

Expiring Spectrum Licences

Pricing approach

Choice of valuation methodology

Plum Consulting's 2023 report to the ACMA outlined 6 potential methodologies:

- > Direct benchmarking
- > Adjusted benchmarking
- > Econometrics
- > Avoided cost modelling
- > Iterated cost modelling
- > Business modelling (a.k.a. full enterprise valuation modelling)

Choice of valuation methodology

The key issues we considered in selecting a preferred methodology were:

- > Availability of data
- > Relevance of data inputs and methodology outputs
- > Complexity, time and cost

Direct benchmarking and adjusted benchmarking were considered most appropriate methodologies to use for ESL pricing.

The intended outcome is for a \$/MHz/pop price (or range of prices) for each spectrum band (or group of substitutable bands) to be derived from benchmarking.

Benchmarking – direct and adjusted

Direct benchmarking

- > Involves determining a valuation for a particular spectrum band based on benchmark valuations for the same band.

Adjusted benchmarking

- > Involves determining a valuation for a particular spectrum band based on its value relationship to one or more other spectrum bands.

We are proposing a methodology that relies mainly on direct benchmarking, but where there is a lack of relevant direct benchmarks for a band, we intend to perform a supplementary adjusted benchmarking exercise.

Direct benchmarking approach

The direct benchmarking approach includes 4 general steps:

- > Step DB1: Compile benchmark prices
- > Step DB2: Convert benchmark prices to a consistent currency, timing and licence duration
- > Step DB3: Weighting
- > Step DB4: Determine final valuation

Direct benchmarking approach

Step DB1 – Compile benchmark prices

We need to compile raw data for benchmark spectrum prices, such as:

Country	Year	Duration (Years)	Price (local)	Bandwidth (MHz)	Population	Price/MHz/pop (local)
USA	2021	15	80 billion	300	300 million	0.89
Canada	2021	20	8 billion	200	34 million	1.18
UK	2021	20	13.2 billion	250	66 million	0.80
Sweden	2013	25	14 billion	260	9 million	5.98

We also need to compile data for weighting purposes, such as:

Country	Year	Real GDP per capita (US\$)	# of MNOs	Geographic area (million km ²)	Population density
USA	2021	70,000	4	9.834	30.5
Canada	2021	55,000	3	9.985	3.4
UK	2021	58,000	4	0.244	270.5
Sweden	2013	68,000	3	0.450	20.0

Direct benchmarking approach

Step DB2 – Convert benchmark prices

Step DB2(1) involves converting each valuation into a single-year cashflow.

For example, the USA benchmark from the previous slide was US\$0.89/MHz/pop for a 15-year licence. Using a WACC of 8.4% and cashflow growth of 2.5%:

$$PPV_n = FPV_L \times \left\{ \frac{1 - \left\{ \frac{1+z}{1+r} \right\}^n}{1 - \left\{ \frac{1+z}{1+r} \right\}^L} \right\} = 0.89 \times \left\{ \frac{1 - \left\{ \frac{1+2.5\%}{1+8.4\%} \right\}^{15}}{1 - \left\{ \frac{1+2.5\%}{1+8.4\%} \right\}^{15}} \right\} = 0.0852$$

The 1-year cashflows are the following:

Country	Duration (Years)	Price/MHz/pop (local)	1-year Price/MHz/pop (local)
USA	15	0.89	0.0852
Canada	20	1.18	0.0951
UK	20	0.80	0.0647
Sweden	25	0.60	0.4323

Direct benchmarking approach

Step DB2 – Convert benchmark prices

Step DB2(2) involves converting the single-year cashflow to Australian dollars using the spot exchange rate and PPP exchange rate. In the example, the spot exchange rate with the USA was 0.70, so the Australian dollar value is:

$0.0852 \div 0.70 = A\$0.1217 \text{ per MHz per pop}$

Converting at the spot and PPP exchange rates lead to:

Country	Local price	Exchange rate (spot)	A\$ price (spot)	Exchange rate (PPP)	A\$ price (PPP)
USA	0.0852	0.70	0.1217	0.75	0.1136
Canada	0.0951	0.95	0.1001	1.00	0.0951
UK	0.0647	0.55	0.1175	0.50	0.1293
Sweden	0.0432	6.75	0.0641	6.00	0.0721

Direct benchmarking approach

Step DB2 – Convert benchmark prices

Step DB2(3) involves carrying forward benchmark valuations to the present. We propose to use an index based on mobile service revenue per MHz per head of population (MSR/MHz/pop), where the present is equal to 100. For example:

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
MSR/MHz/pop index	91.24	92.16	95.11	98.51	96.54	94.50	95.57	97.04	97.05	96.56	98.04	100

We can then divide each \$A 1-year cashflow by the index value for the relevant year to bring the valuation to the present. For example:

Country	Year	Index value	A\$ price (spot)	A\$ price (PPP)	2024 A\$ price (spot)	2024 A\$ price (PPP)
USA	2021	97.05	0.1217	0.1136	0.1254	0.1170
Canada	2021	97.05	0.1001	0.0951	0.1031	0.0980
UK	2021	97.05	0.1175	0.1293	0.1211	0.1332
Sweden	2013	91.24	0.0641	0.0721	0.0702	0.0790

Direct benchmarking approach

Step DB2 – Convert benchmark prices

Step DB2(4) involves carrying forward benchmark valuations from the present to the potential payment timing (e.g. 2028 for licences that expire in 2028). We propose to use projections of a continued MSR/MHz/pop index.

