Predicting the Value of Public Transport In-Vehicle Time

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Abstract

The value of in-vehicle time is an important parameter in transport demand modelling. It is used in generalised cost equations to forecast patronage and is used to convert travel times into dollars in economic evaluations to enable project benefits to be compared with project costs.

This paper looks at the values of time that have been estimated for Australia, mainly NSW and New Zealand over a twenty-two year period 1990-2012. Twenty eight studies dating back to 1990 were reviewed that provided over 80 values of time covering bus, rail, light rail and ferry. All but two studies used Stated Preference market research to estimate values; the remaining two studies using Household Travel data.

The study looks at the estimated values of time and correlates the trends with the consumer price index, GDP, GDP per capita and wage indices.

The difference between the NSW and NZ values is assessed using exchange rates, purchasing power parity factors and the Big Mac Index. All the evidence points to an underestimation in the NZ value of time and a need to re-position the value and update it at a rate greater than the CPI.

Some observations are made about the relative merits of using Willingness to Pay values of time versus a single 'equity' value in economic evaluations and demand forecasts.

Keywords: Value of Time, Evaluation, Demand forecasting, Stated Preference, Time Saving, Fast Food, Big Mac Burgers.

1. Introduction

The value of in-vehicle time is an important parameter in transport demand modelling. It is used in generalised cost equations to forecast patronage and is used to convert travel times into dollars in economic evaluations to enable project benefits to be compared with project costs.

This paper looks at the values of time that have been estimated for bus, rail and ferry travel in Australia (primarily NSW) and for New Zealand over a two decade period. Twenty eight studies dating back to 1990 that provide just over 80 values of time for bus, rail, light rail and ferry are reviewed in Section 2.

A simple regression model is fitted in section 3 that uses hourly GDP per person to explain the estimated values of time for NZ and NSW whilst keeping both the two 'sets' in their 'local' currencies. Then in Section 4, alternative economic indices are compared in their ability to track the two 'value of time' functions.

Section 5 introduces exchange rates to convert the NZ values into Australian dollars. Rather than close the gap, the exchange rate widens the difference. Purchasing power parity indices, a Big Mac Index and GDP per capita at international prices are then assessed in terms of their ability to 'narrow the gap'. Although some of the difference can be explained in terms of income differences, the evidence points to a significant underestimation of the NZ valuation.

Section 6 makes some comments on the use of 'Willingness to Pay' survey based values of time in demand forecasts and economic evaluations. Section 7 draws together the main findings of the study.

2. Studies Reviewed

A total of 28 studies were reviewed that provided 81 values of time for bus, rail and ferry. A tabular summary of the studies and values is presented in Appendix A (which includes a label pointing to the reference list). The studies straddle more than two decades: the first study was in 1990 and the last in 2013.[1] However, the bulk of the studies were undertaken between 1995 and 2005.

Twenty-four studies were Australian, mostly undertaken in NSW, with some studies in Brisbane and one in Canberra. Four studies were undertaken in NZ which provided seven values of time.

The studies provided values of time for bus, rail, light rail and ferry. Some values for travelling by car were provided but these values were omitted from the data-set. To emphasis this omission, the review uses the term Public Transport Value of Time or PTVoT.

The studies cover peak, off-peak and 'all day' travel. Some studies produced estimates by trip purpose rather than peak/off-peak values and where this was done, commuting to work or education trips were considered as 'peak' and non commuting trips as off-peak with overall estimates treated as 50% peak and 50% off-peak.

[1] In later sections, the time period is reduced to twenty years: 1992-2012 for easier commentary and analysis.

Most of the surveys were undertaken as part of patronage forecasting exercises. Other studies were undertaken as part of building demand models or estimating parameters for economic evaluations.

Some studies only interviewed users of the travel mode but some studies also surveyed car, walk/cycle and other non PT users.

All but two of the studies used Stated Preference (SP) market research. SP surveys present respondents with a series of pair-wise choices in which travel times, fares and other service levels are varied. The 26 studies covered four types of journey choice: (a) same mode choices such as bus versus bus; (b) public transport choices such as bus versus rail; (c) public transport versus car choices; or as in a few instances (d) walking/cycling versus bus/rail.

Generally, those SP studies that presented 'same mode' choices (e.g. bus v bus) produced less variable estimators (a lower standard error in relation to the mean estimate) than studies that presented 'different mode' choices (e.g. bus v car). The probable reason is that 'same mode' choices focus attention on the trade-off of time versus cost and are less prone to respondents consistently choosing one alternative (for example car over bus) irrespective of the fares and times shown for bus.

The two non-SP studies were analyses of Household Travel data commissioned by the Transport and Data Centre of NSW (which became the Bureau of Transport Statistics NSW) to develop a travel model for Sydney, Hague (2001) and Fox (2010). The lack of similar Revealed Preference (RP) studies reflects the statistical problems typically encountered; the two main problems being insufficient variation in time/cost in time-series data and a correlation in times and costs for cross-sectional data.

The review did undertake some analysis to see whether the value of time varied according to the type of data (SP and RP), transport mode (e.g. bus or rail) and (iii) respondent (e.g. rail or car user). None of the segmentations produced differences that were statistically significant at the 95% confidence level, Douglas Economics (2013).

To take account of the relative accuracy of the 81 different estimates, the ratio of the standard error to the mean estimate (|t| value) was used as a weighting factor.

3. Trend in the Value of Time

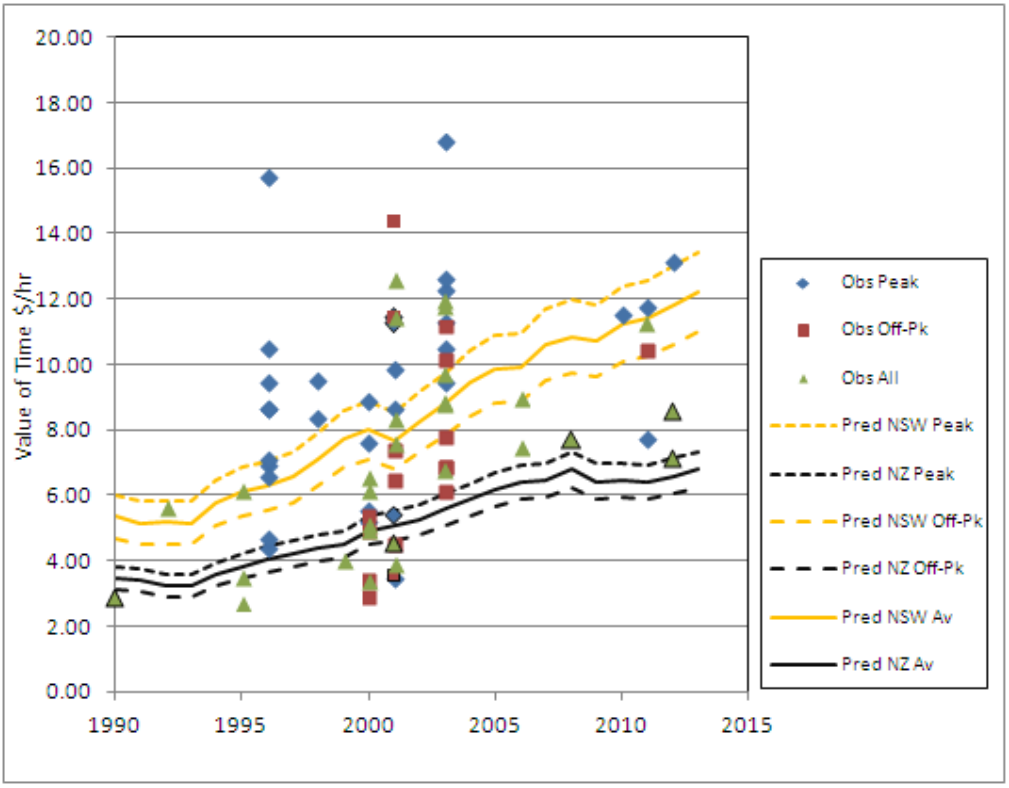
Figure 1 plots the estimated PT values of time (PTVoT). Peak, off-peak and 'all' estimates are distinguished by different symbols with NZ observations outlined in black.

