

Attachment 1: rate of return in the Draft Decision

1. Introduction

- 1.1. Having ascertained what it considered to be the appropriate parameter values for the CAPM, and for the calculation of a real pre-tax WACC, the ERA made that calculation, reported the results in Table 46 of the Draft Decision, and, in paragraphs 758 and 759, identified this real-pre-tax WACC – 7.16% – as the rate of return required by Rule 87 of the NGR. In so determining the rate of return, the ERA focused solely on the calculation of a WACC as might be carried out in accordance with Rule 87(2). The ERA did not take into account the specific requirements of Rule 87 of the NGR, in particular, the criteria of Rule 87(1). More generally, the ERA failed to consider all of the requirements of the NGL as these pertain to the rate of return.
- 1.2. In section 2 of Submission 55, DBP sets out the requirements of the NGL and the NGR for the rate of return and, in subsequent sections, establishes a rate – 10.03% (real, pre-tax) – which complies with these requirements. In Submission 55, DBP does not consider, in detail, the reasoning which led the ERA to not approve the rate of return – 10.76% (real, pre-tax) – which was proposed in the Original AA Proposal, and substantiated in DBP's April 2010 *Submission 8: Rate of Return (Submission 8)*.¹
- 1.3. DBP is of the view that, in addition to its not properly taking into account the requirements of the NGL and NGR (or, in the event of DBP being wrong as to the interpretation of the NGL and NGR in relation to rate of return (which DBP does not submit)), the ERA made a number of errors in its reasoning in the Draft Decision which invalidated the conclusions reached, and which precluded a determination that a real pre-tax WACC of 7.16% was the rate of return required by Rule 87.
- 1.4. DBP's reasons for this view are set out in this Attachment 1 to Submission 55. The following aspects of the ERA's reasoning in the Draft Decision are examined:
 - (a) approach to determination of the rate of return;
 - (b) methods for estimating the cost of equity, and estimates of that cost;
 - (c) cost of debt;
 - (d) valuation of imputation credits (gamma);
 - (e) nominal risk free rate of return;
 - (f) expected inflation; and
 - (g) market risk premium.

¹ The ERA's decision not to approve DBP's April 2010 proposal in relation to the rate of return is recorded in paragraph 757 of the Draft Decision.

2. Approach to determination of the rate of return – the relevant market for funds

2.1. Paragraphs 348 and 349 of the Draft Decision raise a number of major issues:

- (a) firstly, the ERA appears to have failed to take into account relevant considerations by either ignoring or rejecting the requirements of Rule 87(1) in the NGR; and
- (b) secondly, the ERA appears to have given undue weight to certain considerations which demonstrate a failure to consider the requirements of Rule 87(1) and of the requirements of the NGL – in particular, the ERA has focused on the issue of the relevant market for funds for a benchmark service provider because this is what the AER has done in its review of the WACC parameters to be used in access pricing for electricity transmission and distribution network service providers under the *National Electricity Law* and associated rules.

2.2. In paragraphs 348 and 349 of the Draft Decision, the ERA advised that it did not agree with DBP that the relevant market for funds (whether for the purposes of assessing the cost of equity, the cost of debt, the rate of return or simply determining which market to have regard to for the purposes of determining what were the prevailing conditions), given the scale of the business, was the international capital market.

2.3. It is important to note that DBP did not actually submit that the relevant market for funds was only the international capital. Rather DBP submitted that the provisions of the NGL and NGR demand that regard must be had to the domestic **and** international markets in determining what were the market for funds to consider in order to assess the prevailing conditions in the market for funds.

2.4. Leaving that aside, in paragraph 348, the ERA made the observation:

One of the key areas of debate in the Australian regulatory literature is the extent to which foreign investors should be recognised when the WACC parameters, such as the nominal risk free rate, the debt risk premium, the market risk premium, the equity beta of the regulated businesses, and the value of imputation credits, are estimated. These estimates are likely to be affected by the choice of a domestic CAPM or international CAPM.

2.5. The findings of the AER, in this context, were summarised in paragraph 349:

In its WACC Review in 2009, the AER proposed to continue using the Officer WACC framework because this framework is consistent with past Australian regulatory practice and is accepted by finance practitioners. The AER considers that the relevant market for funds for a benchmark service provider needs to be relevant to the reference services, and the relevant market for funds in Australia. In addition, the WACC Review also notes that a domestic (not international) market model matches observed

conditions in the Australian financial market and that all financial parameters in WACC calculations must be estimated on a consistent basis.

- 2.6. The AER's view of the benchmark service provider referred to in paragraph 349, and the ERA's agreement with that view, were set out in paragraph 351 of the Draft Decision:

In its 2009 WACC Review, the AER considered that benchmark levels of efficiency mean that the return on capital should be a benchmark return, not the return on capital for the specific circumstances of the service provider. In addition, the AER also notes that the benchmark levels of efficiency are determined in relation to a notional benchmark service provider. The benchmark efficient network service provider is defined as a 'pure-play' regulated network business operating within Australia without parent ownership. The Authority agrees with the AER's view on the issue and adopts it for the purpose of its assessment of DBP's proposed access arrangement.

- 2.7. The AER's views, with which the ERA concurred, were views expressed in the context of the national regulator's decision making under the *National Electricity Rules*. They may have some validity for the electricity network service providers regulated by those Rules, but that supposition does not, of itself, justify them simply being "carried over" to the regulatory regime of the NGL and the NGR.
- 2.8. The requirements of the NGL and the NGR cannot be ignored, or even given little weight, in preference to the requirements of the *National Electricity Law* and associated rules. Yet this seems to have been the ERA's approach in much of its reasoning concerning the rate of return.
- 2.9. Moreover, the requirements of the NGL and the NGR cannot be explicitly rejected, as seems to have been the case in paragraph 348 of the Draft Decision:

The Authority does not agree with DBP's proposal that the rate of return on capital is required to be commensurate with prevailing conditions in the market for funds . . .

- 2.10. The requirement that the rate of return on capital only be commensurate with prevailing conditions in the market for funds is not DBP's proposal. It is one of the two key criteria of Rule 87(1) of the NGR.
- 2.11. There is, within the NGL and the NGR, a hierarchy of rules governing the access arrangement, tariff design, the determination of total revenue, and the setting of reference tariffs. At the top of this hierarchy are the national gas objective and the rules which require that the access arrangement be consistent with that objective. In particular, section 28(1) of the NGL requires that the ERA, in performing or exercising a regulatory function or power, perform that function or power in a manner that will or is likely to contribute to the achievement of the national gas objective.
- 2.12. In addition, section 28(2) of the NGL requires that the ERA take into account the revenue and pricing principles of section 24. These principles ensure that the process of tariff determination, as it is set out in Part 9 of the NGR, is carried out in a way which contributes to the achievement of the national gas objective. In particular, the ERA must take into account section 24(2):

A service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs in:

- (a) providing reference services; and*
- (b) complying with a regulatory obligation or requirement or making a regulatory payment.*

2.13. The ERA must also take into account the pricing principle of section 24(5):

A reference tariff should allow for a return commensurate with the regulatory and commercial risks involved in providing the reference service to which that tariff relates.

2.14. If the process of tariff determination fails to provide the service provider with a reasonable opportunity to recover at least its efficient costs, and to earn a return commensurate with the regulatory and commercial risks of reference service provision, that process will not promote efficient investment in, and efficient operation and use of, natural gas services in the long term interests of consumers.

2.15. The requirements of sections 24(2) and 24(5) of the NGL are both specific and clear:

- (a) the service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs in reference service provision; and
- (b) the reference tariff – the instrument which provides the service provider with the opportunity to recover at least its efficient costs – should allow for a return commensurate with the regulatory and commercial risks involved in providing the reference service to which that tariff relates.

2.16. The key provisions of the NGL which govern the tariff setting process, and which ensure that it delivers an outcome which contributes to the achievement of the national gas objective, give recognition to the specific circumstances of the service provider: to the efficient costs the service provider incurs in reference service provision, and to the regulatory and commercial risks involved in providing the reference service offered by the service provider (the reference service to which the tariff relates).

2.17. Sections 24(2) and 24(5) of the NGL do not govern a process of tariff setting for a hypothetical entity. They do not govern a process of setting tariffs for the AER's benchmark efficient network service provider, which is referred to in paragraph 349 of the Draft Decision. A benchmark efficient network service provider, defined as a 'pure-play' regulated network business operating in Australia without parent ownership, may be appropriate for the purposes of the *National Electricity Rules*. However, sections 24(2) and 24(5) of the NGL require that, in the process of setting reference tariffs, recognition be given to the specific circumstances of the service provider. The ERA may, as it stated in paragraph 351 of the Draft Decision, agree with the AER's view on the issue, but it cannot adopt the concept of the benchmark efficient network service provider as the standard against which it assesses DBP's access arrangement revisions proposals.

- 2.18. Furthermore, because sections 24(2) and 24(5) govern a process of tariff setting which gives recognition to the specific circumstances of the service provider, that process cannot be arbitrarily limited by the constraints imposed by the use of particular theoretical models. The proper use of a WACC framework may require a consistency among the parameter estimates which is most easily achieved by making those estimates using data from Australian financial markets. However, as is made clear in section 2 of Submission 55, the WACC which results from calculations made using such a framework is not the rate of return required by Rule 87 of the NGR. Before it can be adopted as the required rate of return, a WACC which has been calculated using data from Australian financial markets must be assessed against the criteria of Rule 87(1). The objectives to be met in applying those criteria are, in the first instance, the objectives of section 24(2) and 24(5) (providing the service provider with an opportunity to recover the costs incurred in reference service provision, and to earn a return commensurate with the regulatory and commercial risks involved in providing that reference service), and, ultimately, the national gas objective of section 23 of the NGL.
- 2.19. Determination of the rate of return is not arbitrarily restricted by the use of a domestic CAPM, and by the market for funds being limited to the Australian financial market. Use of a domestic CAPM, and restriction to the Australian financial market, may be appropriate in the context of the AER's decision making under the *National Electricity Rules*. However, a different view must be taken when applying the rules of the regulatory regime of the NGL and the NGR. The ERA cannot, when applying these rules, disagree with, and therefore fail to consider, DBP's proposal that the scale of the operations of the business requires consideration of financing in international markets because the AER and the ERA choose to limit their view to the Australian financial market.
- 2.20. The process of tariff setting required by the regulatory regime of the NGL and the NGR is not a theoretical exercise, guided solely by reference to theoretical principles. It is a process which is to have a very practical outcome. Through this process, the service provider is to be provided with a reasonable opportunity to recover the costs which it incurs in service provision. Those costs which the service provider is to be given a reasonable opportunity to recover must, however, be the service provider's efficient costs. Only tariffs which are set to recover the service provider's efficient costs of providing reference services will promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas.
- 2.21. Although the process of tariff setting required by the regulatory regime of the NGL and the NGR is not a theoretical exercise, guided solely by reference to theoretical principles, certain theoretical principles must be used in the determination of the rate of return. Rule 87(2) requires that the primary tools to be used are a well accepted approach and a well accepted financial model. These tools are not to be applied arbitrarily. Rule 87(2) explicitly requires that, in the application of a well accepted approach and a well accepted financial model, the service provider be assumed to meet benchmark levels of efficiency and to use a financing structure that meets benchmark standards as to gearing and other financial parameters. These assumptions are necessary, but not sufficient, to ensure that the application of a well accepted approach and a well accepted financial model can produce a result which, were it to be found to be the rate of return required by Rule 87(1), would provide the service provider with a

reasonable opportunity to recover at least the efficient costs which the service provider incurs in providing reference services. They are also necessary, but not sufficient, to ensure that the reference tariffs determined using the rate of return contribute to the achievement of the national gas objective.

- 2.22. The requirements to assume a benchmark efficient service provider, and benchmark standards as to gearing and other financial parameters, guide the application of the primary tools to be used in rate of return determination to ensure that the objectives of the regulatory regime of the NGL and the NGR can be achieved. However, they do not replace those objectives. They do not allow replacement of the service provider with the hypothetical entity assumed by the AER, and do not allow the specific circumstances of the service provider in its provision of reference services to be ignored.

3. Methods for estimating the cost of equity, and estimates of that cost

- 3.1. In paragraphs 362 to 482 of the Draft Decision, the ERA concluded that:
- (a) Black's Capital Asset Pricing Model and the Fama-French three factor model were not well accepted financial models;
 - (b) DBP ignored the results, not only from the CAPM, but also from the other asset pricing models which it put forward, and adopted an estimate of the cost of equity based on dividend yield forecasts prepared by SFG;
 - (c) CAPM is the model most widely used for estimation of the cost of equity and, with a point estimate for the equity beta of 0.8 (at a gearing level of 60 per cent debt to assets), is to be used to estimate the cost of equity for the Amended AA Proposal.
- 3.2. Before responding to each of these conclusions in turn, it is apparent from the ERA's reasoning that the key factor which led to each conclusion is the fact that the ERA followed its own past practice and the decisions of the AER and other Australian regulators. However, none of this practice, and none of these decisions, had made an assessment of a service provider's rate of return proposal in accordance with the requirements of the NGL and the NGR, and the ERA did not make an assessment of DBP's rate of return proposal in accordance with those requirements.
- 3.3. As discussed in Submission 55, Rule 87 of the NGR, which is central to these requirements, has two parts:
- (a) Rule 87(1) sets out the criteria – commensurability with prevailing conditions in the market for funds, and commensurability with the risks involved in providing reference services – for determining the rate of return; and
 - (b) Rule 87(2) requires that, in determining a rate of return which satisfies these criteria, the primary tools to be used are a well accepted approach and a well accepted financial model.
- 3.4. There are, however, a number of reasons why the result obtained from the use of a well accepted approach and a well accepted financial model may not satisfy the criteria of Rule 87(1). (These are set out in detail in section 3 of Submission 55.) In consequence, that result may have to be modified by the exercise of judgement to reach an outcome which satisfies the criteria of Rule 87(1), and which satisfies the pricing and revenue principles and the national gas objective of the NGL.
- 3.5. In Submission 55, DBP makes clear the steps to be followed in the process of determining the rate of return in accordance with Rule 87, and provides the information required to determine the rate of return.
- 3.6. The starting point for rate of return determination is the application of a well accepted approach. The well accepted approach which DBP has proposed (both in the Original

AA Proposal, and in the Amended AA Proposal), and with which the ERA concurs in paragraph 361 of the Draft Decision, is calculation of a real pre-tax WACC.

