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Paper Abstract

Paper title: **Measuring road freight growth**

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Abstract (200 words):
The Australian Bureau of Statistics (ABS) has produced the Survey of Motor Vehicle Use (SMVU) since the early 1970s. It has been the principal source of our understanding of the growth in the freight task over the years. However, there have been two major periods of methodological adjustment that complicate the use of the data in computing growth rates in road freight (one in 1998 and one in 2001).

The Bureau of Transport and Regional Economics (BTRE) has recently completed an exercise in adjusting past SMVU freight data to make it comparable to the current survey methodology. This paper details these adjustments, and then uses the 'cleaned' data to look at the implied growth rates for road freight into the future.

Introduction

Road freight growth is obviously important for planning road systems. This is true with regard to the design pavement strengths for new roads (and thus their cost) and with regard to the expected growth in maintenance expenditures due to pavement damage. And this is in addition to the obvious importance of road freight for the smooth interchange of goods in our market economy.

The Australian Bureau of Statistics (ABS) has produced the Survey of Motor Vehicle Use (SMVU) since the early 1970s. It has been the principal source of our understanding of the growth in the freight task over the years. However, there have been two major periods of methodological adjustment that complicate the use of the data in computing growth rates in road freight (one in 1998 and one in 2001).

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Changes in survey methodology and adjusting for them

The Survey of Motor Vehicle Use is a survey conducted by the Australian Bureau of Statistics. It provides estimates on kilometres travelled, fuel consumption and tonne-kilometres travelled by registered vehicles in Australia. This data is available for all of Australia and disaggregated by vehicle type and State/Territory of registration. In the years from 1971 to 1995 the SMVU was conducted every 3 to 5 years. From 1998, it has been conducted annually. However, it has not been designed specifically to measure the change between years, as there is no overlap between the samples selected in consecutive years. Thus the ABS warns that 'Caution must be used when using the SMVU to measure change'.

However, given the importance of growth in road freight, this paper attempts to develop methods of allowing such inter-period comparisons. The two major periods of methodological adjustment that complicate the use of the data in computing growth rates occurred in 1998 and 2001. Before 1998, the old 12-month recall survey was fairly unchanged from 1971 to 1995 (the last year of that survey). In 1998 a new 3-month pre-advice survey methodology was instituted. In 2001, a post-stratification exercise resulted in a substantial decrease in the estimates of freight carried. Figure 1 shows the aggregate road freight task (and 95% confidence intervals) as measured by the various surveys (with interpolation between surveys of the same methodology). The task in this paper is to construct a standardised time series out of this disjointed and non-comparable data. The method of standardisation is termed 'disaggregation correction'. It was first used in an earlier paper by BTRE authors (Cosgrove & Mitchell 2001).

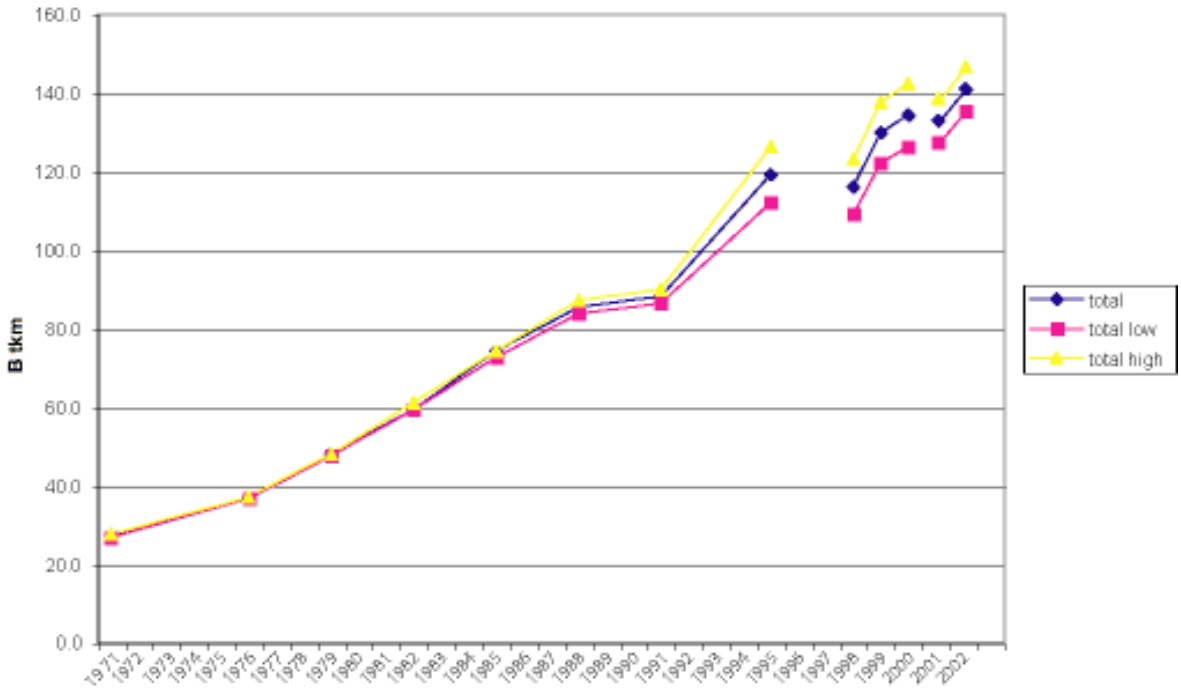

Figure 1: Raw SMVU Freight

The correction method use two 'disaggregations'. The first disaggregation is by vehicle type: articulated trucks (artics), rigid trucks (rigids), and light commercial vehicles (LCVs).

The second disaggregation (using articulated trucks as the example for the rest of the discussion) works off the following equation:

Stock of registered artics	*	Proportion with laden business kilometres	*	Average laden business kms for those laden	*	Average load when laden	=	Total Artic Freight Task

^

equals

Number of Laden Artics

The stock of registered artics is composed of 3 mutually exclusive sub-groups as far as the survey is concerned: those vehicles **unused** during the survey time period (currently about 6% of the artic stock for any 3 month period), those used but **unladen** (currently about 1.5% of artics), and those **laden** during the 3 months (about 92.5% of artics).

As it is only the last group that carries any freight, it is the focus of the adjustment methodology developed, as reflected in the equation above.

The table below shows how the items for the framework are calculated and the sources of data for the years 1998 to 2002.

Table 1: Calculating the Raw Data for Disaggregation Correction – Articulated Vehicles

A	B	C	D	E	F	G	H	I	J	K	L
Year	**SMVU Artics**	Total laden bus. kms	Aver laden bus. kms	No. laden artics	**Pro-por-tion with lbkms**	Total TKM	Total laden bus. kms	**Av load when laden**	**Av. laden Bus. kms**	**Calcul'd SMVU total TKM**	Actual SMVU total TKM
	(no.)	(000)	(kms)	(no.)	(%)	(m)	(000)	(kgs)	(kms)	(B tkm)	(B tkm)
1998	**59573**	3563	66.9	53259	**89.4**	88759	3563	**24911**	**66.9**	**88.8**	88.8
1999	**62493**	3946	70.7	55813	**89.3**	101024	3946	**25602**	**70.7**	**101.0**	101.0
2000	**61117**	4071	72.8	55920	**91.5**	103515	4071	**25427**	**72.8**	**103.5**	103.5
2001	**61502**	3933	69.6	56509	**91. 9**	101892	3933	**25907**	**69.6**	**101.9**	101.9
2002	**61519**	4012	70.4	56989	**92.6**	106977	4012	**26664**	**70.4**	**107.0**	107.0
Source	*ABS*	*ABS*	*ABS*	***C/D***	***E/B***	*ABS*	***C***	***G/H***	***D***	*(**B*F**/100*	*ABS*
or	*2003b*	*2003b*	*2003b*	**1000*	**100*	*2003b*		**1000*		**I*/1000*	*2003b*
Calcu-	*p9*	*p10*	*p10*			*p10*				**J*1000)*	*p10*
lation										*/1 billion*	

Note: The average load for laden vehicles is an average excluding both unused vehicles and vehicles used but unladen.

The numbers in bold are then input to the disaggregation correction framework.