The values of time are in nominal dollars (i.e. in 'local' Australian and NZ dollars). Only in section 5 are exchange rates introduced to convert the NZ values into Australian dollars.

The values are expressed in market prices inclusive of indirect taxation i.e. Goods and Service Taxation (GST) levied at the time of estimation. Before 2000, there was no GST in Australia. Since 2000, a 10% GST has been levied on public transport fares. In NZ, GST was set at 12.5% until 2010 when it was raised to 15%.

Three prediction lines are shown for Australia and NZ: peak (the highest value); average and off-peak (the lowest value). The predictions were forecast on the basis of GDP per capita which produced the best fit. Alternative models using (i) a time trend and (ii) consumer price index (CPI) were tried but gave a worse fit.

Figure 1: Trend in the Value of Time



ABS Gross State Product (GSP) and population figures for NSW were used to calculate a per capita figure which was then divided by 2,000 working hours based on UK/USA assumptions to calculate an hourly figure. A similar approach was used for NZ.

Rather than modelling the absolute value of time, the model fitted the ratio of the value of travel time over hourly GDP per person (GDPPH). To allow for different relationships by time period and country, 'dummy variables' were introduced.

The functional form was semi logarithmic allowing the value of time to increase with GDPPH albeit at a declining rate. Equation 1 shows the model and equation 2 the estimated coefficients with standard errors (se) in parenthesis.

$$\frac{PTVoT}{GDPPH} = -\alpha + (\beta_{GDPP} + \beta_{NZ} NZ + \beta_{PK}) \ln GDPPH \qquad .....(1)$$

$$\frac{PTVoT}{GDPPH} = -0.577 + (0.276 + 0.063NZ + 0.024Pk) \ln GDPPH \qquad .....(2)$$

$$\qquad\qquad (0.401) \quad (0.126) \quad (.028) \qquad (0.011)$$

All the estimated GDPPH related coefficients were significant at the 95% confidence level with t values exceeding 2 (β/se). The positioning parameter (alpha) was not significantly different from zero (t = 1.4) however.

The fitted model parameters imply that the value of time (PTVoT) increased over the 23 year period at a rate faster than GDPPH. In other words, people were willing to pay proportionately higher fares to save time as their income rose; an effect measured by the coefficient of 0.276 for β_{GDPP}.

NZ was estimated to be more responsive per dollar of nominal 'domestic' GDPP than Australia which is reflected in the β_{NZ} parameter of 0.063.

Finally, the value of time for peak travel (primarily commuters) was estimated to be more responsive to GDPPH than off-peak travel, with responsiveness measured by the β_{PK} parameter of 0.024.

Hourly GDPP in 1990 was $11.85/hr in NZ and $19.34/hr in NSW. NZ GDPP was therefore 61% that of NSW (in local dollars).

The earliest study estimate was $2.87/hr for rail travel in Wellington, SDG (1990). The value of time was a quarter of GDPPH. The earliest NSW value was $5.61/hr for Sydney rail travel in 1992 estimated by SDG (1992); this estimate was 30% of GDPPH.

By 2012, GDPP had risen to 16.30/hr in NZ and to $29.60/hr in NSW whereas the value of time had risen to $7.75/hr in a Wellington study of mainly off-peak rail users by Douglas Economics (2013) and to just over $13/hr in a study of Sydney rail and bus users by Douglas and Jones (2013).

By way of comparison, the Australian Transport Council (ATC) Guidelines recommended a value of time of $10/hr for bus and rail travel in 2006 (peak $10.80/hr and off-peak $9.20/hr), ATC (2006). As can be seen from Figure 1, the NSW value for 2006 was very close to $10/hr.

In 2013, Transport for NSW (TfNSW) recommended a 'harmonised' value of private travel time for road and public transport investment' of $13.76/hr for car and public transport onboard time, TfNSW (2013). This value is 16.5% higher than the value of $11.80/hr predicted using equation 2 for 2012. Section 6 discusses the TfNSW value in more detail.

For NZ, the values of time for bus and rail travel in the Economic Evaluation Manual (EEM) are based on a Stated Preference survey undertaken in 2001 by SDG in 2002, Beca (2002). The values (after removal of GST) have been updated by NZTA using the consumer price index (CPI). For 2012, the peak value was $6.44/hr (based on commuting trips) with an off-peak value of $4.18/hr (based on 'other' trips) and an all day average of $5.31/hr (adopting a 50% peak weighting). By comparison, equation 2 estimates higher values for 2012 of $7.10/hr for the peak, an off-peak value of $6/hr and an average value of $6.60/hr. For the 'all day' figure, the estimated value was a quarter higher than the EEM value.

Table 1 summarises the predicted values of time for 1992 and 2012. As a percentage of GDPPH, the value of time increased from 28% in 1992 to 40% in 2012. However, given the semi-logarithmic formulation the elasticity declines with GDPPH. For Australia, the peak elasticity declined from 2.08 in 1992 to 1.75 in 2012.

$$\eta = \frac{\partial VOT}{\partial GDPPH} . \frac{GDPP}{VOT} = 1 + \frac{\beta_{GDPPH} + \beta_{NZ} + \beta_{PK}}{GDPPH} \quad .....(3)$$

Figure 1 shows a spread in estimate, particularly between 1995 and 2005, when most of the studies were undertaken. The variability partly reflects peculiarities in the studies themselves most of which were undertaken as part of producing patronage forecasts.

To standardise the variability, each observation was updated to 2012. The inter-quartile range (i.e. the difference between the 75 percentile value and the 25 percentile value) was

calculated. For Australia, the inter-quartile range was $5.40/hr; 46% of the average value of $11.80/hr. The 25 percentile was $9.10/hr and the 75 percentile was $14.50/hr.

For NZ, the inter-quartile range was $2.90, 44% of the average value. It should be noted however there were only four studies providing seven values.

Table 1: Values of Time and Elasticity with respect to Hourly GDP/capita

	Australia Value of Time $/hr			NZ Value of Time $/hr			GDPP/hr $ (1)		Av VOT/GDPP/hr	
	Peak	Off-Pk	Av	Peak	Off-Pk	Av	NSW	NZ	NSW	NZ
1992	5.80	4.50	5.20	3.60	2.90	3.20	19.05	11.51	27%	28%
2012	13.00	10.60	11.80	7.10	6.00	6.60	29.63	16.31	40%	40%
Elast 1992	1.98	2.17	2.08	2.16	2.35	2.25	not applicable			
Elast 2012	1.75	1.69	1.72	1.83	1.92	1.88				

(1) Gross Domestic (State) Produce per capita calculated using 2,000 hours per year

Table 2: Estimation Range in the 2012 Value of Time (dollars per hour)

	NSW/Australia			New Zealand		
	Peak	Off-Pk	Av	Peak	Off-Pk	Av
75% Tile	14.90	13.20	14.50	8.70	7.40	8.00
Average	13.00	10.60	11.80	7.10	6.00	6.60
25% Tile	11.10	8.00	9.10	5.50	4.70	5.10
25-75% Range	3.80	5.20	5.40	3.20	2.70	2.90
Average/Range	29%	49%	46%	45%	45%	44%

4. Updating the Value of Time & Economic Indicators

Re-surveying the value of time each year would be a resource consuming exercise. A more realistic approach would be to use equation 2 (or an incremental version of equation 2) that links the updated value to the last survey estimate. Equation 4 presents the 'incremental' approach.

$$VoT_{t+1} = VoT_t \frac{FVoT_{t+1}}{FVoT_t} \quad .....(4)$$

where $FVoT$ denotes the forecast values for the most recent year (t) and forecast year (t+1).

