Memorandum

Response to AER questions On CEG 2022 and 2024 reports

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1 Purpose

1. This memorandum responds to questions put by the Australian Energy Regulator (AER) in written communication with the ENA and verbally to CEG in a meeting held on 25 November 2024. These questions relate to:

   a. Our July 2024 report for the ENA "*Using international comparators to estimate the benchmark Australian equity beta*"; and

   b. Our March 2022 report for the Australian Pipeline and Gas Association (APGA) "Use of foreign asset beta comparators"

2 Answers to AER questions

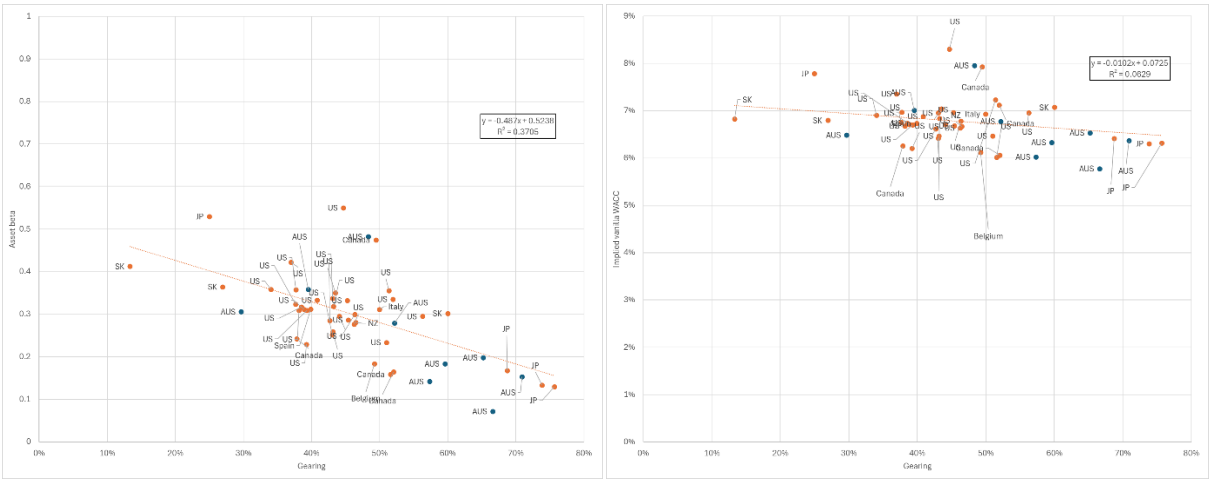
2.1 Underlying data to generate Figure 5-3 and Table 5-6 of our July 2024 report

2. The attached spreadsheet provides this data. In preparing this spreadsheet we noticed that Figure 5-3 was labelled "for the most recent 10-year period" when, in fact, the figure was reporting data for the longest period of data. The spreadsheet provides the data for both and the relevant figures for both are correctly labelled below. It can be seen that they both tell the same story, namely:

   a. There is a strong significant negative relationship between gearing and asset beta (estimated with a zero debt beta); but

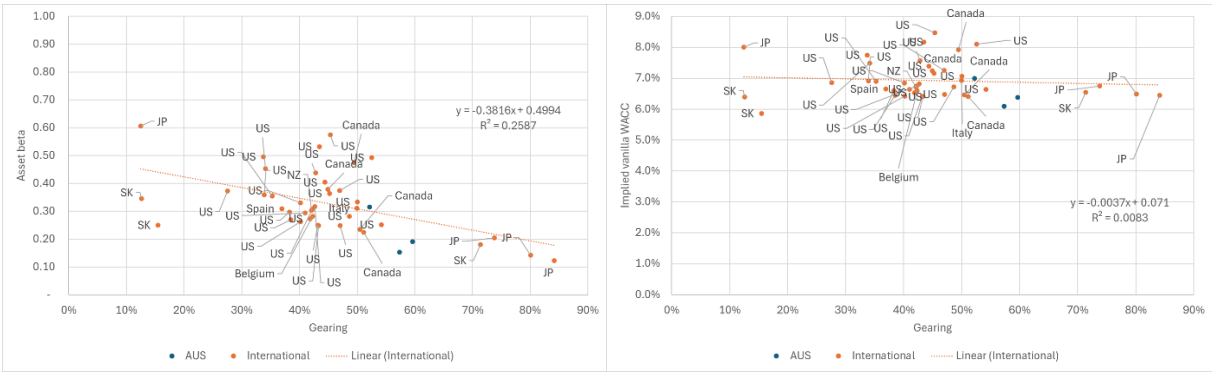
   b. There is no obvious relationship between gearing and WACC (when WACC is measured at the company specific gearing level using a common MRP (6.2%), risk free (4.0%) and DRP (2.0%) (assumptions based on Australian historical averages for these values as per footnote 23 of our July 2024 report)).