The disaggregation correction for articulated trucks

For convenience the equation above is reordered to read:

Stock * Average load * Average laden * % laden = Total artic tkm.

This then becomes the framework for the disaggregation corrections.

We will be using the framework to adjust its components to "standardise" on the current survey methodology.

The major changes to be adjusted for, come from the two major methodological changes to the survey, splitting it into 3 component periods: 1971-1995, 1998-2000 and the current survey (ABS 2003b).

Table 2 below sets out the four major differences between survey periods to be adjusted for. The next four sections of the paper detail the standardisation procedures followed to correct for each of these major differences. There are also miscellaneous changes made in individual instances.

Finally, there were changes in the definitions of LCVs and rigids in 1991 that necessitated corrections to the stock numbers and average loads of these vehicle types before that date.

Table 2: Major Differences between Current and Past Survey Periods

Survey Period	*Stock of Artics*	*Average Laden Business-kms*	*Per Cent With Laden Kms*	*2001 Post-sample Stratification*
1971 to 1995	As at 30 September	12 month recall method	Respondent has laden kms anytime over 12 months	Pre-sample stratification
1998 to 2000	Average over year to 31 July, except 2000 – 31 October	3 month pre-advice method	Respondent has laden kms in the 3 months of survey	Post-sample stratification
2001 on – current methodology	Average over year to 31 October	3 month pre-advice method	Respondent has laden kms in the 3 months of survey	Basically Pre-sample stratification

Adjusting the stock of vehicles

There are two sources of data on the stock of articulated vehicles: the SMVU and the Motor Vehicle Census (MVC), also conducted by the ABS (ABS 2002).

Table 3 shows the calculations used in this paper to adjust past survey numbers to the current survey stock period of the average of the year to 31 October. In essence, it is assumed this corresponds to a stock number at the middle of the year – 30 April – and vehicle numbers in previous years are adjusted to this date using growth rates per year then current.

For example, the 1976 SMVU artic stock number is 39735 (at 30 September). Adjusting this to 30 April would remove 5 month's growth at the then current growth rate of 4 per cent per year. The resulting adjusted stock figure is then 39069. Similar adjustments are done for the MVC stock numbers. The two standardised series generally agree quite well (see Table 3).

The exception is over the period of the new 3-month pre-advice survey (from 1998 on), when the SMVU series drops inexplicably below the MVC numbers. The ABS says that this is as a result of a number of 'articulated' trucks on the MVC register turning out to actually be rigids when their owners are surveyed. The number is about 3 per cent of the MVC artic numbers. Accordingly, the MVC adjusted numbers less 3 per cent were taken as a standardised time-series of artic numbers. The trucks removed each year from the artic stock were added in to the rigid stock calculations (giving the MVC(-) and MVC(+) series of Table 7 presented later in the paper).

Finally, in 1991, the definitional boundary between rigids and LCVs was raised (in tonnage terms). This resulted in a drop in rigid numbers and an increase in their average load. At the same time, LCV numbers increased and their average load increased. Corrections for this remaining series break will be discussed in a section below. The corrections affect both the stock of vehicles and the average loads of rigids and LCVs.

Table 3: SMVU Disaggregation Calculations of Articulated Vehicle Numbers

Year	Raw Artics SMVU	Date of SMVU	Adjust. to 30 April	**Adj'd Artics SMVU**	Raw Artics MVC	Raw % ch per Year	Date of MVC	Adjust to 30 April	**Adj'd Artics MVC**
1971	32000	30 Sep	- 5 mo	**31464**	31982		30 Sep	- 5 mo	**31446**
1976	39735	30 Sep	- 5 mo	**39069**	38950	4.0	30 Sep	- 5 mo	**38297**
1979	43949	30 Sep	- 5 mo	**43243**	43683	3.9	30 Sep	- 5 mo	**42981**
1982	46575	30Sep	- 5 mo	**46076**	47179	2.6	30 Sep	- 5 mo	**46673**
1985	49641	30 Sep	- 5 mo	**49210**	50220	2.1	30 Sep	- 5 mo	**49784**
1988	48722	30 Sep	- 5 mo	**48906**	48857	-0.9	30 Sep	- 5 mo	**49041**
1991	52106	30 Sep	- 5 mo	**51697**	51697	1.9	30 Sep	- 5 mo	**51292**
1995	57939	31 May	- 1 mo	**57791**	58322	3.1	31 May	- 1 mo	**58173**
1998	59573	Av 31 Jul	+ 3 mo	**59899**	62274	2.2	31 Oct	- 6 mo	**61593**
1999	62493	Av 31 Jul	+ 3 mo	**62749**	63295	1.6	31 Oct	- 6 mo	**62776**
2000	61117	Av 31 Oct	None	**61117**			*none*		**62741**
2001	61502	Av 31 Oct	None	**61502**	62597	0.0	31 Mar	+ 1 mo	**62706**
2002	61519	Av 31 Oct	None	**61519**	63905	2.1	31 Mar	+ 1 mo	**64012**
2003					64261	0.6	31 Mar	+ 1 mo	**64291**

Adjusting the average laden business kilometres

The major change to be adjusted for here is the change in methodology from a 12-month-recall basis from 1971 to 1995 to a 3-month-pre-advice basis for the 1998-and-thereafter quarterly surveys.

The ABS has always maintained that the annual recall method significantly overstated distance travelled (except in its 1985 report where 'no statistical evidence of bias' was claimed – ABS 1987, p3). With regard to artics there were two "checking" validation studies carried out by the ABS. In 1988 (ABS 1990, p.41), it was estimated that the distance travelled by artics was overstated by 5.5% (and rigids by 9.3%). For the 1995 survey (ABS 1996, p.24) the estimate was 4.8%.

Accordingly, the pre 1998 SMVU estimates for laden bus km in Table 4 have been lowered 5% (as have the estimates for rigids and LCVs).
This is one of the 3 major adjustments to the historical data made in this paper (the others being the number of vehicles as detailed above, and the 2001 methodological changes as detailed below).

A one-off change was made to the laden business km for 1995, which were still judged to be overstated. The 1995 laden business-kms was set 4/7s of the way between the adjusted 1991 and 1998 figures.

A final 0.9454 fractional adjustment to laden business-kms (for artics only) was made for the years 1971 to 2000 to account for the effects of the 2001 post-sample stratification exercise. The rationale for this is explained in a following section.

Table 4: Average Laden Business Kilometres

Year	Raw average laden business kilometres (000)	**Adjusted laden business kilometres (000)**
1971	32.5	**29.2**
1976	35.2	**31.6**
1979	41.2	**37.0**
1982	46.4	**41.7**
1985	53.4	**48.0**
1988	59.6	**53.5**
1991	57.8	**51.9**
1995	67.3	**58.4**
1998	66.9	**63.3**
1999	70.7	**66.9**
2000	72.8	**68.8**
2001	69.6	69.6
2002	70.4	70.4

The proportion with laden business kilometres

The adjustment problem here is more apparent than real. Table 5 shows the major drop in the raw proportion of vehicles with laden business kilometres after 1995. (ie with the new quarterly survey). However, a substantial drop is to be expected, and should have no effect on the estimates. However, the drop in the level of the raw proportion in 1998 and 1999 especially seems overstated, and may be related to the use of out-of-date sample frames in those years. Since 2000 the frame has been becoming progressively better at sampling the newly registered vehicles. Thus the major adjustment made to this component, as shown in Table 4, is to set the post 1995 proportion at 92.5%. In addition a smoothing of the trend pre 1995 has been introduced.

Table 5: Per Centage of Vehicles with Laden Business Kilometres

Year	Raw proportion with lbk	**Adjusted proportion with lbk**
1971	100	100
1976	100	100
1979	100	100
1982	99	99
1985	100	**98**
1988	100	**98**
1991	97	97
1995	96.9	96.9
1998	89.4	**92.5**
1999	89.3	**92.5**
2000	91.5	**92.5**
2001	91.9	**92.5**
2002	92.6	**92.5**

Adjusting for the 2001 post-sample stratification exercise

In 2002 the ABS undertook a review of the methodology used for the SMVU. This review identified that a problem had occurred affecting the representativeness of the SMVU samples especially for the years 1998 to 2000. In 2003, post-stratification estimates were given for the 5 years 1998 to 2002. The ABS explanation is as follows.

