



## Australian Government

### Department of Infrastructure and Regional Development

Bureau of Infrastructure, Transport and Regional Economics



## Petrol Prices and Diesel Prices in Australia

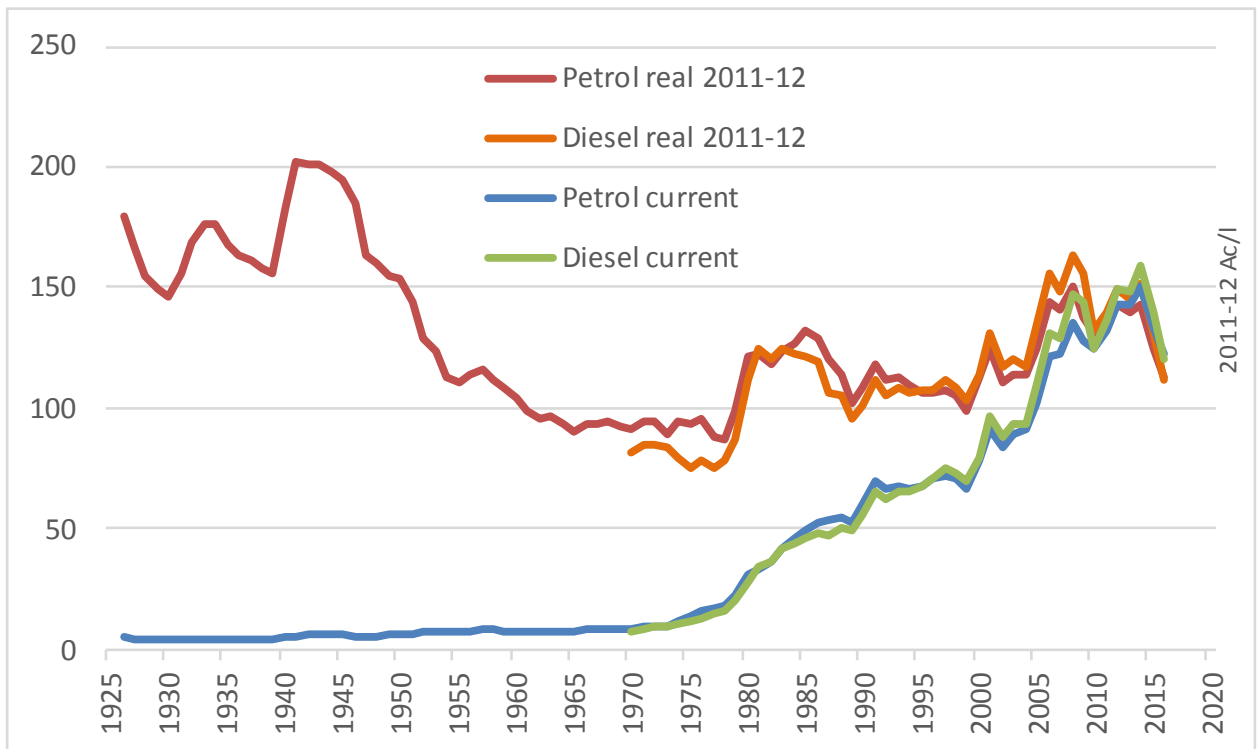
### At a Glance

This Information Sheet presents estimates of petrol and diesel prices in Australia from 1925-26 to the present. Then a relationship is derived, linking Australian fuel prices to international oil prices over the same period. The result is a basic one-to-one link at the wharf between world oil prices and Australian fuel prices.

### Past Retail Petrol and Diesel Prices in Australia

Using a variety of sources, time-series estimates of financial year petrol prices from 1925-26 and diesel prices from 1969-70 have been assembled. Figure 1 shows the real value and current value series.

Figure 1 Petrol and diesel prices (current and real value series)



The highest real prices of fuel (petrol) were in the pre-1960s, when the costs of shipping oil to Australia were much higher (i.e. prior to the introduction of large bulk carriers).

## Petrol: World oil price to Wharf price to Retail pump price

The first step in understanding how Australian fuel prices are determined is to link the overseas price of crude oil (in US\$/barrel) to a 'wharf' price (in Ac/l).

Then a second 'wharf' price is calculated working backwards from the retail pump price.

Finally, a regression of the overseas-derived wharf price on the domestic-derived wharf price allows both prediction and forecast of the domestic wharf price from the overseas oil price. And when the retail-to-wharf calculation is reversed, a prediction/forecast of the Australian retail price from the overseas oil price is possible. The following discussion illustrates the process for the Australian petrol price.

The first step (world oil price to Australian wharf price) is calculated as follows:

$$\text{Oil price (US\$/barrel) + transport cost fuel (US\$/barrel) + transport cost non-fuel (US\$/barrel) = price off-shore (US\$/barrel) * exchange rate = wharf price (A\$/barrel) * 0.613 = wharf-from-oil price (Ac/l)}$$

For the year 2015-16, that calculation was as follows:

$$43.26 \text{ (Brent US\$/barrel) + 0.60 (US\$/barrel) + 4.09 (US\$/barrel) = 47.94 (US\$/barrel) * 1.375 (\$/A/US\$) = 65.9 (\$/barrel) * 0.613 = 40.41 (Ac/l)}$$

The second step (retail pump price back to wharf) is calculated as follows for petrol (all in Ac/l):