For NZ, the predicted value for 2013 was $7.30/hr (2013F) using the incremental approach which compares with 6.72/hr (2013E) using equation 2.

Table 3: Updating the NZ Value of Time Estimates (dollars per hour)

	Value of Time $/hr (nominal)			Update Statistics			
	Peak	Off-Peak	Average	GDP ($M)	Pop	GDPP $	$ GDPP/Hr
2012	7.41	4.81	6.11	na	na	na	na
2012F	7.12	6.02	6.57	144,725	4,437,300	32,616	16.31
2013F	7.30	7.30	7.30	147,909	4,471,000	33,082	16.54
2013E	7.60	5.83	6.72	na	na	na	na

F denotes forecast, E estimate

Equation 2 parameters, GDPP/hr calculated using 2000 hours

Average value of time calculated as 50% of peak and 50% off-peak

Source: Population Statistics NZ, GDP: NZ Treasury Economic Chart Pack March 2013

The last major survey of the value of time in NZ was in 2001 by Beca et al (op cit). Since 2001, the consumer price index (CPI) has been used by NZTA to update the values. The CPI records how the price of a bundle of consumer goods and services changes over time. Statistics NZ provides a quarterly CPI index. In Australia, the Australian Bureau of Statistics (ABS) provides a range of CPI indices including an index for each capital city.

RailCorp NSW has undertaken surveys in 1992, 2004 and 2010/11 and between the survey years, the values have been updated. In the early 1990s, the average fare was used as an updating method, followed by the CPI in the late 1990s and early 2000s. During the mid 2000s, a NSW wage index was used. In 2011, a review of alternative indices recommended a composite index based on 63% of the NSW wage index and 37% of the Sydney CPI to take account of the proportion of employed (full or part-time) and non-employed (pensioners, school children, unemployed, house persons), Douglas and Karpouzis (2012).

As regards income, the ABS and Statistics NZ provide a variety of average weekly earnings (AWE) estimates (wage plus salaries). Care therefore needs to be taken in deciding which statistic to use. For Australia, AWE represents the average gross (before tax) earnings of employees derived by dividing weekly total earnings by the number of employees. Changes in the averages will result from changes in pay rates and in the composition of labour force. To convert weekly estimates to hourly, Austroads figures of 38 hours per week was used, Austroads (1997). For NZ, average hourly earnings and weekly income estimates are provided by Statistics NZ. The ratio of the two statistics gives 36.5 hours per week.

There is a debate as to whether 'before tax' or 'after tax' earnings should be used for updating purposes. Fosgerau argues that 'after tax' income should be used when tax rates progressively rise with income, Fosgerau (2005).

An alternative update statistic is Gross Domestic (or State) Product per capita (GDPP). GDPP is a ratio of two statistics: GDP and population. For NSW, GSP is calculated by allocating Australian Gross Domestic Product (GDP) to States (using an average of three approaches: income, expenditure or production).[2] Population for NZ and Australia is based on five year Censuses.

Growth in GDP affects the value of time through after-tax personal income. However for proportionality, all components of GDP (personal consumption, public consumption, investment and the balance of trade) need to grow at the same rate.

Table 4 presents the average value of public transport in-vehicle time predicted by equation 2 for NSW and NZ over the twenty year period 1992-2012. Alongside the predicted values are the economic indicators. The CPI for Sydney is presented in column 2 and the GSP per capita per hour in column 5 which was calculated by dividing GSP in column 3 by population in column 4. In column 6, the NSW Average Weekly Earnings per hour is given and in column 7, the implied 'Austroads' value of time calculated at 40% of Australian average full time average weekly earnings (/38 hours). Similar figures are provided for NZ with the addition of income per week. The earnings and income series started in 1994 for Australia and in 1997 for New Zealand. For earlier years, estimates were 'back filled' using a regression of each variable and GDPP.

[2] The income approach adds employee compensation, gross operating surplus, gross mixed income and taxes less subsidies on production and imports. The expenditure approach sums all final expenditures, changes in inventories and exports of goods and services less imports of goods and services. The production approach uses the sum of gross value added for each industry at basic prices plus taxes less subsidies on production. GDP figures are deflated for price inflation.

Table 4: Trend in Estimated Value of Time & Economic Indicators 1992-2012

	NSW / Australia							New Zealand							
Year	1 VOT $/hr	2 Syd CPI	3 GSP $B	4 Pop (m)	5 GSPP/ hr $	6 NSW AWE $/hr	7 40% AWE VOT$/hr	8 VOT $/hr	9 CPI	10 GDP $B	11 Pop (m)	12 GDPP/ hr $	13 AWE $/hr	14 40% AWE VOT$/hr	15 Income $/wk
1992	5.17	62.8	227	6.0	19.05	*13.08*	5.23	3.23	746	81	3.5	11.75	*10.92*	4.37	*283*
1993	5.15	64.6	228	6.0	19.01	*13.04*	5.22	3.21	757	82	3.5	11.74	*10.86*	4.34	*281*
1994	5.76	65.8	244	6.1	20.10	14.71	5.88	3.57	771	87	3.5	12.34	*12.05*	4.82	*316*
1995	6.10	68.0	253	6.1	20.68	15.26	6.10	3.83	798	92	3.6	12.79	*12.97*	5.19	*343*
1996	6.26	70.4	260	6.2	20.96	15.83	6.33	4.04	817	95	3.6	13.15	*13.74*	5.50	*366*
1997	6.55	71.1	269	6.3	21.45	15.99	6.40	4.22	825	99	3.7	13.39	*14.38*	5.75	*385*
1998	7.08	71.5	283	6.3	22.34	16.39	6.56	4.40	840	101	3.7	13.57	15.06	6.02	405
1999	7.73	72.6	300	6.4	23.39	17.13	6.85	4.48	835	103	3.8	13.59	15.33	6.13	414
2000	7.98	74.5	309	6.5	23.80	18.03	7.21	4.91	860	108	3.8	14.18	15.60	6.24	464
2001	7.65	79.1	306	6.6	23.27	18.93	7.57	5.08	881	111	3.8	14.44	16.30	6.52	484
2002	8.26	80.4	321	6.6	24.24	19.46	7.78	5.27	904	115	3.9	14.89	16.65	6.66	507
2003	8.79	82.0	335	6.7	25.08	20.75	8.30	5.58	918	121	3.9	15.53	17.82	7.13	545
2004	9.43	83.5	350	6.7	26.08	21.24	8.50	5.86	941	126	4.0	15.87	18.19	7.28	581
2005	9.87	85.2	361	6.8	26.74	22.63	9.05	6.14	973	130	4.0	16.13	19.24	7.70	619
2006	9.89	89.0	365	6.8	26.77	23.17	9.27	6.39	1,007	135	4.1	16.44	19.99	8.00	652
2007	10.59	89.6	383	6.9	27.83	24.32	9.73	6.46	1,025	137	4.1	16.53	21.35	8.54	662
2008	10.85	92.8	394	7.0	28.22	24.48	9.79	6.78	1,077	142	4.2	16.90	22.26	8.90	705
2009	10.70	94.1	396	7.1	28.00	25.11	10.04	6.42	1,095	139	4.2	16.43	22.98	9.19	655
2010	11.22	96.4	411	7.1	28.77	26.10	10.44	6.45	1,111	141	4.3	16.52	23.88	9.55	661
2011	11.42	100.3	419	7.2	29.06	26.87	10.75	6.38	1,162	141	4.3	16.36	24.78	9.91	650
2012	11.80	100.0	431	7.3	29.63	28.10	11.24	6.58	1,171	145	4.4	16.54	25.07	10.03	677
%Δ	128%	59%	90%	22%	56%	115%	115%	103%	57%	78%	26%	41%	130%	130%	139%
%Δ p.a.	4.2%	2.4%	3.3%	1.0%	2.2%	3.9%	3.9%	3.6%	2.3%	2.9%	1.2%	1.7%	4.2%	4.2%	4.5%

italics denote extrapolations based on GSPP/hr

(6) calculated on NSW AWE assuming 38 hours per week (in current 'nominal' values)

