Memorandum

From: Denis Lawrence, Tim Coelli and John Kain **Date:** 29 April 2016

To: Mark McLeish, Andrew Ley, Anne Sastro

CC: AER Opex Team

Subject: TNSP MTFP Results

Economic Insights has been asked to update the electricity transmission network service provider (TNSP) multilateral total factor productivity (MTFP) and multilateral partial factor productivity (MPFP) results presented in the Australian Energy Regulator's 2015 TNSP Benchmarking Report (AER 2015b). The update involves including data for the 2014–15 financial year reported by the TNSPs in their latest Economic Benchmarking Regulatory Information Notice (EBRIN) returns. It also includes a small number of revisions to TNSP data, mainly relating to the entry and exit points output. We have also been asked to consider ways of calculating the opex productivity growth rate suitable for use in applications of the building blocks 'rate of change' formula.

Specification used

The TNSP MTFP measure has five outputs included:

- Energy throughput (with 21.4 per cent share of gross revenue)
- Ratcheted maximum demand (with 22.1 per cent share of gross revenue)
- Voltage–weighted entry and exit connections (with 27.8 per cent share of gross revenue)
- Circuit length (with 28.7 per cent share of gross revenue), and
- (minus) Energy not supplied (with the weight based on current AEMO VCRs).

The illustrative TNSP MTFP measure includes four inputs:

- Opex (total opex deflated by a composite labour, materials and services price index)
- Overhead lines (quantity proxied by overhead MVAkms)
- Underground cables (quantity proxied by underground MVAkms), and
- Transformers and other capital (quantity proxied by transformer MVA).

In all cases, the annual user cost of capital is taken to be the return on capital, the return of capital and the tax component, all calculated in a broadly similar way to that used in forming the building blocks revenue requirement.

Data revisions

There have been a small number of data revisions included in the updated TNSP analysis. Most of these relate to calculation of the voltage–weighted entry and exit points output variable and the MVA rating of lines. TransGrid has revised its numbers of entry and exit points for the whole period. AusNet, ElectraNet and TransGrid have made minor refinements to the MVA rating of particular line categories in some years. And ElectraNet has corrected an error in its reported maximum demand data for 2014. In addition, the latest WACC data are used and a change has been made to the method used to index the value of consumer reliability (VCR).

MTFP and MPFP results

TNSP MTFP and MPFP results are presented in the following figures.