'This problem had different effects on each sample selected. Post-stratification was used to correct for this bias in the samples. Post-stratification improves the quality of results through stratifying by variables that were not used at the time of sample design. All published data from 1998 to 2002 was revised after post-stratification was applied, and therefore there is no methodological break in series between 1998 and 2002. Each of the samples from 1998 to 2002 was post-stratified independently.'

'However, the success of post-stratification in correcting for sample bias in the five samples will vary, as it depends on the level of bias in the original samples selected.' (ABS, pers. com.)

The major impact of the 2001 post-sample stratification exercise was on the estimates of the freight task pre-2001. Table 6 is drawn from the 2001 SMVU (ABS 2003a, p.39). It shows that before the post-sample stratification, the freight task rose 4 B tkm between 2000 and 2001, whereas after it fell 2 Btkm.

The major reason for this difference was a large downward shift (about 5.5%) in the estimate of average laden business kilometres for artics. The only previous decline in artic kilometres was in the 1991 survey. In that year, both the percentage of artics with laden kms and registrations of new artics hit a V-shaped bottom in comparison with the earlier and later SMVU survey dates. It was also a year when GDP growth went negative heading into the 1991-92 recession. All these pieces of evidence lend support to the reality of the 1991 decline in artic average laden business kilometres. But in 2001, neither the percentage with laden kilometres nor the registrations of artics lent any confirmation to the decline in kilometres. Nor did GDP, which rose 1.8 per cent.

So it seems the decline in average laden kilometres in 2001 is the result of the post-sample stratification exercise. If plausible values for artic average kilometres are put into the estimates for the pre-2001 methodology, and all other component values for artics, rigids and LCVs move between 2000 and 2001 as in the post-2001 methodology estimates, the total given in Table 6 for 2001 tonne-kms using the pre-2001 methodology can be recreated.

Accordingly, estimates presented in this paper of artic laden business kilometres before 2001 have been lowered by multiplying by a fractional amount (0.9454 as discussed in the section on adjusting laden business kilometres). As artics represent about 77 per cent of the total road freight tonne-kms, this translates to about a 4.3 per cent downward adjustment in pre 2001 tonnage totals, similar to the magnitude indicated in Table 6.

Table 6: Impact of post-stratification exercise on SMVU data, Australia

	Before review	After review	% change
2000			
Total kilometres travelled (million)	180 782	184 593	2.11
Total tonne-kilometres travelled (million)	128 702	134 378	4.41
Total fuel (million litres	24 926	25 853	3.72
2001			
Total kilometres travelled (million)	187 819	190 152	1.24
Total tonne-kilometres travelled (million)	132 756	132 422	-0.25
Total fuel (million litres	25 931	25 948	0.07
Freight change 2000 to 2001	+ 4 B tkm	- 2 B tkm	

Miscellaneous adjustments

Several miscellaneous adjustments have been made. First, vehicle numbers in some years have been set to the SMVU adjusted numbers. These years are: artics 1985 and 1991, rigids 1982 to 1995, and LCVs 1991.

The average laden business kilometres have been interpolated in some years. These years are: artics 1995, rigids 1982, 1985 and 1995, and LCVs 1985, 1988 and 1995. In addition, for LCVs 2000 and 2001 have been smoothed.

The average load per truck has also been interpolated in some years. These years are: artics 1985 and 1991, rigids 1979, 1982, 1995 and 1998, and LCVs 1991, 1999 and 2000. From 1999 onwards, the 3-year average of average load per truck has been used for all vehicle types as the adjusted figure. This attempts to smooth out survey noise.

Finally, for various years the proportion of vehicles with laden business kilometres has been smoothed.

The 1991 vehicle definition changes

From 1991 onwards, there was a change in the definition of LCVs and rigids.

Table 7, drawn from a special ABS run for Apelbaum Consulting, shows the 1988 SMVU vehicle data (old vehicle definitions) categorised by Gross Vehicle Mass (the new definition being LCVs up to 3.5 tonnes and rigids above 3.5 tonnes).

Note that some vehicles would have been reclassified under the 1991 definition from LCVs to rigids (the 16059 vehicles greater than 3.5 tonnes), and some would have moved from rigids to LCVs (the 36646+29605+13077=79328 vehicles less than 3.5 tonnes).

Table 7: 1988 SMVU Rigid and LCV Numbers by Gross Vehicle Mass (tonnes)

Type of Vehicle		*Weight*	*Category*	*(Gross*	*Vehicle*	*Mass)*
	Below 2.5	***2.5 – 3.0***	***3.0 – 3.5***	***Above 3.5***	***Not stated***	**Total**
LCVs	478171	193092	93761	16059	397816	1178899
Rigids	36646	29605	13077	325330	0	404658
Artics				48722	0	48722
Other trucks					23138	

To make a rough correction for the definition change, it was assumed that the amount of freight task (tkm) moving each way was balanced.

Then, assuming also that the laden business kilometres and the per cent laden also remained unchanged, it was possible to adjust the stock numbers and calculate new average loads (using the disaggregation correction identity).

The number of LCVs and rigids switching categories in earlier surveys were based on the 1988 percentages held constant, ie. 19.6 per cent of rigids going to LVCs, and 1.36 per cent of LCVs going to rigids (assuming the 'not stated' vehicles were all utes – less than 3.5 tonnes).

Finally, the 1991 defintion change also resulted in about 6.6 per cent of what were LCVs before 1991 being reclassified as cars (and assumed therefore to carry no load). This per centage was kept constant to adjust the pre-1991 LCV stock numbers down. This correction was done before the final calculation was made of the new average load figures.

Adjusted versus unadjusted tonne-kilometres

In summary, adjustments have been made in four major areas affecting the estimate of the aggregate freight task: (1) artic stock numbers have been adjusted to approximate the average number in the12 months ending October 31. (2) average laden business kilometres in the old 12 month recall survey have been lowered 5 per cent to adjust to the current 3 month pre-advice methodology. (3) the percentage of vehicles laden has been raised somewhat in 1998 and 1999 to account for deficiencies in the sample frame and (4) the average laden business kilometres for artics pre-2001 have been lowered by about 5.5% to adjust for the effect of the 2001 post-stratification exercise.

In addition, miscellaneous changes have been made, as have adjustments for the effect of the 1991 vehicle definition change on rigid and LCV stock numbers and average load.

The effects of these revisions are shown in Tables 8 and 9, and in Figures 2 to 5 for, respectively, artics, rigids, LCVs and the total. Extrapolating the components in the framework allows a rough forecast one year ahead of the data.

Table 8: Summary of changes by type of vehicle

ARTICS year	raw artics SMVU	**adj artics MVC(-)**	raw aver load/lbk	**adj aver load/lbk**	raw aver laden bus km	**adj aver laden bus km**	raw propor with lbk	**adj propor with lbk**	B tkm raw artic freight	**Btkm adj artic freight**
71	32000	**30503**	14616	**14616**	32.5	**29.2**	100.0	**100.0**	15.2	**13.0**
76	39735	**37149**	16510	**16510**	35.2	**31.6**	99.8	**99.8**	23.0	**19.4**
79	43949	**41692**	17656	**17656**	41.2	**37.0**	99.7	**99.7**	31.9	**27.2**
82	46575	**45273**	18784	**18784**	46.4	**41.7**	99.1	**99.1**	40.2	**35.1**
85	49641	**47320**	19959	**19716**	53.4	**48.0**	99.5	**98.3**	52.7	**44.0**
88	48722	**47570**	20648	**20648**	59.6	**53.5**	99.6	**97.6**	59.7	**51.3**
91	52106	**49753**	21474	**21474**	57.8	**51.9**	97.3	**97.0**	62.9	**53.8**
95	57939	**55463**	23659	**23438**	67.3	**58.4**	96.9	**96.9**	89.4	**73.6**
98	59573	**59745**	24911	**24911**	66.9	**63.3**	89.4	**92.5**	88.8	**87.1**
99	62493	**60893**	25602	**25313**	70.7	**66.9**	89.3	**92.5**	101.0	**95.3**
2000	61117	**60814**	25427	**25645**	72.8	**68.8**	91.5	**92.5**	103.5	**99.3**
2001	61502	**60736**	25907	**26000**	69.6	**69.6**	91.9	**92.5**	101.9	**101.7**
2002	61519	**62096**	26664	**26524**	70.4	**70.4**	92.6	**92.5**	107.0	**107.3**
2003		**62362**		**27000**		**71.1**		**92.5**		**110.7**