- 3.7. The calculation of a real pre-tax WACC requires an estimate of the cost of equity. For both the Original AA Proposal, and the Amended AA Proposal, DBP has calculated a cost of equity using the CAPM. In the Original AA Proposal, DBP used the CAPM with an estimate of the equity beta of 0.51. That estimate had been made for DBP, by consultant economists NERA, and the way in which it was made – using methods and Australian data similar to those used by the AER’s consultant Associate Professor Olan Henry – was described in NERA’s report which was Annexure 1 to Submission 8. In the Amended AA Proposal, DBP has used an estimate of the equity beta of 0.8 (at a gearing level of 60 per cent debt to total assets). Required Amendment 7, which required amendment of the Original AA Proposal to reflect the values of the CAPM and WACC parameters in Table 45 of the Draft Decision, required the use of this estimate of the equity beta.
- 3.8. Leaving the matter of the estimate of the cost of equity at the result obtained by applying the CAPM is inadequate, even without further consideration of the requirements of Rule 87. Rule 74(2) requires that an estimate be arrived at on a reasonable basis, and be the best estimate possible in the circumstances. The ERA advised:
- (a) the CAPM is the most widely used model to estimate the cost of equity (Draft Decision, paragraph 468);
 - (b) the ERA is not aware of any regulators in Australia who use different asset pricing models to estimate the cost of equity (Draft Decision, paragraph 468);
 - (c) the AER considers that 0.8 is the best estimate of the equity beta for reasons of regulatory certainty and the need to adopt a conservative approach (Draft Decision, paragraph 472); and
 - (d) the ERA adopted the range of 0.8 to 1.0 for the equity beta in its Final Decision on proposed access arrangement revisions for the Goldfields Gas Pipeline in May 2010, and adopted a point estimate of 0.8 in its most recent Draft Decision on proposed access arrangement revisions for the WA Gas Networks gas distribution system.
- 3.9. None of these is more than a statement of reliance on the opinions of others, or on past practice. None constitutes a reasonable assessment of whether the CAPM estimate is the best estimate of the cost of equity in the circumstances. Certainly none of (a) to (d) provides evidence on whether the estimate of the cost of equity made using the CAPM with an equity beta of 0.8 is commensurate with prevailing conditions in the market for funds, and with the risks involved in providing reference services.
- 3.10. The CAPM is a model and, like all models, it is a simplification of a complex reality and necessarily involves approximation, allowing the possibility that the estimate of the cost of equity obtained from it may not be the best estimate in the circumstances, and may not satisfy the criteria of Rule 87(1).

- 3.11. As DBP argued in its Submission 8, and has argued again in Submission 55, there are good reasons to expect that the CAPM will not provide an estimate of the cost of equity which is the best estimate in the circumstances, and which satisfies the criteria of Rule 87(1). The CAPM is a simple, but flawed, model. The simplifying assumptions made for its derivation have been questioned, and it does not provide good estimates or forecasts of the cost of equity.
- 3.12. The conceptual and empirical limitations of the CAPM are further substantiated in a report which NERA has prepared for DBP, *Cost of Equity in the ERA DBNGP Draft Decision*, which is Attachment 7 to Submission 55.
- 3.13. In these circumstances, an assessment must be made of any result obtained by applying the CAPM to ascertain whether that result is the best estimate in the circumstances, and whether it is commensurate with prevailing conditions in the market for funds and with the risks involved in providing reference services.
- 3.14. In the absence of an observable cost of equity (there are no traded shares in a company which carries on a business of providing gas transportation services using the Dampier to Bunbury Natural Gas Pipeline, nor are there traded shares in a company which only owns shares in the service provider of the DBNGP), this assessment must be made using the results of other asset pricing models, and using information available from other sources such as equity analysts' reports. DBP proposed for the Original AA Proposal (and continues to propose in its Amended AA Proposal) that the required assessment be made using:
- (a) results obtained from Black's Capital Asset Pricing Model, the Fama-French three factor model, and a zero-beta version of the Fama-French three factor model; and
 - (b) estimates, obtained using data from equity analysts' reports, of the returns on equity expected by investors in six energy infrastructure businesses which are seen by investors as being comparable to DBP in the sense that an investment in any of them would be regarded as an alternative to an investment in DBP.
- 3.15. In the paragraphs which follow, DBP turns to responding to the three specific conclusions outlined in paragraph 3.1 of this Attachment.

Alternative asset pricing models – are they well accepted?

- 3.16. DBP submits that there are a number of errors in the ERA's reasoning which led it to conclude that the three alternative asset pricing models put forward by DBP in its Original AA Proposal were not well accepted, or at least should be rejected.
- 3.17. Firstly, the ERA purportedly relied on a theoretical discussion of the models. While each of the three alternative asset pricing models (Black's Capital Asset Pricing Model, the Fama-French three factor model, and a zero-beta version of the Fama-French three factor model) was described in paragraphs 368 to 374 of the Draft Decision, paragraph 367 indicated that a theoretical discussion of the models was provided in Appendix 3. However, Appendix 3 did no more than restate a number of submissions made by DBP in its Submission 8. Appendix 3 did not provide any theoretical discussion of the models and, in particular, did not address the fact that their development, and a continuing

program of research into asset pricing now extending over a period of some 45 years, have been motivated by the theoretical and empirical failures of the CAPM.

- 3.18. Secondly, in relation to the ERA's rejection of each of the three alternative asset pricing models proposed by DBP in its Original AA Proposal, DBP responds to the ERA's reasoning for each model in turn.
- 3.19. In relation to the Black's Capital Asset Pricing Model (the model was discussed in paragraphs 378 to 380 of the Draft Decision, and use of a zero-beta premium in the model was noted in paragraph 405), it appears that the ERA's reasons for rejecting it were as follows:
- (a) the ERA considered that the four academic papers and one working paper referred to in NERA's report for DBP did not constitute a significant body of evidence;
 - (b) the ERA noted that four out of five of these papers were for the US capital market, and not for the Australian market;
 - (c) the ERA rejected the use of the zero-beta premium from a working paper by Lajbcygier and Wheatley on the grounds that it had not been through the process of rigorous review normally required for publication in an academic journal;
 - (d) the ERA was not aware of any empirical studies published in academic journals regarding estimates of the zero-beta premium for Australia, or of any commercial source from which such estimates were available; and
 - (e) the ERA had not identified any evidence that Black's Capital Asset Pricing Model has been broadly applied by financial analysts and business practitioners in Australia.
- 3.20. The ERA noted that four out of five academic papers were for the US market (and not the Australian market), and concluded that "the evidence presented does not reflect prevailing market conditions in which the reference services are provided to meet the requirements of Rule 87(1) of the NGR". The five papers were, as the NERA report stated on page 13, intended to provide "some evidence on the CAPM". In its haste to find reasons to dismiss Black's Capital Asset Pricing Model, the ERA was unclear about whether the evidence on which it relied related to that model, or to the CAPM.
- 3.21. The ERA appears to have rejected use of the estimate of the zero-beta premium made by Lajbcygier and Wheatley because the paper in which it was reported was only a working paper, and not an article published in an academic journal. However, no comment was made, in this context, on the fact that NERA did not use this estimate of the premium to estimate the cost of equity using Black's Capital Asset Pricing Model, and presented arguments for – and used – an alternative estimate which was applicable to the Australian context.² Moreover no comment was made on the fact that many of the estimates used in the setting of regulated access prices are not reported in academic journals. The ERA's estimate of the nominal risk free rate, for example, has

² See also Draft Decision, paragraphs 408 and 410. DBP comments on paragraph 410 of the Draft Decision in paragraph 3.26 of this Attachment.

not been reported, not because it is defective or unimportant, but because it fails to meet the publication criteria of those journals for original scientific work.

- 3.22. The ERA was not able to identify any evidence that Black's Capital Asset Pricing Model has been broadly applied by financial analysts and business practitioners in Australia. However, as was discussed in paragraphs 5.66 to 5.73 of Submission 55, this says little about the model itself, and more about those analysts and practitioners.
- 3.23. In summary, the ERA gave no consideration to the rationale for Black's Capital Asset Pricing Model (although this had been noted by DBP in paragraphs 7.16 to 7.21 of its Submission 8), and gave no consideration to the question of whether the model might be used to ascertain whether an estimate of the cost of equity made using the CAPM was the best estimate in the circumstances, and whether it satisfied the criteria of Rule 87(1).
- 3.24. The rationale for Black's Capital Asset Pricing Model and an assessment of its use by practitioners, are provided in section 2.2 of NERA's further report, *Cost of Equity in the ERA DBNGP Draft Decision*, which is Attachment 7.
- 3.25. In relation to the Fama-French three factor model (which was assessed in paragraphs 381 to 395, 405 to 416, and 438 to 449 of the Draft Decision), the ERA appears to have undertaken a conceptual assessment and an assessment of its empirical application and performance.
- 3.26. DBP submits that there are a number of errors with the ERA's reasoning for rejecting the Fama-French three factor model as being well accepted.
- 3.27. First, DBP notes that, in paragraph 410 of the Draft Decision, the ERA observed that: "NERA mistakenly uses the MRP of 6.5 per cent in its estimates". This is not correct. DBP instructed NERA to use 6.5% as its estimate of the market risk premium. This was the estimate which DBP had used in determining the rate of return in the Original AA Proposal. It is the estimate used in the Amended AA Proposal. The reasons why 6.5%, and not 6.0%, is the better estimate of the market risk premium are set out in section 8 of this Attachment 1.
- 3.28. Second, the ERA concluded, in its conceptual assessment of the Fama-French three factor model, that the model was without theoretical foundations. This is wrong. In paragraph 387, the ERA appears to have argued that:
- (a) a well accepted financial model is a model developed from a theory which yields testable propositions; and
 - (b) that theory must exist prior to any application of the model.
- 3.29. These criteria, the ERA argued in paragraph 388, supported use of the CAPM, which is based on a theory – Markowitz's portfolio theory – about risk and return. They did not support use of the Fama-French three factor model because that model was based only on empirical evidence. Furthermore, even though the model advanced by Fama and French was tied to risk factors (size and book-to-market equity), these two factors have not gained universal acceptance.

- 3.30. This view was consistent with the view of the AER in its June 2010 Final Decision on proposed revisions to the access arrangement for the Jemena Gas Networks New South Wales gas distribution system. In its Jemena Final Decision, the AER rejected the use of the Fama-French three factor model because there was no strong theoretical basis to support the inclusion of the additional risk factors (this was summarised by the ERA in its Draft Decision, paragraph 390).
- 3.31. The ERA advised, in paragraph 391 of the Draft Decision, that although the Fama-French three factor model had received a degree of support in academic circles, there was concern about “data mining” – the reporting of strong correlations between the variables, without the benefit of a priori theory justifying the use of those variables.
- 3.32. The view that the Fama-French three factor model is without theoretical foundations is not correct. There are theoretical foundations for the model. Fama and French saw the theoretical foundations of their work as being the multiple linear factors framework for asset pricing, or the linear factors model implied by arbitrage pricing theory.
- 3.33. The theoretical foundations of the Fama-French three factor model are discussed in section 2 of NERA’s report, which is Attachment 7, and in the Annexure to this Attachment 1.
- 3.34. Fama and French noted:

Since the FM [Fama-MacBeth regression] intercept is constrained to be the same for all stocks, FM regressions always impose a linear factor structure on returns and expected returns that is consistent with the multifactor asset pricing models of Merton (1973) and Ross (1976). Thus our tests impose a rational asset-pricing framework on the relation between average return and size and book-to-market equity.³

- 3.35. Fama and French acknowledged that neither the multiple linear factors framework, nor arbitrage pricing theory, provided specific guidance on the choice of factors, but noted that they constrained the way in which the data could be interpreted. Fama and French also noted that further work was required to expose the nature of the economic risks captured by size and book-to-market equity.⁴ (A brief discussion of the issue, and of subsequent further work, is provided in the Annexure to this Attachment.) Size and book-to-market equity may not have gained “universal acceptance”, as the ERA has claimed in paragraph 388 of the Draft Decision, but, as the research cited by the ERA in Table 30 indicates, they have been widely recognised as risk factors potentially important to issues of asset pricing.⁵ Section A3 of the Annexure notes that they are no longer the only risk factors which might be considered in explaining asset prices.

³ Eugene F. Fama and Kenneth R. French (1992), “The Cross-section of Expected Stock Returns”, Journal of Finance, 47(2), page 450. The Fama-French three factor model was not established, as the ERA claimed, in a 1993 paper referred to in the Draft Decision. The 1993 paper extended work which Fama and French had reported in 1992.

⁴ Ibid.

⁵ Size and book-to-market equity may not have gained “universal acceptance”, but is there any concept from the social sciences which can be considered “universally accepted”?