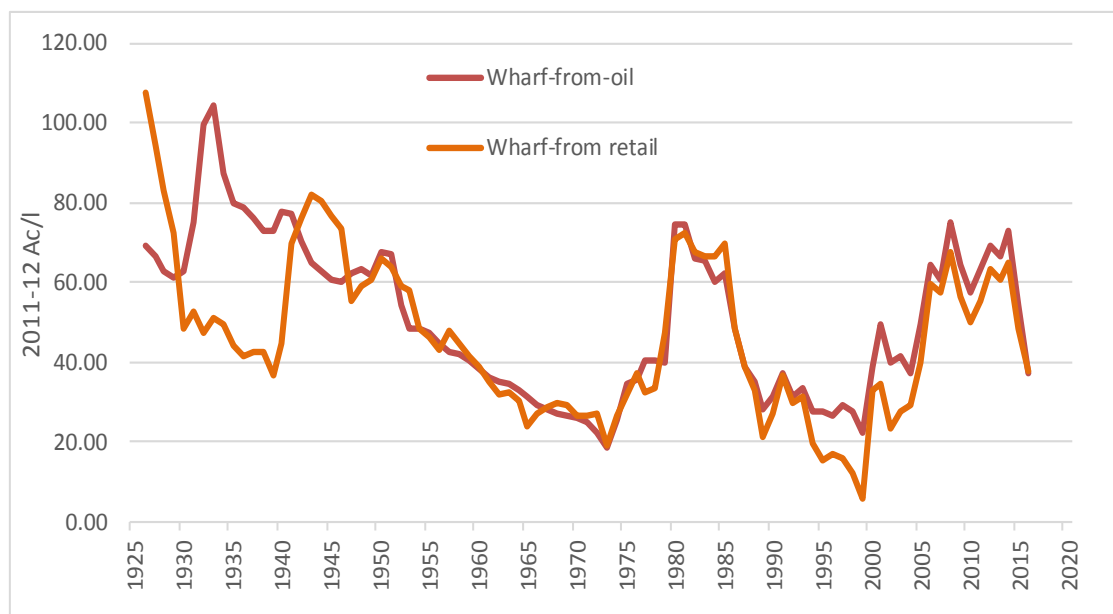
$$\text{Retail petrol price} - \text{excise} - \text{state taxes} - \text{GST} - \text{retail margin} - \text{wholesale margin} - \text{distribution cost} - \text{refining cost} = \text{wharf-from-retail price (Ac/l)}$$

For the year 2015-16, that calculation was as follows:

$$122.73 - 39.03 - 0.00 - 11.16 - 10.72 - 7.80 - 6.28 - 6.69 = 41.05 (Ac/l)}$$

Dividing the two series so produced by the Consumer Price Index, gives the two wharf real petrol price series shown in Figure 2.

Figure 2 'Wharf-from-oil' and 'wharf-from retail' real petrol prices (2011-12 Ac/l)



The fit looks one to one except for four periods:

1. The 1920s
2. The depression period
3. The second world war period, and
4. The period from the mid-90s to 2015.

Using dummy variables for these periods, the following regression equation was estimated.

Table I 'Wharf-from-retail' petrol price prediction equation

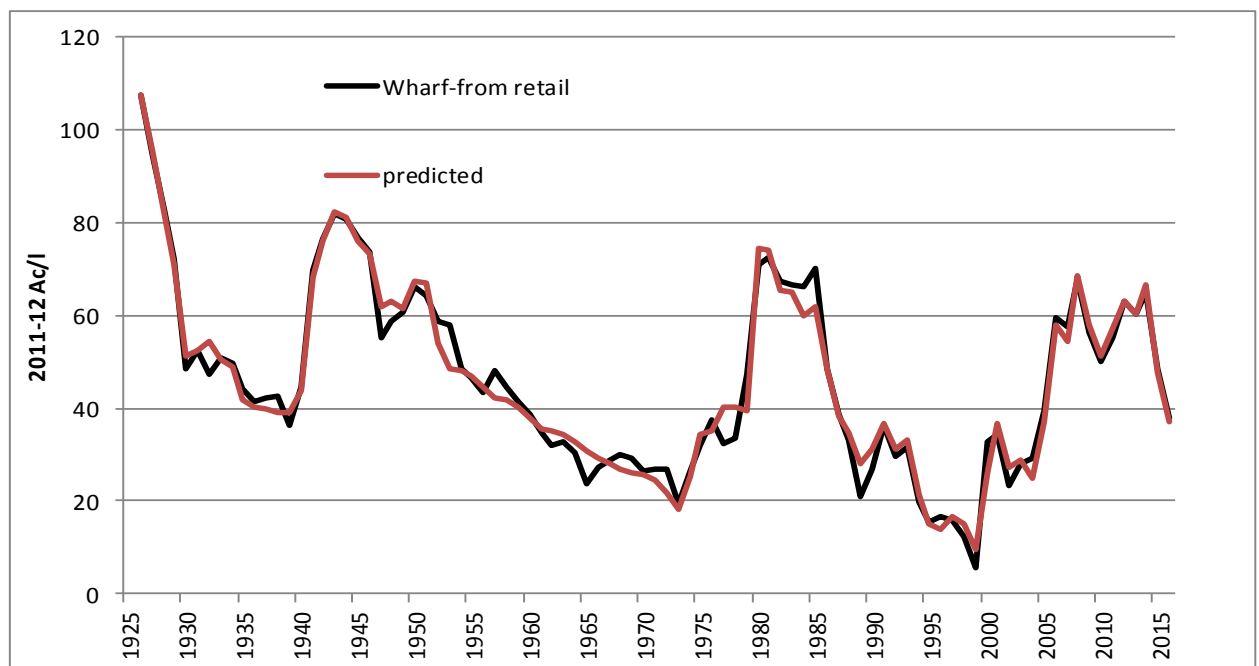
Regression Statistics	
Multiple R	0.985929
R Square	0.972056
Adjusted R Square	0.970412
Standard Error	3.415758
Observations	91