RIGIDS year	raw rigids SMVU	**adj rigids MVC(+)**	raw aver load/lbk	**adj aver load/lbk**	raw aver laden bus km	**adj aver laden bus km**	raw propor with lbk	**adj propor with lbk**	Btkm raw artic freight	**Btkm adj artic freight**
71	365800	**301424**	3048	**3702**	10.3	**9.8**	96.7	**95.0**	11.1	**10.4**
76	383227	**309736**	3206	**3859**	10.4	**9.9**	94.6	**95.0**	12.1	**11.2**
79	350563	**344613**	3686	**4060**	11.4	**10.8**	95.1	**95.0**	14.0	**14.4**
82	442823	**363952**	3156	**4255**	12.6	**11.4**	94.8	**94.0**	16.7	**16.5**
85	426272	**353834**	3724	**4433**	12.5	**11.9**	93.6	**93.0**	18.6	**17.3**
88	404658	**339910**	3955	**4687**	14.5	**12.7**	92.7	**92.0**	21.5	**18.6**
91	330784	**355116**	4795	**4795**	14.2	**13.5**	91.2	**91.0**	20.5	**20.9**
95	335430	**338053**	5284	**5131**	15.5	**14.2**	91.2	**90.0**	25.0	**22.1**
98	344817	**347415**	5416	**5383**	14.7	**14.7**	83.1	**87.0**	22.8	**23.9**
99	349736	**348902**	5437	**5467**	15.0	**15.0**	83.2	**87.0**	23.7	**24.9**
2000	346628	**344595**	5547	**5430**	16.1	**16.1**	81.3	**87.0**	25.2	**26.2**
2001	332102	**340289**	5305	**5573**	16.3	**16.3**	86.6	**86.6**	24.9	**26.8**
2002	341651	**343662**	5867	**5741**	16.2	**16.2**	87.3	**87.3**	28.3	**27.9**
2003		**351214**		**6050**		**16.2**		**87.0**		**29.9**

LCVs year	raw LCVs SMVU	**adj LVCs MVC**	raw aver load/lbk	**adj aver load/lbk**	raw aver laden bus km	**adj aver laden bus km**	raw propor with lbk	**adj propor with lbk**	Btkm raw artic freight	**Btkm adj artic freight**
71	532700	**547245**	301	**284**	9.7	**9.2**	63.7	**63.7**	1.0	**0.9**
76	723846	**749783**	385	**377**	9.1	**8.6**	62.2	**62.2**	1.6	**1.5**
79	939424	**873630**	419	**413**	9.9	**9.4**	57.4	**57.4**	2.2	**1.9**
82	1004112	**991714**	388	**385**	12.6	**12.0**	49.2	**49.2**	2.4	**2.3**
85	1136166	**1113526**	414	**417**	13.8	**12.0**	47.2	**47.2**	3.1	**2.6**
88	1178899	**1162900**	436	**441**	15.4	**12.0**	54.3	**54.3**	4.3	**3.3**
91	1346416	**1303563**	484	**426**	12.6	**12.0**	57.8	**57.8**	4.8	**3.8**
95	1566628	**1526192**	415	**415**	13.8	**12.7**	53.5	**53.5**	4.8	**4.3**
98	1566161	**1658380**	394	**394**	13.2	**13.2**	56.2	**56.2**	4.6	**4.8**
99	1621634	**1703458**	425	**397**	12.9	**12.9**	57.5	**57.5**	5.1	**5.0**
2000	1696631	**1737521**	434	**400**	14.7	**14.0**	52.6	**55.0**	5.7	**5.4**
2001	1719654	**1771584**	407	**403**	15.3	**14.0**	52.8	**55.0**	5.6	**5.5**
2002	1810071	**1824314**	400	**402**	14.0	**14.0**	55.5	**55.5**	5.6	**5.7**
2003		**1884899**		**402**		**14.0**		**55.0**		**5.8**

Table 9: Total road freight estimates and data

fin yr	SMVU raw Total B tkm	SMVU adjd **Total B tkm**	**pred Marul Btkm**	**pred GDP Btkm**	**ACG Btkm**	GDP $m1998	road Rate c/ntk	cpi 1990 =100	marulan Trucks (no)	SMVU load Artics (kg)	GDP Index 1998 =100	Adjd Total % ch	GDP % ch	pred Marul **GDP** % ch
71	**27.3**	**24.3**	**24.6**	**24.3**		246212	1.44	17.95	258977	14616	43.2			
72	29.2	25.9	**26.9**	**25.8**		255680	1.51	19.12	283384	14995	44.8	6.4	3.8	9.1
73	31.1	27.4	**26.1**	**27.1**		264505	1.62	20.68	339856	15374	46.4	6.0	3.5	-3.1
74	32.9	29.0	**29.3**	**30.0**		278124	1.77	23.71	388363	15752	48.8	5.7	5.1	12.6
75	34.8	30.5	**30.8**	**31.3**		281052	2.00	27.71	404622	16131	49.3	5.4	1.1	5.0
76	**36.7**	**32.1**	**33.8**	**33.1**		288602	2.18	31.02	447299	16510	50.6	5.1	2.7	9.8
77	40.5	35.9	**35.2**	**36.0**		297870	2.35	35.22	460711	16892	52.2	11.9	3.2	4.0
78	44.3	39.7	**40.5**	**39.7**		300195	2.46	38.05	457692	17274	52.7	10.6	0.8	15.1
79	**48.1**	**43.5**	**43.5**	**43.8**		316750	2.58	41.37	491852	17656	55.6	9.6	5.5	7.3
80	51.9	47.0	**47.5**	**45.9**		324485	2.61	45.85	541879	18032	56.9	8.0	2.4	9.3
81	55.6	50.5	**50.2**	**50.0**		334865	2.69	49.85	570679	18408	58.7	7.4	3.2	5.6
82	**59.4**	**53.9**	**52.7**	**54.0**		345290	2.85	55.22	597451	18784	60.6	6.9	3.1	5.1
83	64.4	57.3	**51.9**	**54.2**		336257	3.04	61.37	530303	19175	59.0	6.2	-2.6	-1.6
84	69.3	60.6	**60.4**	**58.7**		354126	3.10	63.80	635346	19567	62.1	5.8	5.3	16.4
85	**74.3**	**63.9**	**61.8**	**63.7**		372053	3.22	68.00	642906	19959	65.3	5.5	5.1	2.4
86	78.0	67.1	**67.1**	**69.0**		387724	3.38	73.76	708456	20189	68.0	4.9	4.2	8.5
87	81.8	70.2	**67.8**	**70.3**		397491	3.74	80.59	710019	20419	69.7	4.6	2.5	1.0
88	**85.5**	**73.3**	**73.8**	**75.6**	**96.5**	418795	3.96	86.34	785201	20648	73.5	4.4	5.4	8.8
89	86.4	75.0	**79.0**	**80.5**	100.5	435727	4.19	92.88	849382	20923	76.4	2.4	4.0	7.2
90	87.3	76.8	**81.9**	**85.0**	104.5	451977	4.46	100.00	879360	21198	79.3	2.4	3.7	3.7
91	**88.2**	**78.6**	**82.7**	**83.7**	**108.5**	451563	4.69	103.41	878834	21474	79.2	2.3	-0.1	0.9
92	96.0	83.9	**83.5**	**82.2**	114.2	452779	4.86	104.68	869994	21965	79.4	6.8	0.3	0.9
93	103.7	89.3	**88.6**	**86.0**	119.8	469355	4.94	106.63	920700	22456	82.3	6.4	3.7	6.1
94	111.5	94.6	**92.8**	**89.4**	125.5	487611	5.07	108.49	958654	22947	85.5	6.0	3.9	4.8
95	**119.2**	**100.0**	**97.0**	**96.9**	**131.1**	507945	5.11	113.37	995356	23438	89.1	5.7	4.2	4.5
96		105.3	**104.5**	**103.9**	136.8	529355	5.15	116.88	1075127	23929	92.8	5.3	4.2	7.7
97		110.6	**110.6**	**111.3**	142.4	548814	5.21	117.27	1136062	24420	96.3	5.0	3.7	5.9
98	**116.1**	**115.9**	**116.8**	**116.8**	**148.1**	573243	5.27	118.05	1196996	24911	100.5	4.8	4.5	5.6
99	**129.9**	**125.2**	**124.0**	**124.2**	**152.6**	603446	5.33	119.32	1275568	25313	105.8	8.1	5.3	6.2
00	**134.4**	**130.9**	**131.0**	**132.1**	**164.1**	627559	5.48	124.70	1354139	25645	110.1	4.5	4.0	5.6
01	**132.4**	**133.9**	**134.4**	**133.7**	**160.9**	638597	5.66	132.20	1382489	26000	112.0	2.3	1.8	2.6
02	**140.9**	**140.8**	**141.4**	**142.5**	**173.4**	662676	5.70	136.00	1449107	26524	116.2	5.1	3.8	5.2
03		146.5	**147.6**	**145.9**		682300	5.95	140.20	1507071	27000	119.7	4.0	3.0	4.4
04				**152.9**		707450	6.07	143.50					3.7	**4.8**
05				**160.1**		732211	6.04	143.50					3.5	**4.7**
06				**167.6**		757838	6.01	143.50					3.5	**4.7**
07				**175.5**		784362	5.98	143.50					3.5	**4.7**
08				**182.1**		805932	5.95	143.50					2.8	**3.8**
09				**188.9**		827693	5.92	143.50					2.7	**3.7**
10				**195.8**		849626	5.89	143.50					2.7	**3.7**
11				**202.9**		871717	5.86	143.50					2.6	**3.6**
12				**210.1**		893946	5.83	143.50					2.6	**3.5**
13				**217.4**		916294	5.80	143.50					2.5	**3.5**
14				**224.7**		938285	5.77	143.50					2.4	**3.4**
15				**232.1**		960335	5.74	143.50					2.4	**3.3**
16				**239.6**		982423	5.72	143.50					2.3	**3.2**
17				**247.2**		1004527	5.69	143.50					2.3	**3.2**
18				**254.9**		1026627	5.66	143.50					2.2	**3.1**
19				**262.7**		1048699	5.63	143.50					2.2	**3.1**
20				**270.6**		1070722	5.60	143.50					2.1	**3.0**

