Public Submission

Estimation of CPI-X in the WA Rail Industry

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1. SUMMARY

Indec Consulting has reviewed the Draft Final Report "Estimation of CPI-X in the WA Rail Industry" prepared by the Institute for Research into International Competitiveness (IRIC) and GHD Pty Ltd dated March 2004.

We consider that several of the assumptions made in the Report appear to be at odds with our understanding of the current position within the WestNet network:

- The factors used to adjust the cost of Maintenance and Operating & Overhead Expenses to represent full capacity costs were significantly higher than any calculations by Indec Consulting.
- The derivation of the 2001 data has lead to significant variations in the TFP and hence the X Factors for each of the four lines examined. This seems inconsistent with the theoretical (rather than actual) nature of most of the costs which are used to derive the ceiling price in the Code. We consider that the benefits of using the TFP approach is reduced because actual costs cannot be used in the Tornqvist Index.

We also found some of the results for the X Factor on certain lines (presumably as a result of the interpolation of the 2001 data) lead to inconsistent conclusions on the effectiveness of the methodology used to derive the X Factor. Whilst this would not occur when the new data is used in 2006, it does make evaluation of the methodology more difficult.

Whilst we are yet to be convinced that the approach suggested by IRIC as a means of calculating X will provide the Regulator with an appropriate method for the years between major ceiling price reviews, two issues have been highlighted by this Report:

- The complexity of the calculations and the miniscule effect on the result of some of the inputs suggests that this approach may be "overkill" for the current regulatory regime where full resets occur every three years.
- A simpler version of the formula based on ABS Data and Outputs only may be better understood by both the users and the railway owner and provide no lesser level of accuracy to all concerned and would be more cost effective.

It should be noted that our review of the IRIC Report was made more difficult because there would appear to be an error in the presentation of the examples in the IRIC Report where the use of calculations to log base 10 rather than natural logs presents a distorted picture of the TFP methodology being promoted by the paper. The resulting larger variation in CPI-X generated adverse views on the use of the methodology and certainly lead to our closer examination of the differences in the X Factor across the four major lines in the network. If the recalculations by Indec shown in Appendix A are correct, then there is little difference in the result of the calculation of the X Factor for the four lines.

In summary, we consider that the detailed calculations in the Tornqvist Index provide little improvement in the accuracy of the calculation of X and we recommend that a simplified version of the index be used to calculate the X Factor in the two years between full regulatory resets.

The following section provides specific responses to sections of the IRIC Report [Section numbers from the IRIC Report are shown in square brackets]. Where we had been unable to research issues or where we had no comments on specific sections of the Report, these sections are omitted from our submission.

2. RESPONSE TO THE IRIC REPORT

The following comments are provided in response to specific sections of the IRIC Report.

2.1. Adjustments for Capacity [Section 3.4]

Before considering any adjustment to Maintenance and Operating Expense, it should be noted that the Code requires the maintenance costs for the MEA (modern equivalent asset) and the resulting operating expense to reflect the fact that the asset is new and therefore excludes any MPM (major planned maintenance) and that train control and signalling are based on a single train control centre for the whole network.

As a result maintenance costs, and to a lesser degree operating costs, do not reflect actual costs but are based on an estimate of the likely costs incurred on a new asset. As such, the movement in maintenance and operating costs as the utilisation increases will require careful modelling as the incremental costs will be less than expected on an existing ageing network.

It is not clear what approach was used to calculate the capacity factor to apply to the base maintenance costs in the IRIC Report. The use of factors ranging from 1.3 for Leonora, 1.8 for the Esperance Line and 2.2 for the EGR or SWM lines [Table 4 in the IRIC Report] do not appear logical. For example, a Maintenance Capacity Adjustment Factor of 2.2 on the SWM is proposed and yet this line, of all the lines surveyed, is close to its current rated capacity operating at 2.3 billion GTK per year on 165 km of track. It is difficult to see how a doubling of maintenance spend would be required if the current tonnage increased by 10% to 100%. The same figure has been used for the EGR but again, it is difficult to understand the basis for such a large capacity factor for the EGR given the higher track standard and the current traffic volume of 9.7 billion GTK over the 650 km.