ANOVA					
	df	SS	MS	F	Significance F
Regression	5	34498.35	6899.671	591.363	1.94E-64
Residual	85	991.7293	11.6674		
Total	90	35490.08			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.26826	1.228101	-0.21843	0.827615	-2.71005	2.173537
wharf-from-oil price	1.00008	0.025053	39.91818	7.74E-57	0.950268	1.049893
dumles29	9.667646	0.666643	14.50198	1.05E-24	8.342181	10.99311
dum9415	-12.2051	1.080758	-11.2931	1.34E-18	-14.3539	-10.0563
dumDepr	-44.8304	1.802678	-24.8688	9.04E-41	-48.4146	-41.2462
dumWar	15.51372	1.70965	9.074206	3.82E-14	12.11448	18.91296

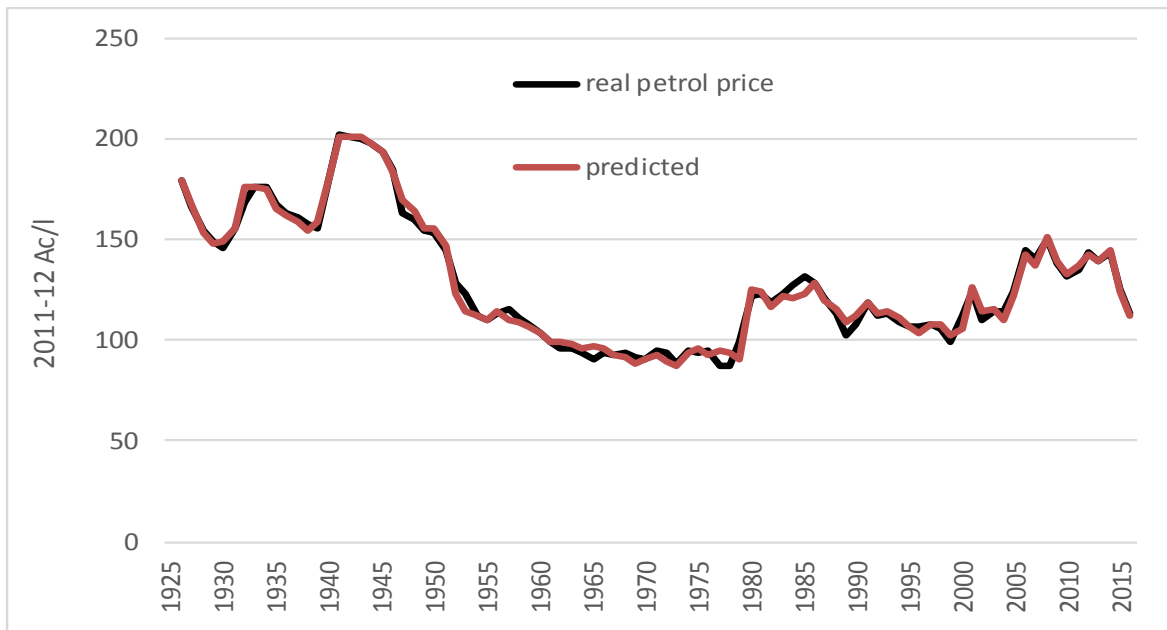
The fit of actual to predicted is very close (see Figure 3), based on a coefficient of 1.0 for the wharf-from-oil, wharf-from-retail link. When forecasting, only the highlighted coefficients in Table I are relevant.

Figure 3 Australian real 'wharf-from-retail' petrol price and prediction



Adding back in the wharf to retail cost elements (refining, margins, taxes) one gets the following prediction of the real retail price of petrol in Australia, derived from the world oil price (West Texas Intermediate to 1998 and Brent thereafter).

Figure 4 Australian real retail petrol price and prediction



## Diesel: World oil price to Wharf price to Retail pump price

The process of linking world oil prices to the Australian diesel price is identical to the process for petrol.

The first step in understanding how Australian diesel prices are determined is to link the overseas price of crude oil (in US\$/barrel) to a 'wharf' price (in Ac/l). Then a second 'wharf' price is calculated working backwards from the retail pump price of diesel.

Finally, a regression of the overseas-derived wharf price on the domestic-derived wharf price allows both prediction and forecast of the domestic wharf price from the overseas oil price. And when the retail-to-wharf calculation is reversed, a prediction/forecast of the Australian retail price from the overseas oil price is possible. The following discussion illustrates the process for the Australian diesel price.