Figure 5-3a): Asset beta and vanilla WACC vs gearing for the longest period (OECD sample with 90% regulated assets filter and 0.5% bid-ask-spread filter)



Source: Bloomberg, CEG analysis.

Figure 5-3b) Asset beta and vanilla WACC vs gearing for the recent 10-year period (OECD sample with 90% regulated assets filter and 0.5% bid-ask-spread filter)



Source: Bloomberg, CEG analysis.

2.2 90% regulated assets/revenue filter

3. The AER's written questions asked:

> *How is the 90% filter applied to the OECD sample, what was the rationale for this choice in methodology, and why are some based on revenue while others are based on assets?*
>
> And
>
> *How are the WACC figures calculated in Table 5-6, including the values of its subcomponents (risk-free rate, equity beta, MRP, gearing, and cost of debt)?*

4. The rationale for having a filter based on the proportion of regulated activities is that companies that have a higher proportion of regulated activities are likely to have risks that are more similar to the risk of a 100% regulated Australian network service provider than companies that have a low proportion of regulated activities.

5. The choice of a 90% filter reflects a trade-off between setting the filter low enough to have a large sample but not so low as to make the sample unrepresentative. Other filters could reasonably be

chosen but, as the attached spreadsheet makes clear, the results are not sensitive to the choice of 90%.

6. The reason that the percentage of assets is used for some firms and the percentage of revenues is used for others is explained at paragraph 37 of our July 2024 report.

> We then calculated the percentage of regulated assets by dividing the sum of all regulated business segments with the total of regulated and non-regulated business segments. The latest available year is used as the final number for each firm. If segment asset values are not available, we use segment revenues.

7. The WACC figures calculated in Table 5-6 were calculated in the same way as in Figure 5-3. This is explained at footnote 23:

> *This has been estimated for each firm based on their observed gearing and equity beta and applying a common MRP of 6.2%, risk free rate of 4.0% and an average Debt risk premium of 2.0%.*

2.3 Differences between US market and Australian market

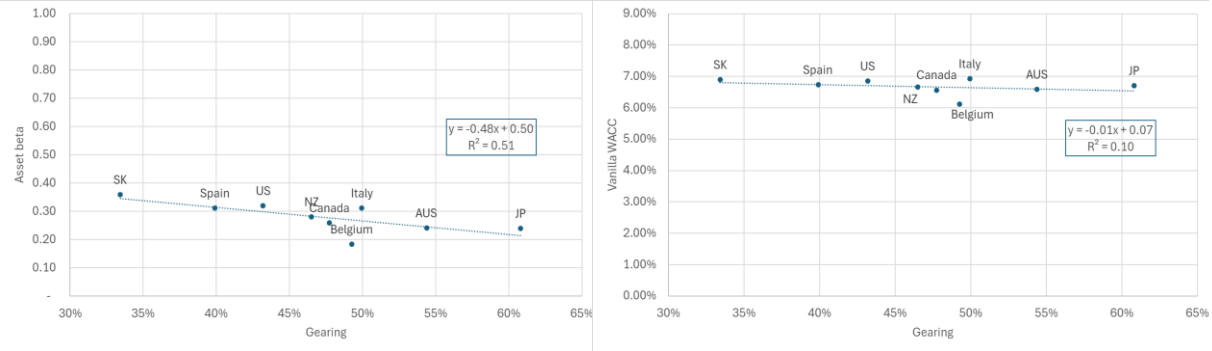
8. In our meeting AER staff were focussed on the fact that the US equity market may have material compositional differences to the Australian equity market. However, our dataset is comprised of OECD countries and includes 15 non-US foreign companies. The attached spreadsheet allows the AER to explore whether there are material differences between US and non-US estimates of asset beta and WACC.