The factors used appear to contradict practical experience which would suggest that, firstly, a significant portion of maintenance cost is inspection which is a fixed cost and secondly that increasing tonnages hauled (in the case of the SWM from say 2.3 bGTK to 2.55 bGTK) requires a 220% increase in maintenance. In reality, once tonnages reach these figures, the percentage increase in maintenance cost would be unlikely to match the percentage increase in gross tonnage.

For example, if the inspection component were, say, $5,000 per km and the total maintenance cost (as per the regulatory determination for the SWM[1]) was $15,000 per km, then the increase based on tonnage in the example above would be 10% of $10,000 or $1,000 per km resulting in a Capacity Adjustment Factor of 1.07.

Alternatively, if we use the ARTC estimate based on volume of $1.45 per thousand GTK[2], then this same increase of 0.25 bGTK would result in an increase of $362,500 for the SWM or $2,197 per km. This would result in a Capacity Adjustment Factor of 1.15.

Neither of these figures approach the factor of 2.2 suggested in the IRIC report.

A more detailed explanation of how all the capacity factors were calculated should be provided for comment as the IRIC correctly states that *"Due to the way in which the MEA is calculated, this capacity adjustment will need to be undertaken in future reviews, which utilise actual MEAs."* [Section 3.4 p13] and is not a one-off calculation for the purposed of illustration of a possible X calculation within the IRIC report.

We are also confused by the adjustment factors used for operating and overheads as factors of 1.4 and 1.6 are used for three of the four lines examined by the report. Given that the operating costs are substantially driven by the cost of train control services which are already provided on a 24 hour, 7 day per week basis, it is difficult to comprehend the factors suggested in relation to any tonnage increase on the line. Since there is even less of a linkage between overhead costs and increasing tonnage, the resulting factors appear very high. This argument is further reinforced by the fact that increasing tonnes typically come from existing users and through only one or two above rail operators. The example provided in the IRIC Report *"if demand doubles, you might need twice as many drivers, but no more CEOs"* [Para 2 p13] is also confusing as the inputs associated with Operational and Overheads Expenses for the track owner do not directly relate to increasing traffic. Train controllers, Schedulers or Customer Service personnel do not double if the traffic doubles. Driver numbers may well increase with tonnage but drivers are not employed by the track owner. Five train controllers operating

[1] Floor and Ceiling Costs to apply to WestNet Rail, ORAR, 24 September 2003 page 52

[2] Floor and Ceiling Costs to apply to WestNet Rail, ORAR, 24 September 2003 page 42

a round the clock service are required whether there are six trains running every four hours or 36 trains running every 40 minutes.

We also found that the modelling was not at all sensitive to large variations in the capacity factor (for example changing 2.2 and 1.6 to 1.1 changes the CPI-X for the SWM from 1.4669% to 1.4657% so whilst the examples chosen were, in our view, not representative, the effect on the result was insignificant.

2.2. Levels of Disaggregation [Section 3.5]

There would appear to be little gain and an increasing possibility of error if any further level of disaggregation beyond the four mainlines was contemplated. In fact, given the fact that X is required only to glide the ceiling price to the next full reset, it may more appropriate to have only one X for the whole network as the movement in real costs and prices is unlikely to be uniquely dependent on section of line issues.

The use of a single X Factor is further reinforced by the example provided in Appendix A where the difference between the four major lines is a maximum of 0.05% which is probably less than the margin of error in the raw data used for the calculation of the X factor in the first place.

We would suggest that only one X Factor be used for the whole network.

2.3. Calculation of Revenue [Section 4.1]

We agree that the IRIC assumption that the "second best solution" of adopting the revenue cap as the output measure appears to be the only available solution at this time however the use of the ceiling price does have the potential to create some problems.

The revenue ceiling is set by the regulator and any significant change in the ceiling which does not flow through to a change in input costs would result in a marked change in the X Factor. Further, there is an issue with actual cost movements in the firm's inputs versus the theoretical input costs used in the regulatory model. Technological improvements which may reflect in a ceiling price reduction may not be implemented by the firm however the firm will be subjected to a reduced CPI increase.

We consider that any effort made towards using or comparing average prices on other railways would reap the double benefit of providing more meaningful data for revenue figures for the purposes of calculating the X Factor and also provide the regulator with useful data on the use of different methods for calculating revenue ceilings (e.g. DORC versus GRV).