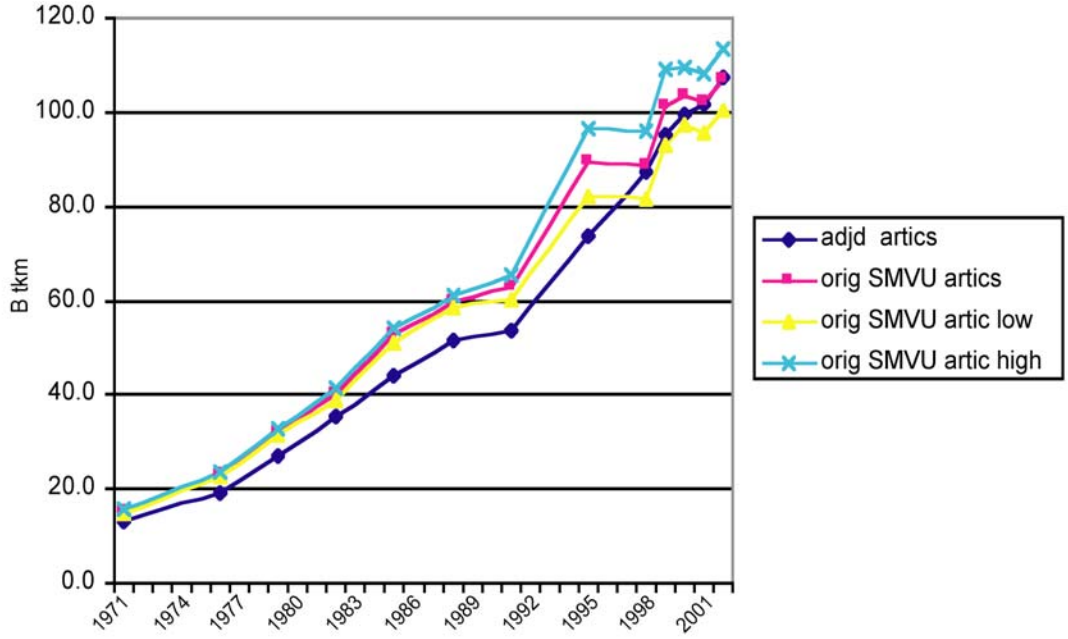

Figure 2: Original vs Adjusted Artic tkm

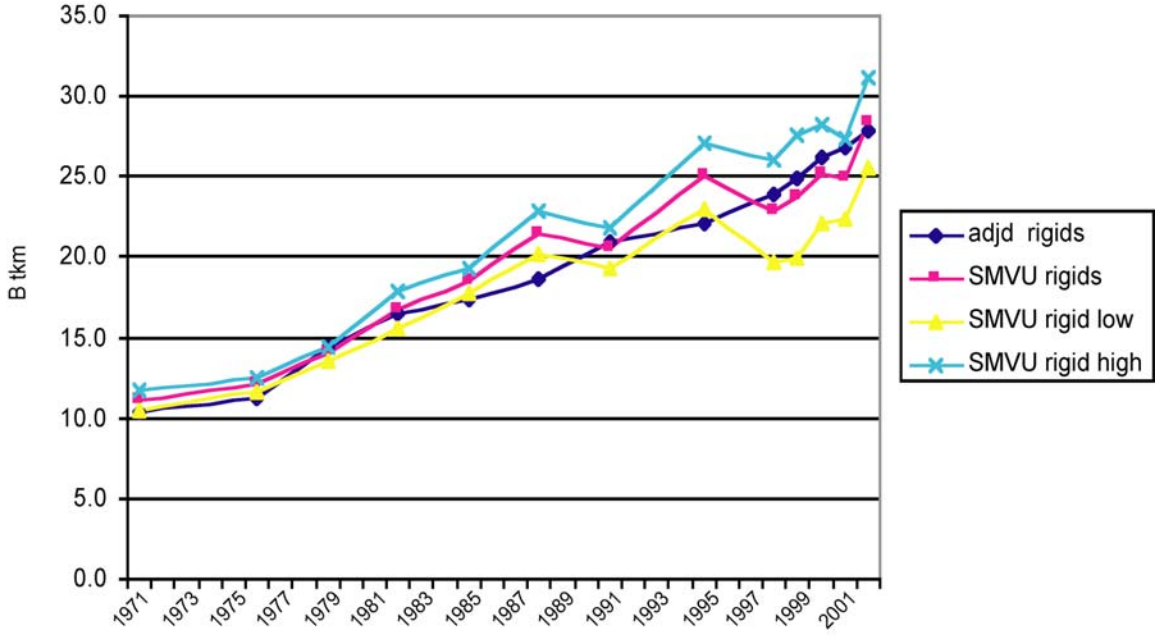

Figure 3: Adjusted vs Original Rigid tkm

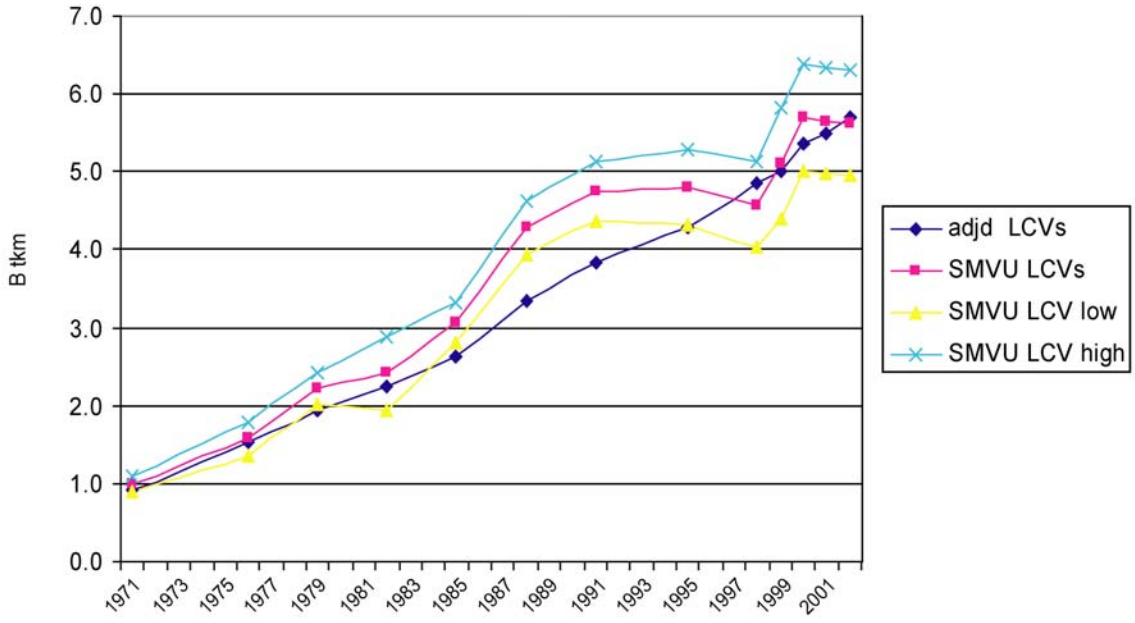

Figure 4: Adjusted vs Original LCV tkm

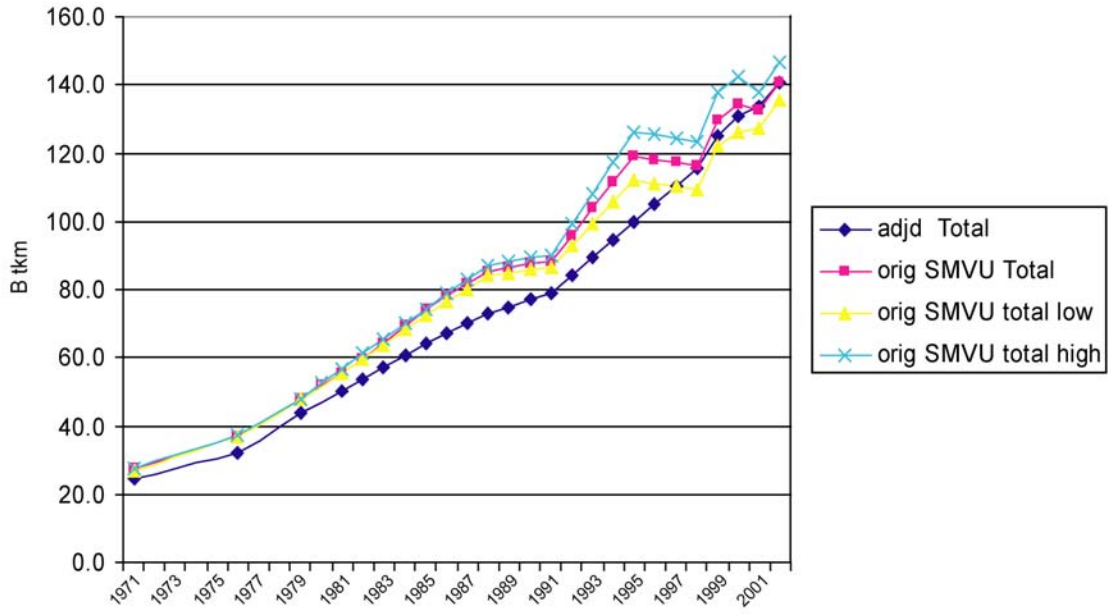

Figure 5: Adjusted vs Original Total tkm

Using the cleaned data

Once the cleaned data is available, the first question one thinks of is – How valid are the adjusted data as a representation of the total road freight task? There are only two long-term series useful in answering this question: the series of truck counts at Marulan, and the Apelbaum Consulting Group estimates (see Table 8).

The Marulan series is drawn from data subject to a lot of measurement error since 1995, but our best efforts have been made to correct for this. Using this series multiplied by the artic load per truck series from the SMVU, one gets a series approximating road freight tonnages through Marulan. This is a fast growing intercapital