.1214278	30.0101386	41.8684336
10	0.736718E-01	26.8282798	32.0393324	41.1323879
11	0.761065E-01	26.5297027	32.9721224	40.4981749
12	0.784509E-01	27.1418556	33.1039024	39.7542420

Appendix 4.

Model 2: Primary Fuel Components

This model disaggregates total energy consumption into natural gas, black coal and petroleum products. The real price of oil and real GDP are retained in the model. Real GDP was converted to logarithm. The figures on natural gas, coal and petroleum products were transformed by taking square roots instead of logarithms because the consumption of natural gas was zero before 1968.

Tight prior distributions were imposed on coal in the equations for natural gas and petroleum and vice versa. Looser priors lead to serial correlation in the equation for coal. The variance decompositions of a model that includes the real price of coal also show that coal consumption is independent of price. For this reason, the price of coal was dropped from the model. The independent behaviour of coal may be explained by the fact that coal is now mostly used for electricity generation by the State government.

The variance decompositions of the final model indicate that natural gas substitutes for petroleum. Natural gas consumption depends on real GDP while petroleum consumption is moved by the real price of oil and consumption of natural gas. As in model 1, the real price of oil and real GDP are exogenous. The impulse responses display the expected signs. A positive shock to natural gas has a negative impact on petroleum for five years, a shock to the price of oil reduces petroleum consumption, and a shock to real GDP leads to an expansion in natural gas.

THE PRIOR IS....

TIGHTNESS PARAMETER 0.40000

HARMONIC LAG DECAY WITH PARAMETER 1.00000

MEANS AND STANDARD DEVIATIONS AS PERCENTAGE OF OWN LAG
LISTED UNDER THE DEPENDENT VARIABLE

	PRIC	RGDP	NGAS	PETR	COAL
PRIC	1.00000000	0.50000000	0.50000000	0.50000000	0.50000000
RGDP	0.50000000	1.00000000	0.50000000	0.50000000	0.50000000
NGAS	0.50000000	0.50000000	1.00000000	0.50000000	0.10000000
PETR	0.50000000	0.50000000	0.50000000	1.00000000	0.10000000
COAL	0.50000000	0.50000000	0.10000000	0.10000000	1.00000000
MEAN	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000

EQUATION 1
 DEPENDENT VARIABLE 10 PRIC
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .90710955 RBAR**2 .90710955
 SSR 11.746955 SEE .69961166

DURBIN-WATSON 1.99125960

Q(12)= 9.63028 SIGNIFICANCE LEVEL .648360

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	PRIC	10	1	.7559875	.1529940	4.941289
2	PRIC	10	2	-.1277906	.1360471	-.9393115
3	PRIC	10	3	.1009927E-01	.1013906	.9960756E-01
4	PRIC	10	4	-.2050131E-01	.8199398E-01	-.2500343
5	PRIC	10	5	.2116354E-01	.7130856E-01	.2967883
6	PRIC	10	6	-.3561181E-02	.6092206E-01	-.5845470E-01
7	RGDP	6	1	-1.347923	4.381820	-.3076171
8	RGDP	6	2	-2.165112	3.446551	-.6281967
9	RGDP	6	3	-.7718626E-02	2.439774	-.3163665E-02
10	RGDP	6	4	.7306003	1.880439	.3885265
11	RGDP	6	5	-.5254751E-01	1.525072	-.3445575E-01
12	RGDP	6	6	.1608367	1.278001	.1258503
13	NGAS	9	1	-.7072047E-01	.1290268	-.5481068
14	NGAS	9	2	.2058817E-01	.8161425E-01	.2522620
15	NGAS	9	3	.8829295E-02	.5699536E-01	.1549125
16	NGAS	9	4	-.3918899E-04	.4399435E-01	-.8907732E-03
17	NGAS	9	5	.7085394E-02	.3568816E-01	.1985362
18	NGAS	9	6	.7691200E-02	.2994834E-01	.2568155
19	PETR	8	1	.2704251	.2440789	1.107942
20	PETR	8	2	.7732767E-01	.1802123	.4290919
21	PETR	8	3	.7503736E-01	.1281311	.5856294
22	PETR	8	4	.4553798E-01	.9928251E-01	.4586707
23	PETR	8	5	.1276807E-01	.8060583E-01	.1584013
24	PETR	8	6	.2173950E-01	.6773801E-01	.3209350
25	COAL	7	1	.4026653	.2492162	1.615727
26	COAL	7	2	-.5943212E-01	.1659382	-.3581582
27	COAL	7	3	.1934818E-01	.1151863	.1679729
28	COAL	7	4	.2555387E-01	.8758653E-01	.2917557
29	COAL	7	5	.1952022E-01	.7092002E-01	.2752427
30	COAL	7	6	-.2291532E-02	.5952165E-01	-.3849913E-01
31	CONSTANT	0	0	24.98868	37.35643	.6689258

EQUATION 2
 DEPENDENT VARIABLE 6 RGDP
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .99638466 RBAR**2 .99638466
 SSR .50923210E-02 SEE .14566401E-01
 DURBIN-WATSON 2.41220535

Q(12)= 11.1319 SIGNIFICANCE LEVEL .517652

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	PRIC	10	1	-.1849983E-02	.2493224E-02	-.7420043
2	PRIC	10	2	.4351331E-03	.1727110E-02	.2519429
3	PRIC	10	3	.1021926E-02	.1210308E-02	.8443515
4	PRIC	10	4	.9452281E-03	.9375313E-03	1.008210
5	PRIC	10	5	.2397301E-03	.7721933E-03	.3104535
6	PRIC	10	6	.1714473E-04	.6477853E-03	.2646669E-01
7	RGDP	6	1	.8865238	.1330630	6.662438
8	RGDP	6	2	.1867627E-01	.1250425	.1493594
9	RGDP	6	3	.1505713E-01	.9226766E-01	.1631897
10	RGDP	6	4	.3150850E-01	.7327138E-01	.4300247
11	RGDP	6	5	.3852470E-01	.6065023E-01	.6351946
12	RGDP	6	6	.4696844E-02	.5091118E-01	.9225565E-01
13	NGAS	9	1	-.8959784E-03	.2714001E-02	-.3301319
14	NGAS	9	2	-.9584949E-03	.1708117E-02	-.5611413
15	NGAS	9	3	-.5029571E-03	.1189966E-02	-.4226649
16	NGAS	9	4	-.1958664E-03	.9172012E-03	-.2135479
17	NGAS	9	5	-.1766805E-03	.7435114E-03	-.2376298
18	NGAS	9	6	-.3548082E-04	.6236020E-03	-.5689658E-01
19	PETR	8	1	-.2663130E-02	.5021303E-02	-.5303664
20	PETR	8	2	-.7653587E-03	.3723949E-02	-.2055234
21	PETR	8	3	-.1149993E-02	.2643251E-02	-.4350677
22	PETR	8	4	-.5220510E-03	.2051605E-02	-.2544597
23	PETR	8	5	.2888850E-03	.1672001E-02	.1727780
24	PETR	8	6	-.4499168E-06	.1407752E-02	-.3195995E-03
25	COAL	7	1	-.1620434E-02	.5217597E-02	-.3105709
26	COAL	7	2	-.4984753E-03	.3432245E-02	-.1452330
27	COAL	7	3	.1150585E-02	.2372719E-02	.4849224
28	COAL	7	4	.1218793E-02	.1814812E-02	.6715808
29	COAL	7	5	.3763566E-03	.1476666E-02	.2548691
30	COAL	7	6	.3776999E-05	.1240412E-02	.3044955E-02
31	CONSTANT	0	0	.1790884	.7969950	.2247046