The first step (world oil price to Australian wharf price) is calculated as follows:

$$\text{Oil price (US\$/barrel)} + \text{transport cost fuel (US\$/barrel)} + \text{transport cost non-fuel (US\$/barrel)} = \\ \text{price off-shore (US\$/barrel)} * \text{exchange rate} = \text{wharf price (A\$/barrel)} * 0.613 = \text{wharf-from-oil price (Ac/l)}$$

For the year 2015-16, that calculation was as follows:

$$43.26 \text{ (Brent US\$/barrel)} + 0.60 \text{ (US\$/barrel)} + 4.09 \text{ (US\$/barrel)} = \\ 47.94 \text{ (US\$/barrel)} * 1.375 \text{ (\$/A/US\$)} = 65.9 \text{ (\$/barrel)} * 0.613 = 40.41 \text{ (Ac/l)}$$

The second step (retail pump price back to wharf) is calculated as follows for diesel (all in Ac/l):

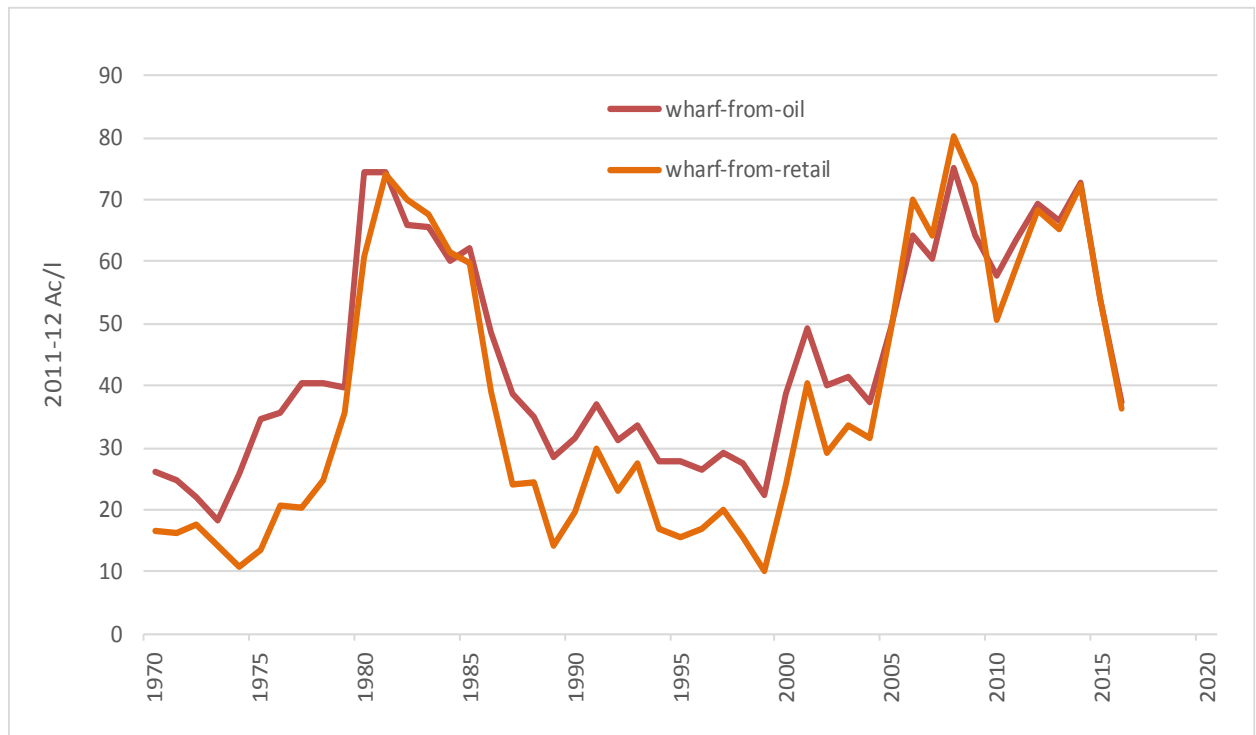
$$\text{Retail diesel price} - \text{excise} - \text{state taxes} - \text{GST} - \text{retail margin} - \text{wholesale margin} - \text{distribution cost} \\ - \text{refining cost} = \text{wharf-from-retail price (Ac/l)}$$

For the year 2015-16, that calculation was as follows:

$$120.56 - 39.03 - 0.00 - 10.85 - 10.72 - 7.80 - 6.28 \\ - 6.69 = 39.18 \text{ (Ac/l)}$$

Dividing the two series so produced by the Consumer Price Index, gives the two wharf real diesel price series shown in Figure 5.

Figure 5 'Wharf-from-oil' and 'wharf-from retail' real diesel prices (2011-12 Ac/l)



The fit looks one to one except for periods of switching higher or lower (perhaps due to sudden changes in margins or switches in fuel sourcing not taken into account in the calculation). Using dummy variables for these periods, the following regression equation was estimated.