(7) Based on 40% of hourly (/38) adult full time australian ordinary weekly earnings

Sources: ABS, Statistics NZ, Austroads (1997)

Table 4 shows that basing the value on 40% of hourly weekly earnings (AWE) fits the NSW data quite closely. For 2012, the 40% assumption would value time at $11.24/hr for NSW which is slightly lower than the estimated value of $11.80/hr. However for NZ, the 40% value would be $10.03/hr which is half as high again as the estimated value of $6.58/hr.

The bottom of Table 4 presents the percentage change in each variable over the twenty year period (2012/1992). For both NSW and NZ, the value of time more than doubled from $5.17/hr to $11.80/hr in NSW and from $3.23/hr to $6.58/hr in NZ. By contrast, inflation increased 59% for NSW and 57% for NZ. Thus updating the values by the CPI, as has been the practice in NZ, will tend to underestimate the growth in value of time. Moreover, assuming only CPI growth in an economic evaluation (i.e. over the forecasting period) will also tend to underestimate the value of time.

The trend in GDP (which is a statistic already adjusted for price inflation) provides a closer match to the observed growth in the value of time. NSW GSP increased by 90% averaging 3.3% per year and NZ GDP grew by 78% at 2.9% per year. Although closer, GDP growth was still noticeably less that the growth in the value of time: for NSW, the value of time increased 20% more than GSP and for NZ the increase was 14% above GDP.

The movement in average weekly earnings (AWE) per hour was closer to the value of time than GDP.[3] Over the 20 years, nominal AWE increased 115% in NSW and 130% in NZ. Both increases exceeded inflation (by 1.5% p.a. for NSW and by 1.9% for NZ) and also GDP per capita. When compared to the value of time, the AWE growth was lower than the value of time in NSW (115% versus 128%) but higher in NZ (130% versus 103%).

The final statistic, only provided for NZ, was weekly income; this statistic includes all income sources not just earnings and salaries. Weekly income increased by 139% or 4.5% which was higher than any of the other indices.

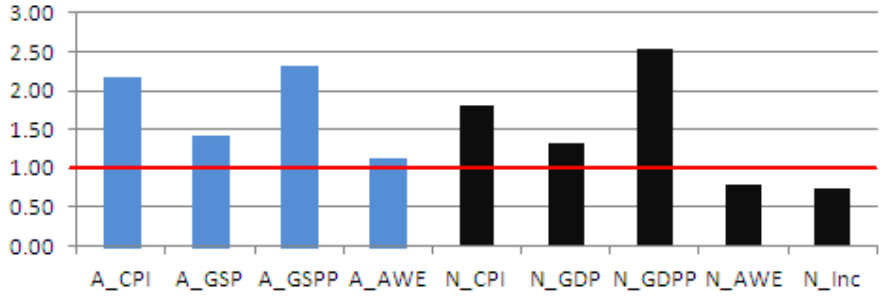
Expressed as a percentage of hourly GDPP, the value of time increased from 27% in 1992 to 40% in 2012 for both NSW and NZ. The percentage is modestly higher than the 36% adopted by the UK Department of Transport since 2010 and is equal to the 40% benchmark figure of adult employee hourly earnings used in the US, Miller (1996). In Switzerland, a lower percentage of 30% of average hourly wages was estimated by Axhausen (2004) for public transport travel.

Each of the economic indices shown in Table 4 can be 'matched' to the estimated value of time through elasticities (η) calculated as the ratio of the percentage change in the value of time (VOT) over the percentage change in the economic indicator (EI), equation 5.

$$\eta = \frac{\Delta VOT_{t2-t1} / VOT_{t1}}{\Delta EI_{t2-t1} / EI_{t1}} \quad .....(5)$$

Figure 2 presents the elasticity values as a histogram. Below the histogram the elasticities are calculated for the first decade (1992-2002) and the second decade (2002-2012).

Figure 2: Value of Time Elasticities



	NSW Australia				New Zealand				
	CPI	GSP	GSPP	AWE	CPI	GDP	GDPP	AWE	Income
2002/92	2.14	1.44	2.19	1.23	2.96	1.52	2.35	1.20	0.80
2012/02	1.76	1.26	1.93	0.97	0.84	0.96	2.24	0.49	0.74
2012/92	2.17	1.43	2.31	1.12	1.81	1.33	2.53	0.80	0.74

The closer the elasticity is to 1, the less 'leverage' required. The CPI elasticities were 2.17 for NSW and 1.81 for NZ. The GDP per head (GDPP) elasticities were higher at 2.31 for NSW and 2.53 for NZ. The elasticity closest to one was average weekly earnings (AWE). For NSW, the elasticity was 1.12 and for NZ it was less than one at 0.8 reflecting the fact that AWE increased more than the value of time.

[3] Given hours worked per week were held constant in NSW (at 38) and varied little in the NZ statistics (between 36 and 37 hours) the change in the index was unaffected by expressing the index on an hourly rather than weekly basis.

Splitting the data into two ten year periods shows the elasticity measures to be reasonably stable for NSW but declining for NZ. For NZ, the CPI elasticity reduced from 2.96 in the first decade to 0.84 in the second with the AWE elasticity declining from 1.2 to 0.49. By contrast for NSW, the AWE elasticity declined from 1.23 in the first decade to 0.97 in the second.

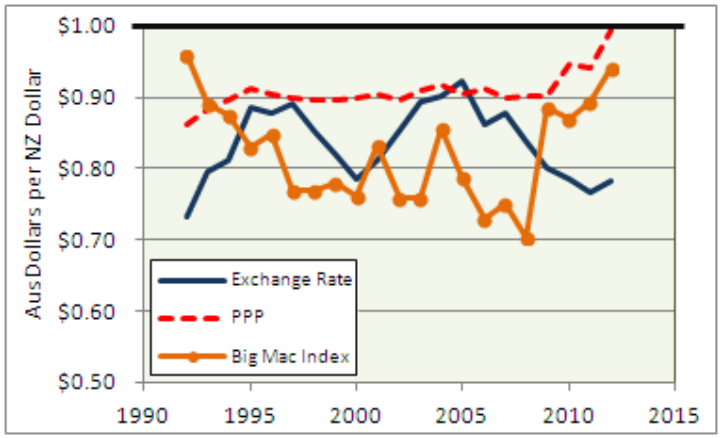
The income elasticity of 0.74 for NZ is comparable to overseas estimates. Wardman (2001a) reported an income elasticity of 0.6 for the UK using cross-sectional data (that is a sample of people of different incomes surveyed at the same time) and a value of 0.5 using time series data. Wardman (2001b) estimated a GDP elasticity of 0.5 which is much lower than the values estimated here for NSW and NZ. For Denmark, Fosgerau (op cit) estimated an income elasticity of 0.63 using before-tax income and 0.79 using after-tax income. The overall AWE elasticity of 0.8 for NZ is the same as the value recommended by the UK DoT whereas the NSW elasticity of 1.12 is higher.