EQUATION 3
 DEPENDENT VARIABLE 9 NGAS
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .98008498 RBAR**2 .98008498
 SSR 8.4041653 SEE .59175464

DURBIN-WATSON 1.88372989

Q(12)= 4.73674

SIGNIFICANCE LEVEL .966199

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	***** *****	*****	*****
1	PRIC	10	1	-.9602855E-01	.9556065E-01	-1.004896
2	PRIC	10	2	.6686672E-02	.6947451E-01	.9624641E-01
3	PRIC	10	3	.1361148E-01	.4880469E-01	.2788969
4	PRIC	10	4	.2442468E-01	.3793278E-01	.6438938
5	PRIC	10	5	.1519362E-01	.3126834E-01	.4859106
6	PRIC	10	6	.1487208E-02	.2628764E-01	.5657440E-01
7	RGDP	6	1	7.334012	3.615822	2.028311
8	RGDP	6	2	.5990528	2.928316	.2045724
9	RGDP	6	3	.3896602	2.065552	.1886470
10	RGDP	6	4	.2665321	1.584603	.1682012
11	RGDP	6	5	-.5273313E-01	1.286237	-.4099799E-01
12	RGDP	6	6	.7004110E-01	1.077058	.6503004E-01
13	NGAS	9	1	.8366051	.1431943	5.842447
14	NGAS	9	2	-.2004909	.1188954	-1.686279
15	NGAS	9	3	-.6522510E-01	.8570421E-01	-.7610489
16	NGAS	9	4	-.4253333E-01	.6719524E-01	-.6329814
17	NGAS	9	5	-.3318540E-01	.5545548E-01	-.5984152
18	NGAS	9	6	-.2550204E-01	.4759428E-01	-.5358215
19	PETR	8	1	-.7067518E-01	.1983455	-.3563235
20	PETR	8	2	-.2098132E-01	.1515857	-.1384122
21	PETR	8	3	-.5426844E-01	.1073293	-.5056255
22	PETR	8	4	-.1947870E-01	.8303371E-01	-.2345878
23	PETR	8	5	-.2644963E-02	.6764544E-01	-.3910038E-01
24	PETR	8	6	.2116794E-02	.5699197E-01	.3714198E-01
25	COAL	7	1	.6175453E-02	.5975551E-01	.1033453
26	COAL	7	2	-.2809470E-03	.3029819E-01	-.9272732E-02
27	COAL	7	3	.2825207E-03	.2023553E-01	.1396162E-01
28	COAL	7	4	.1572994E-03	.1518986E-01	.1035555E-01
29	COAL	7	5	.6028363E-03	.1216035E-01	.4957392E-01
30	COAL	7	6	.1428410E-03	.1013715E-01	.1409084E-01
31	CONSTANT	0	0	-98.25765	30.80998	-3.189150

EQUATION 4
 DEPENDENT VARIABLE 8 PETR
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .94096783 RBAR**2 .94096783
 SSR 2.1442247 SEE .29890249
 DURBIN-WATSON 2.08878582
 Q(12)= 10.4638 SIGNIFICANCE LEVEL .575340

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	PRIC	10	1	-.8529349E-01	.5190737E-01	-1.643186
2	PRIC	10	2	.1427184E-01	.3565719E-01	.4002513
3	PRIC	10	3	.2210785E-02	.2481434E-01	.8909301E-01
4	PRIC	10	4	-.8143614E-02	.1919665E-01	-.4242205
5	PRIC	10	5	-.8578378E-02	.1581090E-01	-.5425611
6	PRIC	10	6	-.2670888E-02	.1329643E-01	-.2008725
7	RGDP	6	1	-1.965062	1.798338	-1.092710
8	RGDP	6	2	.4079401	1.470172	.2774778
9	RGDP	6	3	.3717201	1.041546	.3568927
10	RGDP	6	4	.4495288E-01	.8003378	.5616738E-01
11	RGDP	6	5	.3817354E-01	.6487032	.5884592E-01
12	RGDP	6	6	-.7591852E-01	.5427183	-.1398857
13	NGAS	9	1	.3582951E-01	.5478140E-01	.6540452
14	NGAS	9	2	.1848312E-01	.3498401E-01	.5283305
15	NGAS	9	3	.6688430E-02	.2416356E-01	.2767982
16	NGAS	9	4	.7687949E-02	.1852209E-01	.4150691
17	NGAS	9	5	-.2855266E-03	.1505070E-01	-.1897099E-01
18	NGAS	9	6	-.3432980E-02	.1270664E-01	-.2701722
19	PETR	8	1	.8994631	.1418446	6.341189
20	PETR	8	2	-.6816464E-01	.1310277	-.5202308
21	PETR	8	3	.4106520E-01	.9659864E-01	.4251116
22	PETR	8	4	-.1093637E-02	.7671605E-01	-.1425564E-01
23	PETR	8	5	.1417610E-01	.6389172E-01	.2218770
24	PETR	8	6	.5052288E-02	.5448624E-01	.9272594E-01
25	COAL	7	1	-.6881881E-02	.3002603E-01	-.2291971
26	COAL	7	2	-.8480269E-03	.1529210E-01	-.5545525E-01
27	COAL	7	3	-.8022275E-03	.1021966E-01	-.7849848E-01
28	COAL	7	4	-.4578177E-03	.7672676E-02	-.5966858E-01
29	COAL	7	5	-.4271846E-03	.6142652E-02	-.6954400E-01
30	COAL	7	6	-.1408741E-03	.5120720E-02	-.2751062E-01
31	CONSTANT	0	0	15.95756	13.57824	1.175230

EQUATION 5
 DEPENDENT VARIABLE 7 COAL
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .95662541 RBAR**2 .95662541
 SSR 3.0511523 SEE .35655483