9. One way to do this is to generate charts similar to Figure 5-3 above except, instead of reporting every company separately, we group each country together and report the average. It is, for the reasons set out in our July 2024 report, important to compare asset betas (estimated with zero debt beta) plotted against gearing in order to account for potential bias due to the use of a zero debt beta. These figures tend to support the view that:

   a. The US sample asset beta or WACC estimates are similar to other countries in both the longest and most recent period (i.e., close to the fitted regression line);

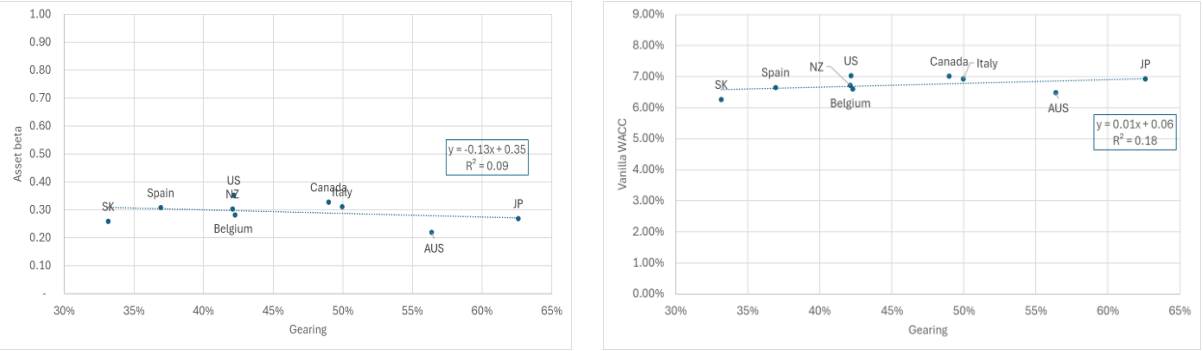
   b. The Australian sample asset beta and WACC estimates are similar to other countries in the longest period but are something of a low outlier in the most recent 10-year period (and not just relative to the US).

Figure 5-3c): Country averages - asset beta and vanilla WACC vs gearing for the longest period (OECD sample with 90% regulated assets filter and 0.5% bid-ask-spread filter)



Source: Bloomberg, CEG analysis.

Figure 5-3d) Country averages - vanilla WACC vs gearing for the recent 10-year period (OECD sample with 90% regulated assets filter and 0.5% bid-ask-spread filter)



Source: Bloomberg, CEG analysis.

10. The data in the above charts can be found in the attached spreadsheet but is also reported in Table 2-1 below.

Table 2-1: Country average asset beta and WACC

Longest period						
Country	**Count**	**Gearing**	**Asset beta**	**p-value (against AUS)**	**Implied vanilla WACC**	**p-value (against AUS)**
AUS	9	54%	0.24	100%	6.59%	100%
US	26	43%	0.32	11%	6.85%	26%
Canada	4	48%	0.26	84%	6.57%	97%
SK	3	33%	0.36	6%	6.90%	20%
Belgium	1	49%	0.18	21%	6.12%	6%
Spain	1	40%	0.31	13%	6.73%	50%
JP	4	61%	0.24	99%	6.71%	78%

Italy	1	50%	0.31	14%	6.93%	14%
NZ	1	47%	0.28	38%	6.67%	70%
Recent 10 years						
Country	**Count**	**Gearing**	**Asset beta**	**p-value (against AUS)**	**Implied vanilla WACC**	**p-value (against AUS)**
AUS	3	56%	0.22	100%	6.49%	100%
US	26	42%	0.35	13%	7.03%	20%
Canada	4	49%	0.33	23%	7.01%	31%
SK	3	33%	0.26	61%	6.27%	56%
Belgium	1	42%	0.28	33%	6.60%	72%
Spain	1	37%	0.31	21%	6.66%	60%
JP	4	63%	0.27	71%	6.92%	40%
Italy	1	50%	0.31	20%	6.93%	24%
NZ	1	42%	0.30	23%	6.72%	48%