5. Comparing NSW/Australia & NZ Values

So far, the analysis has kept the NSW/Australian and NZ values in their respective local currencies. In Table 5, exchange rates published by the Reserve Bank of NZ have been used to convert the NZ values into Australia dollars.

Over the twenty year period, the NZ dollar has remained consistently lower than the Australia dollar typically buying 86 Australian cents but with considerable volatility around this value. In 1992, the NZ dollar was at its lowest buying 73 Australian cents; it then appreciated to 90cents before sliding back to 80cents in 2000. Over the next five years it appreciated to 90cents before gradually depreciating to 78 cents in 2012.

Figure 3 Fluctuations in NZ/Australia Conversion Factors



The impact on the NZ value of time after converting to Australian values is to lower it. The effect can be considered as NZ adopting the Australian dollar as its currency. If converted over one night in 2012, all NZ prices and wages etc would have dropped by a factor of 0.78. It is therefore natural to assume that the value of time would also fall by a factor of 0.78 since its value is only meaningful when measured relative to the prices of other goods and services.

Exchange rates are often criticised as being too volatile for comparing prices in different countries. A preferred alternative is Purchasing Power Parity (PPP). PPP is based on the idea that identical goods in different countries should have the same price. Deviations from parity imply differences in purchasing power. The higher the PPP, the less the buying power.

PPP conversion factors for Australia and NZ published by the World Bank have been used to convert the NZ value of time. As can be seen from Figure 3, PPP was far more stable than the exchange rate being anchored around 0.9 between 1995 and 2008. Since 2008, the PPP has increased to reach near parity in 2012.

Table 5: Comparing NSW/Australia & NZ Value of Time

Year	Conversion Factors				Local VOT$/hr		NZ converted to A$/hr				(Australia-NZ)/NZ %				
	1 XC Rate	2 PPP CF	3. BMI	4 GDPPIP	5 Aus VOT	6 NZ VOT	7 XC Rate	8 PPP CF	9 BMI	10 GDPPIP	11 Nom	12 XC Rate	13 PPP CF	14 BMI	15 GDPPIP
1992	0.73	0.86	0.96	1.09	5.17	3.23	2.37	2.79	3.10	3.51	63%	46%	54%	60%	68%
1993	0.80	0.88	0.89	1.12	5.15	3.21	2.56	2.84	2.86	3.61	62%	50%	55%	56%	70%
1994	0.81	0.90	0.88	1.18	5.76	3.57	2.89	3.19	3.12	4.20	62%	50%	55%	54%	73%
1995	0.89	0.91	0.83	1.23	6.10	3.83	3.39	3.49	3.18	4.72	63%	56%	57%	52%	77%
1996	0.88	0.90	0.85	1.23	6.26	4.04	3.55	3.66	3.43	4.97	65%	57%	58%	55%	79%
1997	0.89	0.90	0.77	1.35	6.55	4.22	3.76	3.79	3.24	5.69	64%	57%	58%	50%	87%
1998	0.85	0.90	0.77	1.37	7.08	4.40	3.75	3.95	3.38	6.01	62%	53%	56%	48%	85%
1999	0.82	0.90	0.78	1.38	7.73	4.48	3.68	4.02	3.49	6.18	58%	48%	52%	45%	80%
2000	0.78	0.90	0.76	1.47	7.98	4.91	3.85	4.41	3.74	7.23	61%	48%	55%	47%	91%
2001	0.81	0.90	0.83	1.50	7.65	5.08	4.13	4.59	4.23	7.60	66%	54%	60%	55%	99%
2002	0.85	0.90	0.76	1.28	8.26	5.27	4.49	4.72	4.00	6.73	64%	54%	57%	48%	82%
2003	0.89	0.91	0.76	1.25	8.79	5.58	4.99	5.07	4.24	6.99	63%	57%	58%	48%	79%
2004	0.90	0.92	0.86	1.24	9.43	5.86	5.28	5.37	5.02	7.28	62%	56%	57%	53%	77%
2005	0.92	0.90	0.79	1.24	9.87	6.14	5.68	5.56	4.84	7.61	62%	58%	56%	49%	77%
2006	0.86	0.91	0.73	1.26	9.89	6.39	5.51	5.83	4.67	8.02	65%	56%	59%	47%	81%
2007	0.88	0.90	0.75	1.26	10.59	6.46	5.68	5.82	4.85	8.18	61%	54%	55%	46%	77%
2008	0.84	0.90	0.70	1.27	10.85	6.78	5.68	6.10	4.77	8.62	62%	52%	56%	44%	79%
2009	0.80	0.90	0.89	1.29	10.70	6.42	5.14	5.79	5.68	8.25	60%	48%	54%	53%	77%
2010	0.79	0.95	0.87	1.26	11.22	6.45	5.07	6.11	5.62	8.13	58%	45%	54%	50%	72%
2011	0.77	0.94	0.89	1.27	11.42	6.38	4.89	6.00	5.70	8.07	56%	43%	53%	50%	71%
2012	0.78	0.99	0.94	1.28	11.80	6.58	5.15	6.53	6.19	8.39	56%	44%	55%	52%	71%

XC rate: NZ dollar buys tabulated number of Australian dollars
PPP: Aus/NZ PPP figure; (2012 est. on 08-12 values)
GDPPIP: GDP per capita measured in international prices (World Bank estimates)
BMI: Price of Big Mac in Australia / NZ
Sources: RBNZ, World Bank and Economist Magazine

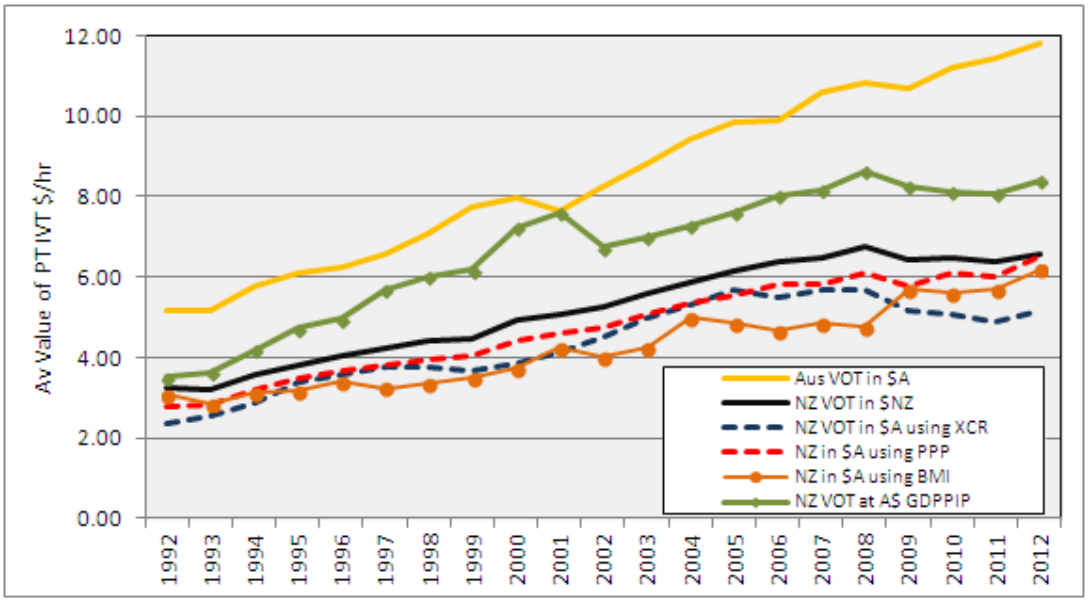
A third, and some might think flippant measure, is the Big Mac Index (BMI). The Big Mac index was introduced by 'The Economist' magazine in September 1986 and has been published annually thereafter. In 1998, Australian restaurants were included on the menu of countries with NZ having to wait until 1995.[4] The beauty of the BMI is its simplicity. Most people know what a Big Mac is (a beef burger). As a PPP indicator, Big Mac's appeal is its standard specification across many countries with its price reflecting local production, delivery and overhead costs, advertising expenditure and what the locals are willing to pay. In 2012, a Big Mac cost $4.80 in Australia compared to $5.10 in NZ. The implied PPP was therefore 0.89 ($4.80/$5.10). This compares with the actual exchange rate of 0.78. The NZ dollar was therefore undervalued against the Australian dollar by a fifth calculated as (0.78-0.89)/0.89 = minus 20%. As can be seen from Figure 3, the BMI was lower than the PPP index for most of the twenty year period and also tended to be lower than the exchange rate.