Figure 1 **TNSP multilateral total factor productivity indexes, 2006–2015**

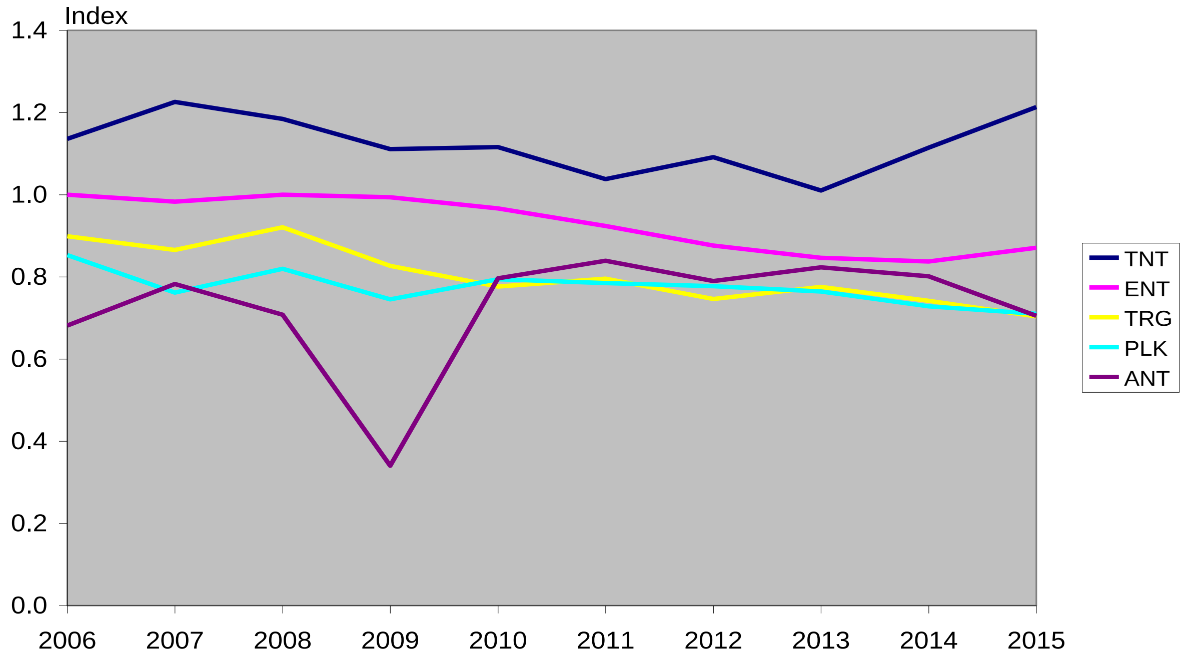


Figure 2 **TNSP multilateral opex partial factor productivity indexes, 2006–2015**