DURBIN-WATSON 2.01384827

Q(12)= 15.7532 SIGNIFICANCE LEVEL .202802

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	PRIC	10	1	-.7439178E-02	.5338059E-01	-.1393611
2	PRIC	10	2	-.1265994E-01	.4172608E-01	-.3034060
3	PRIC	10	3	.2456372E-03	.2963357E-01	.8289156E-02
4	PRIC	10	4	.1705257E-02	.2294994E-01	.7430335E-01
5	PRIC	10	5	-.6120940E-02	.1880825E-01	-.3254391
6	PRIC	10	6	-.2969841E-02	.1572372E-01	-.1888765
7	RGDP	6	1	-.1597847	2.144352	-.7451421E-01
8	RGDP	6	2	.2018728E-01	1.718708	.1174561E-01
9	RGDP	6	3	1.094513	1.218748	.8980639
10	RGDP	6	4	.4525488	.9427245	.4800435
11	RGDP	6	5	.2491914	.7675138	.3246735
12	RGDP	6	6	.1643967	.6450411	.2548623
13	NGAS	9	1	-.2215570E-02	.1808190E-01	-.1225297
14	NGAS	9	2	.2936432E-02	.9249439E-02	.3174713
15	NGAS	9	3	.1454812E-02	.6199401E-02	.2346697
16	NGAS	9	4	.5871393E-03	.4660337E-02	.1259864
17	NGAS	9	5	.1907738E-03	.3731337E-02	.5112747E-01
18	NGAS	9	6	.1434455E-03	.3110296E-02	.4611955E-01
19	PETR	8	1	.9527316E-02	.3879630E-01	.2455728
20	PETR	8	2	-.2777088E-02	.2066720E-01	-.1343717
21	PETR	8	3	-.4341089E-03	.1395380E-01	-.3111045E-01
22	PETR	8	4	.5662058E-03	.1051436E-01	.5385071E-01
23	PETR	8	5	.7032459E-03	.8428446E-02	.8343719E-01
24	PETR	8	6	.4825643E-03	.7030902E-02	.6863476E-01
25	COAL	7	1	.8227608	.1485276	5.539448
26	COAL	7	2	-.1199460	.1402790	-.8550533
27	COAL	7	3	-.2989552E-01	.1031425	-.2898469
28	COAL	7	4	.5039428E-01	.8104396E-01	.6218142
29	COAL	7	5	.2637370E-01	.6752739E-01	.3905630
30	COAL	7	6	-.1535250E-01	.5757720E-01	-.2666420
31	CONSTANT	0	0	-19.79790	10.26237	-1.929175

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN PRIC

ENTRY	PRIC	RGDP	COAL	NGAS
1	.685477	-.179219E-02	.918924E-01	-.346892E-01
2	.535499	-.273267E-02	.700032E-01	-.100998
3	.309445	-.274529E-02	.333665E-01	-.133387
4	.140833	-.127806E-02	.471829E-02	-.109380
5	.420303E-02	.974675E-03	-.624745E-02	-.332034E-01
6	-.808161E-01	.282654E-02	-.122541E-01	.666235E-01
7	-.150524	.393758E-02	-.172915E-01	.151376
8	-.204751	.447796E-02	-.162589E-01	.205063
9	-.234121	.464640E-02	-.879652E-02	.224555
10	-.236002	.453228E-02	.268259E-02	.213591
11	-.212700	.416071E-02	.145578E-01	.179686
12	-.171344	.358842E-02	.245833E-01	.131958

ENTRY	PETR
1	-.909056E-01
2	-.138586
3	-.154529
4	-.154142
5	-.152888
6	-.150976
7	-.141172
8	-.119318
9	-.886111E-01
10	-.549249E-01
11	-.234632E-01
12	.244848E-02

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN

RGDP

ENTRY	PRIC	RGDP	COAL	NGAS
1	.000000	.141591E-01	-.390895E-01	.669371E-01
2	-.312945E-01	.124744E-01	-.342808E-01	.157442
3	-.893713E-01	.112214E-01	-.252058E-01	.220264
4	-.126355	.101637E-01	-.473575E-03	.250768
5	-.123441	.940300E-02	.228170E-01	.252974
6	-.103245	.892169E-02	.401940E-01	.228528
7	-.691986E-01	.820326E-02	.525349E-01	.188935
8	-.321911E-01	.736325E-02	.594926E-01	.141861
9	.323251E-02	.656882E-02	.633795E-01	.970319E-01
10	.345397E-01	.591553E-02	.645351E-01	.618091E-01
11	.581379E-01	.543487E-02	.632207E-01	.396891E-01
12	.719051E-01	.511214E-02	.598781E-01	.310097E-01

ENTRY	PETR
1	.305621E-01
2	.233322E-02
3	-.890492E-02
4	.474068E-04
5	.147171E-01
6	.292826E-01
7	.389796E-01
8	.441545E-01
9	.449380E-01
10	.412996E-01
11	.338256E-01
12	.237917E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN COAL

ENTRY	PRIC	RGDP	COAL	NGAS
1	.000000	.000000	.334774	-.907998E-01
2	.142546	-.474151E-03	.275687	-.742418E-01
3	.202962	-.114477E-02	.185558	-.594849E-01
4	.199584	-.117379E-02	.106054	-.539016E-01
5	.166864	-.473677E-03	.687515E-01	-.461627E-01
6	.124747	.492552E-03	.555724E-01	-.250128E-01
7	.790739E-01	.132329E-02	.396219E-01	.884019E-02
8	.305696E-01	.195168E-02	.241217E-01	.445343E-01
9	-.154057E-01	.244571E-02	.129918E-01	.750372E-01
10	-.527413E-01	.283578E-02	.838562E-02	.968224E-01
11	-.778102E-01	.309122E-02	.847162E-02	.108469
12	-.901203E-01	.318240E-02	.107378E-01	.109816

ENTRY	PETR
1	.489113E-02
2	-.115780E-02
3	-.191208E-01
4	-.360296E-01
5	-.487920E-01
6	-.588104E-01
7	-.663923E-01
8	-.700666E-01
9	-.682640E-01
10	-.612754E-01
11	-.506475E-01
12	-.381699E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN NGAS

ENTRY	PRIC	RGDP	COAL	NGAS
1	.000000	.000000	.000000	.567660
2	-.899309E-01	-.183244E-04	-.301169E-02	.487919
3	-.145510	-.298525E-03	-.209269E-02	.316996
4	-.153423	-.524910E-03	.216228E-02	.160373
5	-.131895	-.730864E-03	.660375E-02	.388918E-01
6	-.861778E-01	-.113217E-02	.874059E-02	-.495317E-01
7	-.374030E-01	-.150862E-02	.892852E-02	-.109981
8	.267177E-02	-.173627E-02	.790624E-02	-.132366
9	.288044E-01	-.178294E-02	.569048E-02	-.124598
10	.397387E-01	-.167243E-02	.247442E-02	-.987124E-01
11	.381829E-01	-.146472E-02	-.127483E-02	-.655074E-01
12	.280978E-01	-.121810E-02	-.487676E-02	-.332077E-01