- 3.36. The third error in the ERA's reasoning for rejecting the Fama-French three factor model as a well accepted model arises from the ERA's view that the model relied on US statistics which are not relevant to Australian capital markets and that even if they were, the statistics were some 20 years old, and were therefore dated. Furthermore, subsequent Australian studies of the Fama-French model had not produced consistent conclusions. In consequence, the Fama-French three factor model had limited relevance for the purpose of estimating a forward-looking cost of equity for the Dampier to Bunbury Natural Gas Pipeline.
- 3.37. At the time it was first advanced by Fama and French, the Fama-French three factor model was not simply an empirical regularity. In consequence, the form of the model remains potentially relevant to the Australian capital market, and to the problem of estimating the cost of equity for Australian businesses. Whether it is relevant, and whether it can provide a cost of equity commensurate with prevailing conditions in the market for funds, depend on whether the model has produced consistent results when estimated for the Australian capital market, and on its estimation using current data from that market.
- 3.38. The fourth error in the ERA's reasoning for rejecting the Fama-French three factor model as a well accepted model followed from the ERA's argument that the model had not produced consistent results, and that NERA's work for DBP to estimate the model using current Australian data was deficient in a way which might be expected from a model which did not have the backing of economic theory (Draft Decision, paragraph 445). These issues are addressed for DBP, in NERA's further report, *Cost of Equity in the ERA DBNGP Draft Decision*, which is Attachment 7 to Submission 55.
- 3.39. Paragraphs 383 to 385 of the Draft Decision commented on the estimation of the Fama-French three factor model for the Australian capital market by O'Brien, Brailsford and Gaunt.⁶ The ERA noted:
- (a) the SMB (small minus big) risk premium was not significantly different from zero;
 - (b) the HML (high minus low) risk premium was not significant in 9 of the 25 portfolios used in the study; and
 - (c) a lower reported alpha, indicated a lower error when the CAPM was used to price portfolio returns.
- 3.40. In making these comments, the ERA has sought to show the limitations of the Fama-French three factor model when estimated using Australian data. Unfortunately, the ERA's comments are incorrect. In section 4.3 of Attachment 7, NERA assesses the work by O'Brien, Brailsford and Gaunt and addresses each of the comments on that work made by the ERA. NERA notes that

⁶ Michael A. O'Brien, Tim Brailsford and Clive Gaunt (2008), "Size and Book-to-Market Factors in Australia". Paper presented to 21st Australasian Finance and Banking Conference. Electronic copy available at <http://ssrn.com/abstract=1206542>.

Since O'Brien, Brailsford and Gaunt provide more evidence against the hypothesis that the SL CAPM correctly measures the cost of equity than against the hypothesis that the FFM correctly measures the cost of equity, they conclude that:

'the three-factor model is found to be consistently superior to the CAPM.'

- 3.41. A study by Kothari, Shanken and Sloan, which was noted in paragraph 389 of the Draft Decision, raised doubt about the validity of the Fama-French three factor model.⁷ According to the ERA, the study reported that the power of the statistical tests carried out by Fama and French was too low, that the economic magnitude of firm size was small, and that the book to market premium could have been the result of survivorship bias. This is, in part, misleading. The statistical tests which Kothari, Shanken and Sloan described as being of low power were certain tests (carried out by Fama and French) in the context of the CAPM. They were not tests of the Fama-French three factor model. Moreover, the ERA's assertion that "the economic magnitude of firm size is small" is curious. The conclusions drawn by Kothari, Shanken and Sloan are worth noting at some length:

*We have presented evidence that average returns do indeed reflect substantial compensation for beta risk, provided that betas are measured at the annual interval. Of course, this does not mean that beta alone accounts for all the cross-sectional variation in expected returns, as implied by the capital asset pricing model. While doubt has been cast on the explanatory power of B/M equity, we do see evidence of a size effect.*⁸

- 3.42. The key issue which arose from the work by Kothari, Shanken and Sloan was whether the data requirements for studies which use book-to-market equity ratios are such that failing companies are excluded. Failing companies can be expected to have low returns and high book-to-market equity ratios. In consequence, the use of portfolios which include companies with high book-to-market equity ratios, but which are not failing, may impart an upward survivorship bias to average returns. Kothari, Shanken and Sloan argued that this bias was largely responsible for the results obtained by Fama and French which supported the three factor model. Fama and French subsequently refuted this view in a substantial paper, but this was not noted by the ERA.⁹ Further research, which contests the survivorship bias purportedly found by Kothari, Shanken and Sloan, is noted in section 2.3 of Attachment 7.
- 3.43. The fifth error in the ERA's reasoning for rejecting the Fama-French three factor model as a well accepted financial model is the ERA's misunderstanding that the model adjusts for business specific risks.
- 3.44. In paragraph 438 of the Draft Decision, the ERA commented that "... the FFM is used to adjust for business specific risks, including the firm size and the book to market ratio of businesses in the sample". This would seem to indicate that the ERA may not have fully understood the Fama-French three factor model. That view is reinforced by further

⁷ S. P. Kothari, Jay Shanken, Richard G. Sloan (1995), "Another Look at the Cross-Section of Expected Stock Returns", Journal of Finance, 50(1): 185-224.

⁸ Ibid., page 220.

⁹ See Eugene F. Fama and Kenneth R. French (1996), "The CAPM is Wanted, Dead or Alive", Journal of Finance, 51(5): 1947-1958.

comments in paragraphs 439 and 441, and by the final sentence of paragraph 440, which advises:

The Authority is also of the view that it is inappropriate for all nine regulated utilities to be pooled together to estimate the HML and SML risk premia and their betas.

- 3.45. The Fama-French three factor model does not adjust for business specific risks. The model specifies a relationship between the expected rate of return on equity and three factors: the market (measured by the market risk premium), book-to-market equity ratio (measured by the factor HML), and size (measured by factor SML):

$$E(r) = r_f + [E(r_m) - r_f] \times \beta_{rm} + HML \times h + SMB \times s.$$

- 3.46. The Fama-French three factor model relates expected return on equity to three sources of risk: the market, book-to-market equity, and size. In section 3.1 of Attachment 7 to Submission 55, NERA describes book-to-market equity and size as “characteristics”. They are not attributes of the business or asset for which a rate of return is to be estimated. They are specific sources of economy-wide risk.
- 3.47. β_{rm} is the “beta” associated with the market risk premium. It is (as it is in the CAPM) the ratio of the covariance of return on the asset for which expected return is being estimated and return on a market portfolio, to the variance of return on the market portfolio. Like the CAPM equity beta, β_{rm} measures the exposure of the asset for which expected return is being estimated to “the market”.
- 3.48. h is the “beta” associated with book-to-market equity. It is the ratio of the covariance of return on the asset for which expected return is being estimated and return on a portfolio which captures economy-wide book-to-market effects, to the variance of return on that portfolio which captures economy-wide book-to-market effects. h measures the exposure of the asset for which expected return is being estimated to book-to-market equity.
- 3.49. s is the “beta” associated with size. It is the ratio of the covariance of return on the asset for which expected return is being estimated and return on a portfolio of which captures economy-wide firm size effects, to the variance of return on the portfolio that captures economy-wide firm size effects. s measures the exposure of the asset for which expected return is being estimated to size.
- 3.50. NERA, in its work for DBP, which has been updated and reported in Attachment 4 to Submission 55, made estimates of the “betas” (β_{rm} , h and s) for an Australian “benchmark” utility represented by the returns on a portfolio of shares in nine Australian regulated energy businesses. (These were the nine businesses for which the AER obtained returns to make the estimate of the CAPM equity beta for its 2009 review of WACC parameters to be used in the setting of access prices for regulated electricity network service providers.) NERA did not construct the factors HML and SML. It obtained Australian data (returns) on these factors from DFA and MSCI, two commercial providers of investment decision support tools. Factor construction is a complex statistical process which starts with data for a large set of companies (a set much larger than the nine companies used in the estimation of β_{rm} , h and s). Book-to-market equity

and firm size data for all of the companies in this large set are used to construct portfolios which have the characteristics labelled HML and SML. NERA used the returns on these portfolios, to estimate β_{rm} , h and s .¹⁰

- 3.51. The sixth error in the ERA's reasoning for rejecting the Fama-French three factor model as a well accepted model is because the ERA was of the view (in paragraph 440 of the Draft Decision) that NERA had manipulated the factor (HML and SMB) data it obtained from either DFA or MSCI for the purpose of estimating the model. This was not the case. The data had to be delevered and relevered so that it was consistent with the assumed benchmark gearing of 60%. NERA provides a full explanation of the process in section 3.2 of Attachment 7 to Submission 55. The delevering and relevering of the factor data, and the requirement for an appropriate tax adjustment in delevering and relevering, were issues raised by the AER in its February 2010 Draft Decision on proposed revisions to the access arrangement for the Jemena Gas Networks New South Wales gas distribution system. In section 3.3 of Attachment 7 to Submission 55, NERA also notes that, in its June 2010 Jemena Final Decision, the AER did not question the delevering and relevering of the HML and SML data, and did not question NERA's argument (for Jemena) that no tax adjustment was required.
- 3.52. The seventh error in the ERA's reasoning for rejecting the Fama-French three factor model as a well accepted financial model is that, at paragraphs 442 to 449 of the Draft Decision, the ERA incorrectly questioned the validity of the model when the parameters were estimated using Australian data because of the varying results obtained:
- (a) by NERA in its work for DBP when using DFA and MSCI factor data (see Draft Decision, Table 28);
 - (b) by NERA in its work for DBP, and in its earlier work for proposed revisions to the access arrangement for Jemena's New South Wales gas distribution system which were submitted to the AER in August 2009 (see Draft Decision, Table 29); and
 - (c) by others who have published the results of estimation of the Fama-French model using Australian data (see Draft Decision, Table 30).
- 3.53. The reasons for this variation in results are set out, at length, in section 3.4 of Attachment 7 to Submission 55. In section 3.4.3, NERA concludes that estimates of HML and SMB are sensitive to:
- (a) the time period used; and
 - (b) the way in which the factors are calculated.
- 3.54. In this, the estimates of HML and SMB are no different to estimates of the market risk premium. The use of data for different periods, or different methods of calculating the market risk premium would produce different results, and would lead to numerically

¹⁰ Further discussion on the factors is provided in section 3 of Attachment 7. A brief, but technical, description of factor construction is provided in John Y. Campbell, Andrew W. Lo and A. Craig MacKinlay (1997), *The Econometrics of Financial Markets*, (Princeton University Press), pages 233 to 240.

different forms of the CAPM. The different results obtained by NERA have been obtained using different measures of the factors, and the different results reported by others are the result of data for different time periods and different factor measures. What is important is that, although their numerical results are different, the different studies generally support the Fama-French three factor model against the CAPM. Provided an estimated model and the data used with it are internally consistent, there is no reason for not accepting the estimate of the cost of equity which it produces.

- 3.55. In summary, the ERA appears to have failed to understand the Fama-French three factor model, and has rejected its use largely on the basis of findings in the AER's February 2010 Jemena Draft Decision, which have been contested, and on findings in the AER's June 2010 Jemena Final Decision. The ERA gave no real consideration to the rationale for Fama-French three factor model (although this had been noted by DBP in paragraphs 7.22 to 7.37 of Submission 8), and gave no consideration to the question of whether the model might be used to ascertain whether an estimate of the cost of equity made using the CAPM was the best estimate in the circumstances, and whether it satisfied the criteria of Rule 87(1).

Estimates of the cost of equity from analysts' reports

- 3.56. DBP proposed for its Original AA Proposal (and continues to propose in Submission 55) that the cost of equity be assessed using other asset pricing models, and using estimates of the returns on equity obtained from data in equity analysts' – brokers' – reports on six Australian energy infrastructure businesses. The ERA's assessment of the estimates of the returns expected by equity investors, estimates which were made for DBP by SFG, was set out in paragraphs 451 to 467 of the Draft Decision.
- 3.57. In paragraph 467, the ERA concluded that it did not approve the use of brokers' research reports and the residual income model proposed by SFG, to estimate the cost of equity for the Dampier to Bunbury Natural Gas Pipeline. The reasons for this conclusion appear to have been:
- (a) the ERA's view that earnings forecasts, which are subjective and vary significantly across time, were not fit for the regulatory purpose of estimating the cost of equity for regulated businesses (Draft Decision, paragraph 455) (**ERA's First Reason**);
 - (b) the ERA's view that, given the poor record of economic forecasting on which the brokers' reports were based, it is inappropriate to use the broker's research reports to derive an estimated cost of equity, particularly for a period with a high level of uncertainty (Draft Decision, paragraph 457) (**ERA's Second Reason**);
 - (c) SFG's residual income model has only been reported in a working paper which does not have the status of a published academic paper (Draft Decision, paragraph 458) (**ERA's Third Reason**); and
 - (d) there are potential problems with some of the data used with the residual income model (Draft Decision, paragraphs 460, 461, 462, 463, 464 and 465) (**ERA's Fourth Reason**).
- 3.58. In the further report, which is Attachment 5 to Submission 55, SFG not only updates its earlier work for DBP using information from the most recently available equity analysts'

reports. SFG also addresses the ERA's reasons for not approving the use of these reports and the residual income model in the estimation of the cost of equity, and examines – and refutes – additional reasons which the AER has given for rejecting use of data from the reports in its February 2011 Draft Decision on proposed revisions to the access arrangement for the Envestra Limited Queensland gas distribution system.