2.4 Questions in relation to our 2022 report

Table 2-2: AER questions in relation to 2022 report

CEG numbering	Paragraph reference	AER question
A	81	How is CEG's model related to (and consistent with) the CAPM that the AER uses as the foundation model (and the market model that the AER uses for beta estimation)? It appears the model's results appear to be driven by firm specific risk, something we would like to understand better. It would also be helpful if CEG could provide academic references to support CEG's model.
B	78	*Table 15 lists four different sources of bias and all would affect standard deviation and only two would affect the correlation between utility and market returns. Can you provide more details about the magnitude of their relative impacts on beta, i.e. whether* β *is driven by* $\rho_{(r_m,r_u)}$ *or* $^{S}d_u$ *and* $^{S}d_m$*?*
C	80	What does it mean u_t affects utility returns more than market returns, and e_t affects the economy (and market) more strongly than the u_t shock? Can you provide some examples of these two types of shocks and explain how they affect the expected returns of utility firms and the market as the two shocks are defined?
D	81	Is the utility specific shock from diversifiable risk or non-diversifiable risk?

		Why is the expected return of the market affected by the utility specific shock but not other industry specific shocks?
E	81-85	The simulation relies on a number of assumptions, in relation to these assumptions: What is the theoretical and/or empirical basis for the uniform distribution assumption of u_t. In addition, what are the implication for the distribution of the expected returns in the CEG model, and are the return distributions in the model consistent with the CAPM assumptions. What are the theoretical and/or empirical basis for the uniform distribution assumption of et. Since the systematic shock is uniformly distributed, placing the same probabilistic weight on outliers as the mean/median, how do you reconcile this assumption with the empirical estimation method using Least Absolute Deviation (LAD)? What the theoretical and/or empirical reasons why u_t and e_t are assumed to take the same range of values (-0.5, 0.5) with equal probability Can a derivation of the formulas for standard errors and correlation, including any assumptions e.g. the correlation between u_t and e_t and the basis for the assumptions be provided? What is the logic behind the various chosen parameter values for a and b.

11. Before dealing with each question in turn, it is useful to note that we consider that our July 2024 report largely supersedes out 2022 report. The premise of out 2022 report was that there was a material difference between the average Australian estimated asset betas and foreign estimated assets betas. Our 2022 report set out to examine whether this material difference (which was taken for granted) was:

    a. A statistical artefact associated with imprecise statistical estimates for a small Australian sample; versus

    b. A reflection of real differences in risk for Australian vs foreign companies.

12. The key finding in our 2024 report is that differences in estimated asset betas across jurisdictions are, in fact, largely illusory. However, this conclusion is not for the reasons hypothesised in our 2022 report, namely, imprecise statistical estimates for a small Australian sample. Rather, our 2024 report concludes that the estimated differences are largely due to estimation errors associate with using a zero-debt beta.

13. This is important because it suggests that the equity beta in Australia would be overestimated if the AER were to:

    a. Use foreign sample asset betas (estimated with a zero debt beta and an average gearing of around 45%);

    b. in conjunction with the rate of return instrument (RoRI) gearing of 60%.

14. That is, the difference between out 2022 and 2024 report conclusions can fairly be summarised as follows.

    2022: *It is, as a matter of theory, difficult to see why foreign regulated utilities would have lower risk than Australian regulated utilities. Nonetheless, estimated asset betas are materially different. Therefore, it is reasonable to give material weight to foreign sample asset betas on the basis that any difference is likely to reflect problems associated uncertainty due to the small Australian sample.*

2024: *It remains the case that, as a matter of theory, it is difficult to see why foreign regulated utilities would have lower risk than Australian regulated utilities. However, estimated differences in asset betas materially overstate the true difference in risk due to the failure to properly account for the relationship between equity beta and gearing (i.e., the use of a zero-debt beta). Therefore, we continue to believe that it is reasonable to give material weight to foreign sample asset betas. However, this can only be done if the AER is careful to adjust for differences in gearing accurately – using one (or all) of the three methods listed at paragraph 95 of our July 2024 report.*

15. All of the AER questions A to E relate to Appendix B of our 2022 report. In Appendix B we were attempting to explore a phenomenon that, based on our 2024 report, we no longer believe exists (at least not to the same degree). We developed a mathematical simulation of variation in utility and market returns. The motivation for this was to try and emulate something like the stylised facts shown in Table 7 and discussed in paragraphs 56 to 58 of that report.