Figure plots the converted NZ values of time alongside the Australian and NZ (in NZ currency) values. As can be seen, conversion widened the gap making the NZ values of

[4] The analysis 'backfilled' the NZ estimates for 1992-1994 by a regression of the Big Mac price on the CPI.

time look even lower against their Australian counterparts. Comparing the three measures shows the PPP conversion to produce the highest NZ estimates. Applying the exchange rate reduced the converted NZ value after 2008 in contrast to the BMI. In 2012 the exchange rate conversion produced an NZ value of time of $A5.15/hr which was 44% of the Australian value of $A11.80/hr. PPP conversion produced a value of $A6.53/hr (55%) and the BMI a value of $A6.19/hr

Figure 4: Trends in NSW/Australia & NZ Value of Time
Average value of Public Transport Time $/hr



A fourth comparator calculated by the World Bank is GDP per capita expressed in international dollars (GDPPIP). An international dollar has the same purchasing power over GDP as a US dollar has in the US. GDPPIP is gross domestic product divided by population and converted into international dollars using purchasing power parity rates. GDP (at purchaser's prices) is the sum of gross value added by all resident producers in the economic plus any product taxes (less subsidies) not included in the value of the products.

In 1992, GDPPIP for Australia was $18,200, a quarter higher than in NZ where it was $14,800. By 2012, Australian GDPPIP had increased to $43,000 which was just over a third higher than NZ ($31,600). Table 5 and Figure 4 also show what would happen to the NZ value of time if factored by the ratio of Australian to NZ GDPPIP. Unlike the other conversion rates, the GDPPIP moves the NZ value of time closer to the Australian value since it assumes New Zealanders would be as income rich as Australians. Indeed in 2001, the values of time were effectively the same at $7.60/hr. After 2001 however, the values of time diverged so that by 2012, the NZ value was 71% of the Australian value.

Before getting too diagnostic, it is worth noting that that there were only four NZ studies in the data set and it is plausible that all four underestimated the value of time. By contrast, it is far less likely that all 24 Australian studies over-estimated the value of time.

Three 'non survey' explanations are offered. Firstly, incomes of bus and rail passengers in NZ are lower than in Sydney (where most of the studies were undertaken) and the GDPPIP converter shows that the gap is narrowed by 20 percentage points when higher Australian GDP per capita is taken into account but only to within 70% of the Australian value.

Secondly, the quality of NZ bus and rail services could be higher than in Sydney. Crowding on trains has been an issue on Sydney trains since the mid 2000s and surveys have shown that Sydneysiders are willing to pay more to save time in crowded conditions, Douglas and Karpouzis (2006). Further as most of the studies reviewed did not include crowding as an attribute it is possible that respondents included crowding when deciding their values of time.

Thirdly, trip lengths in NZ may be shorter than in Sydney and there is evidence that passengers do not value their travel time as highly as when making longer trips, O'Fallon and Wallis (2012).

6. Value of Time, Demand Forecasts & Economic Evaluations

Values of time are used in demand forecasts and economic evaluations. For accurate patronage forecasts, values of time should reflect the behavioural response to travel times and costs as closely as possible. To forecast demand for new or improved services, many studies (as have been reviewed in this paper) have used Stated Preference (SP) market research to derive values of time and other service attributes based on Willingness to Pay. The resultant values have then been used in economic appraisals. In NZ, the values of time contained in the NZTA Economic Evaluation Manual have been based on WTP behavioural studies undertaken by Beca (2002). Likewise RailCorp NSW has based its patronage and forecasting parameters on WTP surveys of passengers.

In 2011, the planning of passenger transport in NSW was centralised with the creation of Transport for NSW (TfNSW). In March 2013, TfNSW released *"Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives"* (PGEATII) which recommended a 'harmonised' value of private travel time for road and public transport investment' of $13.76 per hour for car drivers and passengers, onboard train travel, onboard bus travel, ferry travel, cycling and walking.[5] The basis of the valuation was a 1997 Austroads workshop that reviewed Australasian and international evidence and agreed that all private travel time including waiting and access time[6] should be valued at 40% of the full-time equivalent average hourly earnings calculated assuming 38 working hours per week, Austroads (1977). The workshop also recommended that the value of time should be updated annually with a complete review every five years).

There continues to be a seemingly unresolvable debate about the basis of travel time valuations in the social appraisal of projects. On the one side, Mackie has opined that *"there is no reason for the value that the individual is willing to pay to reduce travel time to be equal to the value that society as a whole attaches to the reassignment of time of that individual to other activities".* Mackie concluded that *"using individuals' or groups' willingness to pay as their value of time savings is inappropriate for social evaluation"* and therefore supports the UK practice of adopting an 'equity' approach to the valuation of non-working time, Mackie et al (2003).

The official UK DoT (2011b) position has been that *"if values of time for appraisal are based on an individual's willingness-to-pay (behavioural values) which are related to income, then strategies and plans will be biased toward those measures which most benefit travellers with higher incomes (which may favour some modes over others)".* Accordingly, the same value

[5] PGEATII also recommends a value of travel time for paid or business travel of $44.03 per hour. However for urban passenger transport, business travel represents only a small percentage of trips, around 5% for rail travel in Sydney.

[6] Departing from the Austroads recommendations, PGEATII recommends weighting car access time by 1.2, walking access by 1.5 and waiting time by 1.5 for rail and bus travel.

of time is provided for all modes differentiated only between 'commuting' and 'other' trip purposes.

On the other side of the argument opposing single 'equity' values is Nash. In 2010 Nash wrote: *"the British approach, again like many others, attempts to allow for equity considerations by using common values of time, risk of accidents and environmental amenity regardless of income. This might have been reasonable at a time when appraisal was mainly applied to road schemes which were paid for by the government but gave time savings to users, but now that appraisal is often applied to schemes which trade-off time savings against money cost (e.g. whether to replace buses with higher priced light rail services, whether to reduce road congestion by means of road pricing), it may be highly misleading. It would be quite possible for the appraisal to conclude that the scheme was desirable on the basis of a standard value of time, when according to the actual values of the users it was not (or vice versa)."* (Nash, 2010, p. 9)

Even if a *'one equity value to rule them all'* is accepted, there remains the task of deciding what the value should be. Mackie (op cit) comments: *"theory cannot tell us the relationship between the value of non-working time and the wage rate; an empirical approach is required".* Other than time versus cost trade-offs (the basis of the estimates in this review), it is not obvious what other empirical approach there could be.