- 3.59. In response to the ERA's First Reason, DBP acknowledges that earnings forecasts from equity analysts' reports have a subjective element, and can vary across time. They are built up from the financial and other data which analysts obtain from company reports, from investor presentations, from meetings with company executives, and from a wide range of secondary sources. Their limitations are well understood.
- 3.60. To judge the equity analysts' forecasts, as the ERA does in paragraphs 452 and 457 of the Draft Decision, against criteria developed for the purpose of assessment of mathematically sophisticated time series forecasting techniques used by academic econometricians is inappropriate. Indeed, it is misleading. The equity analysts' forecasts provide information about expected returns from equity investments which is difficult to obtain from other sources. Analysts continue to produce these forecasts because the information which they provide continues to be seen as valuable by the clients – the investors – for whom it is produced.
- 3.61. Furthermore, to present, as the ERA has done, graphs of the time series of dividend yields, real GDP growth, and inflation, and to report the standard deviation of each series (in paragraph 454 of the Draft Decision), in no way supports the ERA's assertion of a "poor record of economic forecasting on which the brokers' research reports are based (see Attachment 5, section 3).
- 3.62. In relation to the ERA's Second Reason, the ERA provides no basis for its assertion, in paragraph 457 of the Draft Decision, that the use of the broker's research reports to derive an estimated cost of equity is particularly inappropriate during a period with a high level of uncertainty.¹¹ DBP would certainly prefer not to be estimating the cost of equity at a time when there is still considerable uncertainty in financial markets following the Global Financial Crisis (the indicators of this uncertainty are provided in a report from Value Advisor Associates which is Attachment 2 to Submission 55).¹² However, DBP cannot choose to avoid that uncertainty. Stable statistical relationships, which might reasonably be relied upon in conditions of relative certainty, cannot be assumed to hold in these circumstances, and more flexible forecasting methods, which can take into account more nuanced views of the situation, are enormously valuable. Current uncertainty is a reason for giving greater weight to an estimate of the cost of equity made from equity analysts' forecasts, and not a reason for rejecting such an estimate.
- 3.63. In relation to the ERA's Third and Fourth Reasons, neither DBP nor SFG submitted that the residual income model was a highly original and complex model, thereby justifying careful peer group review before it was used. As SFG notes in paragraph 77 of

¹¹ Indeed, the assertion is somewhat puzzling given the ERA's arguments that financial markets have returned to "normal" made in the context of its assessment of DBP's proposal for an estimate of 6.5% for the market risk premium (see section 8 of this Attachment 1).

¹² See also paragraph 68 c. of Attachment 5.

Attachment 5, the model has been used extensively in the valuation literature. Rejection of the results it produces, because the residual income model has only been reported in a working paper which does not have the status of a published academic paper is therefore inappropriate. Furthermore, the concerns which the ERA had over the estimate of the cost of equity obtained by using the model were concerns arising from limitations in the data used with the model (noted in paragraphs 460 to 465 of the Draft Decision); they were not concerns about the model itself. DBP acknowledges these data limitations but maintains that the estimate of the cost of equity obtained from the residual income model is useful, especially when it is considered in the context of a range of estimates obtained using other models and methods.

- 3.64. In summary, the ERA did not provide sound reasons for its rejection of the estimates of the cost of equity derived from the forecasts in equity analysts' reports and using SFG's residual income model. Moreover, the ERA gave no consideration to the question of whether these estimates might be used to ascertain whether an estimate of the cost of equity made using the CAPM was the best estimate in the circumstances, and whether it satisfied the criteria of Rule 87(1).

- 3.65. Paragraph 450 of the Draft Decision advised:

The Authority is also aware that the proposed cost of equity of 13.5 per cent by DBP is not directly derived from the estimates of the four CAPM models. The estimates from these four CAPM models are used to confirm DBP's position on the estimate of the cost of equity derived by SFG which uses different approaches.

- 3.66. As should now be clear from Submission 55, this is not "DBP's position". DBP has calculated a real pre-tax WACC using the CAPM to estimate the cost of equity. DBP has then sought to establish whether this real pre-tax WACC is the rate of return required by the regulatory regime of the NGL and the NGR.

ERA decision

- 3.67. In paragraph 450 of the Draft Decision, the ERA concluded that it did not approve the use of Black's Capital Asset Pricing Model, the Fama-French three factor model, and the zero-beta version of the Fama-French model, to estimate the cost of equity. In paragraph 467, the ERA concluded that it did not approve the use of brokers' reports, and SFG's residual income model for estimating the cost of equity. The ERA's reasons for these conclusions were, as DBP has argued in the preceding paragraphs of this section of Attachment 1, far from substantial. Furthermore, in rejecting the alternative asset pricing models, the evidence from equity analysts' reports, and the results from SFG's residual income model, the ERA rejected the basis on which DBP sought to assess whether its estimate of the cost of equity was arrived at on a reasonable estimate, and was the best forecast in the circumstances. It also rejected the basis on which DBP sought to assess whether its estimate of the cost of equity might be used to determine a rate of return which was commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services.
- 3.68. The ERA's decision in respect of the estimate of the cost of equity was set out in paragraphs 468 to 482 of the Draft Decision.

- 3.69. In paragraph 480, the ERA concluded that it did not agree with DBP that Black's Capital Asset Pricing Model, the Fama-French three factor model, and the zero-beta version of the Fama-French model were well accepted models. DBP remains of the view that these models are well accepted for the reasons set out in paragraphs 7.38 to 7.42 of Submission 8. However, in Submission 55, DBP has not commented further on this issue. There is no need to do so. In determining the rate of return for the Amended AA Proposal, DBP has, in applying Rule 87(2), used the CAPM. Rule 87(2) notes that the CAPM is an example of a well accepted financial model. Those other asset pricing models then have a key role to play in assessing whether the estimate of the cost of equity obtained using the CAPM is the best estimate in the circumstances and satisfies the criteria of Rule 87(1).
- 3.70. In paragraph 481 of the Draft Decision, the ERA did not approve the approach of using dividend forecast reports to estimate the cost of equity. However, the ERA provided no substantial reason for its rejection of the use of these reports. There is, then, no reason to reject the use of the estimates of the costs of equity derived from the forecasts in equity analysts' reports in assessing whether the estimate of the cost of equity obtained using the CAPM is the best estimate in the circumstances and satisfies the criteria of Rule 87(1).
- 3.71. Paragraph 482 of the Draft Decision required use of the CAPM and a point estimate of the equity beta of 0.8 at gearing level of 60% debt to assets. In paragraph 470, the ERA advised that the ERA rejected DBP's approach to assessment of the estimate of the cost of equity, and offered, in its place reliance on a simple but flawed model – the CAPM (Draft Decision, paragraph 468).
- 3.72. Paragraph 468 of the Draft Decision noted that the CAPM was the model most widely used to estimate the cost of equity, and that the ERA was not aware of any regulators in Australia who used different asset pricing models for this purpose. Paragraph 470 then noted:
- The Authority considers that in ascribing a value to the equity beta, primary reliance should be placed on capital market evidence and statistical estimates of beta values, where these are available for comparable businesses.*
- 3.73. Paragraph 472 of the Draft Decision noted that the statistical evidence indicated a reasonable of the equity beta was in the range 0.4 to 0.7. The ERA, however, ignored the principle which it set down in paragraph 470, and ascertained that the estimate of the equity beta should be 0.8. The reasons for this appear to have been the AER's decision to adopt an estimate of 0.8 for beta for reasons of regulatory consistency and conservatism (Draft Decision, paragraph 472), the past decisions of the AER and other Australian regulators (Draft Decision, paragraphs 473 to 475, paragraph 477, and Table 32); and the ERA's own past decisions (Draft Decision, paragraph 478).
- 3.74. In paragraphs 468 to 482 of the Draft Decision, the ERA rejected DBP's approach to determining a cost of equity that meets the requirements of Rule 87 and offered, in its place, reliance on a simple but flawed model – the CAPM - and reference to its own past practice, and to the decisions of the AER and other regulators. None of this practice, and none of these decisions, has sought to assess whether the CAPM

produces an estimate which is the best estimate possible in the circumstances, or which is commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services. The ERA has not sought to make such assessments in the Draft Decision. There is, then, no basis for its estimate of the cost of equity, and no basis for its required rate of return, the real pre-tax WACC of 7.16% which has been calculated using that estimate of the cost of equity.

4. Cost of debt

DBP's estimate of the cost of debt

- 4.1. In Submission 8, DBP argued that the estimate of the cost of debt of 9.73% used in the Original AA Proposal was commensurate with prevailing conditions in the market for funds, and with the risks involved in providing reference services. It was also an estimate which had been arrived at on a reasonable basis, and was the best estimate possible in the circumstances. DBP subsequently provided additional support for the practical approach to estimation of the cost of debt in its response to the ERA's December 2010 discussion paper, *Measuring the Debt Risk Premium: A Bond-Yield Approach (Discussion Paper)*.
- 4.2. In the Draft Decision, the ERA rejected the estimate of the cost of debt which DBP used in the Original AA Proposal (Draft Decision, paragraph 618).
- 4.3. The issues raised in Submission 8 concerning the cost of debt, and DBP's concerns with the procedures and methods proposed in the Discussion Paper (procedures and methods which have now been adopted by the ERA), were largely ignored in the Draft Decision.
- 4.4. While this in itself is an error of law on the part of the ERA, DBP submits that there are a number of errors in the ERA's reasoning which led it to reject DBP's estimated cost of debt.
- 4.5. The first error is the ERA's rejection of the need to have regard to international financial markets in determining the prevailing conditions in the market for debt funding. The ERA concluded, in DBP's view incorrectly, for the reasons set out in section 2 above, that the relevant market was the Australian financial market.
- 4.6. The second error arises from the ERA's having misunderstood DBP's estimation of the cost of debt. There were, in fact, two misunderstandings. First, paragraph 483 of the Draft Decision advised that, on page 21 of Submission 8, DBP had estimated a nominal pre-tax rate of return on debt as the sum of three components: the nominal risk free rate of return, a debt risk premium and an allowance for debt raising costs. This is not correct. DBP did not estimate the cost of debt in the way described in paragraph 483, and the ERA's error has been carried into subsequent parts of the Draft Decision.¹³ (For the Amended AA Proposal, DBP has estimated a nominal pre-tax rate of return on debt as the sum of the nominal risk free rate of return and a debt risk premium. However, DBP has used the AER's approach to estimating the debt risk premium, and not the approach of the Discussion Paper. Furthermore, DBP has sought to assess

¹³ In paragraph 8.1, on page 21 of Submission 8, DBP noted that in the application of regulation in Australia, the nominal cost of debt was usually estimated as the sum of three components. This was not DBP's approach to estimating the cost of debt.

whether the estimate of the cost of debt made using that debt risk premium satisfies the criteria of Rule 87(1).)

- 4.7. The second misunderstanding was in paragraph 499 of the Draft Decision, which stated that DBP proposed to use a BBSW as a proxy for the risk free rate of return. This is not correct. DBP did not estimate the cost of debt in the way the ERA maintains in the Draft Decision, and did not use a BBSW as a proxy for the risk free rate of return. DBP's approach to estimating the cost of debt did not require an estimate of the nominal risk free rate of return. Furthermore, when DBP used an estimate of the nominal risk free rate for estimating the cost of equity, it made that estimate from yields on Australian Government bonds, in the same way that the ERA had estimated the nominal risk free rate for its previous regulatory decisions.
- 4.8. That DBP did not use a BBSW as a proxy for the risk free rate of return is made clear in the additional report from DBP's debt advisor, AMP Capital Investors (**AMPCI**), which is Attachment 8 to Submission 55.
- 4.9. In these circumstances, paragraphs 500 to 509 of the Draft Decision are not relevant to DBP's submissions pertaining to estimation of the cost of debt.
- 4.10. The third error in the ERA's reasoning for rejecting DBP's proposed cost of debt in the Original AA Proposal lies in the assertions made by the ERA about debt financing for large infrastructure businesses like DBP. These assertions, which were made in paragraphs 510 to 512 of the Draft Decision, viewed debt financing as the type of theoretical exercise which DBP rejects for the reasons which it has set out in section 2 of this Attachment 1. They are wrong and have no basis.
- 4.11. Paragraph 512 of the Draft Decision noted the requirement for consistency in the estimation of parameters to be used in the calculation of a WACC. This issue was addressed in section 2 of this Attachment. Paragraph 512 also returned to the issue of the relevant financial markets, asserting that "... under the NGL and the NGR, the market for funds is meant as the Australian financial market". No reference was made to the specific provisions of the NGL or the NGR which supported this assertion. None could be made. The assertion is incorrect.
- 4.12. In paragraph 510, the ERA asserted that:
 - (a) DBP, and AMPCI, did not provide any convincing evidence for the different allocation of debt into different markets; and
 - (b) this allocation was very arbitrary, and the cost of debt would be significantly different when the allocation changed.
- 4.13. AMPCI was retained by DBP because it was an experienced debt advisor with a deep practical knowledge of the financing requirements of large infrastructure businesses, and of the way in which those financing requirements could be met in Australian and international capital markets. AMPCI's credentials are summarized in Attachment 8 to Submission 55.

4.14. On the basis of its experience, AMPCI advised that DBP would need to source at least a part of any substantial debt raising in international markets. There was limited capacity in the Australian financial market (the reasons were set out in AMPCI's report which was Attachment 2 to Submission 8 (Confidential), and have been noted again in Attachment 6 to this Submission 55). There was, then, a need to consider the allocation of debt raising across different markets. On the basis of its market knowledge and experience, AMPCI advised on what that allocation might be were DBP to actually seek to raise the amount of debt which it was seeking to price for the purpose of setting the rate of return. This allocation was not, as the ERA asserted in paragraph 510 of the Draft Decision, "very arbitrary". In fact, to the contrary. The allocation was made in order to achieve certain stated objectives, which are outlined in the report in Attachment 6 to this Submission 55.

4.15. As far as DBP is aware, the ERA has no experience in raising amounts of debt in the Australian and international financial markets and, unlike DBP, does not seem to have sought expert advice on the matter. In these circumstances, the ERA is simply not in a position to conclude that DBP did not provide "convincing evidence on the allocation of debt into different markets", and that its proposed allocation was "very arbitrary". The ERA was certainly not in a position to conclude, as it did in paragraph 511 of the Draft Decision, that:

As such, the Authority considers that it is the regulated business' responsibility to phase out the amount borrowed in each period to minimise its borrowing risks. As a result, the argument from DBP cannot be justified.