It should be further noted that the influence of the ceiling price in the calculation of the X Factor is significant as the example[3] from the IRIC Report illustrates:

Tornqvist Index = [difference in the ln of the outputs]- sum of [half the product of the difference in ln of the inputs and the change in weighting of each input]

For the SWM, the first component of the equation (the change in outputs) is :

3.0768 - 3.0361 = 0.0407 or 4.07%

and the second part of the equation (the change in inputs) is

$\frac{1}{2}[-4.841 \times 10^{-6} + 1.1731 \times 10^{-5} - 5.107 \times 10^{-6}] = 8.9158 \times 10^{-7}$ or 0.000089%

As a result, in the example provided in the report, the calculation of the change in inputs is very small and would need to be 1,000 times more significant to move the TFP by 0.1%. This would suggest that the effort should be directed towards an accurate calculation of the change in outputs rather than the change in input costs. Using the regulated ceiling as the proxy for outputs would therefore seem unsatisfactory given the problem of self-reference as stated in the IRIC report [p16]. Developing an appropriate Australia wide weighted average price for various line standards and traffic types would seem to be a priority.

2.4. Use of indexing [Section 4.2]

We have reviewed this section in detail and consider that the figures used and the results obtained appear to be incorrect due to the use of log base 10 (log) calculations instead of natural logs (ln).

[3] Note that this example uses natural logs and not $\log_{10}$ figures from the IRIC Report (see Section 2.4).

For example, Appendix 1 of the IRIC Report calculates a Change in TFP of 1.7692% for the SWM. This is based on the Tornqvist Equation but using log base 10 conversions (log) as follows:

Tornqvist = log y(t)-log y(t-1) - Sum 0.5[V(I,t)-V(I,t-1)][log x(I,t)- log x(I,t-1)]

0.017692 = 1.3362596 - 1.3185667 - 0.00000039

If the published formula is used, the result for the SWM is 4.0737% not 1.77%. This is based on using natural logs (ln) of the data as follows:

Tornqvist = ln y(t)-ln y(t-1) - Sum 0.5[V(I,t)-V(I,t-1)][ln x(I,t)- ln x(I,t-1)]

0.04073747 = 3.0768513 -3.0361121 -0.0000008916

Table 2.4.1 shows the difference between these methods as a revision to Table 6 in the IRIC Report.

Line	**Change in TFP based on ln**	**Change in TFP based on $\log_{10}$**
Esperance	-1.6839%	-0.73%
Leonora	-4.7376%	-2.04%
EGR	2.2373%	0.97%
SWM	4.0737%	1.77%

Table 2.4.1 Results of TFP Calculations using ln and $\log_{10}$ data.

If our conclusions are correct and there is a significant difference between the use of ln and $\log_{10}$ in the Tornqvist Index, we would suggest that the IRIC Report should be updated to show the correct TFP.

2.5. Change in Input Prices - Regulated Rail Firm[Section 5.4]

We have calculated the change in input prices based on the percentage change between the sum of the Capital, OOE and Maintenance Costs for 2003 and the sum of these same three figures for 2001 after both the adjustment for factor shares and the capacity adjustment factors were added. The results we obtained differ slightly from the IRIC Report and, due to the minor differences, no further explanation has been sought prior to lodging this submission. It would be useful if IRIC provided a more detailed explanation of the derivation of these figures in their final report.

Line	Change in Input Prices - IRIC	Change in Input Prices - Indec
Esperance	-1.683%	-1.674%
Leonora	-4.59771%	-4.620%
EGR	2.2925%	2.2218%
SWM	4.1552%	4.1610%

Table 2.4.1 Results of Calculations for Firm's Input Prices.

2.6. Summary of Findings [Section 6.1]

We have concluded that there is a significant difference to the way the TFP and hence the X Factor is calculated depending on the use of the logarithmic base in the Tornqvist Equation. Indec Consulting considers that only natural logarithms are valid in this equation as the delta values for the calculation of X include reference to ABS statistics for Australia based on natural logarithms in a Tornqvist superlative index.