If the MSR/MHz/pop index is projected to increase from 100 in 2024 to 110.38 in 2028 (i.e. 4 years growth at 2.5% per annum), we get the following values:

Country	2024 A\$ price (spot)	2024 A\$ price (PPP)	2028 A\$ price (spot)	2028 A\$ price (PPP)
USA	0.1217	0.1136	0.1343	0.1253
Canada	0.1001	0.0951	0.1105	0.1049
UK	0.1175	0.1293	0.1298	0.1427
Sweden	0.0641	0.0721	0.0707	0.0795

Direct benchmarking approach

Step DB2 – Convert benchmark prices

Step DB2(5) involves converting the 2028 1-year cashflows into 20-year valuations using the same tilted annuity formula as in Step DB2(1) but flipping the shorter and longer licence duration parameters.

For example, to convert the USA 2028 spot exchange rate 1-year valuation:

$$PPV_n = FPV_L \times \left\{ \frac{1 - \left\{ \frac{1+z}{1+r} \right\}^n}{1 - \left\{ \frac{1+z}{1+r} \right\}^L} \right\} = 0.1343 \times \left\{ \frac{1 - \left\{ \frac{1+2.5\%}{1+8.4\%} \right\}^{20}}{1 - \left\{ \frac{1+2.5\%}{1+8.4\%} \right\}^1} \right\} = 1.6618$$

The resulting 20-year valuations from this approach are the following:

Country	1-yr A\$ price (spot)	1-yr A\$ price (PPP)	20-yr A\$ price (spot)	20-yr A\$ price (PPP)
USA	0.1343	0.1253	1.6618	1.5510
Canada	0.1105	0.1049	1.3670	1.2986
UK	0.1298	0.1427	1.6055	1.7661
Sweden	0.0707	0.0795	0.8748	0.9842

Direct benchmarking approach

Step DB3 – Weighting

Weighting allows for more relevant benchmark prices to more greatly influence the determination of final \$/MHz/pop prices.

Appropriate parameters to use as weights need to be identified and their similarity to Australia needs to be ascertained.

For example, we can use real GDP per capita, # of MNOs and population density to find the following weights (reflecting percentage similarity to Australia):

Country	Year	Real GDP per capita (US\$)	# of MNOs	Population density
USA	2021	0.86	0.75	0.09
Canada	2021	0.92	1.00	0.83
UK	2021	0.97	0.75	0.01
Sweden	2013	0.88	1.00	0.14

Direct benchmarking approach

Step DB3 – Weighting

There are 2 methods of weighting:

- > Cohort analysis
 - > Cohorts are created for each weighting parameter. The benchmarks included in each cohort must be above a threshold weight (e.g. benchmarks with a real GDP per capita weight above 0.75 make up the *real GDP per capita* cohort).
 - > Pricing analysis is performed for each individual cohort.
- > Numeric weighting
 - > Combined weight determined for each benchmark based on the weights for each individual parameter.
 - > Pricing analysis uses weighted values.

At this time, we are undecided as to what will be the optimal method.

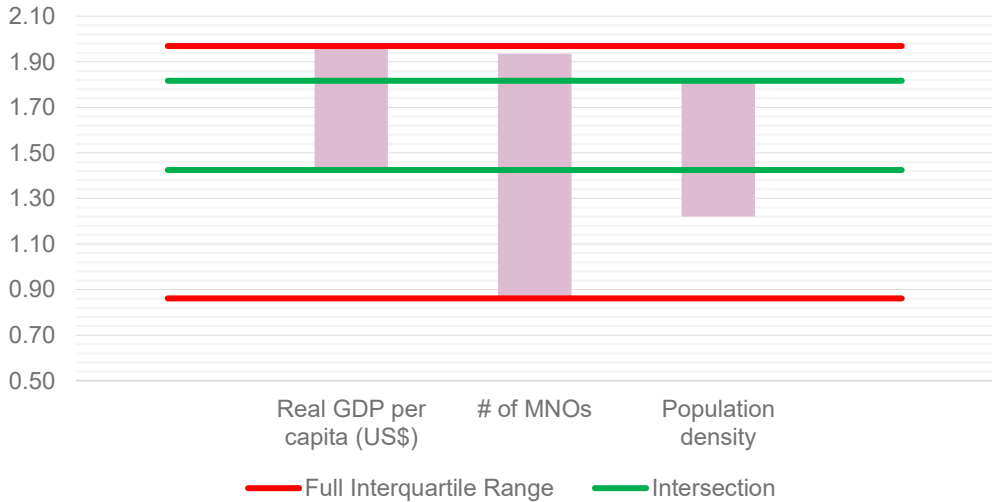
Direct benchmarking approach

Step DB4 – Determining band valuation

The way to find a valuation (or range of valuations) depends on the weighting method used.