route, so the elasticity of total road freight (including bulk plus non bulk, urban plus non-urban) with respect to Marulan freight is expected to be less than one. The equation (fitted over 1971 to 2002, with dummy variables from 1973-1977 and 1978-1982) confirms this:

Total Road Freight (Btkm) = exp(-13.425+0.754*log (Marulan freight) -.187*dum7377 -.058*dum7882)

Figure 6 shows that the three variables resulted in a fair match with the adjusted total road freight task (especially over the two break-in-series periods).

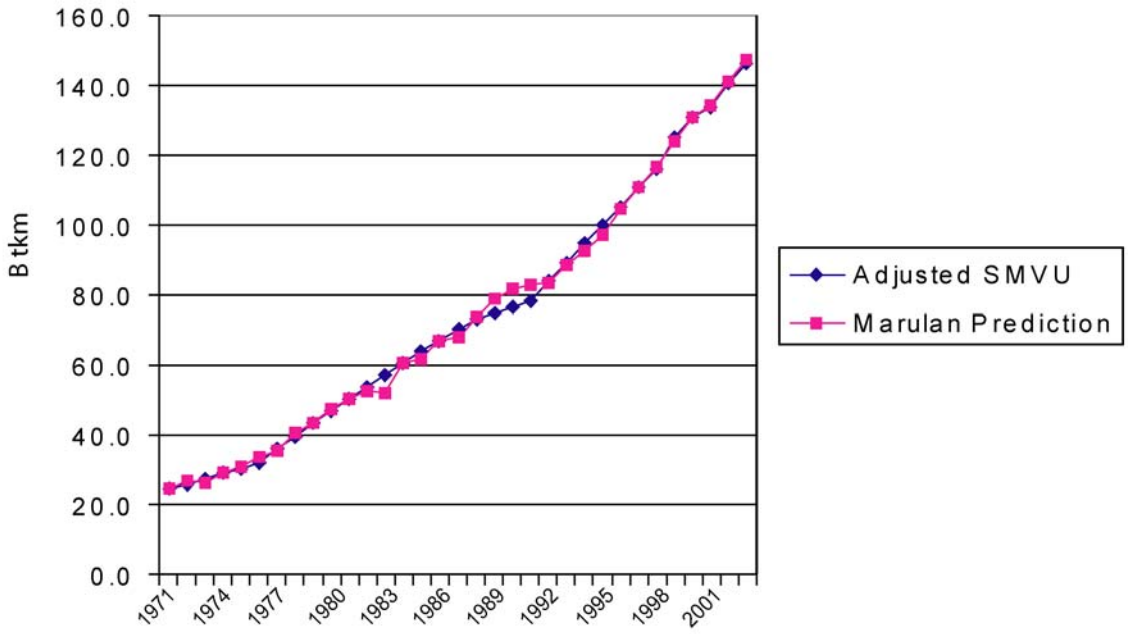

Figure 6: Adusted SMVU vs Marulan Prediction

The Apelbaum Consulting Group has derived bottom-up estimates of the total road freight task (Apelbaum Consulting Group 2004). These differ in level from the adjusted series presented here, but from 1998 broadly support its trend (see Figure 7). The issue of whether the current ABS survey correctly estimates the *level* of road freight remains an open question, but not one that is relevant here.