Table 2 'Wharf-from-retail' diesel price prediction equation

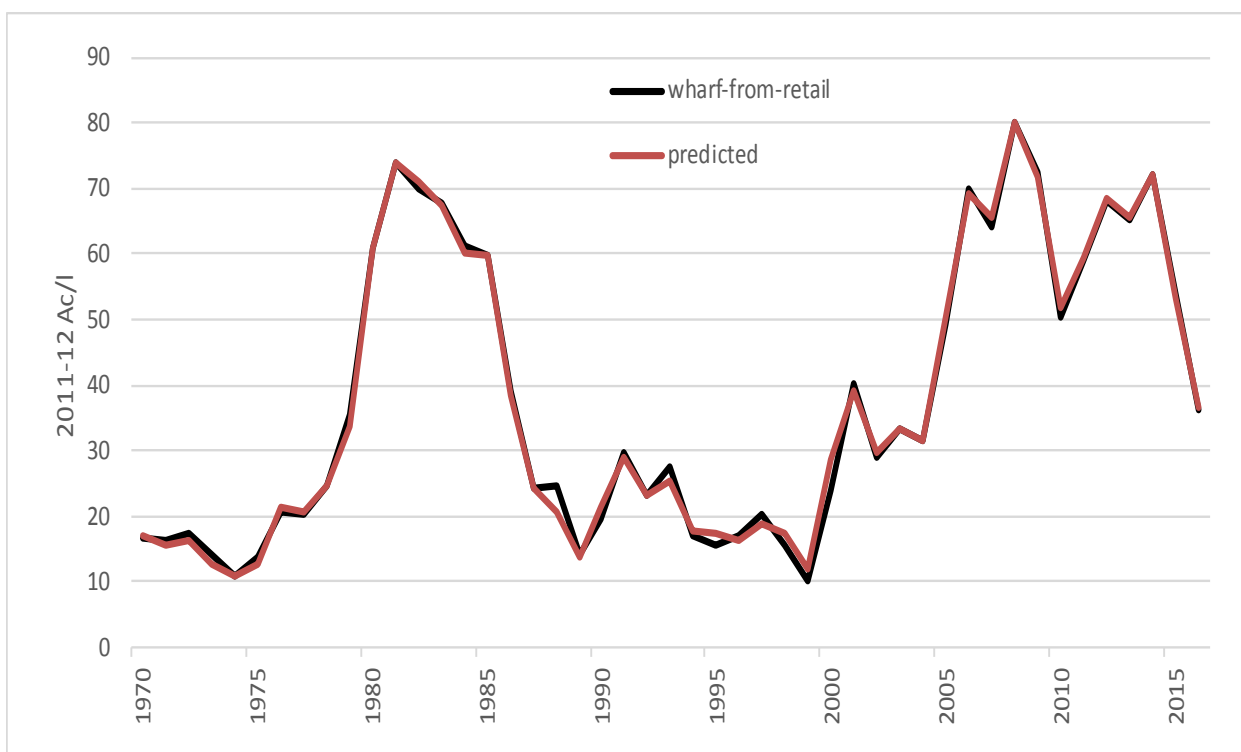
Regression Statistics	
Multiple R	0.998283925
R Square	0.996570794
Adjusted R Square	0.995848856
Standard Error	1.420153695
Observations	47

ANOVA					
	df	SS	MS	F	Significance F
Regression	8	22272.49746	2784.062183	1380.410439	2.24878E-44
Residual	38	76.63978767	2.016836518		
Total	46	22349.13725			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-5.870083136	0.963699076	-6.091199299	4.26809E-07	-7.820989922	-3.919176351
landed oil price	0.999558238	0.022265144	44.89341033	1.55547E-34	0.954484811	1.044631665
dum7478	-16.28694748	1.06946827	-15.22901422	9.17723E-18	-18.45197281	-14.12192216
dum8603	-8.588056113	0.942560981	-9.11140636	4.24567E-11	-10.49617106	-6.679941165
dum0509	13.40466772	1.20793546	11.09717213	1.74966E-13	10.95933023	15.85000522
dum8185	10.97834447	1.465251453	7.492464482	5.35562E-09	8.01209798	13.94459096
dum11on	5.054845524	0.944936188	5.349404108	4.43739E-06	3.141922221	6.967768828
dum80	-7.936674492	1.700416042	-4.667489778	3.72981E-05	-11.3789868	-4.494362181
dum7071	-3.278726175	1.139586508	-2.877119159	0.006549119	-5.585698451	-0.971753899

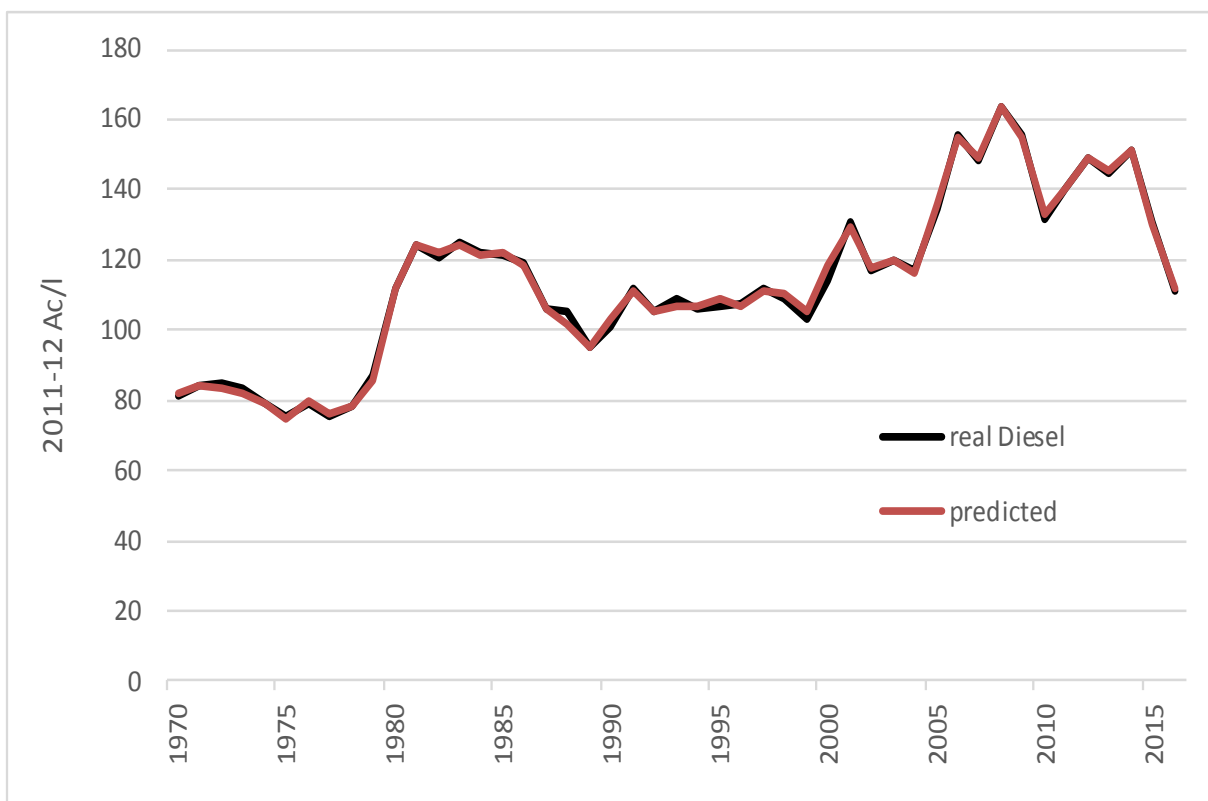
The fit of actual to predicted is very close (see Figure 6), based on a coefficient of 1.0 for the wharf-from-oil, wharf-from-retail link. When forecasting, only the highlighted coefficients in Table 2 are relevant.