ENTRY	PETR
1	-.184102
2	-.145254
3	-.823999E-01
4	-.358781E-01
5	-.148243E-02
6	.158813E-01
7	.191164E-01
8	.155899E-01
9	.860602E-02
10	.531665E-03
11	-.671659E-02
12	-.118308E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN PETR

ENTRY	PRIC	RGDP	COAL	NGAS
1	.000000	.000000	.000000	.000000
2	.558503E-01	-.550011E-03	.196766E-02	-.145964E-01
3	.110994	-.123381E-02	.251994E-02	-.390584E-01
4	.153085	-.201712E-02	.134629E-02	-.750198E-01
5	.180012	-.264543E-02	-.127742E-02	-.108728
6	.186672	-.287469E-02	-.485268E-02	-.128883
7	.180918	-.282409E-02	-.947648E-02	-.130387
8	.161006	-.258281E-02	-.149566E-01	-.115862
9	.130134	-.221990E-02	-.202962E-01	-.901041E-01
10	.933965E-01	-.179553E-02	-.245097E-01	-.587898E-01
11	.553220E-01	-.136145E-02	-.269675E-01	-.275425E-01
12	.201844E-01	-.968733E-03	-.275418E-01	-.880813E-03

ENTRY	PETR
1	.206528
2	.185764
3	.148791
4	.121492
5	.949241E-01
6	.707967E-01
7	.476640E-01
8	.252115E-01
9	.565498E-02
10	-.926765E-02
11	-.188712E-01
12	-.233048E-01

DECOMPOSITION OF VARIANCE, SERIES

11

PRIC

STEP	STAN ERR	PRIC	RGDP	COAL	NGAS
1	.685477	100.0000000	.0000000	.0000000	.0000000
2	.888337	95.8809048	.1241021	2.5748671	1.0248545
3	.983653	88.0961021	.9267081	6.3574308	3.0241314
4	1.04412	80.0077101	2.2869835	9.2963080	4.8431795
5	1.08769	73.7266969	3.3953727	10.9198229	5.9333096
6	1.12165	69.8492400	4.0401605	11.5055495	6.1697860
7	1.15149	67.9848654	4.1946220	11.3885449	5.9596766
8	1.18142	67.5874667	4.0590275	10.8857785	5.6620512
9	1.21185	67.9682507	3.8584568	10.3621271	5.4377734
10	1.24039	68.4971294	3.7605133	10.0716521	5.2931024
11	1.26402	68.7909752	3.8327407	10.0774485	5.1882508
12	1.28125	68.7419725	4.0453238	10.3030171	5.0977630

STEP	PETR
1	.000000
2	.395271
3	1.595628
4	3.565819
5	6.024798
6	8.435264
7	10.472291
8	11.805676
9	12.373392
10	12.377603
11	12.110585
12	11.811924

DECOMPOSITION OF VARIANCE, SERIES

8

RGDP

STEP	STAN ERR	PRIC	RGDP	COAL	NGAS
1	.142721E-01	1.5768559	98.4231441	.0000000	.0000000
2	.191650E-01	2.9075634	96.9487749	.0612089	.0000914
3	.224427E-01	3.6166200	95.6984988	.3048239	.0177600
4	.247857E-01	3.2310651	95.2759886	.4741892	.0594114
5	.266731E-01	2.9235095	94.6970723	.4409927	.1263811
6	.284399E-01	3.5593160	93.1375469	.4178969	.2696429
7	.300604E-01	4.9017065	90.8134384	.5678390	.4932199
8	.314864E-01	6.4903928	88.2429022	.9017810	.7536379
9	.327142E-01	8.0295915	85.7752241	1.3942635	.9951599
10	.337612E-01	9.3414812	83.6078568	2.0146492	1.1797870
11	.346442E-01	10.3137088	81.8611303	2.7094131	1.2991618
12	.353806E-01	10.9175642	80.5770307	3.4068725	1.3641823

STEP	PETR
1	.000000
2	.082361
3	.362297
4	.959346
5	1.812044
6	2.615597
7	3.223796
8	3.611286
9	3.805761
10	3.856226
11	3.816586
12	3.734350

DECOMPOSITION OF VARIANCE, SERIES

3

COAL

STEP	STAN ERR	PRIC	RGDP	COAL	NGAS
1	.349351	6.9188707	1.2519762	91.8291531	.0000000
2	.451816	6.5370783	1.3241847	92.1323972	.0044432
3	.490234	6.0159065	1.3891344	92.5851096	.0055963
4	.501603	5.7551362	1.3269659	92.9059112	.0072038
5	.506890	5.6509031	1.5020537	92.8176973	.0240271
6	.511753	5.6013479	2.0905211	92.2411769	.0527442
7	.516420	5.6126812	3.0877866	91.1702173	.0816871
8	.520924	5.6134694	4.3389300	89.8150406	.1033159
9	.525422	5.5457789	5.7200032	88.3446785	.1132838
10	.530017	5.4526105	7.1038283	86.8447224	.1135078
11	.534722	5.4312014	8.3772281	85.3483080	.1120876
12	.539458	5.5439222	9.4628125	83.8959150	.1183005

STEP	PETR
1	.000000
2	.001897
3	.004253
4	.004783
5	.005319
6	.014210
7	.047628
8	.129244
9	.276256
10	.485331
11	.731175
12	.979050

DECOMPOSITION OF VARIANCE, SERIES

9

NGAS

STEP	STAN ERR	PRIC	RGDP	COAL	NGAS
1	.579799	.3579603	1.3328427	2.4525328	95.8566642
2	.784184	1.8544722	4.7595282	2.2370213	91.1143321
3	.887020	3.7107203	9.8861597	2.1981207	83.9840274
4	.946523	4.5942348	15.7013493	2.2547346	76.6274314
5	.988164	4.3280896	20.9597208	2.2869420	70.4601641
6	1.02607	4.4358030	24.4001523	2.1805115	65.5832198
7	1.06799	6.1033898	25.6518201	2.0195417	61.5961318
8	1.11163	9.0366365	25.3061627	2.0246115	58.2734092
9	1.15101	12.2349349	24.3146277	2.3134319	55.5254925
10	1.18188	14.8701495	23.3345515	2.8652855	53.3603781
11	1.20313	16.5800586	22.6264307	3.5777792	51.7886831
12	1.21617	17.4038252	22.2089880	4.3168408	50.7589647