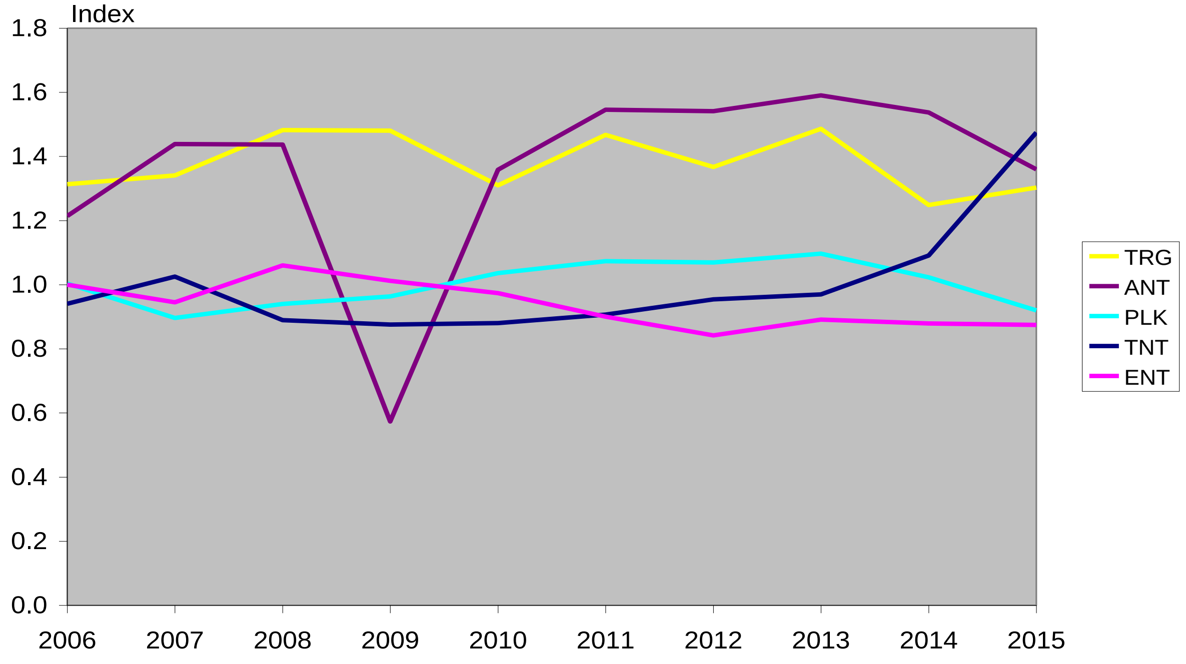
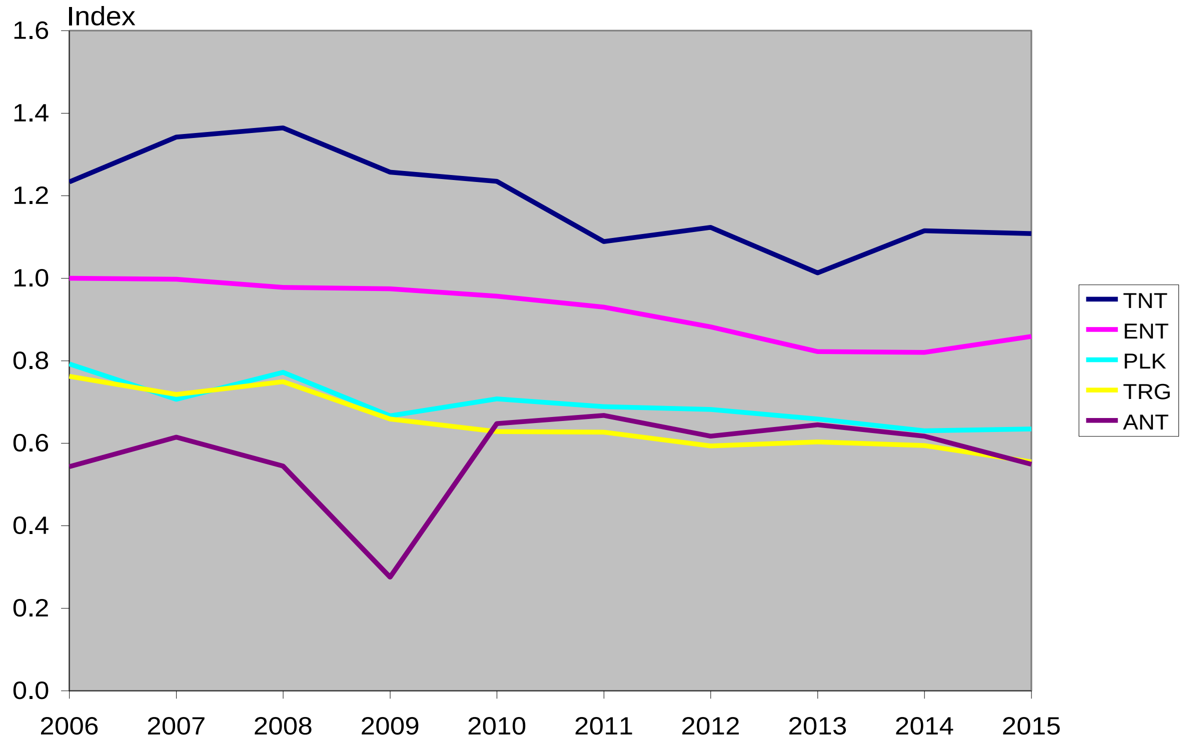
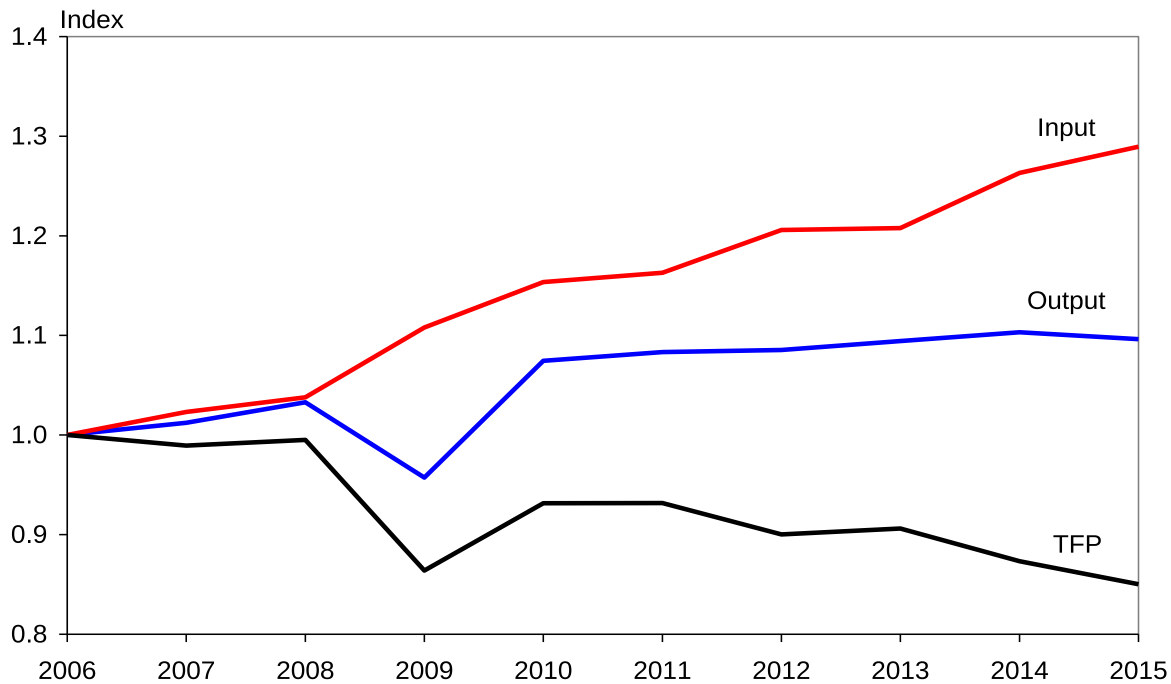