- 1. For a *cohort analysis*, find summary statistics for each cohort. There are several ways to approach the summary statistics to find a valuation, such as looking at the full range or intersection ranges of the interquartile range for each cohort:

	Cohort	Sample size	Mean	Min	1st quartile	Median	3rd quartile	Max
SPOT	Whole sample	10	1.536	0.385	0.998	1.591	1.651	3.386
	Real GDP per capita	7	1.812	0.875	1.486	1.618	1.917	3.386
	# of MNOs	7	1.497	0.385	0.795	1.367	1.874	3.386
	Pop density	4	1.498	0.875	1.244	1.472	1.726	2.172
PPP	Whole sample	10	1.561	0.346	1.063	1.612	1.749	3.386
	Real GDP per capita	7	1.833	0.984	1.425	1.672	1.969	3.386
	# of MNOs	7	1.518	0.346	0.861	1.299	1.935	3.386
	Pop density	4	1.538	0.984	1.220	1.498	1.817	2.172



Direct benchmarking approach

Step DB4 – Determining band valuation

The way to find a valuation (or range of valuations) depends on the weighting method used.

- 2. For *numeric weighting*, find weighted summary statistics. For example, the weighted average can be found by dividing the sum of ‘Price x weight’ by the sum of the ‘Weight’ column below, which equals **1.5963**.

Country	Year	2028 A\$ price (PPP)	Weight	Weight percentage	Price x Weight
USA	2021	1.5510	0.567	8.43%	0.8791
Canada	2021	1.2986	0.917	13.64%	1.1909
UK	2021	1.7661	0.576	8.56%	1.0168
Sweden	2013	0.9842	0.675	10.03%	0.6642
⋮	⋮	⋮	⋮	⋮	⋮
Belgium	2018	1.6724	0.536	7.97%	0.8964
Total	N/A	N/A	6.726	100.00%	10.7369

Direct benchmarking approach

- > The result of this approach will be a single valuation or range of valuations for a particular spectrum band (or group of substitutable spectrum bands).
- > The ranges may be fairly wide, indicative of small sample sizes and volatility in spectrum prices around the world. Wide valuation ranges could occur with all spectrum valuation methodologies.
- > We will need to give more thought to our approach to analysing summary statistics (e.g. which point of a valuation range should a single valuation be?).
- > Where direct benchmarking does not provide relevant results, we can supplement it with adjusted benchmarking.

Adjusted benchmarking approach

While the value of a spectrum band in a given country may not be relevant in the Australian context, its relative value to other bands could be highly relevant.

The 4 general steps to perform adjusted benchmarking are similar to the steps for direct benchmarking, with some slight differences:

- > Step AB1: Valuations must be collected for the *target* and *comparator* bands.
- > Step AB2: Valuations only have to be converted for consistent timing and duration with related target/comparator bands, then the *relative value method* or *distance method* can be applied.
- > Step AB3: Weighting is applied to value relationships rather than actual values.
- > Step AB4: Value relationships (or a range of value relationships) are determined, then applied against the comparator band(s) benchmark pricing to find an adjusted target band valuation.

Adjusted benchmarking approach

For example, assume target and comparator band valuations have been found and converted for consistent timing and duration in each country. The *relative value method* would find the ratio of the target band to comparator band valuation

For example, a target value of 0.89 to comparator value of 0.71 equals 1.26:

Country	Target \$/MHz/pop	Comparator \$/MHz/pop	Relative value
USA	0.89	0.71	1.26
Canada	1.18	1.01	1.17
UK	0.80	0.63	1.28
Sweden	0.60	0.43	1.38

We apply the weighting approach in Step AB3 to the relative values.

In Step AB4, we use the weighted relative values to find an appropriate relative value (or range of relative values). This is then multiplied by the direct comparator band benchmark valuation to determine an adjusted target band valuation.

Conclusion

- > Direct benchmarking will be used to the extent possible.
- > Adjusted benchmarking is expected to be largely supplementary where direct benchmarking struggles to find useful results, but it may also help ensure that the relative values of all of our valuations are consistent.
- > Staff need to work through the process to determine the best approach to matters like weighting and determining final valuations.

Thank you