STEP	PETR
1	.000000
2	.034646
3	.220972
4	.822250
5	1.965083
6	3.400313
7	4.629117
8	5.359180
9	5.611513
10	5.569635
11	5.427048
12	5.311381

DECOMPOSITION OF VARIANCE, SERIES 10 PETR

STEP	STAN ERR	PRIC	RGDP	COAL	NGAS
1	.292863	9.6349754	1.0890178	.0278926	39.5171311
2	.400736	17.1057950	.5850237	.0157319	34.2440041
3	.462430	24.0127791	.4764186	.1827837	28.8914002
4	.504923	29.4606776	.3996056	.6624906	24.7380889
5	.538453	33.9679499	.4260922	1.4036588	21.7538095
6	.567720	37.6281097	.6493352	2.3357642	19.6469816
7	.592284	40.2529009	1.0297189	3.4025754	18.1552984
8	.610553	41.6991920	1.4920201	4.5189693	17.1502794
9	.622425	42.1504583	1.9569081	5.5510790	16.5214178
10	.629266	42.0007758	2.3453356	6.3792423	16.1642023
11	.632959	41.6495412	2.6036383	6.9452970	15.9874048
12	.635097	41.3709818	2.7264684	7.2598088	15.9146090

STEP	PETR
1	49.730983
2	48.049445
3	46.436618
4	44.739137
5	42.448490
6	39.739809
7	37.159506
8	35.139539
9	33.820137
10	33.110444
11	32.814119
12	32.728132

Appendix 5.

Model 3: Petroleum Products

In this model the consumption of petroleum products is split into automotive gasoline and automotive distillate. The variables used for modelling are the real price of oil, real GDP, automotive gasoline consumption and automotive distillate consumption. To maintain consistency with model 2, the fuels are transformed into square root form, and real GDP is logarithmic. A standard symmetric prior is applied. The Q-values indicate that serial correlation is not a problem.

This model displays the most complex variance decompositions and impulse responses. Automotive distillate consumption depends on all other variables in the model, automotive gasoline consumption is somewhat influenced by real GDP, and the real price of oil is related to automotive gasoline consumption. As in the other models, real GDP is exogenous. The impulse responses display negative price effects and positive income effects, and the effect of automotive gasoline consumption on the real price of oil is positive.

THE PRIOR IS.....

TIGHTNESS PARAMETER 0.40000

HARMONIC LAG DECAY WITH PARAMETER 1.00000

MEANS AND STANDARD DEVIATIONS AS PERCENTAGE OF OWN LAG
LISTED UNDER THE DEPENDENT VARIABLE

	RGDP	PRIC	AGAS	ADIS
RGDP	1.00000000	0.50000000	0.50000000	0.50000000
PRIC	0.50000000	1.00000000	0.50000000	0.50000000
AGAS	0.50000000	0.50000000	1.00000000	0.50000000
ADIS	0.50000000	0.50000000	0.50000000	1.00000000
MEAN	1.00000000	1.00000000	1.00000000	1.00000000

EQUATION 1
 DEPENDENT VARIABLE 5 RGDP
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .99627788 RBAR**2 .99627788
 SSR .52427279E-02 SEE .14779953E-01
 DURBIN-WATSON 2.43524754

Q(12)= 9.29842 SIGNIFICANCE LEVEL .677252

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	5	1	.9174111	.1293411	7.092959
2	RGDP	5	2	.2761924E-01	.1257786	.2195861
3	RGDP	5	3	.1979128E-01	.9478007E-01	.2088127
4	RGDP	5	4	.3579005E-01	.7527215E-01	.4754753
5	RGDP	5	5	.3721144E-01	.6194665E-01	.6007014
6	RGDP	5	6	-.1403364E-03	.5200459E-01	-.2698539E-02
7	PRIC	4	1	-.1400570E-02	.2354947E-02	-.5947350
8	PRIC	4	2	.5190285E-03	.1725974E-02	.3007163
9	PRIC	4	3	.1089272E-02	.1218853E-02	.8936865
10	PRIC	4	4	.1003031E-02	.9438918E-03	1.062655
11	PRIC	4	5	.2783668E-03	.7743932E-03	.3594644
12	PRIC	4	6	.2969034E-04	.6515667E-03	.4556761E-01
13	AGAS	6	1	-.6021849E-03	.2314031E-01	-.2602320E-01
14	AGAS	6	2	-.3059961E-03	.1532143E-01	-.1997177E-01
15	AGAS	6	3	.2222337E-03	.1071848E-01	.2073370E-01
16	AGAS	6	4	-.8631983E-03	.8215842E-02	-.1050651
17	AGAS	6	5	.1298167E-02	.6627423E-02	.1958781
18	AGAS	6	6	.1072080E-02	.5522841E-02	.1941176
19	ADIS	7	1	-.1621969E-01	.1310158E-01	-1.237995
20	ADIS	7	2	-.4278474E-02	.8749896E-02	-.4889743
21	ADIS	7	3	-.1370078E-02	.6100715E-02	-.2245767
22	ADIS	7	4	.1873584E-02	.4639838E-02	.4038037
23	ADIS	7	5	.9637080E-03	.3743095E-02	.2574629
24	ADIS	7	6	.2947328E-03	.3134852E-02	.9401810E-01
25	CONSTANT	0	0	-.2966854	.9879257	-.3003115

EQUATION 2
 DEPENDENT VARIABLE 4 PRIC
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .90311484 RBAR**2 .90311484
 SSR 12.252127 SEE .71449654
 DURBIN-WATSON 2.19571861

Q(12)= 11.5409 SIGNIFICANCE LEVEL .483215

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	5	1	-5.620638	4.561364	-1.232227
2	RGDP	5	2	-4.132813	3.533012	-1.169771
3	RGDP	5	3	-1.014690	2.521293	-.4024482
4	RGDP	5	4	.3159611	1.937678	.1630617
5	RGDP	5	5	-.2834280	1.564673	-.1811420
6	RGDP	5	6	.3068348E-01	1.309827	.2342560E-01
7	PRIC	4	1	.7965809	.1447050	5.504860
8	PRIC	4	2	-.1287226	.1370952	-.9389288
9	PRIC	4	3	.7573778E-02	.1027292	.7372566E-01
10	PRIC	4	4	-.2251612E-01	.8260740E-01	-.2725678
11	PRIC	4	5	.1634280E-01	.7020538E-01	.2327855
12	PRIC	4	6	-.1908127E-01	.6017802E-01	-.3170803
13	AGAS	6	1	.3588521	1.112297	.3226225
14	AGAS	6	2	.4587873	.7395750	.6203390
15	AGAS	6	3	.3741253	.5191738	.7206166
16	AGAS	6	4	.1620305	.3985511	.4065490
17	AGAS	6	5	.3030846E-01	.3213243	.9432357E-01
18	AGAS	6	6	.5667780E-01	.2680346	.2114570
19	ADIS	7	1	.8844373	.6415114	1.378677
20	ADIS	7	2	.8199796E-01	.4242715	.1932676
21	ADIS	7	3	.9037646E-01	.2958447	.3054861
22	ADIS	7	4	.3111713E-01	.2249631	.1383210
23	ADIS	7	5	.4465688E-01	.1815069	.2460341
24	ADIS	7	6	.2425843E-01	.1519839	.1596119
25	CONSTANT	0	0	114.1583	46.68484	2.445296