As a result, our conclusions are very different from IRIC, in that the differences between the X Factors for the four lines are minimal and also the effect of the capacity factor on the end result is negligible. We therefore recommend that if a Tornqvist Index and TFP are finally considered to be a representative method of

"gliding" between one full reset and the next, that only one X Factor should apply and it should be the weighted average of all four lines.

The following table shows the results of the Indec Consulting modelling:

SUMMARY CPI-X	Esperance	Leonora	EGR	SWM
Weighted change in input prices	-1.6736%	-4.6200%	2.2218%	4.1610%
Change in TFP (Tornqvist)	-1.6837%	-4.7164%	2.2370%	4.0738%
X Factor 30 months	2.8899%	2.8036%	2.9152%	2.8128%
Annualised X Factor	1.1560%	1.1214%	1.1661%	1.1251%
Change in Prices (CPI-X) 30 months	3.5901%	3.6764%	3.5648%	3.6672%
Annualised CPI-X	**1.4360%**	**1.4706%**	**1.4259%**	**1.4669%**
			Weighted Avg	**1.4379%**

Table 2.6.1 Summary of Indec Model Outputs

As Table 2.6.1 shows, the four lines have an X factor range of 1.12% to 1.67% giving a weighted average X Factor of 1.15% which combined with a CPI of 2.59% resulting in a net annual increase of 1.44%. The current "temporary" method based on 75% of CPI gives a result of 1.94% based on the same CPI. The details of the calculations in this summary are provided in Appendix A.

APPENDIX A

CALCULATION OF TORNQVIST INDEX AND X FACTORS BASED ON NATURAL LOGARITHMS

SUMMARY CPI-X	Esperance	Leonora	EGR	SWM
Weighted change in input prices	-1.6736%	-4.6200%	2.2218%	4.1610%
Change in TFP (Tornqvist)	-1.6837%	-4.7164%	2.2370%	4.0738%
X Factor 30 months	2.8899%	2.8036%	2.9152%	2.8128%
Annualised X Factor	1.1560%	1.1214%	1.1661%	1.1251%
Change in Prices (CPI-X) 30 months	3.5901%	3.6764%	3.5648%	3.6672%
Annualised CPI-X	**1.4360%**	**1.4706%**	**1.4259%**	**1.4669%**
			Weighted Avg	**1.4379%**

Note: Weighted change for input prices do not agree with IRIC data
Calculations based on natural logarithms

CPI-X Weighted Average Calculation	Esperance	Leonora	EGR	SWM	
	$m	$m	$m	$m	Totals
2003/04 ceiling	32.12	18.93	99.13	21.69	171.87
estimated 2004/05 ceiling	32.58	19.21	100.54	22.01	174.34
Weighted Average Increase					1.4379%

Table A1 Summary Table for CPI-X using natural logarithms

	2001	2003	ln 2001	ln 2003	delta ln output		
Outputs	32.66533	32.12	3.486314	3.469479	-0.01683532	-1.6835320%	<change in outputs
Inputs							
Capital	25.93627	25.5	3.255642	3.238678	-0.016963962		
OOE	3.658517	3.612	1.297058	1.284262	-0.012796184		
Maintenance	7.408497	7.272	2.002628	1.984031	-0.01859616		
Total inputs	**37.00328**	**36.384**				-1.674%	< change in input prices

V					sum of inputs	
Capital	0.794	0.793898		-0.0001021	1.73202E-06	
OOE	0.112	0.112453		0.0004533	-5.80051E-06	
Maintenance	0.2268	0.226401		-0.000399	7.41987E-06	
					3.35138E-06	
					0.000168%	<half the sum of inputs
					-1.683700%	**<Tornqvist TFP**

Summary					
Weighted change in input prices					-1.6736%
Change in TFP (Tornqvist)					-1.6837%
X Factor	-1.68%	2.60%	5.50%	-1.674%	2.8899%
Annualised X Factor			30	12	1.1560%
Change in Prices (CPI-X)			6.48%		3.5901%
Annualised CPI-X					**1.4360%**

Table A2 Esperance Line - Calculations based on natural logs [Excel Spreadsheet "ln based Esperance"]