In NSW, TfNSW has adopted the Mackie / UK DoT equity value approach over the WTP approach. As presented earlier, TfNSW recommended a value of $13.76/hr for 2012 based on 40% of average hourly earnings which is 16.5% higher than the value of $11.80/hr for 2012 presented in this paper. In NZ, the values of time in the Economic Evaluation Manual have been based on a large scale survey undertaken in 2001 (Beca, op cit) with different values for car, bus and rail travel. However as of July 2013, NZTA proposes to replace the mode specific values with a common value, NZTA (2013).

There is a way forward which can accommodate both the WTP and 'equity' viewpoints. It is to base values of time and other parameters on WTP surveys but to standardise the values for income. In this way, the income effect can be removed whilst leaving the parameters to reflect any residual differences in the perceived quality between buses, trains and ferries etc Douglas and Jones (2013).

After deciding the value of time, the next question is whether and how to update it. Most demand forecasting studies and economic evaluations only update the value to a 'base year' typically using CPI indicators. From then onwards, the value is kept constant in real terms. This is the approach in the NZTA Economic Evaluation Manual.

For Australia, the value of time has generally not been projected through an evaluation period, ATC (2006). In PGEATII, TfNSW argues *"where cost or benefit items are expected to increase at a rate greater than general price inflation, then they should similarly be adjusted upwards prior to use in a CBA. This may occur with values of travel time which are generally related to wage levels; wage levels have shown a trend to increase in real terms (i.e. above general price inflation rates) in past years"* (p22). Nevertheless for small to medium sized projects, the value of time has been kept constant. Only for large scale projects, such as the South West Rail Link (SWRL) and North West Rail Link (NWRL), has the value been increased. For these two evaluations, the value of time was increased at 1% p.a. through the evaluation period based on an historic analysis of real income growth.

The UK has historically projected the value of time through an evaluation period. This was the practice in road appraisal (COBA) during the 1980s and 1990s which updated values in proportion to GDP per capita. Currently, the value of private travel time is projected on the basis of income but with an elasticity of 0.8 applied, DoT (2011).

In the US, the evaluation methodology for 'new start' urban transport funding applications to the Federal Transport Authority has allowed for the value of time to be increased proportionately with real median household income, US DoT (2011).

The UK and USA approaches require an income forecast in order to predict the future value of time. In NSW, the NSW Treasury makes two stipulations regarding evaluations. The most important being a discount rate of 7%. The second stipulation set out in TPP 07-5 (p2) referring to economic evaluations is: *"Treasury sets certain key parameters to be used in appraisals, such as ... the rate of real earnings growth",* NSW Treasury (1990). However, only five year projections have been prepared by Treasury; much shorter than the typical thirty year appraisal period.

Parker (2012) has suggested, based on a review of Wellington and Auckland studies, that demand forecasters should project values of time through an evaluation period on the basis of GDP per capita or similar economic measure. The past trends presented in this paper provide some guidance on how to base future projections.

Table 6 presents the real annual average compound growth rate in the value of time compared to real GDP, real GDP per capita and real average weekly earnings and real income (the latter two economic indices divided by the CPI inflation rate).

Table 6: Comparison of Real Value of Time & Economic Indicators

Annual compound percentage change (1992-2012)

	NSW/Australia				NZ				
	VOT*	GDP	GDPP	AWE*	VOT*	GDP	GDPP	AWE*	Income*
1992-2002	2.2%	2.5%	3.5%	1.5%	3.0%	3.5%	2.4%	2.3%	4.0%
2002-2012	1.4%	2.2%	2.0%	1.5%	-0.4%	2.3%	1.1%	1.5%	0.3%
1992-2012	1.8%	2.4%	2.2%	1.5%	1.3%	2.9%	1.7%	1.9%	2.1%

* {(1+x) ÷ (1+cpi)} -1

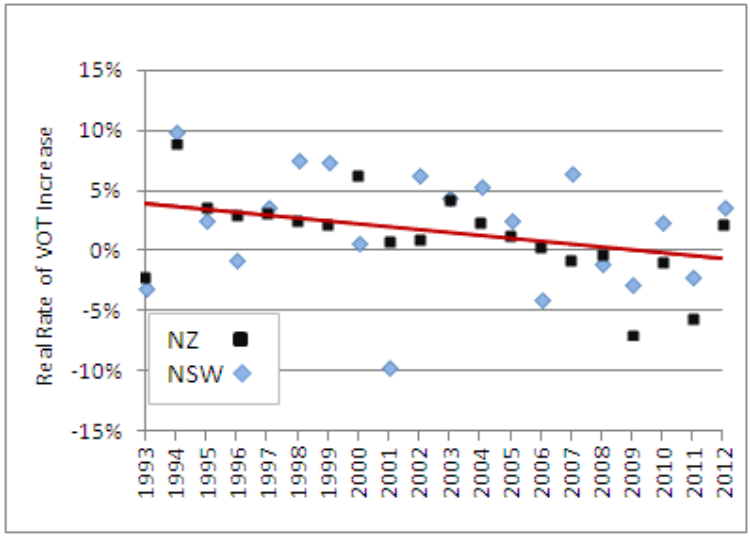
Over the twenty year period, the 'real' value of time (VOT) increased by 1.8% p.a. in NSW and 1.3% p.a. in NZ. Thus, based on the assumption of continuing inflation, the simplest projection would be to increase the 'real' value of time at this rate.[7] Based on these historic trends, the annual 1% growth assumptions made in the NWRL and SWRL economic evaluations appear conservative.

There is a caveat however. As Table 6 shows, the real rate of increase was lower in the second decade than the in the first. For NSW, VOT increased at 2.2% p.a. between 1992 and 2002 then declined to 1.4% p.a. between 2002 and 2012. For NZ, the decline was particularly pronounced with a 3% p.a. growth in the first decade followed by a decline of 0.4% p.a. in the second decade.

Figure 5 shows the decline in the increase in real VOT over the twenty year, a decline which explains the rationale for the Douglas and Karpouzis (2011) hybrid index based on earnings and the CPI for Sydney rail travel.

[7] However it is worth placing a caveat on continually rising prices since the opposite, deflation which has been experienced in Japan during the 1990s-2000s, (see Ito, 2006) is a possibility,

Figure 5: Trend in Value of Time /CPI elasticity



7. Summary & Concluding Remarks

This paper has used the values of time estimated by 28 Australian (mainly NSW) and NZ studies covering a twenty year period 1992-2012. The studies provided 81 estimates for urban bus, rail and ferry travel. All but two studies used Stated Preference surveys that estimated 'Willingness to Pay' values via hypothetical choice questions.

The estimates were used in a regression model that used hourly GDP per person as an explanatory factor. For 2012, the model predicted an average value of time of $A11.80/hr for NSW and $NZ6.58/hr for NZ. Although the estimated parameters were statistically significant, the inter-quartile prediction range was relatively wide.

Exchange rate and PPP factors were used to compare the NZ and NSW values. In fact, conversion lowered the NZ value of time to one half that of NSW. Taking account of higher NSW incomes narrowed the gap to 70% and some explanations for the remaining difference were offered although none were particularly convincing. This leaves the most likely cause for the low NZ values as the surveys themselves of which there were only four.

The paper also analysed the growth in the value of time over the two decades as a way of updating values and also projecting values through an economic evaluation. Over the twenty year period, the value of time increased by 1.8% a year more than inflation in NSW and by 1.3% in NZ. There is therefore an historical basis for increasing the value of time in real terms through the duration of an economic evaluation.

