Appendix H-1: Discussion of Market Risk Premium Issues

1. Introduction

This Appendix provides background information on the MRP and related issues that have been discussed in various AER decisions, Australian Competition Tribunal decisions, and reports from independent experts.

The following matters are discussed:

- The AER's *Statement of Regulatory Intent on the revised WACC parameters*
- The Tribunal findings in relation to appeals brought by the NSW electricity distributors
- The AER's draft and final decisions for Envestra Gas Networks in Queensland and South Australia
- Use of macroeconomic forecasts, survey information and broker reports
- Arithmetic and geometric averages
- Leading indicators of the MRP
- Analysis of the changing properties of the market portfolio
- Updates to the analysis of the market portfolio
- Adjusting the historical data for the lower volatility recorded during the earlier period.

As explained in Chapter 8 of the AAI, Multinet's views on these matters may be relevant if the AER revisits these matters in its assessment of the cost of equity. For details of Multinet's WACC proposal, please refer to Chapter 8.

2. Summary of the AER's assessment of the MRP in the final decision of the WACC review

The AER established an MRP of 6.5% in its *Statement of Regulatory Intent on the revised WACC parameters* (SORI) published in May 2009. With regard to the forward looking value of the *MRP*, the Final Decision of the WACC review concluded[1]:

> *"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.*
>
> *However, relatively stable market conditions do not currently exist and taking into account the uncertainty surrounding the global economic crisis, the AER considers two possible scenarios [that] may explain current market conditions:*
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> - *that the prevailing medium term MRP is above the long term MRP, but will return to the long term MRP over time, or*

[1] Final Decision, Electricity transmission and distribution network service providers. Review of the weighted average cost of capital (WACC) parameters. Australian Energy Regulator, May 2009, pages xiv to xv.

- *that there has been a structural break in the MRP and the forward looking long term MRP (and consequently also the prevailing) MRP is above the long term MRP that previously prevailed.*

Whilst it cannot be known which of these scenarios explain current financial conditions, both are possible, and both suggest a MRP above 6 per cent at this time may be reasonable. However, having regard to the desirability of regulatory certainty and stability, the AER does not consider that the weight of evidence suggests a MRP significantly above 6 per cent.

Accordingly, the AER considers that a MRP of 6.5 per cent is reasonable, at this time, and [is] an estimate of a forward looking long term MRP commensurate with the conditions in the market for funds that are likely to prevail at the time of the reset determinations to which this review applies."

While the SORI is not directly applicable to gas access arrangements, the statement has been considered to represent the AER's starting point with respect to the rate of return that can be earned by gas distribution businesses.

In this context, it is noted that Multinet has obtained an independent expert opinion from Professor Steven Gray[2] (which is appended to Multinet's AAI) regarding, amongst other things, the basis of the AER's views on the MRP. Professor Gray states at paragraph 19 of his report:

"The WACC Review Final Decision provides no analysis of why the appropriate adjustment to the estimate of MRP (to reflect the effect of the GFC) was precisely 50 basis points. The 50 basis point adjustment was not based on any calculations or modelling. Rather, the AER selected an estimate of 6.5% "having regard to the desirability of regulatory certainty and stability." Moreover, the 50 basis point increase is a relatively small adjustment given that almost all financial indicators of risk were at their highest levels for decades. For these reasons, it is my view that the 6.5% estimate should not be treated as any sort of theoretical or empirical maximum upper bound for MRP estimates."

3. The conjunction of a low risk-free rate and an historical average equity risk premium: the case of the NSW distributors

The NSW electricity distributors (as well as Transgrid, the NSW electricity transmission business, and Transend, the Tasmanian transmission entity) were subject to an electricity pricing review in late 2008 and early 2009. The economic environment at the time was characterised by high levels of uncertainty in debt and equity markets, owing to the global financial crisis (GFC) and the events surrounding the collapse of the Lehman banking group. The yields on Commonwealth Government Securities (CGS), which were used by the AER to measure the risk-free rate, were at historic lows. Furthermore, in the context of the price review, the equity risk premium, which is calculated as the equity beta multiplied by the MRP, was set at 6.0%. The constituent parameters, the equity beta and the MRP, were hard-coded into the transitional National Electricity Rules, at values of 1.0 and 6.0% respectively.

The initial and revised averaging periods chosen by Energy Australia were rejected by the AER, with another reference period being substituted in their place. The calculated cost of equity was very low, at a time of significant turmoil in financial markets, because of the conjunction of historically low yields on Commonwealth Government bonds, and the fixity of the parameters used to work out the cost of equity.

[2] SFG, *Market Risk Premium: Response to selected issues arising out of the AER Final Decision for Envestra (South Australia)*, March 2012.