Figure 6 Australian real 'wharf-from-retail' diesel price and prediction



Adding back in the wharf to retail cost elements (refining, margins, taxes) one gets the following prediction/forecast of the real retail price of diesel in Australia, derived from the actual/assumed world oil price (West Texas Intermediate to 1998 and Brent thereafter).

Figure 7 Australian real retail diesel price and prediction



## Conclusions

Looking back over the previous 90 years, the highest real prices of fuel (petrol) were in the pre-1960s, when the costs of shipping oil to Australia were much higher (i.e. prior to the introduction of large bulk carriers).

The two latest periods of high Australian real fuel prices (1980 to 1985 and 2007 to 2013) are linked to high world oil prices.

The modelling presented here shows that for both petrol and diesel prices, there is a direct one-to-one link at the wharf with world oil prices, except for periods of switching higher or lower. But as these switches are relatively rare, the models provide a good guide to likely Australian fuel prices given world oil prices and the Australian exchange rate.

## References

- ABS (2005) *Australian Consumer Price Index: Concepts, Sources and Methods*, Cat. No. 6461.0. Canberra, ACT.
- ABS (2007) *Average Retail Prices of Selected Items, Eight Capital Cities*, Cat. No. 6408.0, Canberra, ACT.
- Australian Institute of Petroleum, Petroleum Information Bureau (1973) *List of Prices of Petrol, Australian Capital Cities, 1945-73*.
- Donnelly, W.A. (1981) *The Demand for Petrol in Australia*, CRES Working Paper R/WP-61, Centre for Resource and Environmental Studies, ANU, Canberra.
- NRMA *Black and White Data Book*, Sydney.
- Reserve Bank of Australia (1991) *Australian Economic Statistics 1949-50 to 1989-90*, Sydney, Australia.
- Vamplex, W. (1987) *Australian Historical Statistics*, Sydney, NSW.