EQUATION 3
 DEPENDENT VARIABLE 6 AGAS
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .99000884 RBAR**2 .99000884
 SSR .17239374 SEE .84753009E-01

DURBIN-WATSON 1.74614539

Q(12)= 6.69379 SIGNIFICANCE LEVEL .877168

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	5	1	.5239411E-01	.5156768	.1016026
2	RGDP	5	2	.8572579E-01	.4190701	.2045619
3	RGDP	5	3	.1554384	.2990671	.5197443
4	RGDP	5	4	.8229873E-01	.2300411	.3577566
5	RGDP	5	5	.3712043E-01	.1858772	.1997041
6	RGDP	5	6	-.1880084E-01	.1555551	-.1208629
7	PRIC	4	1	-.5792716E-02	.1422376E-01	-.4072563
8	PRIC	4	2	.2753304E-02	.9994640E-02	.2754781
9	PRIC	4	3	.3857704E-02	.7020855E-02	.5494635
10	PRIC	4	4	-.6687217E-03	.5415465E-02	-.1234837
11	PRIC	4	5	-.2360714E-02	.4431995E-02	-.5326527
12	PRIC	4	6	-.9978267E-03	.3731670E-02	-.2673941
13	AGAS	6	1	.9795439	.1756430	5.576903
14	AGAS	6	2	-.1133244	.1509776	-.7506039
15	AGAS	6	3	.1553432E-01	.1140924	.1361556
16	AGAS	6	4	.1818507E-01	.8980703E-01	.2024905
17	AGAS	6	5	.7819912E-02	.7297774E-01	.1071548
18	AGAS	6	6	-.6170071E-02	.6047749E-01	-.1020226
19	ADIS	7	1	-.6380170E-01	.7552397E-01	-.8447875
20	ADIS	7	2	-.3991075E-03	.5036424E-01	-.7924422E-02
21	ADIS	7	3	-.6999643E-03	.3517238E-01	-.1990096E-01
22	ADIS	7	4	.1010359E-01	.2672126E-01	.3781107
23	ADIS	7	5	.4152270E-02	.2153835E-01	.1927850
24	ADIS	7	6	-.1532413E-02	.1799814E-01	-.8514285E-01
25	CONSTANT	0	0	-3.625023	5.165525	-.7017724

EQUATION 4
 DEPENDENT VARIABLE 7 ADIS
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .99273398 RBAR**2 .99273398
 SSR .36606107 SEE .12350119
 DURBIN-WATSON 1.95146039

Q(12)= 13.6970 SIGNIFICANCE LEVEL .320474

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	5	1	.6449321	.7502384	.8596362
2	RGDP	5	2	.2220958	.6115640	.3631603
3	RGDP	5	3	.2764301	.4367228	.6329647
4	RGDP	5	4	.4459694E-01	.3361645	.1326640
5	RGDP	5	5	-.1492949E-01	.2712106	-.5504758E-01
6	RGDP	5	6	-.4304806E-01	.2267611	-.1898388
7	PRIC	4	1	-.3258315E-01	.2050150E-01	-1.589305
8	PRIC	4	2	-.4251170E-02	.1464479E-01	-.2902855
9	PRIC	4	3	-.1055969E-02	.1028448E-01	-.1026759
10	PRIC	4	4	-.2260589E-02	.7921716E-02	-.2853661
11	PRIC	4	5	-.2860865E-02	.6468244E-02	-.4422940
12	PRIC	4	6	-.4163229E-03	.5444471E-02	-.7646710E-01
13	AGAS	6	1	.2990419	.2002607	1.493263
14	AGAS	6	2	.1701703E-01	.1297992	.1311028
15	AGAS	6	3	.4750560E-01	.9014166E-01	.5270105
16	AGAS	6	4	.2105837E-01	.6888426E-01	.3057066
17	AGAS	6	5	.1197833E-01	.5543038E-01	.2160968
18	AGAS	6	6	-.2420160E-02	.4618627E-01	-.5239999E-01
19	ADIS	7	1	.7222286	.1419851	5.086649
20	ADIS	7	2	-.1191413	.1251496	-.9519909
21	ADIS	7	3	-.2990016E-01	.9211525E-01	-.3245951
22	ADIS	7	4	-.3197338E-01	.7169146E-01	-.4459859
23	ADIS	7	5	.1202155E-01	.5895498E-01	.2039108
24	ADIS	7	6	.1830528E-01	.4962911E-01	.3688417
25	CONSTANT	0	0	-13.03989	7.775418	-1.677066

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN PRIC

ENTRY	PRIC	RGDP	AGAS	ADIS
1	.700061	-.885576E-03	-.223176E-01	.118256E-01
2	.565083	-.197129E-02	-.267172E-01	-.215144E-01
3	.336875	-.193975E-02	-.237987E-01	-.481729E-01
4	.148411	-.392743E-03	-.156603E-01	-.572654E-01
5	-.110045E-01	.201672E-02	-.844300E-02	-.518970E-01
6	-.113931	.404100E-02	-.500947E-02	-.364460E-01
7	-.191952	.519222E-02	-.385376E-02	-.162226E-01
8	-.232602	.557216E-02	-.314208E-02	.296238E-02
9	-.236690	.540358E-02	-.244010E-02	.177186E-01
10	-.214585	.488758E-02	-.184383E-02	.267429E-01
11	-.176688	.417360E-02	-.135948E-02	.303677E-01
12	-.133391	.339216E-02	-.864248E-03	.299151E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN RGDPL