Figure 2.4-1: Extract from our 2022 report

Table 7: Average utility and market standard deviation (SD_U and SD_M)

	SD_U		SD_M	
	Australia	Foreign	Australia	Foreign
1 Jan 2006 to 30 June 2021	3.1%	3.0%	2.2%	2.4%
Post GFC	2.8%	2.8%	2.0%	2.2%
5-years ending 30 June 2021	2.8%	3.3%	2.0%	2.5%

Source: Bloomberg, CEG analysis

56. These results are inconsistent with a most obvious hypothesis for why foreign utilities would be higher underlying risk. Namely, that differences in regulation (and operating environment more generally) cause foreign utilities' equity returns to be more sensitive to systemic shocks. If this was the case, we would expect to observe higher volatility of foreign utility stock returns (especially given foreign markets have higher volatility) but we do not see this.

57. In addition, these results are also inconsistent with two out of the remaining three hypothetical sources of difference in true underlying risk. The only explanation for a difference in "true" betas that is consistent with the above facts is the last explanation iiib) in Table 6. Namely, that differences in composition of foreign and Australian equity markets lead foreign equity markets to have higher correlation with utility returns (but not higher volatility of utility returns).

58. This is mathematically possible (as illustrated in Appendix B) but it is not economically obvious why it would be the case. In any event, the maximum possible impact of this source of difference can be derived by estimating foreign utility betas relative to the Australian equity market.

16. The conundrum that we were trying to explore was how it was possible that:

    a. Australian utilities had similar volatility of stock returns; and

    b. Operated in less volatile markets; but

    c. Still had lower beta risk?

17. We noted that this was possible if the correlation between Australian utility returns and the market return was higher. However, as a matter of theory, this higher correlation with the market would have to somehow not "show up" in higher volatility of utility returns – even though foreign markets were more volatile. We thought (and continue to think) that it is difficult to conceive of why this would be the case. That is:

    a. If foreign utilities have higher correlation with their market; and

b. Foreign markets are more volatile; then

c. Foreign utilities should have more volatile returns than Australian utilities.

d. But this was not the case.

18. Appendix B involved a formal mathematical model that attempted to illustrate that there would need to be something akin to "threading of a needle" in order for the model to generate results where foreign utilities have higher beta risk without higher volatility in returns (and with higher foreign market volatility).

19. However, our 2024 report has, in our view, resolved this conundrum. Appendix B of our 2022 report focussed on differences in equity beta implicitly assuming the same gearing for Australian and foreign firms. However, this overlooked the fact that the differences between Australian and foreign utilities were always small at the level of equity beta. The differences only became material when the equity betas were de-levered to an asset beta (assuming a zero debt beta).

20. Nonetheless, for completeness, we respond to each of the AER's questions in Table 2-3.

Table 2-3: AER questions

CEG numbering	AER question
A	*How is CEG's model related to (and consistent with) the CAPM that the AER uses as the foundation model (and the market model that the AER uses for beta estimation)?* The Monte Carlo model is a simulation of utility and market equity returns according to the formulae and distributions set out in paragraph 81. Equity betas are derived from this simulation. Equity beta is a concept defined in the CAPM that the AER uses as the foundation model. The derived equity betas are consistent with the CAPM *It appears the model's results appear to be driven by firm specific risk, something we would like to understand better.* The equity betas in the simulation, like equity betas generally, are independent of firm specific risk. However, it may help the AER for us to describe the last two dot points in paragraph 81. These formulae postulate two different classes of shocks: shocks that primarily affect utilities (but can also have some effect on the market) and a shocks that primarily affect the market (but can also have some effect on the market). In this model, as in reality, there is no such thing as "pure" firm specific risk. That is, if a firm is listed on the stock market then any shock that it experiences will also have an effect on the stock market (however small). *It would also be helpful if CEG could provide academic references to support CEG's model*. There is a great deal of academic use of Monte Carlo simulations to attempt to tease out relationships between variables with complex interactions. This includes in relation to equity beta. For example see : Rivas, *Derivation of a Synthetic Beta Using the Monte Carlo Method as an Alternative to the Comparable Company Approach for Determining the Cost of Capital*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4926123 However, this question appears to be asking for academic references in support of CEG's model on the basis that "CEG's model" is an alternative to "the CAPM that the AER uses as the foundation model". Our simulation is not an alternative to the CAPM it is simply a simulation of CAPM betas under specified assumptions.