Table A.I Data

FY	Fuel Prices (nominal)										A c/l	A c/l	2011-12	US\$/bar	US\$/bar	US\$/bar	US\$/bar	\$/A/US\$	A\$/bar	A c/l	
	A c/l	A c/l	A c/l	A c/l	A c/l	A c/l	A c/l	A c/l	A c/l	A c/l											petrol
	petrol	diesel	Federal	State	petrol	diesel	retail	wholesale	distribution	refining	from-retail	from-retail		CPI	Brent	fuel	nonfuel	offshore	Rate	on wharf	from-oil
1926	5.00		0.00	0.00	0.00		0.27	0.20	0.16	1.38	2.98			2.78	1.78	0.87	5.01	7.66	0.41	3.13	1.92
1927	4.65		0.00	0.00	0.00		0.28	0.20	0.16	1.37	2.64			2.79	1.59	0.86	4.92	7.37	0.41	3.04	1.86
1928	4.30		0.00	0.00	0.00		0.27	0.20	0.16	1.36	2.30			2.78	1.24	0.84	4.83	6.91	0.41	2.85	1.75
1929	4.20		0.18	0.00	0.00		0.28	0.20	0.16	1.35	2.03			2.81	1.22	0.83	4.74	6.78	0.41	2.81	1.73
1930	4.05		0.73	0.00	0.00		0.27	0.20	0.16	1.34	1.34			2.78	1.23	0.81	4.65	6.69	0.43	2.85	1.75
1931	4.00		0.73	0.00	0.00		0.25	0.19	0.15	1.34	1.35			2.57	0.92	0.79	4.56	6.27	0.50	3.15	1.93
1932	4.00		1.01	0.00	0.00		0.23	0.17	0.14	1.33	1.12			2.37	0.76	0.78	4.47	6.00	0.64	3.85	2.36
1933	4.00		1.01	0.00	0.00		0.22	0.16	0.13	1.32	1.15			2.26	0.77	0.76	4.38	5.91	0.65	3.86	2.37
1934	3.95		1.01	0.00	0.00		0.22	0.16	0.13	1.31	1.12			2.25	0.84	0.75	4.29	5.87	0.55	3.20	1.96
1935	3.85		1.01	0.00	0.00		0.23	0.17	0.13	1.30	1.01			2.29	0.99	0.73	4.19	5.91	0.51	2.99	1.84
1936	3.80		1.01	0.00	0.00		0.23	0.17	0.13	1.29	0.97			2.32	1.03	0.71	4.10	5.85	0.51	2.98	1.83
1937	3.85		1.01	0.00	0.00		0.24	0.17	0.14	1.28	1.01			2.39	1.14	0.70	4.01	5.85	0.51	2.96	1.81
1938	3.90		1.01	0.00	0.00		0.24	0.18	0.14	1.27	1.05			2.47	1.16	0.68	3.92	5.76	0.51	2.94	1.80
1939	3.95		1.19	0.00	0.00		0.25	0.18	0.15	1.26	0.92			2.53	1.08	0.67	3.83	5.57	0.54	3.01	1.84
1940	4.75		1.74	0.00	0.00		0.26	0.19	0.15	1.25	1.16			2.61	1.02	0.65	3.74	5.41	0.61	3.31	2.03
1941	5.50		1.74	0.00	0.00		0.27	0.20	0.16	1.24	1.90			2.71	1.08	0.64	3.65	5.37	0.64	3.43	2.10
1942	5.85		1.74	0.00	0.00		0.29	0.21	0.17	1.23	2.21			2.90	1.17	0.62	3.56	5.34	0.62	3.33	2.04
1943	6.20		1.74	0.00	0.00		0.31	0.22	0.18	1.22	2.53			3.09	1.20	0.60	3.47	5.27	0.62	3.27	2.01
1944	6.20		1.74	0.00	0.00		0.31	0.23	0.18	1.21	2.53			3.14	1.21	0.59	3.38	5.17	0.62	3.20	1.96
1945	6.06		1.74	0.00	0.00		0.31	0.22	0.18	1.21	2.40			3.12	1.13	0.57	3.29	4.99	0.62	3.10	1.90
1946	5.77		1.56	0.00	0.00		0.31	0.23	0.18	1.20	2.30			3.13	1.20	0.56	3.20	4.96	0.62	3.08	1.89
1947	5.27		1.56	0.00	0.00		0.32	0.23	0.19	1.19	1.79			3.23	1.62	0.54	3.11	5.27	0.62	3.28	2.01
1948	5.59		1.56	0.00	0.00		0.35	0.25	0.20	1.18	2.06			3.49	2.25	0.53	3.02	5.79	0.62	3.60	2.21
1949	5.96		1.56	0.00	0.00		0.38	0.28	0.22	1.17	2.34			3.85	2.57	0.51	2.92	6.00	0.65	3.88	2.38
1950	6.43		1.56	0.00	0.00		0.41	0.30	0.24	1.16	2.76			4.18	2.57	0.49	2.83	5.90	0.78	4.61	2.83
1951	6.82		1.56	0.00	0.00		0.47	0.34	0.27	1.15	3.03			4.73	2.57	0.48	2.74	5.79	0.89	5.17	3.17
1952	7.40		1.56	0.00	0.00		0.57	0.41	0.33	1.14	3.38			5.75	2.57	0.46	2.65	5.68	0.89	5.08	3.11
1953	7.78		1.56	0.00	0.00		0.62	0.45	0.37	1.13	3.64			6.30	2.59	0.45	2.56	5.60	0.89	5.00	3.06
1954	7.31		1.56	0.00	0.00		0.64	0.47	0.38	1.12	3.14			6.48	2.82	0.43	2.47	5.72	0.89	5.11	3.13
1955	7.20		1.56	0.00	0.00		0.65	0.47	0.38	1.11	3.03			6.53	2.82	0.41	2.38	5.62	0.89	5.01	3.07
1956	7.68		2.11	0.00	0.00		0.67	0.49	0.39	1.10	2.92			6.75	2.82	0.40	2.29	5.51	0.89	4.92	3.01
1957	8.26		2.11	0.00	0.00		0.71	0.51	0.41	1.09	3.43			7.13	2.92	0.38	2.20	5.51	0.89	4.92	3.01
1958	8.05		2.11	0.00	0.00		0.71	0.52	0.42	1.08	3.20			7.20	3.06	0.37	2.11	5.54	0.89	4.95	3.03
1959	7.87		2.11	0.00	0.00		0.72	0.52	0.42	1.08	3.01			7.28	3.01	0.35	2.02	5.38	0.89	4.81	2.95