The review looked at the shift away from 'Willingness to Pay' (WTP) values towards a common (equity) value applicable to all modes and trip purposes. A suggestion made in this paper is that both WTP and 'equity' viewpoints can be accommodated by estimating values through WTP surveys but standardising the resultant values for income. In this way, income effects can be taken into account whilst reflecting perceived differences in the travel time quality.

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Appendix: Value of In-Vehicle Time Estimates

#	Study	Location	NZ/A	Year	Reference	Choice	Mode(s)	Users	VoT $/hr			t value			Comment
									Peak/ Wrk	OffPk/Oth	All	Peak/ Wrk	OffPk/ Oth	All	
1	WR90	WTN	N	1990	SDG (1990)	MM	Rail	All			2.87			10.31	No car av $2.16/hr; Car Av $3.39/hr
4	SydR92	Sydney	A	1992	SDG (1992)	RvAll	Rail	Rail			5.61			4.20	Wghtd 't' estimate of mode choice SP estimates
5	SL95T	Sydney	A	1995	BAH(1995)	LvBvR	PT	All			3.49			4.82	
6	SL95B	Sydney	A	1995	" " "	LvBvRvW	PT	B,W			6.12			12.61	PT v PT v walk SP, All observation estimate
6	SL95B	Sydney	A	1995	" " "	LvB	Bus	Bus			2.71			2.89	Glebe SP Bus v LRT, Bus users
8	PC96	Sydney	A	1996	RPPK (1996)	PT v PT	PT	B,R	8.66			10.10			Wghtd av (t stat) of bus and rail estimates
8	PC96	Sydney	A	1996	" " "	PT v PT	PT	Car	9.48			6.42			Wghtd av (t stat) of bus and rail estimates
8	PC96	Sydney	A	1996	" " "	PT v Car	PT	B,R	4.42			8.45			
8	PC96	Sydney	A	1996	" " "	PT v Car	PT	Car	4.73			6.80			
9	M2_96	Sydney	A	1996	RPPK (1996)	PT v PT	Bus	Bus	6.97			8.89			Wghtd average (t stat) of Car v PT & PT v PT estimate
9	M2_96	Sydney	A	1996	" " "	PT v PT	Bus	Car	6.60			9.54			
9	M2_96	Sydney	A	1996	" " "	PT v Car	Bus	Bus	7.11			5.75			
9	M2_96	Sydney	A	1996	" " "	PT v Car	Bus	Car	8.66			4.32			
10	STM96	Sydney	A	1996	Hague (2001)	RPMM	Rail	All	15.75			nk			Average value for rail journey to work
10	STM96	Sydney	A	1996	" " "	RPMM	Bus	All	10.50			nk			Average value for bus journey to work
11	LivTW98	Sydney	A	1998	PPK (1998)	PT v PT	Bus	B,R	8.37			11.44			All observation estimate
11	LivTW98	Sydney	A	1998	" " "	PT v PT	Bus	Car	9.56			3.37			
12	SBQ99	Sydney	A	1999	Hensher (2002)	BvB	Bus	Bus			4.02			4.13	
13	SBQ00	Sydney	A	2000	Hensher (2003)	BvB	Bus	Bus			3.38			7.27	t wghtd average value of bus mkt segments
14	BSG00	Brisbane	A	2000	PCIE (2000)	PT v PT	B,R	All	8.90	2.90	6.11	3.63	2.03	4.16	Longer distance services. Peak = work and off-peak = other. Average of car and PT respondents
15	BJ00	Sydney	A	2000	Halcrow (2000)	PT v PT	B,R	B,R	5.24	4.91	5.08	nk	nk	nk	Av mkt seg estimate, Peak = commuters; Off Peak = Leisure.
15	BJ00	Sydney	A	2000	" " "	PT v PT	B,R	Car	7.65	5.40	6.53	nk	nk	nk	
16	SdNw00	Sydney	A	2000	PCIE (2000)	RvR	Rail	Rail	5.56	3.46	4.94	4.60	4.19	6.83	Inter-urban service with relatively high concession use
17	Bri01	Brisbane	A	2001	Douglas (2003)	Av	PT	PT	8.70	6.50	7.60	nk	nk	nk	Average of PT v Car and PT v PT short and medium SP
17	Bri01	Brisbane	A	2001	" " "	Av	PT	Car	9.90	7.40	8.30	nk	nk	nk	Average value of PTvPT and PTvCar Sps, Large sample sizes
18	SFry01	Sydney	A	2001	BAH (2001)	FvB	F&B	Ferry	11.42	11.41	11.42	2.52	3.64	4.12	
18	SFry01	Sydney	A	2001	" " "	FvB	F&B	Bus	3.49	4.52	3.90	2.73	2.10	2.40	
18	SFry01	Sydney	A	2001	" " "	FvC	F&B	Ferry	11.24	14.35	12.61	5.35	4.20	6.60	
19	NZEM02	WN,AC,CH	N	2001	Beca (2002)	BvB,RvR	B,R	B,R	5.41	3.55	4.52	9.86	8.99	13.18	Peak = commuters/Off-Pk = others
20	Can03	Canberra	A	2003	BAH(2003)	BvB	Bus	Bus	11.30	6.16	6.78	nk	nk	nk	Pk=commuters/ OffPk =other. Taxi $31/hr but low sample 9obs
20	Can03	Canberra	A	2003	" " "	BvC	Bus	Car	12.30	6.87	8.83	nk	nk	nk	
21	SydR03	Sydney	A	2003	Douglas (2003)	RvR	Rail	Rail	9.46	7.83	8.76	15.00	15.00	25.00	Large sample sizes, T values approximate. Weighted concession/non concession value. Values
22	SNW03	Sydney	A	2003	Hensher (2003)	MM	PT	All	16.82	6.88	11.77	nk	nk	nk	All est based on relative sample sizes (≈ equal). Wald stats
23	SLRT03	Sydney	A	2003	BAH (2003)	LvB	L,B	L,B	10.54	10.17	9.70	5.01	6.89	8.02	
23	SLRT03	Sydney	A	2003	" " "	PTvPT	PT	PT	12.63	11.18	11.97	10.48	12.96	15.64	Weighted av (t stat) of bus,rail,LRT & Ferry transfer & CBD trips
28	STM06	Sydney	A	2006	Fox (2010)	RPMM	Rail	Rail			7.48			2.00	Trip purpose value for rail users. Approx t value

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									Peak/ Wrk	OffPk/Oth	All	Peak/ Wrk	OffPk/ Oth	All	
28	STM06	Sydney	A	2006	Fox (2010)	RPMM	Rail	Bus			8.96			2.00	Trip purpose value for bus users Approx t value
30	NZRl08	WTN,AUC	N	2008	Vincent (2008)	BvB,RvR	PT	B,R			7.71			9.11	With and without SP constant model results averaged
31	AusTC10	CapCities	A	2010	CRC (2010)	RvR	PT	All	11.55			16.57			Seated <30 mins & >30 min values averaged.
32	SMet11	Sydney	A	2011	Hensher (2011)	MM	PT	All	7.74			7.52			Commuter valuation. Bus fare and rail fare values averaged
33	SRVoT12	Sydney	A	2011	Douglas (2011)	RvR	Rail	Rail	11.79	10.48	11.24	8.67	6.16	9.86	
34	NZPS12	WTN	N	2012	Douglas (2012)	RvR	Bus	Rail			8.56			3.40	Pricing Strategies pilot survey results - largely off-peak surveys of
34	NZPS12	WTN	N	2012	" " "	BvB,RvR	B,R	Bus			7.13			3.92	rail users
35	SIC12	Sydney	A	2012	Douglas (2013)	PTvPT	B,R	B,R	13.14			12.38			SP survey of rail and bus users to estimate the cost of transfer