4.16. In paragraphs 513, the ERA abandoned further consideration of DBP's estimation of the cost of debt, and turned to its (the ERA's) preferred method of estimating a debt risk premium and, by implication, to its preferred method of estimating the cost of debt.

4.17. The fourth error in the ERA's reasoning for rejecting DBP's proposed cost of debt in the Original AA Proposal is in the value allowed for debt raising costs. In the Draft Decision, the ERA followed Australian regulatory practice and estimated the nominal pre-tax cost of debt as the sum of three components:

- (a) the nominal risk free rate of return;
- (b) a debt risk premium; and
- (c) an allowance for debt raising costs.

4.18. The ERA estimated the nominal risk free rate of return to be 5.46%. Using the "bond-yield" approach of the Discussion Paper, it obtained an estimate of 3.124% for the debt risk premium. An allowance for debt raising costs of 0.125%, which had been used in earlier regulatory decisions, was adopted. The ERA then concluded, in paragraph 618 of the Draft Decision, that 8.71% (= 5.46% + 3.124% + 0.125%) was a reasonable cost of debt.

4.19. The ERA estimated both the nominal risk free rate of return and the debt risk premium from current financial market data. The estimate of the cost of debt which the ERA made from these estimates could, then, have been commensurate with prevailing

conditions in the market for funds, and could have led to a rate of return which satisfied at least one of the criteria of Rule 87(1).

- 4.20. However, the ERA assumed an allowance for debt raising costs of 0.125% (Draft Decision, paragraph 616). Paragraph 614 of the Draft Decision advised that this allowance for debt raising costs was based on the results of a study undertaken by the Allen Consulting Group, for the Australian Competition and Consumer Commission, in December 2004. The ERA also took into account recent advice, provided by Melbourne University Associate Professor John Handley, to the AER (Draft Decision, paragraph 615), and formed the view that an allowance of 12.5 basis points provided regulatory certainty given that this estimate of debt raising costs had been widely used by Australian regulators.
- 4.21. AMPCI advises, in section 3 of the report which is Attachment 8 to Submission 55, that debt issuing costs are in a state of constant change, and have changed significantly since the Global Financial Crisis. The Allen Consulting Group report on which the ERA has relied is obsolete, and the Hanley advice to the AER does not remedy this situation. Observed debt issuing costs, AMPCI concludes, are at odds with the ERA's contentions.
- 4.22. The estimate of the cost of debt in the Draft Decision (8.71%) is not, therefore, an estimate based on current financial market conditions, and cannot lead to a rate of return which is commensurate with prevailing conditions in the market for funds.
- 4.23. The fifth error in the ERA's reasoning for rejecting DBP's proposed cost of debt in the Original AA Proposal relates to the value attributed to the debt risk premium and the methodology adopted by the ERA in selecting that value.
- 4.24. An estimate of the debt risk premium was required for the ERA's estimation of the cost of debt. Estimation of the debt risk premium, the ERA argued, further required a benchmark credit rating.
- 4.25. Although it did not use the ERA's method, DBP used a credit rating to establish a cost of debt which was commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services. As noted in paragraph 485 of the Draft Decision, DBP assumed a credit rating in the BBB range. DBP advised that the pipeline owner and operator APA Group was currently rated BBB, and DBP itself was currently rated BBB-.
- 4.26. The ERA rejected DBP's assumption of a credit rating in the BBB range, and advised that it was of the view that an appropriate credit rating for DBP was BBB+. According to the ERA:

This credit rating of BBB+ is consistent with the Authority's recent Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline in May 2010, the recent Final Decision on Proposed Revisions to the Access Arrangement for

*the Western Australian Gas Networks in February [sic] 2011, and with all recent decisions on gas networks by the AER.*¹⁴

- 4.27. In paragraphs 514 to 539 of the Draft Decision, the ERA observed:
- (a) bond yield data which might have been used to estimate a debt risk premium were no longer available from the CBASpectrum service;
 - (b) there was continuing concern (at least among regulators) that the Bloomberg fair yield curves could not provide reliable estimates of yields, particularly for longer term bonds;
 - (c) the Australian Competition Tribunal had recently argued that there was little point in attempting to estimate the yield on a bond (with maturity of 10 years) which was not commonly traded;
 - (d) the AER and Independent Pricing and Regulatory Tribunal in New South Wales were developing alternative approaches to estimating the cost of debt.
- 4.28. The ERA decided, in view of the continuing concern over the Bloomberg fair yield curves, and the small amount of data available for bonds with terms to maturity of 10 years, to:
- (a) discontinue the previous practice of basing the debt risk premium on a 10-year corporate bond using Bloomberg's extrapolated data; and
 - (b) base the debt risk premium on a sample of bond yields of varying terms to maturity – the bond-yield approach of the Discussion Paper.¹⁵
- 4.29. In paragraph 540 of the Draft Decision, the ERA re-asserted the need for consistency in the estimation of WACC parameters and the use of data from Australian financial markets. However, in paragraph 542, the argument was made that market relevance should carry more weight than the requirement for consistency. The reasons for this “about turn” on consistency were set out in paragraphs 543 to 547, and summarized in paragraph 548. None of the ERA's reasons made reference to the requirements of the NGR or the NGL.
- 4.30. Paragraph 550 of the Draft Decision set out the ERA's criteria for selection of its “benchmark sample” of corporate bonds. Although the wording of the paragraph is not entirely clear, the ERA seemed to have moved away from its requirement for a credit rating of BBB+ to a range BBB-/BBB/BBB+. This was seen as being necessary to recognize “market realities” despite earlier arguments about benchmarks and the need for consistency, and despite the earlier view that the appropriate “benchmark” credit rating was BBB+.
- 4.31. The bond-yield approach was described and applied, in much the same way as it had been in the Discussion Paper, in paragraphs 551 to 559 of the Draft Decision.

¹⁴ Draft Decision, paragraph 498.

¹⁵ Draft Decision, paragraphs 537 to 539.

- 4.32. Paragraphs 560 to 576 set out the issues raised in public submissions on the Discussion Paper. The only point noted from DBP's submission was that market realities dictated a move away from the 10 years to maturity assumption.
- 4.33. In paragraphs 577 to 604 of the Draft Decision, the ERA explained why it had decided to adopt the bond yield approach. Paragraph 579 noted:

In addition, the Authority is of the view that using a large, heterogeneous source of data is likely to provide a more reliable estimate of the debt risk premium. A sample size of the data is also used to determine the confidence level of an estimate.

- 4.34. Although the wording in paragraph 579 is not entirely clear, the ERA appears to have been arguing that a larger sample will yield more a reliable – lower variance – estimate. This will be the case if a large homogeneous data source is used (the sample is drawn from the same population). However, it will not be the case where the data are heterogeneous (drawn from different populations).
- 4.35. This should have been apparent to the ERA from the sample shown in Table 36 of the Draft Decision. The appearance, in that sample, of very different entities – transmission pipeline owner and operator APT, commercial bank Bank of Queensland, industrial packaging and office products distributor Nexus Australia, property group Dexu, property developer Mirvac, and diversified retailer Wesfarmers – should have alerted the ERA to a problem with its bond-yield method. That problem lay, as DBP advised in its submission on the Discussion Paper, with the use of a “benchmark” credit rating. Even if the notion of a “benchmark” credit rating were reasonable, the use of such a rating could not guarantee the degree of homogeneity in the sample apparently sought by the ERA. However, the notion of a benchmark credit rating is not a reasonable one. These issues were discussed at length in DBP's submission responding to the Discussion Paper. They were ignored by the ERA in its Draft Decision. They are set out again in Submission 55.
- 4.36. The reasons which DBP has previously given for its rejection of the notion of a benchmark credit rating, and especially the of way in which such a benchmark has been determined and applied in the bond yield approach, were conceptual and theoretical. In section 5 of Attachment 8 to Submission 55, debt advisor AMPCI notes that use of public credit ratings in the way the ERA has used them provides an overly simplistic assessment of credit risk. Investors certainly make comparisons across companies, but:

As such, it is crucially important when constructing a peer comparison to ensure that the comparison is completed across a peer group which displays similar risk characteristics rather than simply having the same public credit rating.

- 4.37. The argument in paragraph 579 of the Draft Decision is reinforced in paragraph 581:

The Authority is aware of the limitations of including bonds from different industries, of less than 10 years term to maturity and with callable/putable redemption in the benchmark sample. However, as previously discussed, the Authority is of the view that a large sample of bonds will likely result in a better estimate of the debt risk premium

which is then applied to regulated businesses. In addition, the key strengths for the bond yield approach are its “market relevance”, simplicity, and transparency. As a result, putting too many constraints on the selection criteria will add unnecessary and arguable complexities into the approach.

- 4.38. The “benchmark sample” is not, as DBP has argued in its earlier submissions (and now repeats in Submission 55), in any sense a benchmark of the type which is required for the application of Rule 87(2) of the NGR. The “benchmark sample” is based on benchmarking credit ratings, but credit ratings are not adequate measures of default risks which, and are not an adequate basis for benchmarking. A larger sample of bonds with the same, or similar, credit ratings will not, then, produce a better estimate of the debt risk premium as the ERA supposes. The ERA’s approach may have “market relevance” in the sense that the data are current financial market data, and it may be simple and transparent. However, it cannot yield estimates of the debt risk premium and the cost of debt which have been arrived at on a reasonable basis and which are the best estimates in the circumstances. The ERA is incorrect in its conclusion, in paragraph 610 of the Draft Decision, that a debt risk premium of 3.124% (determined for the period of 20 trading days to 28 February 2011) is reasonable.
- 4.39. Not only is the ERA’s estimate of the debt risk premium not reasonable. Because credit ratings are not adequate measures of default risks, the estimate of the debt risk premium, and the resulting estimate of the cost of debt are not commensurate with the risks involved in providing reference services.
- 4.40. In paragraph 618 of the Draft Decision, the ERA arrived at an estimate of the cost of debt of 8.71%, which was the sum of an estimate of the nominal risk free rate of 5.46%, the estimate of the debt risk premium of 3.124%, and an allowance for debt raising costs of 0.125%. As DBP has explained above:
- (a) the allowance for debt raising costs of 0.125% is not commensurate with prevailing conditions in the market for funds; and
 - (b) the estimate of the debt risk premium of 3.124% has not been arrived at on a reasonable basis, is not the best estimate in the circumstances, and is not commensurate with the risks involved in providing reference services.
- 4.41. In consequence, the estimate of the cost of debt which the ERA considered reasonable, and the real pre-tax WACC which the ERA has calculated using that estimate of the cost of debt, cannot lead to the rate of return which is required by Rule 87(1).

5. Valuation of imputation credits (gamma)

- 5.1. DBP used, in preparing the Original AA Proposal, an estimate of gamma (the value of franking credits created as a proportion of their face value) of zero. Paragraph 639 of the Draft Decision advised that the ERA was of the view that zero was not a reasonable estimate. In paragraph 683, the ERA indicated that it considered 0.53 to be a reasonable point estimate for gamma, and the rate of return – 7.16% real, pre-tax – required by Required Amendment 8 had been calculated (as a real pre-tax WACC) using that estimate.
- 5.2. The ERA's point estimate of gamma appears to have been obtained as follows:
- (a) gamma (γ) is the product of the franking credits distribution rate (or payout ratio), F , and the value of distributed credits, θ :
$$\gamma = F \times \theta;$$
 - (b) the value of F is between 0.7 and 1.0, and the value of θ is between 0.37 and 0.81;
 - (c) gamma therefore lies between 0.26 ($= 0.7 \times 0.37$) and 0.81 ($= 1.0 \times 0.81$); and
 - (d) a reasonable point estimate for gamma is the mid-point of the range 0.26 to 0.81; that is, a reasonable point estimate for gamma is 0.53.
- 5.3. DBP submits that the values used by the ERA for both of the elements in the formula it apparently used to estimate a value for gamma are wrong.
- 5.4. In relation to the value of F , the reasons for a value of F which was between 0.7 and 1.0 were set out in paragraphs 664 to 668 of the Draft Decision. The ERA advised:
- (a) the AER has adopted a value of F of 1.0 based on the assumption that all free cash flows are paid out to investors and has, on this basis, rejected empirically observed market average distribution rates (Draft Decision, paragraph 664);
 - (b) the AER has noted that the Officer WACC framework assumes that all cash flows (including the associated imputation credits) are perpetuities which are fully distributed each period; to assume, then, that there is full distribution of the service provider's free cash flow but not a full distribution of the imputation credits associated with that free cash flow will be inconsistent with the use of the Officer WACC framework (Draft Decision, paragraph 665);
 - (c) the AER was of the view that the assumption of a value of zero for retained imputation credits was inconsistent with the Officer WACC framework (Draft Decision, paragraph 666);
 - (d) the AER was of the view that the actual payout ratio was unlikely to be significantly less than 1.0, based on an observed payout ratio from tax statistics of 71%, and the assumption that retained imputation credits have a positive value (Draft Decision, paragraph 667); and

- (e) in its October 2010 Final Decision on the revenue proposals of the Victorian electricity distribution network service providers, the AER adopted the range of 0.7 to 1.0 for F (Draft Decision, paragraph 668).

5.5. Paragraphs 664 to 668 indicate that, in respect of an estimate of F, the ERA relied solely on the decisions of the AER.

5.6. Subsequent to its expressing the opinions noted in (a) to (e) above, and to the outcomes of certain proceedings before the Australian Competition Tribunal, the AER had accepted that F should be set at 0.7. In its February 2011 Draft Decision on proposed revisions to the access arrangement for the Envestra Ltd gas distributions systems in Queensland, the AER concluded:

the empirical evidence currently before the AER supports a value of the payout ratio of 70 per cent, which the AER has adopted as the best estimate possible under the current circumstances in accordance with r. 74(2) of the NGR.¹⁶

5.7. The AER's recent decision making in respect of an estimate of F, the relevant Australian Competition Tribunal proceedings, and substantive reasons for an estimate of F of 0.7, are set out in SFG's report for DBP which is Attachment 3 to Submission 55.