ENTRY	PRIC	RGDP	AGAS	ADIS
1	.000000	.144542E-01	.201711E-01	.359256E-02
2	-.708262E-01	.131901E-01	.202866E-01	.179486E-01
3	-.157589	.122742E-01	.187796E-01	.329694E-01
4	-.200034	.114653E-01	.190350E-01	.487619E-01
5	-.189712	.107771E-01	.194433E-01	.597117E-01
6	-.158170	.101858E-01	.191159E-01	.641193E-01
7	-.117911	.926101E-02	.178087E-01	.630959E-01
8	-.791360E-01	.825212E-02	.167339E-01	.590835E-01
9	-.453299E-01	.733453E-02	.161438E-01	.536143E-01
10	-.180392E-01	.658201E-02	.158057E-01	.477484E-01
11	.139274E-02	.599323E-02	.154792E-01	.421448E-01
12	.133533E-01	.553383E-02	.150692E-01	.371808E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN

AGAS

ENTRY	PRIC	RGDP	AGAS	ADIS
1	.000000	.000000	.774003E-01	.415391E-01
2	.645140E-01	-.720361E-03	.731667E-01	.531467E-01
3	.167617	-.185871E-02	.590798E-01	.540654E-01
4	.278296	-.312836E-02	.463298E-01	.469685E-01
5	.362309	-.425274E-02	.372583E-01	.320510E-01
6	.402616	-.480763E-02	.311392E-01	.146460E-01
7	.407524	-.473706E-02	.260838E-01	-.139261E-02
8	.380173	-.421327E-02	.219965E-01	-.138690E-01
9	.329895	-.338707E-02	.186620E-01	-.214525E-01
10	.267468	-.241483E-02	.158847E-01	-.241427E-01
11	.202343	-.142706E-02	.135117E-01	-.228874E-01
12	.141910	-.527518E-03	.114319E-01	-.189941E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN

ADIS

ENTRY	PRIC	RGDP	AGAS	ADIS
1	.000000	.000000	.000000	.112979
2	.999226E-01	-.183248E-02	-.720824E-02	.815965E-01
3	.168740	-.362359E-02	-.129867E-01	.388777E-01
4	.192812	-.468386E-02	-.155456E-01	.230593E-02
5	.177672	-.459912E-02	-.140538E-01	-.256682E-01
6	.134427	-.371918E-02	-.107051E-01	-.385648E-01
7	.807062E-01	-.259249E-02	-.797777E-02	-.384516E-01
8	.268843E-01	-.159727E-02	-.630724E-02	-.324166E-01
9	-.172695E-01	-.870782E-03	-.546180E-02	-.240967E-01
10	-.469129E-01	-.418130E-03	-.508098E-02	-.159584E-01
11	-.619538E-01	-.189294E-03	-.488742E-02	-.939780E-02
12	-.649614E-01	-.127065E-03	-.473120E-02	-.474662E-02

DECOMPOSITION OF VARIANCE, SERIES

4

PRIC

STEP	STAN ERR	PRIC	RGDP	AGAS	ADIS
1	.700061	100.0000000	.0000000	.0000000	.0000000
2	.910256	97.6872191	.6054249	.5023199	1.2050361
3	1.01166	90.1738779	2.9166501	3.1518195	3.7576525
4	1.09550	78.7350472	5.8214476	9.1412642	6.3022410
5	1.18282	67.5476003	7.5661253	17.2239015	7.6623728
6	1.27171	59.2378967	8.0923894	24.9236298	7.7460841
7	1.35668	54.0517354	7.8658042	30.9224140	7.1600463
8	1.43045	51.2642238	7.3814308	34.8784854	6.4758600
9	1.48775	49.9226433	6.9166522	37.1605741	6.0001303
10	1.52758	49.3262717	6.5745788	38.3135486	5.7856010
11	1.55226	49.0660531	6.3672815	38.8042593	5.7624061
12	1.56584	48.9446592	6.2646259	38.9556793	5.8350357

DECOMPOSITION OF VARIANCE, SERIES

5

RGDP

STEP	STAN ERR	PRIC	RGDP	AGAS	ADIS
1	.144813E-01	.3739682	99.6260318	.0000000	.0000000
2	.197851E-01	1.1930602	97.8165436	.1325636	.8578326
3	.237161E-01	1.4992962	94.8626963	.7064992	2.9315084
4	.269405E-01	1.1831424	91.6264182	1.8959236	5.2945158
5	.297530E-01	1.4294736	88.2427961	3.5974670	6.7302633
6	.322841E-01	2.7808630	84.9026342	5.2730772	7.0434256
7	.344115E-01	4.7243249	81.9723624	6.5362570	6.7670557
8	.361054E-01	6.6732214	79.6850036	7.2990771	6.3426979
9	.374009E-01	8.3063163	78.1062288	7.6223272	5.9651277
10	.383672E-01	9.5159793	77.1643671	7.6393469	5.6803067
11	.390826E-01	10.3111670	76.7166930	7.4955472	5.4765928
12	.396217E-01	10.7654896	76.5941763	7.3107128	5.3296213

DECOMPOSITION OF VARIANCE, SERIES

6

AGAS

STEP	STAN ERR	PRIC	RGDP	AGAS	ADIS
1	.830407E-01	7.2229505	5.9003334	86.8767161	.0000000
2	.115872	9.0261365	6.0955648	84.4913108	.3869879
3	.134181	9.8767644	6.5044038	82.3935136	1.2253183
4	.144915	9.6356571	7.3019223	80.8611218	2.2012987
5	.151774	9.0938657	8.2979844	79.7438973	2.8642527
6	.156557	8.6490765	9.2895912	78.9018565	3.1594757
7	.159956	8.3433887	10.1384590	78.2427985	3.2753538
8	.162479	8.1236774	10.8867513	77.6644610	3.3251103
9	.164451	7.9520425	11.5909214	77.1008839	3.3561523
10	.166059	7.8111415	12.2735228	76.5302337	3.3851020
11	.167402	7.6928893	12.9323694	75.9585054	3.4162360
12	.168536	7.5923578	13.5584053	75.4000068	3.4492301

DECOMPOSITION OF VARIANCE, SERIES

7

ADIS

STEP	STAN ERR	PRIC	RGDP	AGAS	ADIS
1	.121006	.9550686	.0881442	11.7842191	87.1725681
2	.157829	2.4195714	1.3450821	18.2660023	77.9693443
3	.180976	8.9256466	4.3418314	22.8172077	63.9153142
4	.201545	15.2697813	9.3542884	23.8282377	51.5476926
5	.220376	18.3174851	15.1656028	22.0453574	44.4715548
6	.236023	18.3537418	20.6016607	19.6043096	41.4402878
7	.247854	17.0717781	25.1623556	17.7805656	39.9853007
8	.257244	15.8614782	28.6341802	16.7968743	38.7074673
9	.265337	15.3545721	30.9969350	16.4415239	37.2069690
10	.272463	15.5252411	32.4677941	16.3778453	35.6291195
11	.278472	16.0516700	33.3721851	16.3541673	34.2219776
12	.283209	16.6349542	33.9887107	16.2614719	33.1148633

Appendix 6.