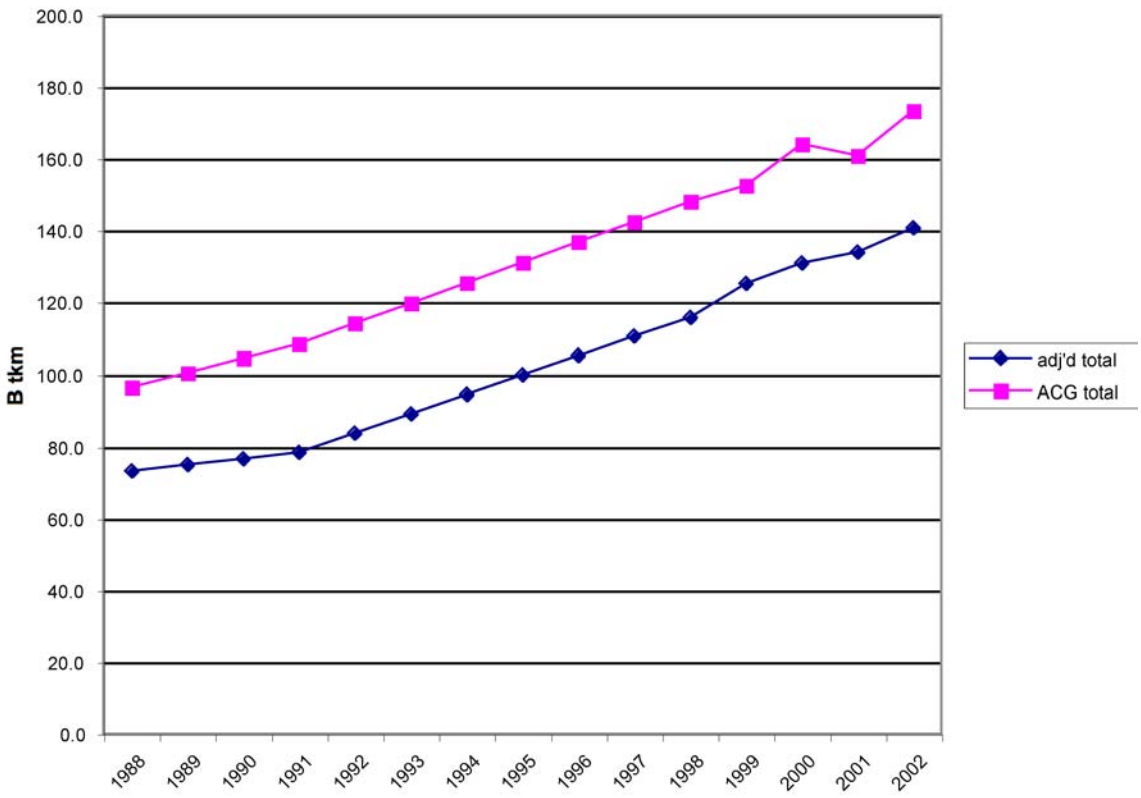

Figure 7: Adjusted vs Apelbaum Consulting Group

The second question that springs to mind is – What are the implied income and price elasticities using the adjusted data. Using real GDP, the real road freight rate and dummies for 1978-1979 and 1997-2000, the following equation (fit over 1971 to 2002) resulted:

Total Road Freight (Btkm) = exp(-9.938 + 1.206 * log (real GDP) - 0.885 * log (real road rate) + 0.062 * dum7879 + 0.032 * dum9700)

Thus past growth suggests that the total road freight task has a 1.21 income elasticity and a –0.89 price elasticity. Figure 8 shows the fit.

The 1.21 income elasticity means that total road freight grows substantially faster than GDP. Figure 9 shows the adjusted road freight task and an index of real GDP on the same scale.

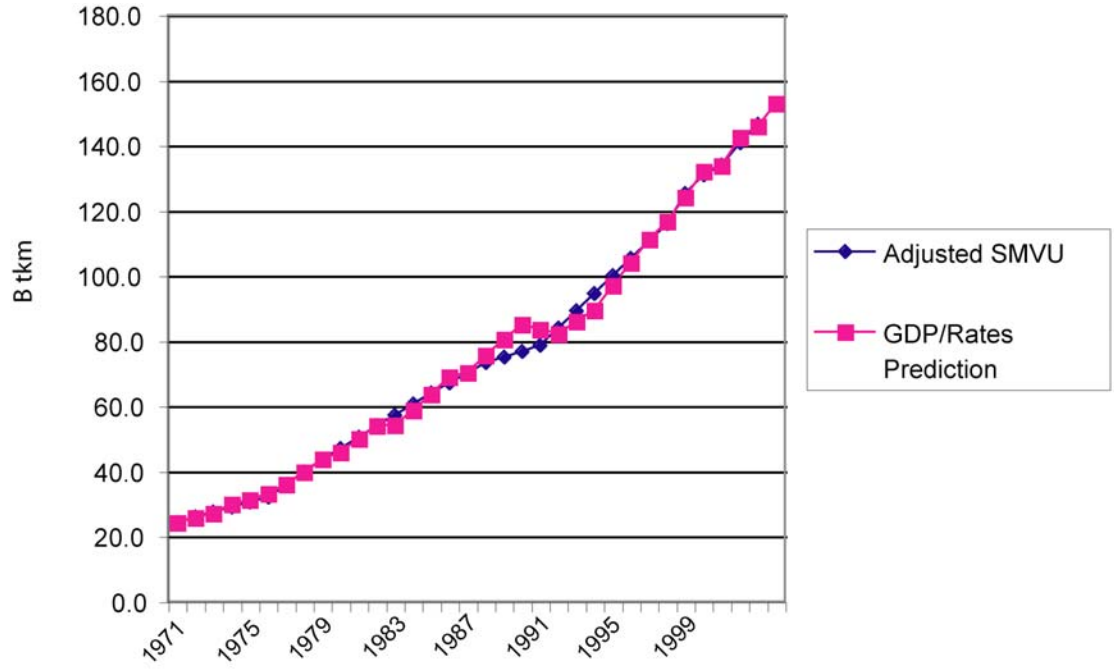

Figure 8: Adjusted SMVU vs GDP/Rates Prediction

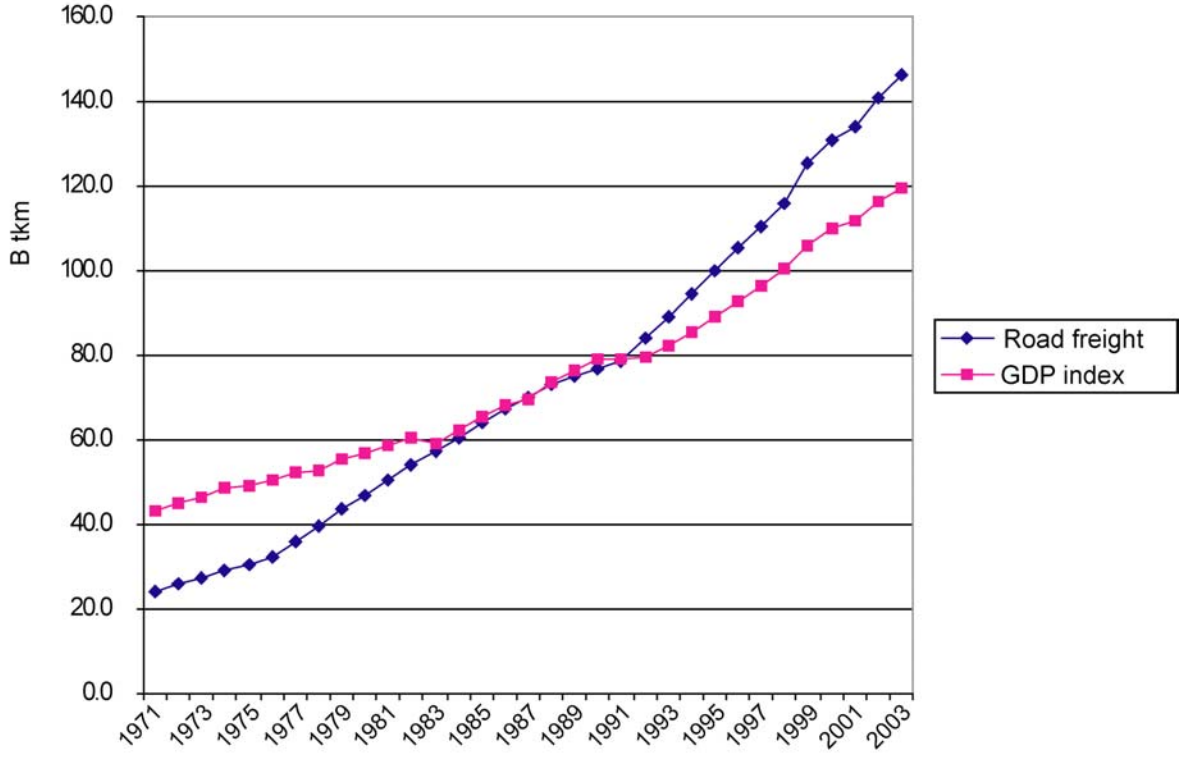

Figure 9: Road Freight and GDP

Suppose one assumes 2.7% per year real GDP growth over the 20 years from 2000 to 2020 (Treasury 2002), as well as a –0.5% per year decline in real road freight rates (BTRE 2002, TransEco 2003). Then one gets the **total road** freight task (urban plus non-urban, bulk plus non-bulk) growing from an estimated 130.1 Btkm in 2000 to 270.6 Btkm in 2020, more than doubling in 20 years. (2.7 times 1.206 = 3.26; -0.5 *-0.885 = 0.44; 1.0326 *1.0044 = 1.0371, ie a 3.71% per year growth rate; 1.0371^{20} = 2.07 times). Figure 10 shows the past and predicted levels of the total road freight task.