5.8. There is therefore no basis that the ERA could rely on to substantiate an estimate of the value of F other than 0.7.

5.9. In relation to the value of θ , the ERA's reasons for a value of θ which was between 0.37 and 0.81 were set out in paragraphs 670 to 681 of the Draft Decision. The ERA advised:

- (a) the AER has placed significant weight on an estimate of θ of 0.57 which was determined from a dividend drop-off study for the period 2001 to 2004 undertaken by Beggs and Skeels and reported in the *Economic Record* in 2006 (Draft Decision, paragraph 671);
- (b) the AER has had regard to estimates of θ from taxation statistics, which indicate a range of values from 0.67 (pre-2000) to 0.81 (post-2000), and a point estimate of 0.74 (Draft Decision, paragraph 672);
- (c) in recognizing estimates of θ made from taxation statistics, the AER rejected arguments (made by NERA at the time of the AER's 2009 review of WACC parameters to be used in the setting of access prices for regulated electricity network service providers) that tax statistics could not be used for this purpose;
- (d) the ERA has recently determined a range of values for θ – 0.37 to 0.81 – based on the results of the Beggs and Skeels dividend drop-off study reported in 2006, and a study by Handley and Maheswaran for the AER, and used (by the ERA) in its Final Decisions on proposed revisions to the access arrangements for Western

¹⁶ Australian Energy Regulator (2011), *Draft Decision Envestra Ltd Access arrangement proposal for the Qld gas network 1 July 2011 – 30 June 2016*, page 101.

Power's South West Interconnected System and the Goldfields Gas Pipeline (Draft Decision, paragraph 678);

- (e) a more recent study, by SFG, which used the data set of the 2006 Beggs and Skeels study, but updated to September 2006, produced an estimate of θ of 0.37 (Draft Decision, paragraph 679), but the AER was of the view the results were affected by "noise" in the data and by multicollinearity (Draft Decision, paragraph 680); and
- (f) given the uncertainty about the estimates of θ made using dividend drop-off studies and tax statistics, a wide range – 0.37 to 0.81 – was appropriate (Draft Decision, paragraph 681).

- 5.10. In 2010, the Australian Competition Tribunal reviewed the use of dividend drop-off studies for the estimation of θ , and expressed concern about the methods which had been used in the 2006 Beggs and Skeels study, in proceedings on an application by Energex Limited.¹⁷ The Tribunal directed the AER to seek expert statistical or econometric advice as part of a newly-commissioned dividend drop-off study which would be "state of the art". The new study was to employ an approach that was agreed upon by SFG and the AER as being the best in the circumstances, and consideration was to be given to any possible enhancements to the data.¹⁸
- 5.11. SFG has advised DBP that the study has been completed, and that the Australian Competition Tribunal has accepted an estimate of θ of 0.35.¹⁹
- 5.12. In its reasons for decision in *Application by Energex Limited (No. 2)*, the Australian Competition Tribunal also examined the estimation of θ from tax statistics. The issues, and the Tribunal's finding, that tax statistics did not provide an estimate of θ but, rather, provided an upper bound which no estimate should exceed, are discussed in paragraphs 51 to 65 of Attachment 3.
- 5.13. In a study using tax statistics, Handley and Maheswaran found that 74% of franking credits distributed to shareholders were redeemed, indicating that 0.74 is an upper bound for θ .²⁰ The SFG estimate of 0.35 does not exceed this upper bound.
- 5.14. In these circumstances, an estimate of gamma cannot exceed 0.25 (= 0.7 x 0.35).
- 5.15. In the SFG and other studies which estimate θ using a dividend drop-off method, θ is estimated jointly with a second parameter, the value of an additional dollar of cash dividend. Estimation produces an elliptical confidence region for pairs of values of θ and the value of an additional dollar of cash dividend.²¹ Parts of this confidence region

¹⁷ *Application by Energex Limited (No. 2)* [2010] AcompT 7 (13 October 2010).

¹⁸ Ibid., paragraph 147.

¹⁹ Attachment 3, paragraphs 49 and 50.

²⁰ John C. Handley and Krishnan Maheswaran (2008), "A Measure of the Efficiency of the Australian Imputation Tax System", *Economic Record*, 84(264): 82-94.

²¹ See SFG, *The impact of franking credits on the cost of capital of Australian firms: Report prepared for ENA, APIA, and Grid Australia*, 16 September 2008, Appendix A, available at <http://www.aer.gov.au/content/index.phtml/itemId/722310>.

can be rejected (regions where the estimate of θ is less than zero, regions where the value of an additional dollar of cash dividend is greater than 1). SFG's estimate of 0.35 for θ is obtained jointly with an estimate of the value of an additional dollar of cash dividend of 0.85. That is, if an estimate of 0.35 is accepted for θ , then each additional dollar of cash dividend is valued at only 85 cents.

- 5.16. When the CAPM is applied to estimate the cost of equity, or that cost is estimated from the alternative asset pricing models which DBP has used, or is estimated from equity analysts' reports, the assumption is made that each additional dollar of cash dividends is valued at \$1.00. The pair of estimates for the value of an additional dollar of cash dividend and θ , (1, 0), has the same statistical significance as the pair of estimates (0.85, 0.35). If, in estimating the cost of equity, each additional dollar of cash dividends is valued at \$1.00, then θ should be set at zero, and the appropriate estimate of gamma is also zero (Attachment 3, paragraph 118).
- 5.17. In applying Rule 87(2) for the purpose of determining the rate of return of the Amended AA Proposal, DBP has used an estimate of zero for gamma.

6. Nominal risk free rate of return

- 6.1. The risk free rate of return is a theoretical construct used in the CAPM and in the ERA's method of estimation of the cost of debt.
- 6.2. When the CAPM is used, and the cost of debt is estimated using the ERA's method, an estimate of the risk free rate of return is required. However, no financial asset is risk free, although some assets (for example Australian Government bonds) are regarded as having very low risk. Historical rates of returns on these low risk financial assets can be used to estimate the risk free rate of return.
- 6.3. DBP proposed estimating the nominal risk free rate as the average of the daily yields, reported by the Reserve Bank of Australia, on Australian Government bonds with term to maturity of 10 years.²² DBP argued that recently reported yields incorporate the latest market information and expectations about future rates, but they also contain a random component ("noise"). Some averaging of yields reduces the effect of this noise on the estimate of the risk free rate of return, with longer-term averages achieving better noise reduction. However, longer term averaging may introduce a bias because greater weight is given to superseded prior expectations. DBP therefore proposed averaging the yields on Australian Government bonds with term to maturity of 10 years over a period of 20 trading days.²³
- 6.4. In paragraph 706 of the Draft Decision, the ERA stated:
- The Authority does not approve DBP's proposal in relation to the calculation of the nominal risk free rate of return.*
- 6.5. In its deliberations on the nominal risk free rate of return, the ERA stated, in paragraph 688 of the Draft Decision:
- The Authority notes that DBP proposed two different proxies for the nominal risk free rate:*
- *DBP proposed using the 10-year Commonwealth Government Securities as the proxy for the nominal risk free rate to estimate the cost of equity, based on advice by its consultant NERA.*
 - *DBP proposed using the Bank Bill Swap Rate as the proxy for the nominal risk free rate to estimate the cost of debt, based on advice by its consultant AMP Capital.*
- 6.6. The second bullet point in this statement is incorrect. As explained in section 4 above, DBP did not propose using the Bank Bill Swap Rate as a proxy for the nominal risk free rate for the purpose of estimating the cost of debt.

²² Submission 8, paragraph 7.47.

²³ Submission 8, paragraph 7.46.

- 6.7. The ERA's reason for not approving DBP's proposal for estimating the nominal risk free rate of return was that there should be consistency between the terms of the risk free rate and the debt risk premium.²⁴ Paragraphs 708 to 713 of the Draft Decision set out the following arguments in support of this view:
- (a) the possibility of over-compensation from the use of a term for the risk free rate that exceeds the length of the regulatory period was not argued before the Australian Competition Tribunal in its 2003 GasNet decision (Draft Decision, paragraph 708);
 - (b) based on various studies by Lally and Davis, the use of a 10-year term assumption is expected to violate the "NPV=0" rule (Draft Decision, paragraph 709);
 - (c) there is no evidence to suggest that regulated businesses will seek to issue long term debt as a matter of preference; instead, the Authority is aware that some regulated businesses secure finance over a period of less than 5 years (Draft Decision, paragraph 710);
 - (d) the Authority is aware that regulated businesses generally avoid the situation of having a significant proportion of their debt funding maturing in any one year (Draft Decision, paragraph 711);
 - (e) the Authority is of the view that regulated businesses are active in hedging markets. This view is based on the Deloitte report in 2008 for the AER (Draft Decision, paragraph 712); and
 - (f) a term of the risk free rate which matches the length of the regulatory period of 5 years better reflects the financing strategies of regulated businesses in Australia. The Authority is of the view that the use of a term of 5 years matching the regulatory period will result in correct compensation consistent with the "NPV=0" rule (Draft Decision, paragraph 713).
- 6.8. Some of these arguments may be relevant in the context of the ERA's proposed method for estimating the debt risk premium; some, such as the first, are simply irrelevant.
- 6.9. However, if the ERA's method of estimating the debt risk premium is accepted, the premium above the nominal risk free rate required by investors purchasing the relevant sample of bonds is a premium on bonds with terms to maturity of around five years.²⁵ In these circumstances, to ensure the correct measure of risk in the aggregate, the debt risk premium should be added to a nominal risk free rate estimated from the yields on government bonds (the assumed risk free security) with terms to maturity of five years.
- 6.10. Furthermore, if the nominal risk free rate of return is estimated from the yields on government bonds with terms to maturity of five years to accord with the term to maturity assumption made in estimating the debt risk premium, then the same "consistency" should be sought when estimating the market risk premium. In applying

²⁴ Draft Decision, paragraph 707.

²⁵ The ERA's method of estimating the debt risk premium should not be accepted for the reasons which DBP has set out in section 4 above.

the CAPM, a scalar multiple of the market risk premium is added to the nominal risk free rate. If the nominal risk free rate is estimated from the yields on government bonds with terms to maturity of five years, the market risk premium should also be estimated using yields on government bonds with terms to maturity of five years. However, the data from which the ERA purports to determine the market risk premia include estimates of the risk free rate made using yields on government bonds with terms to maturity of 10 years.

- 6.11. The ERA's requirements for the nominal risk free rate of return do not meet the regulator's own requirements for consistency in the estimation of the parameters to be used in WACC calculation.

7. Expected inflation

- 7.1. Paragraph 716 of the Draft Decision noted that DBP had proposed a widely accepted method (calculation of a geometric mean of Reserve Bank of Australia inflation forecasts for a period of 10 years) to estimate expected inflation, and in paragraph 721 the ERA indicated that it had adopted the same general approach for the Draft Decision. However, for reasons of consistency with the estimates of the debt risk premium and the calculations of the nominal risk free rate, the ERA decided not to calculate the geometric mean for a period of 10 years, and had made the calculation using Reserve Bank inflation forecasts for a period of five years.
- 7.2. Beyond perceived requirements for consistency with the estimation of the debt risk premium, and the calculation of the nominal risk free rate, the Draft Decision provided no reason for the ERA's not accepting DBP's proposal.
- 7.3. This consistency which the ERA seems to require between the method of estimating expected inflation and the methods of estimating the debt risk premium and calculating the nominal risk free rate is, in the absence of more substantial argument, consistency for reasons of appearance only.
- 7.4. If, as noted in paragraph 6.9 above, the ERA's method of estimating the debt risk premium is accepted, the premium above the nominal risk free rate required by investors purchasing the relevant sample of bonds is a premium on bonds with terms to maturity of around five years.²⁶ In these circumstances, to ensure the correct measure of risk in the aggregate, the debt risk premium should be added to a nominal risk free rate estimated from the yields on government bonds (the assumed risk free security) with terms to maturity of five years.
- 7.5. However, unlike the debt risk premium and the nominal risk free rate of return, expected inflation is not estimated from the return on (or other attributes of) specific financial instruments. There is, then, no reason, other than for appearance, to require the use of a geometric mean of inflation forecasts calculated for a period of five years in place of a geometric mean of inflation forecasts calculated for a period of 10 years.
- 7.6. In the absence of any substantial reason for change, DBP has made the estimate expected inflation used in Submission 55 by calculating a geometric mean of Reserve Bank of Australia inflation forecasts for a period of 10 years.

²⁶ The ERA's method of estimating the debt risk premium should not be accepted for the reasons which DBP has set out in section 4 above.