Model 4: Electricity

An initial version of this model included State electricity price, real GDP and electricity consumption - the latter two in logarithmic form. The price variable was then dropped because the variance decompositions showed that it did not explain electricity consumption. A tight prior is imposed on the coefficients of electricity in the GDP equation. In fact, real GDP is modelled as a simple autoregression. For this reason, electricity does not contribute to the forecast error of real GDP. The variance decompositions and impulse responses indicate that electricity consumption depends positively on real GDP.

THE PRIOR IS....

TIGHTNESS PARAMETER .20000

HARMONIC LAG DECAY WITH PARAMETER 1.00000

MEANS AND STANDARD DEVIATIONS AS PERCENTAGE OF OWN LAG
LISTED UNDER THE DEPENDENT VARIABLE

	RGDP	ELEC
RGDP	1.00000000	.50000000
ELEC	.01000000	1.00000000
MEAN	1.00000000	1.00000000

EQUATION 1
 DEPENDENT VARIABLE 6 RGDP
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .99418975 RBAR**2 .99418975
 SSR .81839153E-02 SEE .18466090E-01
 DURBIN-WATSON 1.83234512

Q(12)= 7.84148 SIGNIFICANCE LEVEL .797392

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	6	1	.9801334	.1018140	9.626706
2	RGDP	6	2	-.1235501E-01	.8849117E-01	-.1396186
3	RGDP	6	3	-.7212528E-02	.6252091E-01	-.1153619
4	RGDP	6	4	-.8949649E-03	.4776674E-01	-.1873615E-01
5	RGDP	6	5	.1584958E-02	.3858988E-01	.4107185E-01
6	RGDP	6	6	-.2556627E-02	.3228334E-01	-.7919341E-01
7	ELEC	7	1	-.2174275E-04	.1079566E-02	-.2014027E-01
8	ELEC	7	2	-.4806136E-05	.5398219E-03	-.8903189E-02
9	ELEC	7	3	-.1752516E-05	.3598869E-03	-.4869631E-02
10	ELEC	7	4	-.1039319E-05	.2699172E-03	-.3850510E-02
11	ELEC	7	5	-.5668581E-06	.2159345E-03	-.2625139E-02
12	ELEC	7	6	.6816408E-08	.1799456E-03	.3788039E-04
13	CONSTANT	0	0	.5323586	.2030698	2.621555

EQUATION 2
 DEPENDENT VARIABLE 7 ELEC
 FROM 1967: 1 UNTIL 1991: 1
 TOTAL OBSERVATIONS 25 SKIPPED/MISSING 0
 USABLE OBSERVATIONS 25 DEGREES OF FREEDOM 24
 R**2 .99460122 RBAR**2 .99460122
 SSR .31141269E-01 SEE .36021561E-01
 DURBIN-WATSON 1.54449491

Q(12)= 9.07078 SIGNIFICANCE LEVEL .696873

NO.	LABEL	VAR	LAG	COEFFICIENT	STAND. ERROR	T-STATISTIC
***	*****	***	***	*****	*****	*****
1	RGDP	6	1	.1936105	.1549448	1.249545
2	RGDP	6	2	.1159540E-01	.9620787E-01	.1205245
3	RGDP	6	3	.1327710E-01	.6577586E-01	.2018537
4	RGDP	6	4	.8883425E-02	.4974104E-01	.1785935
5	RGDP	6	5	.2466669E-02	.3991555E-01	.6179718E-01
6	RGDP	6	6	-.1233486E-02	.3326545E-01	-.3708008E-01
7	ELEC	7	1	.8928856	.1251868	7.132424
8	ELEC	7	2	-.4162515E-01	.9327447E-01	-.4462652
9	ELEC	7	3	.1714500E-02	.6431822E-01	.2665651E-01
10	ELEC	7	4	-.4958883E-02	.4894516E-01	-.1013151
11	ELEC	7	5	-.8117528E-02	.3920183E-01	-.2070701
12	ELEC	7	6	-.6294296E-02	.3224300E-01	-.1952143
13	CONSTANT	0	0	-2.172968	1.915297	-1.134533

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN RGDP

ENTRY	RGDP	ELEC
1	.180930E-01	.188232E-01
2	.177331E-01	.203100E-01
3	.171568E-01	.209941E-01
4	.164657E-01	.216997E-01
5	.157819E-01	.222260E-01
6	.151534E-01	.224010E-01
7	.145044E-01	.222354E-01
8	.138817E-01	.219136E-01
9	.132848E-01	.214774E-01
10	.127135E-01	.209536E-01
11	.121667E-01	.203673E-01
12	.116433E-01	.197399E-01

RESPONSES TO ONE-STANDARD DEVIATION SHOCK IN ELEC

ENTRY	RGDP	ELEC
1	.000000	.298553E-01
2	-.649136E-06	.266574E-01
3	-.135933E-05	.225591E-01
4	-.199525E-05	.190840E-01
5	-.253524E-05	.159981E-01
6	-.297356E-05	.131537E-01
7	-.330327E-05	.105947E-01
8	-.353538E-05	.849347E-02
9	-.368624E-05	.678822E-02
10	-.377135E-05	.540968E-02
11	-.380415E-05	.430137E-02
12	-.379602E-05	.341531E-02

DECOMPOSITION OF VARIANCE, SERIES 6 RGDP

STEP	STAN ERR	RGDP	ELEC
1	.180930E-01	100.0000000	.0000000
2	.253342E-01	99.9999999	.0000001
3	.305970E-01	99.9999998	.0000002
4	.347462E-01	99.9999995	.0000005
5	.381624E-01	99.9999991	.0000009
6	.410608E-01	99.9999987	.0000013
7	.435473E-01	99.9999983	.0000017
8	.457063E-01	99.9999978	.0000022
9	.475979E-01	99.9999974	.0000026
10	.492665E-01	99.9999970	.0000030
11	.507466E-01	99.9999966	.0000034
12	.520652E-01	99.9999963	.0000037

DECOMPOSITION OF VARIANCE, SERIES 7 ELEC

STEP	STAN ERR	RGDP	ELEC
1	.352938E-01	28.4439856	71.5560144
2	.486699E-01	32.3716683	67.6283317
3	.576058E-01	36.3894976	63.6105024
4	.644477E-01	40.4101553	59.5898447
5	.700245E-01	44.3043044	55.6956956
6	.746877E-01	47.9403516	52.0596484
7	.786443E-01	51.2318698	48.7681302
8	.820808E-01	54.1593184	45.8406816
9	.851154E-01	56.7335913	43.2664087
10	.878233E-01	58.9812333	41.0187667
11	.902567E-01	60.9360455	39.0639545
12	.924532E-01	62.6337258	37.3662742