	2001	2003	ln 2001	ln 2003	delta ln output		
Outputs	19.84	18.93	2.9877	2.940748	-0.046952137	-4.6952137%	<change in outputs
Inputs							
Capital	16.65	15.88	2.81241	2.76506	-0.047349761		
OOE	1.12	1.0695	0.113329	0.067191	-0.046137436		
Maintenance	2.89	2.756	1.061257	1.01378	-0.047476149		
Total inputs	**20.66**	**19.7055**				-4.620%	< change in input prices

V				sum of inputs	
Capital	0.84	0.83888	-0.0011199	5.3027E-05	
OOE	0.06	0.056498	-0.0035024	0.000161592	
Maintenance	0.15	0.145589	-0.004411	0.000209417	
				0.000424036	
				0.021202%	<half the sum of inputs
				-4.716415%	**<Tornqvist TFP**

Summary					
Weighted change in input prices					-4.6200%
Change in TFP (Tornqvist)					-4.7164%
X Factor	-4.72%	2.60%	5.50%	-4.620%	2.8036%
Annualised X Factor			30	12	1.1214%
Change in Prices (CPI-X)			6.48%		3.6764%
Annualised CPI-X					**1.4706%**

Table A3 Leonora Line - Calculations based on natural logs [Excel Spreadsheet "ln based Leonora"]

	2001	2003	ln 2001	ln 2003	delta ln output		
Outputs	96.93742	99.13	4.574066	4.596432	0.022366473	2.2366473%	<change in outputs
Inputs							
Capital	74.7388	76.47	4.313999	4.336899	0.022899139		
OOE	13.8039	14.112	2.624951	2.647025	0.022074338		
Maintenance	29.8567	30.448	3.396409	3.41602	0.01961104		
Total inputs	**118.3994**	**121.03**				2.222%	< change in input prices

V					sum of inputs	
Capital	0.771	0.7714		0.0004	9.15966E-06	
OOE	0.1424	0.1424		0	0	
Maintenance	0.308	0.3072		-0.0008	-1.56888E-05	
					-6.52918E-06	
					-0.000326%	<half the sum of inputs
					2.236974%	**<Tornqvist TFP**

Summary					
Weighted change in input prices					2.2218%
Change in TFP (Tornqvist)					2.2370%
X Factor	2.24%	2.60%	5.50%	2.222%	2.9152%
Annualised X Factor			30	12	1.1661%
Change in Prices (CPI-X)			6.48%		3.5648%
Annualised CPI-X					**1.4259%**

Table A4 EGR Line - Calculations based on natural logs [Excel Spreadsheet "ln based EGR"]

	2001	2003	ln 2001	ln 2003	delta ln		
Outputs	20.824123	21.69	3.0361121	3.0768513	0.040739251	4.0739251%	<change in outputs

				Factor Shai	Raw data adj factor shares	
Raw Data	14.05	13.25		0.611	12.723539	
	4.2941226	5.73		0.264	5.497568	
	2.48	2.71		0.125	2.603015	
Totals	**20.824123**	**21.69**			**20.824123**	4.15805%

Capacity Adjustment		
OOE	1.6	1.6
Maintenance	2.2	2.2

Inputs			ln 2001	ln 2003	delta ln		
Capital	12.723539	13.25	2.5434537	2.5839976	0.040543817		
OOE	8.7961094	9.168	2.1743095	2.2157192	0.041409651		
Maintenance	5.7266337	5.962	1.7451279	1.785406	0.040278121		
Total inputs	**27.246282**	**28.38**				4.1610%	< change in input prices

V (Ratio of inputs - modified factor shares)			delta weighting	sum of inputs	
Capital	0.611	0.610881	-0.0001194	-4.84093E-06	
OOE	0.4224	0.422683	0.0002833	1.17314E-05	
Maintenance	0.275	0.274873	-0.0001268	-5.10727E-06	
				1.78316E-06	
				0.000089%	<half the sum of inputs
				4.073836%	**<Tornqvist TFP**

Summary					
Weighted change in input prices					4.1610%
Change in TFP (Tornqvist)					4.0738%
X Factor	4.07%	2.60%	5.50%	4.161%	2.8128%
Annualised X Factor			30	12	1.1251%
Change in Prices (CPI-X)			6.48%		3.6672%
Annualised CPI-X					**1.4669%**

Table A5 SWM Line - Calculations based on natural logs [Excel Spreadsheet "ln based SWM"]