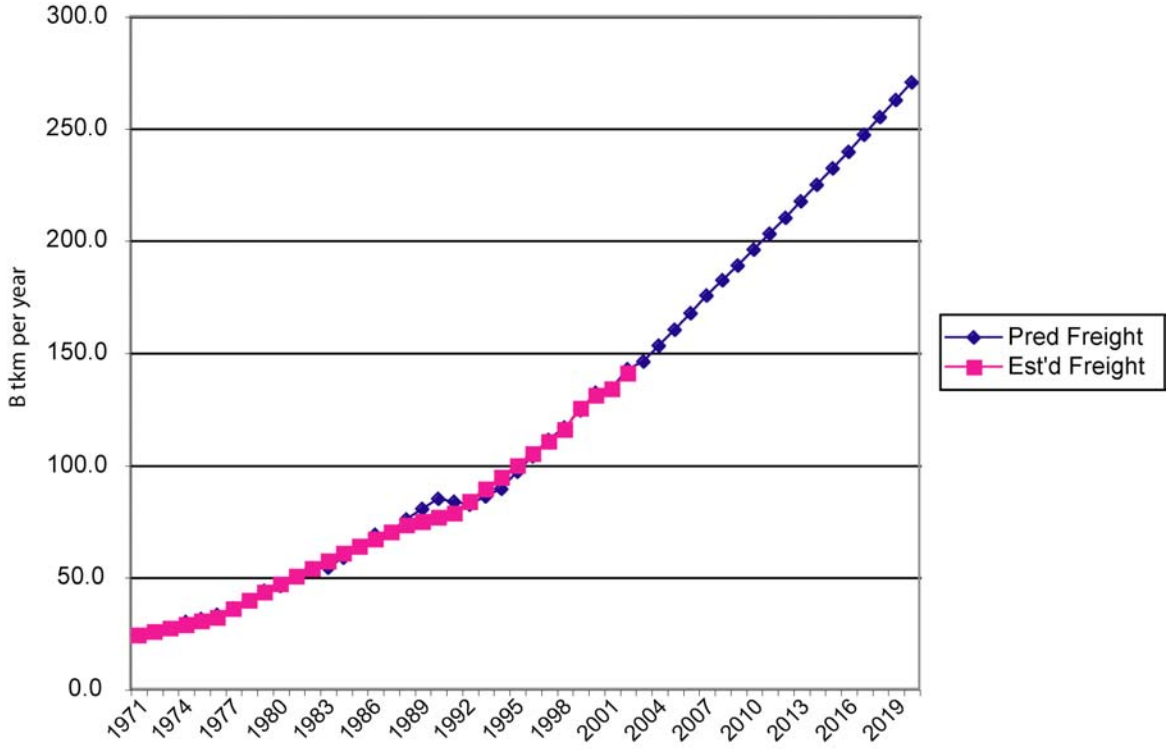

Figure 10: Estimated & Predicted Total Road Freight Task

Figure 11 shows the annual per cent change in total road freight estimated from the Marulan equation (which has the advantage of annual measurement), against the annual GDP growth rate. The first thing to notice is the fairly clear relationship between the annual movements. The recessions of 1983 and 1991/92 are in both data series, as is the 2001 slow-down. The second thing to notice is the much higher growth rates in total road freight than GDP in the 1970s and 80s. This was the period in which real road freight rates fell substantially, making freight cheaper and encouraging its rapid growth. The third thing to notice is that in the 1990s when freight rates decreases have slowed substantially, the ratio of freight growth to economic growth has fallen towards the 20 per cent faster relationship estimated above.

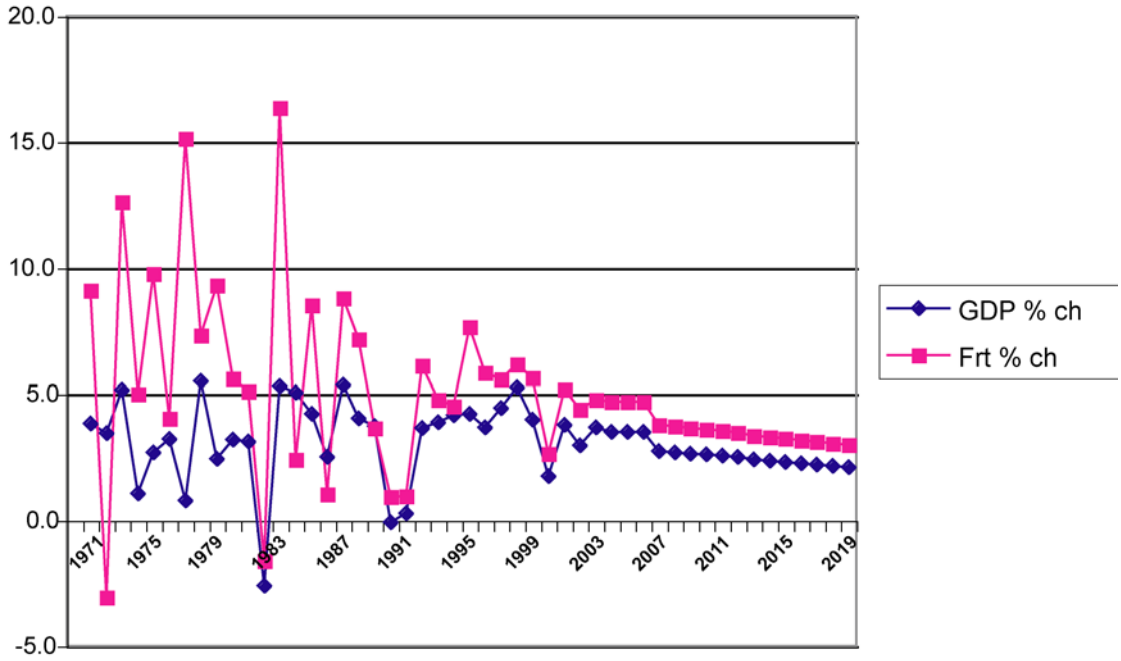

Figure 11: Road Freight vs GDP Change

If one uses the GDP and rates assumptions mentioned above, the *forecast* growth rates in Figure 11 result. The growth rate in total road freight is expected to remain above a declining GDP growth rate. This of course implies that the expected growth rate in the road freight task will also be declining. However, as the calculations above also show, the absolute growth over 20 years should still be substantial.

Summary

One cannot use the data from past and present Surveys of Motor Vehicle Use interchangeably.

The raw data must be adjusted to account for 2 major periods of methodological adjustment, that give rise to four major problem areas, that in turn need to be adjusted within what is called a disaggregation correction framework. These problem areas are: (1) adjusting vehicle stock numbers, (2) adjusting for overstating of vehicle kilometres travelled in the recall surveys pre 1998, (3) correcting the proportion of laden vehicles (especially in 1998 and 1999) and (4) adjusting for the effect on road freight estimates of the 2001 post-sample stratification exercise.

The resulting adjusted total road freight data lines up well with validating road freight data from Marulan, and implies an income elasticity of 1.21 and a price elasticity of –0.89. Applying suitable assumptions about income and price has total road freight more than doubling in the 20 years between 2000 and 2020.

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