8. Market risk premium

- 8.1. In the Original AA Proposal, DBP proposed, for use in calculating a pre-tax real WACC in accordance with the requirements of Rule 87(2) of the NGR, a market risk premium of 6.5%.
- 8.2. The market risk premium is a parameter of the macro-economy. It is not industry-specific. In these circumstances, DBP considered statements made by the AER in its May 2009 decision on the WACC parameters to be applied in the setting of prices for access to electricity transmission and distribution networks to be relevant to the calculation of a WACC under the regulatory regime of the NGL and the NGR. Following an examination of the statistical evidence, the AER had concluded that:
- (a) a market risk premium (MRP) above 6.0% now seemed appropriate; and
 - (b) a premium of 6.5% was commensurate with conditions in the market for funds.²⁷
- 8.3. DBP also noted, in its April 2010 *Submission 8: Rate of Return*, that the ERA had required the use of a MRP of 6.5% in its October 2009 Draft Decision on proposed revisions to the access arrangement for the Goldfields Gas Pipeline, and in its December 2009 Final Decision on proposed revisions to the access arrangement for Western Power's South West Interconnected Network.
- 8.4. In paragraphs 728 to 754 of the Draft Decision, the ERA reviewed current thinking on the market risk premium, mainly by the AER, and, in paragraph 755, concluded that a reasonable point estimate of the premium was 6%. Required Amendment 7 of the Draft Decision required, in effect, that DBP use a market risk premium of 6% in its calculation of a WACC.
- 8.5. The ERA noted, in paragraph 728 of the Draft Decision (reiterating a point made earlier in paragraph 404), that DBP was mistaken in its view that the ERA had required the use of a MRP of 6.5% in its Draft Decision on proposed revisions to the access arrangement for the Goldfields Gas Pipeline, and in its Final Decision on proposed revisions to the access arrangement for Western Power's South West Interconnected Network. In paragraph 729, the ERA advised:
- In these two final decisions, the Authority has adopted the range of 5 per cent to 7 per cent with the view that the point estimate of 6 per cent as the reasonable estimate for the MRP is to be adopted.*
- 8.6. DBP acknowledges that, in paragraph 454 of the Goldfields Gas Pipeline Draft Decision, the ERA concluded:

The Authority considers that a reasonable range of values for the MRP is 5% to 7%.

²⁷ Australian Energy Regulator, *Final Decision: Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters*, May 2009, pages 175-138.

- 8.7. Moreover DBP acknowledges that the rate of return required by the decision, 10.28% (nominal, pre-tax), is an average of a low value of a WACC (calculated using an estimate of the market risk premium of 5%) and a high value of a WACC (calculated using an estimate of the market risk premium of 7%).
- 8.8. However, this does not mean that the decision is evidence of a point estimate of 6.0% being adopted.
- 8.9. DBP also acknowledges that, in paragraph 874 of the Western Power South West Interconnected Network Final Decision, the ERA concluded:

Taking into account the above evidence of realised equity premia over recent decades, market practice and information presented in submissions on the current cost of equity, the Authority considers that there is no justification for departing from the range indicated in its Draft Decision in which a reasonable range of estimates for the market risk premium is 5.0 to 7.0 per cent.

- 8.10. However, examination of the public version of the tariff model issued with the Final Decision for the South West Interconnected Network indicates that the required rate of return, 7.98% (real, pre-tax), was calculated as a WACC using an estimate of 6.5% for the market risk premium.
- 8.11. Paragraph 730 of the Draft Decision advised that the market risk premium is the required return, over and above the risk free rate, on a fully diversified portfolio of assets, and paragraph 731 noted that it is the current practice of regulators across Australia to estimate this premium using historical data on equity premia. Paragraphs 732 to 734 focused on historical estimates of the market risk premium, particularly those estimates which had been made by the AER.
- 8.12. The ERA's limited characterisation, in paragraph 732 of the Draft Decision, overlooked the forward looking nature of the market risk premium. A forward looking market risk premium is to be used in estimating the cost of equity using the CAPM (and other asset pricing models). The AER's appreciation of this point is clear from paragraph 735 of the Draft Decision:

*The AER considers that prior to the onset of the global financial crisis, **an estimate of 6 per cent was the best estimate** of a forward looking long term MRP, and accordingly, under relatively stable market conditions - assuming no structural break has occurred in the market - this would remain the AER's view as to **the best estimate of the forward looking long term MRP**.*

- 8.13. The ERA did not, itself, give consideration to the forward looking nature of the market risk premium. However, it was concerned to establish that markets have now stabilised following the disruption of the Global Financial Crisis. In paragraph 736 of the Draft Decision, the ERA referred to the recent strong growth in real GDP noted by the Reserve Bank of Australia in its August 2010 Statement on Monetary Policy. Paragraph 738 quoted from a number of public statements by senior officers of the Reserve Bank:

Employment growth has been robust, business and consumer confidence is above average, the housing market has been strong, and there are signs that the period of business deleveraging is coming to an end. Collectively, these outcomes provide us with some confidence that the economy is now in a reasonably solid upswing.

Our economy recovered relatively quickly from what was a shallow downturn following the global financial crisis, and over the past year has grown around its trend rate of 3¼ per cent. Domestic demand has grown substantially faster than this – about 5¼ per cent – due importantly to growth in public spending, though this is moderating now...

Business conditions are generally around average levels, although there are clear differences across sectors. Business investment is at a high level, particularly in the mining sector, and information published by the Australian Bureau of Statistics, as well as our own liaison with companies, suggests that it will pick up sharply further over the next couple of years.

In November, the Reserve Bank Board increased the target for the cash rate from 4.50 per cent to 4.75 per cent, the first change to the target in six months. Money market yields suggest markets currently expect a further increase in the cash rate in the first half of 2011.

- 8.14. Paragraph 739 of the Draft Decision included a graph of the ASX30 Index, and a graph of the ASX30 Accumulation Index, which showed that the share market has recovered from its crisis levels, and paragraphs 740 and 741 reported OECD and IMF views on prospects for further growth in Australian investment, employment and output.
- 8.15. The conclusion which the ERA appears to have drawn from all of this – although it is not drawn explicitly – is that the long term average of historical values for the market risk premium can, once again be relied upon as an estimate of the market risk premium as, indeed, regulators in other jurisdictions have done (see Draft Decision, paragraphs 743 to 745).
- 8.16. However, the “evidence” advanced by the ERA has little bearing on the conclusion it appears to have reached – that 6.0% is, once again, the appropriate level of the market risk premium. GDP growth, prospects for employment and investment growth, business outlook, an increase in the cash rate, and even a rising share price, say very little about investor expectations as to the premium (above the risk free rate) which might now be required to induce investors to invest in equities. The nearest the Draft Decision came to addressing the issue of investor expectations was in paragraph 748:
- ... investors’ expectation of the long run forward looking MRP is unlikely to change annually in response to the latest historical estimates of the type calculated by Handley.*
- 8.17. The ERA has given no consideration to the questions of what factors might determine the market risk premium, whether those factors have changed as a result of the Global Financial Crisis and, if they have changed, how the market risk premium has responded to those changes.

- 8.18. Prior to the Global Financial Crisis, economist Martin Weitzman observed, in the context of an examination of the market risk premium:

*... markets are behaving as if investors fear some unknown hidden randomness that isn't obvious from the data. People are acting in the aggregate like there is much more marginal utility-weighted subjective variability about future growth rates than past observations seem to support.*²⁸

- 8.19. Then came the Global Financial Crisis. The fears to which Weitzman referred to were realised, and expectations adjusted. This was clearly demonstrated in a report prepared by Value Advisor Associates for Western Australian gas distribution network service provider, WA Gas Networks.²⁹ In this report, which was dated December 2009, Value Advisor Associates made an estimate of the forward market risk premium using the implied volatility derived from the price of a three month option on the SX 200 Index. The then current implied volatility, Value Advisor Associates concluded, indicated a market risk premium well above the long term average, and was consistent with a forward market risk premium in the order of 12.2%.
- 8.20. This adjustment in expectation will not, as Weitzman made clear, be obvious from past observations. A focus on long term historical averages tells us nothing about current expectations and about the way in which they have adjusted.
- 8.21. Evidence which was available – but not for Australian financial markets – indicated that the adjustment process was likely to be slow: in the order of 3.5 years.³⁰ Taking, as the ERA did, the long term historical average as an estimate of the market risk premium during for the next access arrangement period – during a period when the expectations are continuing to adjust to the effects of the Global Financial Crisis, cannot lead to a rate of return which is commensurate with prevailing conditions in the market for funds.
- 8.22. These were the circumstances which led DBP to seek, from Value Advisor Associates, the advice on the level of the market risk premium which was noted in paragraphs 5.34 and 5.35 of the Submission 55. A copy of the Value Advisor Associates report is Attachment 2 to Submission 55.

²⁸ Martin L Weitzman (2007), "Subjective Expectations and Asset-Return Puzzles", American Economic Review, 97(4): 1102-1130.

²⁹ Value Advisor Associates' report for WA Gas Networks is available at <http://www.erawa.com.au/cproot/8781/2/20100902%20D51418%20Attachment%207%20-%20Value%20Adviser%20Associates%20Pty%20Ltd%20-%20Market%20Risk%20Premium.pdf>.

³⁰ Carmen M Reinhart and Kenneth S Rogoff (2009), "The Aftermath of Financial Crises", American Economic Review Papers and Proceedings, 99(2): 466-472.

Annexure: asset pricing models

A1. Introduction

- A1.1 This annexure provides an outline of the economic framework which has developed for the investigation of asset pricing since the early 1970s. The outline is far from complete. It could not be given the now very extensive literature on asset pricing (a literature which attests to the limitations of the CAPM). Nevertheless, the outline provides some rationale for a number of the arguments made in Submission 55, and for the concerns which DBP's has with parts of the Draft Decision (concerns which have been set out in Attachment 1).

A2. Simple model

- A2.1 An investor chooses between current consumption of products and services, and consumption at a later time. In making this choice, the investor is constrained by the wealth which he or she currently has available. The investor can transfer wealth from the current period (today) to a later time (tomorrow) by purchasing financial assets today, and selling those assets tomorrow. This allows the investor to defer consumption today in the expectation of increased wealth, and hence increased consumption, tomorrow from the return on her investment in financial assets today.
- A2.2 Markets for financial assets are assumed to be competitive, and there are no taxes or transaction costs. The investor can buy or sell as much of a financial asset as she wishes at today's asset price (p_t). She knows p_t but does not know the payoff (x_{t+1}) from her investment tomorrow.³¹ The payoff from an investment is, in general, not known with certainty, although the range of possible payoffs, and the probability distribution of payoffs over that range, is known. In consequence, the investor does not know her wealth tomorrow with certainty and, because she does not know her wealth, she does not know her consumption tomorrow with certainty.
- A2.3 The investor's preferences for consumption today (c_t) and consumption tomorrow (c_{t+1}) are represented by a utility function, $U(c_t, c_{t+1})$, which allows a consistent numerical ranking of those preferences. The investor's assessment, made today, of her utility from consumption today and consumption tomorrow, can be represented as:

$$U(c_t, c_{t+1}) = u(c_t) + E_t[\delta u(c_{t+1})].$$

- A2.4 $u(c_t)$ is the utility from known consumption today. $E_t[u(c_{t+1})]$ is the expected utility (the expectation being formed on the basis of what is known today) of uncertain consumption tomorrow. δ is a parameter indicating the investor's impatience – her preference for consuming today, rather than postponing consumption until tomorrow. The period utility function $u(c)$ is increasing (the investor always prefers more consumption), and concave

³¹ The investor's expected rate of return is $r_{t+1} = x_{t+1}/p_t - 1$. (Asset prices are the link between uncertain returns and expected rates of return. Hence the problem of explaining expected rates of return is the problem of explaining asset prices.)

(although more consumption is always preferred, additional consumption has declining marginal value).

- A2.5 Let k_t denote the investor's consumption today if she buys none of the financial asset today, and let k_{t+1} denote her consumption tomorrow if she buys none of the financial asset today. If, then, she buys n units of the asset today, her consumption today is:

$$c_t = k_t - p_t n.$$

- A2.6 On selling the n units of the asset tomorrow, her consumption tomorrow is:

$$c_{t+1} = k_{t+1} + x_{t+1} n.$$

- A2.7 How much of the financial asset should the investor buy today? The number of units of the asset she should buy is the number which maximises her utility $U(c_t, c_{t+1})$ subject to the constraints:

$$c_t = k_t - p_t n$$

and

$$c_{t+1} = k_{t+1} + x_{t+1} n.$$

- A2.8 The investor's utility is maximised when:

$$p_t u'(c_t) = E_t[\delta u'(c_{t+1}) x_{t+1}].$$

- A2.9 $p_t u'(c_t)$ is the reduction in utility from buying one more unit of the financial asset today, and reducing consumption today by an equivalent amount. $E_t[\delta u'(c_{t+1}) x_{t+1}]$ is the increase in expected discounted utility obtained from additional consumption tomorrow made possible by the payoff from investment in the asset tomorrow. To maximize her utility from consumption today and tomorrow, the investor must buy, today, that number of units of the financial asset for which the reduction in utility today is equal to the increase in expected discounted utility obtained from the additional consumption tomorrow made possible by the payoff from her investment.

- A2.10 When markets are in equilibrium, the price of the financial asset today is obtained from the condition for utility maximisation:

$$p_t = E_t[\delta (u'(c_{t+1})/u'(c_t)) x_{t+1}] = E_t[m_{t+1} x_{t+1}],$$

where $m_{t+1} = \delta u'(c_{t+1})/u'(c_t)$ is called the stochastic discount factor.

- A2.11 The stochastic discount factor, m_{t+1} , is the product of:

- (a) investor "impatience" (δ) – a measure of preference for consuming today, rather than postponing consumption until tomorrow; and
- (b) the ratio of the marginal utility from consumption tomorrow to the marginal utility of consumption today ($u'(c_{t+1})/u'(c_t)$).

A2.12 The stochastic discount factor reveals a fundamental determinant of asset prices and, hence, of rates of return: the rate at which investors are willing to substitute consumption tomorrow for consumption today. This rate is, in turn, determined by the rate of growth in consumption between today and tomorrow. Asset prices (and rates of return) are, therefore, determined by expectations about consumption growth. This important result links asset prices to the state of the economy.