1960	7.79		2.11	0.00	0.00		0.74	0.54	0.44	1.07	2.90			7.50	2.97	0.34	1.93	5.23	0.89	4.67	2.86
1961	7.72		2.16	0.00	0.00		0.77	0.56	0.45	1.06	2.72			7.80	2.97	0.32	1.84	5.13	0.89	4.58	2.81
1962	7.48		2.16	0.00	0.00		0.77	0.56	0.45	1.05	2.49			7.80	2.97	0.30	1.75	5.02	0.89	4.48	2.75
1963	7.53		2.16	0.00	0.00		0.77	0.56	0.45	1.04	2.55			7.80	2.97	0.29	1.66	4.91	0.89	4.39	2.69
1964	7.43		2.16	0.00	0.00		0.79	0.57	0.46	1.03	2.42			7.95	2.97	0.27	1.56	4.81	0.89	4.29	2.63
1965	7.41		2.55	0.00	0.00		0.81	0.59	0.48	1.02	1.96			8.20	2.92	0.26	1.47	4.65	0.90	4.16	2.55
1966	7.99		2.71	0.00	0.00		0.84	0.61	0.49	1.01	2.32			8.53	2.92	0.24	1.38	4.54	0.90	4.08	2.50
1967	8.17		2.64	0.00	0.00		0.87	0.63	0.51	1.00	2.52			8.75	2.97	0.23	1.29	4.49	0.90	4.04	2.47
1968	8.52		2.75	0.00	0.00		0.90	0.65	0.52	0.99	2.70			9.05	3.06	0.21	1.20	4.48	0.90	4.02	2.47
1969	8.56		2.72	0.00	0.00		0.92	0.67	0.54	0.98	2.73			9.30	3.16	0.19	1.11	4.46	0.90	4.01	2.46
1970	8.73	7.78	3.04	0.00	0.00	0.00	0.95	0.69	0.56	0.97	2.52	1.58	9.58	3.35	0.18	1.02	4.55	0.90	4.07	2.50	
1971	9.53	8.47	3.59	0.00	0.00	0.00	0.99	0.72	0.58	0.96	2.68	1.62	10.03	3.46	0.16	0.93	4.55	0.89	4.06	2.49	
1972	10.10	9.09	3.81	0.00	0.00	0.00	1.06	0.77	0.62	0.95	2.88	1.87	10.73	3.56	0.15	0.84	4.54	0.85	3.87	2.37	
1973	10.10	9.52	4.36	0.00	0.00	0.00	1.13	0.82	0.66	0.95	2.19	1.61	11.38	3.56	0.13	0.75	4.44	0.77	3.42	2.09	
1974	12.18	10.18	4.91	0.00	0.00	0.00	1.27	0.92	0.74	0.94	3.40	1.40	12.83	7.15	0.11	0.66	7.92	0.68	5.37	3.29	
1975	14.05	11.30	4.91	0.00	0.00	0.00	1.49	1.08	0.87	0.93	4.78	2.03	15.00	10.90	0.10	0.57	11.56	0.74	8.51	5.22	
1976	16.15	13.32	4.91	0.00	0.00	0.00	1.68	1.22	0.98	1.05	6.31	3.49	16.93	11.56	0.12	0.64	12.32	0.80	9.80	6.01	
1977	16.90	14.52	5.03	0.00	0.00	0.00	1.91	1.39	1.12	1.19	6.27	3.89	19.25	13.61	0.13	0.73	14.47	0.88	12.71	7.79	
1978	18.38	16.49	5.16	0.00	0.00	0.00	2.09	1.52	1.23	1.31	7.07	5.19	21.13	14.77	0.15	0.80	15.72	0.89	13.91	8.53	
1979	22.58	19.89	5.16	0.00	0.00	0.00	2.26	1.64	1.32	1.41	10.78	8.10	22.83	15.73	0.21	0.86	16.80	0.88	14.77	9.05	
1980	30.61	28.07	5.16	0.30	0.00	0.00	2.49	1.81	1.46	1.56	17.83	15.29	25.18	32.94	0.29	0.95	34.18	0.90	30.63	18.78	
1981	33.75	34.17	5.16	0.64	0.00	0.00	2.72	1.98	1.60	1.70	19.95	20.38	27.50	37.38	0.35	1.04	38.76	0.86	33.37	20.46	
1982	35.95	36.72	5.66	0.94	0.00	0.00	3.01	2.19	1.76	1.88	20.51	21.29	30.38	34.36	0.35	1.15	35.86	0.91	32.60	19.99	
1983	41.90	42.25	7.55	1.95	0.00	0.00	3.35	2.44	1.96	2.09	22.55	22.90	33.88	32.16	0.32	1.28	33.76	1.07	36.17	22.17	
1984	46.08	44.28	9.39	2.15	0.00	0.00	3.58	2.64	2.10	2.24	24.01	22.21	36.20	30.49	0.30	1.37	32.16	1.10	35.53	21.78	
1985	49.72	45.84	9.82	2.50	0.00	0.00	3.74	2.72	2.19	2.33	26.42	22.54	37.75	27.86	0.27	1.43	29.55	1.30	38.31	23.48	
1986	52.57	48.70	17.72	3.07	0.00	0.00	4.05	2.95	2.37	2.53	19.88	16.01	40.93	21.16	0.22	1.55	22.92	1.42	32.49	19.92	
1987	53.92	47.39	19.88	3.71	0.00	0.00	4.43	3.22	2.59	2.76	17.32	10.79	44.73	16.87	0.19	1.69	18.74	1.51	28.22	17.30	
1988	54.73	50.59	21.06	3.83	0.00	0.00	4.75														





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ISSN 1440-9593

ISBN 978-1-925401-98-1

INFRA 3068

December 2016

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This publication should be attributed in the following way; Bureau of Infrastructure, Transport and Regional Economics (BITRE), **Petrol Prices and Diesel Prices in Australia** BITRE, Canberra.

### *Acknowledgement*

This Information Sheet was prepared by Dr. David Gargett.

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