The AER did not accord a high level of priority to the impact that its decision was likely to have on the overall rate of return that would be earned by Energy Australia, and the other electricity network service providers that were subject to review. However, the Tribunal ultimately found that, in order to achieve the National Electricity Objective (NEO), the AER should have set a rate of return which was commensurate with the risks involved in providing the relevant reference services[3]. The AER was, in fact, required by the National Electricity Law (NEL) and the National Electricity Rules (NER) to set an appropriate rate of return.

The Tribunal concurred with CEG that the use of historically low risk-free rates (associated with a time of crisis) in conjunction with a fixed MRP was likely to under-estimate the cost of equity. The Tribunal commented on the arguments put forward by the applicants as follows[4]:

> *"The Applicants submitted that these facts demonstrated that basing a risk free rate on the AER's specified averaging periods would not achieve the objective of an unbiased rate of return consistent with market conditions at the date of the final decision. They appealed to expert opinion that the market risk premium was far higher than its deemed value while the risk free rate was abnormally low, so that the return required by investors was much higher than the AER's specified averaging period would generate.*
>
> *The Tribunal considers that an averaging period during which interest rates were at historically low levels is unlikely to produce a rate of return appropriate for the regulatory period."*

The Tribunal ruled that the AER had acted unreasonably in withholding agreement to the averaging period originally proposed by Energy Australia.

The Tribunal ultimately overturned the final decision issued by the AER, and upheld the averaging period which had been put forward by Energy Australia when it submitted its revised regulatory proposal.

4. Response by the AER in the draft and final decisions for Envestra (QLD and SA)

In the course of its reviews of the Queensland and South Australian gas networks, the Australian Energy Regulator determined that the market risk premium should be brought down from 6.5%, the value that had been applied in the aftermath of the global financial crisis, to 6.0%, the value which had originally been set in the SORI[5].

The AER provided the following rationale for its change of perspective on the MRP[6]:

> *"Due to the uncertainty about the effects of the GFC on future market conditions the AER departed from the previously adopted forward looking MRP estimate of 6 per cent and increased it to 6.5 per cent. [However],the significant uncertainty that characterised markets at the time of the WACC review has substantially diminished. The prevailing conditions in the market for funds have eased."*

The AER claimed to have undertaken a thorough appraisal of the available evidence in relation to the MRP. The following were amongst the sources considered:

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[3] The National Electricity Objective, which forms section 7 of the National Electricity Law, reads as follows:

The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to—

(a)price, quality, safety, reliability and security of supply of electricity; and

(b)the reliability, safety and security of the national electricity system.

[4] Application by EnergyAustralia and Others (includes corrigendum dated 1 December 2009) [2009] ACompT 8 (12th November 2009), paragraphs 112 to 114.

[5] Australian Energy Regulator, Electricity distribution network service providers. Statement of regulatory intent on the revised WACC parameters (distribution), 1st May 2009.

[6] AER, Final Decision, Envestra Limited, Access arrangement proposal for the SA gas network, 1st July 2011 to 30th June 2016, June 2011; page 50.

- Historical excess return estimates for three time periods, 1883–2010, 1937–2010 and 1958–2010. These estimates provided a range of 5.9–6.4 per cent if calculated on an arithmetic mean basis, and a range of 3.8–4.8 per cent if calculated on a geometric mean basis. These figures estimated the realised return that stocks have earned in excess of the 10-year government bond rate. According to the AER, the figures could also inform expectations of the excess return that could be earned in the future[7].
- DGM based estimates of the MRP incorporating assumptions which the AER regarded as reasonable. The DGM approach provided an estimated range for the MRP of approximately 4.5–5.6 per cent.
- Implied volatility from the prices of options on the ASX 200 index, which, the AER stated, had returned to pre-GFC levels. The AER therefore deduced that the MRP would be unlikely to be above pre-GFC levels.
- Surveys of market practitioners prior to the GFC that supported 6 per cent as the most commonly adopted value for the MRP. These surveys also indicated that the average MRP adopted by market practitioners was approximately 6 per cent.

In reaching its decision about the appropriateness of a 6% *MRP*, the AER relied, in part, upon commentaries in relation to the macro-economic environment made by the Reserve Bank of Australia (RBA) and the Organisation for Economic Co-operation and Development (OECD). Specifically, in its draft decisions for Envestra (QLD and SA), the AER reproduced sub-sections from the RBA Statement on Monetary Policy (November 2010) and the OECD country summary for Australia, which accompanied the Economic Outlook report, version 88[8].