B	*Table 15 lists four different sources of bias and all would affect standard deviation and only two would affect the correlation between utility and market returns. Can you provide more details about the magnitude of their relative impacts on beta, i.e. whether β is driven by $\rho_{(r_m,r_u)}$ or $^{S}d_{u}$ and $^{S}d_{m}$?* As per paragraph 51 of our 2022 report, the mathematical formula for beta is given by: $$\beta = \rho(r_M, r_u)\frac{SD_U}{SD_M}$$ The answer to the AER's question is provided by this formula. That is, β is driven by $\rho(r_M, r_u)$ SD_U SD_M in the way described in this formula.
C	*What does it mean u_t affects utility returns more than market returns, and e_t affects the economy (and market) more strongly than the u_t shock?* *Can you provide some examples of these two types of shocks and explain how they affect the expected returns of utility firms and the market as the two shocks are defined?* Examples of shocks that might affect utilities more than the market might be surprise regulatory decisions that have implications for all regulated utilities (or other judicial decisions around responsibility for wildfire damage etc). Alternatively, surprise changes in input utility input costs (including wage costs) might be another example. An example of a shock that might affect market returns more than utility returns might be unexpected changes in global energy prices and/or commodity prices generally. Faster than expected technological progress in some generally applicable field (such as AI) etc. An example of a shock that might be similar for utilities and the market generally is an unexpected change in interest rates (noting that utilities' valuations are, arguably, more sensitive to near term interest rate movements than market valuations). The formula at paragraph 81 describes what it means that mean u_t affects utility returns more than market returns, and e_t affects the economy (and market) more strongly than the u_t shock. • Return of utility firms – $utility_t = u_t + ae_t$ • Return of market – $market_t = bu_t + e_t$ The value of "a" and "b" in these formulae are set between 0 and 1.0 (see paragraph 84). By definition, this means that utilities stock returns are more sensitive to u_t than e_t because the coefficient on u_t is 1.0 and the coefficient on e_t is "a" which is less than 1.0. Similarly, the market returns are more sensitive to e_t than u_t because the coefficient on e_t is 1.0 and the coefficient on u_t is "b" which is less than 1.0.
D	*Is the utility specific shock from diversifiable risk or non-diversifiable risk?* *Why is the expected return of the market affected by the utility specific shock but not other industry specific shocks?* A shock that more strongly effects utilities but still has some effect on the market is not a "pure" utility specific shock. It is mostly, but not fully, diversifiable by holding the market portfolio (i.e., beta less than 1.0 but not zero). As noted previously, there is no such thing as a "pure" firm specific shock so long as that firm's equity forms part of the market portfolio. The return on the market is affected by all shocks that affect any industry that is part of the market. In the simulation, e_t is a generic summation across all of those other industries.

E	*The simulation relies on a number of assumptions, in relation to these assumptions:* *What is the theoretical and/or empirical basis for the uniform distribution assumption of u_t. In addition, what are the implication for the distribution of the expected returns in the CEG model, and are the return distributions in the model consistent with the CAPM assumptions.* The simulation model is not attempting to map reality of stock market returns. There has been no attempt made to ground the assumptions in empirical reality. The purpose of the model was simply to illustrate that it is difficult to find higher utility beta risk without higher utility return volatility or lower market volatility. If the AER can make other simulation assumption that do generate such results then that could be interesting to discuss. However, we do not believe that there is any benefit in attempting to ground the simulation in empirical fact – that is not its purpose. *What are the theoretical and/or empirical basis for the uniform distribution assumption of et. Since the systematic shock is uniformly distributed, placing the same probabilistic weight on outliers as the mean/median, how do you reconcile this assumption with the empirical estimation method using Least Absolute Deviation (LAD)?* See answer to above. *What the theoretical and/or empirical reasons why u_t and e_t are assumed to take the same range of values (-0.5, 0.5) with equal probability* See answer to above. *Can a derivation of the formulas for standard errors and correlation, including any assumptions e.g. the correlation between and and the basis for the assumptions be provided?* See answer to above. *What is the logic behind the various chosen parameter values for a and b.* See answer to above.