Figure 3 **TNSP multilateral capital partial factor productivity indexes, 2006–2015**



Transmission industry level output, input and TFP indexes are presented in figure 4.

Figure 4 **Industry–level transmission output, input and total factor productivity indexes, 2006–2015**



Opex PFP growth rate and the rate of change

AER (2013) indicated that the 'base–step–trend' method will be the preferred method for assessing NSP opex proposals going forward. Under this method a nominated year (or years) from the previous regulatory period is determined to be the base from which forecast opex for future years is rolled forward for each NSP's assessment. If the NSP is assessed to have an efficient level of opex in the base year then the NSP's actual opex in that year will be rolled forward using a rate of change formula.

The rate of change can be summarised as:

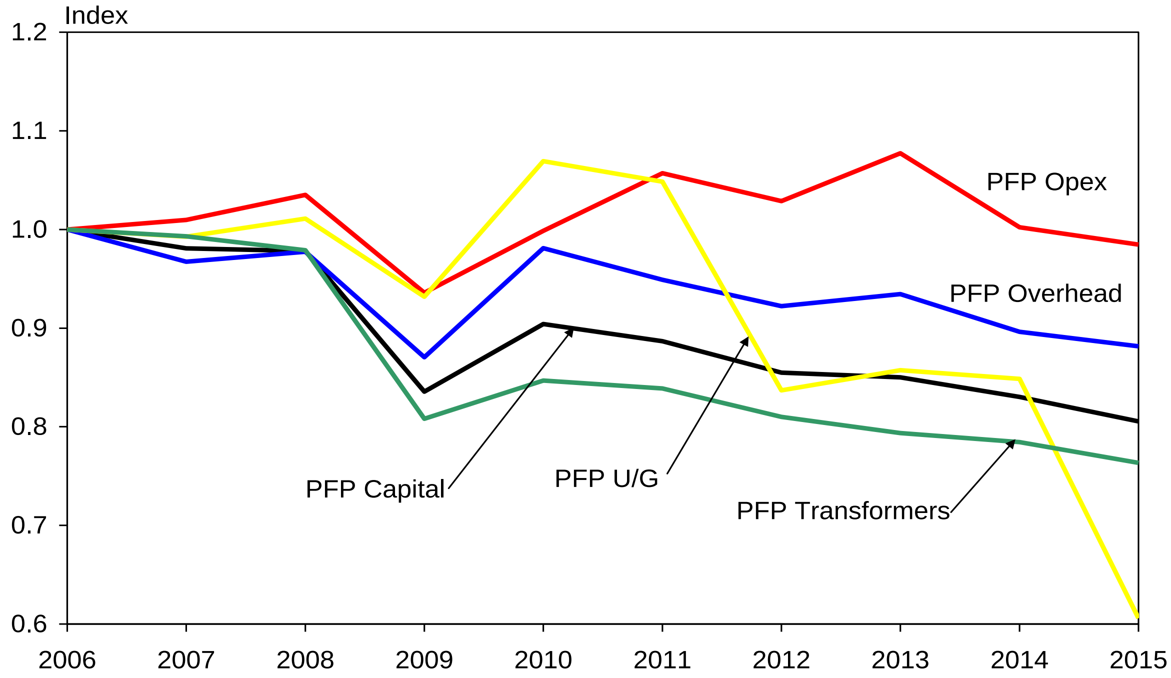
$$\textit{Rate of change}_t = \textit{output growth}_t + \textit{real price growth}_t - \textit{opex productivity growth}_t \quad (1)$$