A2.13 Since the rate of return on an asset is $r_{t+1} = x_{t+1}/p_t - 1$, the asset pricing equation can be written in terms of rate of return:

$$E_t[m_{t+1}(1 + r_{t+1})] = 1.$$

A2.14 Now, a risk free asset is an asset which has the same payoff in every uncertain state, and therefore has the same rate of return in each state. The rate of return on a risk free asset is:

$$r_f = 1/E_t(m_{t+1}) - 1.$$

A2.15 Using this form of the risk free rate, the expected rate of return on any (risky) asset is:

$$E_t(r_{t+1}) = r_f - (1 + r_f) \times \text{cov}(m_{t+1}, r_{t+1}).$$

A2.16 That is, the rate of return on any asset can be represented as the sum of:

- (a) the risk free rate of return, r_f ; and
- (b) a risk premium, $-(1 + r_f) \times \text{cov}(m_{t+1}, r_{t+1})$.

A2.17 The risk premium is determined by the covariance of asset return with the stochastic discount factor: assets for which the covariance of return with the discount factor is large in absolute value, but negative, have higher expected rates of return. The variability of asset returns does not contribute to the risk premium: only the covariance of asset return with investor expectations about consumption growth, as measured by the discount factor, is factored into expected returns (via the risk premium).

Multiple linear factor models

A2.18 Relating the stochastic discount factor directly to consumption growth does not facilitate the development of asset pricing beyond the rather abstract presentation above.³² In these circumstances, more specific representations of the discount factor have been sought. In one line of research, the discount factor is modelled as a linear function of the economic factors, f_{it} , which determine consumption growth:

$$m_{t+1} = \delta u'(c_{t+1})/u'(c_t) \approx a + b_1 \times f_{1,t+1} + b_2 \times f_{2,t+1} + \dots + b_n \times f_{n,t+1}.$$

A2.19 The asset pricing equation, $E_t[m_{t+1}(1 + r_{t+1})] = 1$, then has a "beta representation":

$$E_t(r) = \alpha + b_1 \times \beta_{f1,r} + b_2 \times \beta_{f2,r} + \dots + b_n \times \beta_{fn,r},$$

³² See John H. Cochrane (2005), *Asset Pricing*, (revised edition, Princeton University Press), chapter 9.

where:

$E_t(r)$ is the expected rate of return;

α is a constant;

$b_i = k \times \text{var}(f_i)$, k a constant; and

$\beta_{f_i, r} = \text{cov}(f_i, r) / \text{var}(f_i)$.

A2.20 As noted above, expected returns are high when asset risk premia are large in absolute value but negative. This will be the case when asset returns covary positively with investor consumption of goods and services. If returns are high, consumption is high, the marginal utility of consumption is low, the covariance of the stochastic discount factor and asset return is negative, and the risk premium in asset return is positive.

A2.21 The factors which should, then, be used in a linear factor model of the stochastic discount factor should be positively related to consumption.

A2.22 One such factor is the return on a portfolio of total wealth. Consumption is high when investor returns on a portfolio of all assets is high. This portfolio of all assets would comprise financial assets, real – tangible – assets, and intangible – but valuable – assets such as investments in human capital.

A2.23 If the number of factors is restricted to one, and that one factor is the return on a portfolio of total wealth (r_w), the beta representation of the basic asset pricing equation is:

$$E_t(r_{t+1}) = r_f + (E(r_w) - r_f) \times \beta_{w, r}.$$

A2.24 This is the conditional CAPM: the expected rate of return is conditional on the information available today. If further assumptions are made (for example, returns distributions are identically and independently multivariate normal), the conditioning can be removed, and the model reduces to the CAPM.³³

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Deriving the CAPM in this way makes explicit certain assumptions about preferences which are “hidden” in the mean-variance framework within which the model was originally developed. The assumption that an investor is able to rank all of the available portfolios in terms of the means and variances of their uncertain returns is valid only if further assumptions are made about the shape of the probability distribution of returns and about the mathematical form of the utility function used to rank uncertain prospects. These further assumptions about the shape of the returns distribution and about the form of the utility function were seen by many economists as being unnecessarily specific (see, for example, K. Borch (1969), “A Note on Uncertainty and Indifference Curves”, *Review of Economic Studies*, 36(1): 1-4; M. S. Feldstein (1969), “Mean-Variance Analysis in the Theory of Liquidity Preference and Portfolio Selection”, *Review of Economic Studies*, 36(1): 5-12; and Nils H. Hakansson (1971), “Capital Growth and the Mean-Variance Approach to Portfolio Selection”, *Journal of Financial and Quantitative Analysis*, 6: 517-557). Robert Merton summarised the position in 1973 (“An Intertemporal Capital Asset Pricing Model”, *Econometrica*, 41(5), page 867):

Although the model [the CAPM] has been the basis for more than one hundred academic papers and has had a significant impact on the non-academic financial community, it is still subject to theoretical and empirical criticism. Because the model assumes that investors choose their portfolios according to the Markowitz mean-variance criterion, it is subject to all the theoretical objections to this criterion, of which there are many.

A2.25 Restriction of the number of parameters to one – return on a portfolio of total wealth – is, however, arbitrary. Multiple linear factor models now dominate empirical asset pricing research, and one of the most widely recognised – and tested – of these is the Fama-French three-factor model.³⁴

A2.26 Although early empirical work had provided some support for the CAPM, further work during the 1980s began to reveal “anomalies” – asset pricing behaviour which appeared to deviate from the predictions of the CAPM.³⁵ These anomalies included:

- (a) a size effect: low market value shares have higher returns than can be explained by the CAPM;
- (b) a value effect: returns are predicted by ratios of market value to accounting measures such as earnings and book value of equity; and
- (c) a momentum effect: shares with high returns during the past three to 12 months tend to have higher returns in the immediate future.

A2.27 Fama and French proposed that these anomalies were interrelated and captured by a three-factor model of asset prices. The three factors are:

- (a) the excess return to the market portfolio, $E(r_m) - r_f$;
- (b) the difference between the return to a portfolio of high book-to-market shares and the return to a portfolio of low book-to-market shares (HML); and
- (c) the difference between the return to a portfolio of small capitalization shares and a portfolio of large capitalization shares (SML).

A2.28 The Fama-French three factor model is:

$$E(r) = r_f + (E(r_m) - r_f) \times \beta_{rm} + HML \times h + SMB \times s.$$

A2.29 Tests using US stock market data have shown that the three factor model appears to have significantly greater explanatory power than the CAPM.³⁶ Similar results have also been obtained using Australian share prices.³⁷

A2.30 Multiple linear factor models are an area of current theoretical and empirical research in financial economics. A key issue for this research is the question of what are the appropriate factors. Theoretical considerations, as outlined above, require that they be variables which can be explicitly related to investor marginal utility or consumption growth.

³⁴ Cochrane, 438.

³⁵ Campbell, 1526-1529.

³⁶ See, for example, Eugene F. Fama and Kenneth R. French (1996), “Multi-factor Explanations of Asset-Pricing Anomalies”, *Journal of Finance*, 47: 426-465.

³⁷ Clive Gaunt (2004), “Size and book to market effects and the Fama French three factor asset pricing model: evidence from the Australian stockmarket”, *Accounting and Finance*, 44: 27-44.

A3. Issues

- A3.1 Derivation of the CAPM within the multiple linear factors framework emphasizes the fact that the relevant measure of wealth is not the market value of a portfolio of financial assets. It is the value of all assets held by the investor including financial assets, real assets, and intangible assets. However, the return on total wealth cannot be measured, and this may make the validity CAPM untestable. This is the essence of Roll's critique.³⁸
- A3.2 The sensitivity of tests of the CAPM to the types of assets included in the market portfolio has been assessed using a number of broader proxies for the market portfolio.³⁹ Stambaugh has shown that similar inferences could be made for portfolios comprising shares, bonds, and shares, bonds and real estate. His work suggests that inferences are not sensitive to the composition of the asset portfolio, and that Roll's critique may not be an empirical problem.
- A3.3 Derivation of the CAPM within the multiple linear factors framework also shows that beta is time-dependent. It varies with changes in the information available to investors, and this makes the model untestable without significant auxiliary restrictions being placed on the statistical properties of the underlying economic processes generating returns.⁴⁰ Cochrane refers to this as the "Hansen-Richard critique" by analogy with Roll's "critique", and notes:
- ... even if the wealth portfolio were observable, the fact that we cannot observe agents' information sets dooms tests of the CAPM.*
- A3.4 The multiple linear factors framework has opened up new insights into asset pricing, "connecting" asset prices with macroeconomic risks through the risk premia established in asset markets. However, the framework does not provide specific guidance on the choice of factors. This has led some financial economists to argue that the fact that the Fama-French three factor model provides a better "fit" than the Sharpe-Lintner CAPM is not indicative of superior explanatory power, but a fortuitous outcome from judicious choice of the relevant "explanatory" variables.⁴¹
- A3.5 Others concur with Fama and French that the three factors are proxies for specific macro-economic risks. Liew and Vassalou, for example, find a positive relationship between the factor HML and future growth in the economy, and between SMB and

³⁸ Richard Roll (1977), "A Critique of the Asset Pricing Theory's Tests – Part I: On Past and Potential Testability of the Theory", *Journal of Financial Economics*, 4: 129-176.

³⁹ See Jay Shanken (1987), "Multivariate Proxies and Asset Pricing Relations: Living with the Roll Critique", *Journal of Financial Economics*, 18: 91-110; and Robert F Stambaugh (1982), "On the Exclusion of Assets from Tests of the Two Parameter Model", *Journal of Financial Economics*, 10: 235-268.

⁴⁰ See Cochrane, 143. The CAPM may hold conditionally, but not unconditionally. A review of earlier research which purports to show that the Sharpe-Lintner CAPM holds conditionally, and new theory and evidence which shows that the conditional CAPM performs nearly as poorly as the unconditional CAPM, are provided in Jonathan Lewellen and Stefan Nagel (2006), "The conditional CAPM does not explain asset-pricing anomalies", *Journal of Financial Economics*, 82: 289-314.

⁴¹ See, for example, A Craig MacKinlay (1995), "Multifactor models do not explain deviations from the CAPM", *Journal of Financial Economics*, 38: 3-28.

future growth.⁴² They conclude that their work supports the contention of Fama and French that these variables act as state variables in the context of intertemporal capital asset pricing. Further support for this view is provided by Vassalou.⁴³ Da, Guo and Jagannathan noted, early in 2009, that “the model has received wide attention and has become the standard model for computing risk adjusted returns in the empirical financing literature”.⁴⁴

- A3.6 Since the 1970s, financial economists have advanced a large number of asset pricing models examining a wider range of factors within the multiple factors framework. Some example are provided in the paragraphs which follow.
- A3.7 Labour income is about two-thirds of US GDP, and capital income is only about one third: human capital is therefore an important component of total wealth. This prompted Jagannathan and Wang to argue that labour income growth was a good proxy for return on human capital, and to show that its inclusion as a factor improves the “fit” of the conditional CAPM to the data.⁴⁵ Following Jagannathan and Wang, Heaton and Lucas, Jacobs and Wang, Santos and Veronesi, and Durack, Durand and Maller also examined labour income as a risk factor helping to explain rates of return.⁴⁶
- A3.8 Durack, Durand and Maller replicated the work of Jagannathan and Wang using Australian share price data. They found that extending the market portfolio to include a measure of the return to human capital did little to improve the explanatory power of the Sharpe-Lintner CAPM. Furthermore, they found that the size and book-to-market variables of the Fama-French model three factor model were highly significant in tests using cross section data. Size and book-to-market did not appear to be, as Jagannathan and Wang had argued, simply proxies for risks associated with beta variation over time.
- A3.9 Aggregate liquidity has also been identified as a factor explaining asset prices. An investor who borrows to finance a portfolio, and who faces a margin or solvency constraint must sell assets to raise cash when her total wealth drops sufficiently. If she holds assets with returns which are sensitive to changes in liquidity, then such liquidations are more likely to occur when liquidity is low, since reductions in total wealth are more likely to occur with reductions in liquidity. Liquidation is more costly when liquidity is low, and those additional costs are a further imposition on an investor whose wealth has already fallen and who, in consequence, has a higher marginal utility of

⁴² Jimmy Liew and Maria Vassalou (2000), “Can book-to-market, size and momentum be risk factors that predict economic growth?”, *Journal of Financial Economics*, 57: 221-245.

⁴³ Maria Vassalou (2003), “News related to future GDP growth as a risk factor in equity returns”, *Journal of Financial Economics*, 68: 47-73.

⁴⁴ Zhi Da, Re-Jin Guo and Ravi Jagannathan (2009), “CAPM for Estimating the Cost of Equity Capital: Interpreting the Empirical Evidence”, National Bureau of Economic Research Working Paper 14889.

⁴⁵ Ravi Jagannathan and Z. Wang (1996), “The Conditional CAPM and the Cross-Section of Expected Returns”, *Journal of Finance*, 51(1): 3-53.

⁴⁶ J. C. Heaton and D. J. Lucas (2000), “Asset pricing and portfolio choice: the role of entrepreneurial risk”, *Journal of Finance*, 55: 1163-1198; Nick Durack, Robert B. Durand and Ross A. Maller (2004), “A best choice among asset pricing models? The Conditional Capital Asset Pricing Model in Australia”, *Accounting and Finance*, 44(2): 139-162; K. Jacobs and Z. Wang (2004), “Idiosyncratic consumption risk and the cross section of asset returns”, *Journal of Finance*, 59: 2211-2252; T. Santos and P. Veronesi (2006), “Labour income and predictable stock returns”, *Review of Financial Studies*, 19: 1-44.

consumption. Unless the investor can expect a higher rate of return from holding the financial assets in question, she will prefer assets less likely to require liquidation when aggregate liquidity is low.⁴⁷

⁴⁷ See, for example, Lubos Pastor and Robert F. Stambaugh (2003), "Liquidity Risk and Expected Stock Returns", *Journal of Political Economy*, 111(3): 642-685; and Viral V. Acharya and Lasse H. Pedersen (2005), "Asset pricing with liquidity risk", *Journal of Financial Economics*, 77: 375-410.