Economic benchmarking can be used to quantify the feasible rate of opex partial productivity growth that an NSP could be expected to achieve over the next regulatory period. In electricity and gas distribution where there are a larger number of observations available, econometric operating cost functions can be used to forecast opex partial productivity growth for the next regulatory period taking account of forecast output growth and forecast changes in operating environment conditions for each distribution business. The smaller number of observations available for TNSPs has precluded, however, the use of these techniques and extrapolation of the historic growth rate of opex partial factor productivity has instead been used to proxy forecast opex productivity growth for the next regulatory period (see AER 2015a).

Extrapolation of TNSP industry level opex PFP growth generally has superior incentive properties to that of extrapolating the TNSP's own opex productivity growth rate as the TNSP has considerably less scope to strategically influence the industry growth rate than it does its own growth rate.

TNSP industry level opex and capital partial productivities are presented in figure 5.

Figure 5 **Industry–level transmission partial productivity indexes, 2006–2015**



Opex PFP levels can be seen to have fluctuated while overhead capital and transformer capital PFPs have exhibited a more steady pattern. Underground capital PFP levels have exhibited larger changes because underground lengths have grown from a very small base in 2006.

Two different approaches have been used to calculate the productivity growth rate used in regulatory settings. Economic Insights (2014) used the average annual growth rate between the first and last observations calculated using the logarithm of the ratio of the index values divided by the number of annual changes between the first and last years. Lawrence (2003, 2007) and Economic Insights (2009a), on the other hand, have used a regression–based trend method which regresses the logarithm of the relevant variable against a constant and a linear time trend. The time trend regression coefficient is then the logarithm of (one plus) the relevant growth rate.

Both methods have a number of advantages and disadvantages. The average growth rate method has the advantage of tracking movement in the index exactly between the two endpoints of the series. However, this method is more influenced by outlier observations lying at either the start or the end of the time period. If changes in opex driving these outlier observations are one–off rather than recurrent then these observations may then produce an average growth rate that is not reflective of the underlying trend change over the time period – see Economic Insights (2009b, pp.24–25) for an illustration of this effect.

The trend growth rate method, on the other hand, has the advantage of more closely reflecting the underlying trend rate of growth over the period but it will not track the series from endpoint to endpoint exactly. If an 'outlier' observation at the end of the series turns out to reflect an ongoing change in recurrent opex rather than a one–off change then the trend method will move more smoothly to reflect that over time. That is, the trend method has the advantage of moderating the impact of sudden changes in opex levels but it will be responsive to the effects of ongoing changes over time.

From figure 5 we can see that opex partial productivity trended up from 2006 to 2013 before falling in 2014 and gain in 2015 although to a lesser extent in 2015. The 2014 fall of nearly 7 per cent in TNSP industry opex levels was driven principally by a fall of 16 per cent in TransGrid's opex productivity. TransGrid's opex productivity then grew by 4.4 per cent in 2015. Similarly, the 2015 fall of nearly 2 per cent in TNSP opex productivity was driven principally by falls of 10 per cent in Powerlink's opex productivity and 11.6 per cent in AusNet's opex productivity.

In the case of Powerlink at least, there is evidence that the increase in reported opex at the end of the series is a one–off and not a reflection of recurrent opex. In its regulatory proposal Powerlink has reduced its reported opex in 2015 by 12.6 per cent to allow for non–recurrent factors as part of the process of forming its base year opex for forecasting purposes (Powerlink 2016, pp.5–6). Most of this reduction was attributed to a cancelled project.

Under the circumstances, we are of the view that it is more appropriate to measure opex productivity growth using the trend growth rate method as this will more closely approximate the underlying trend movement in TNSP opex productivity over the historic period and, hence, provide a better forecast for opex partial productivity likely to be achieved over the next regulatory period. This will make this figure the most appropriate one to use in application of the opex rate of change for assessment purposes. The trend growth rate of opex partial productivity from 2006 to 2015 was 0.2 per cent per annum.

References

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