> *"GDP is expected to expand by 3.5 per cent over 2010 and then by 3.75–4 per cent over both 2011 and 2012. This forecast continues to be driven by the effects of the income boost flowing from the very high level of the terms of trade and the expected substantial increase in business investment, particularly in the resource sector".* [9]

And:

> *"The Australian economy, fuelled by the mining boom, should grow robustly in 2011 and 2012 at a rate of between 3½ and 4%. Strong growth, driven by terms of trade gains and dynamic investment, will reduce unemployment".*[10]

The OECD country summary for Australia discussed basic macro-economic indicators, and presented medium term forecasts for core variables. However, there was no detailed discussion about financial market conditions in Australia, and certainly no reference to the market risk premium. The RBA Statement on Monetary Policy considered the state of financial markets in Australia, however this discussion was contained in a separate section of the report, and not the particular part from which the AER extracted its quote. The RBA analysis was mainly centred on conditions in the inter-bank lending market, and the yields on Commonwealth Government Securities. The discussion of household financing and business financing was primarily concerned with debt markets. Although the Statement of Monetary Policy considered equity markets briefly, the discussion was retrospective and simply reported on developments in the latter part of 2010. The RBA did not attempt to provide forecasts of the return on equity, and no information was provided from which it could be reasonably inferred that the forward-looking MRP had fallen to 6%.

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[7] Ibid., page 50.

[8] AER (2011b1), Draft Decision. Envestra Ltd., Access Arrangement proposal for the QLD gas network, 1 July 2011 – 30 June 2016. Australian Energy Regulator, February 2011; page 83.

AER (2011b2), Draft Decision. Envestra Ltd., Access Arrangement proposal for the SA gas network, 1 July 2011 – 30 June 2016. Australian Energy Regulator, February 2011,page 90.

[9] Statement on Monetary Policy, November 2010. Reserve Bank of Australia, 4th November 2010, page 3.

[10] OECD, Australia economic outlook 88 – country summary, November 2010, viewed online 23rd December 2010.

Accordingly, the AER failed to establish a connection between the outcomes for real economic variables (such as the growth in investment and gross domestic product, and the change in unemployment) and the premium required by investors in Australian equity markets. The AER simply asserted that:

> *"The robust economic outlook in Australia, as noted by statements from the IMF, the OECD and the RBA suggest[s] that market conditions appear to have stabilised to the extent that investors are no longer factoring the substantial volatility experienced at the height of the GFC into their expectations of the future."*

The AER presumed that there was a direct and seamless connection between developments in the real economy and conditions in Australian equity markets. However, the commentaries from the OECD and the RBA did not demonstrate that market conditions had stabilised, and that volatility had dissipated. The arguments advanced by the AER were based on conjecture.

The AER also referred to a financial conditions index compiled by the OECD, stating that the index gave an indication of likely future GDP growth[11]. The OECD had reported on financial conditions indices (FCIs) in its macro-economic summary released in November 2010[12]. According to the agency, the indices of financial conditions for the leading economies - the USA, Japan, and the Euro area – had stabilised at close-to-normal levels over the course of calendar 2010. The OECD had further noted that, on account of the lags involved, the earlier improvements in aggregate financial conditions would continue to support activity for some time.

The AER claimed that the levelling off of financial conditions indices was supportive of a positive global market outlook. However, an important consideration which the AER overlooked was that the observed stability of the aggregate FCIs had masked disparate developments in the underlying components of real interest rates, bond spreads, credit conditions, real exchange rates, and household net wealth. Specifically, the OECD had recorded that in the United States, continued weakness in household net wealth was only just being offset by lower real interest rates, particularly at the long end of the yield curve, and looser credit conditions. In the euro area, lending standards had been tightened to some degree, and there had been some diminution of the offset that had previously been provided by a weaker exchange rate. In Japan, the improvement in credit conditions and spreads had broadly offset the impact of the yen appreciation and equity price declines.

The AER appeared therefore to have considered the aggregate result for the FCIs, without analysing in any depth the fragility of the constituent series for the indices. Moreover, the AER did not demonstrate or explain the linkage between the FCIs for the leading economies, and the MRP which investors expect in Australia.

5. Use of macroeconomic forecasts, survey information and broker reports

The Australian Competition Tribunal has provided comments on the applicability of macro-economic commentary, and the merits or otherwise of surveys of market participants and broker WACC estimates.

In relation to the consideration of general macro-economic forecasts, the Tribunal effectively stated that there was nothing inherently incorrect about paying attention to the comments and projections put forward by central banks and multi-lateral agencies (such as the IMF and the World Bank)[13]. However, the Tribunal cautioned against the use of such material to draw inferences about the market risk premium:

[11] AER (2011b2), Draft Decision. Envestra Ltd., Access Arrangement proposal for the SA gas network, 1 July 2011 – 30 June 2016. Australian Energy Regulator, February 2011,page 90.

[12] OECD Economic Outlook, Volume 2010/2, Preliminary Version. Chapter 1, General Assessment of the Macroeconomic Situation, page 16.Organisation for Economic Co-operation and Development.

[13] Application by Envestra Ltd (No 2), ACompT3, decision of 11th January 2012; paragraph number 158.

> *"It is not appropriate for the AER to infer from generally positive economic forecasts conclusions as to the likely MRP. These reports are not intended to provide forecasts of equity returns. Further, the reports do not endeavour to address the extent of correlation between economic performance and equity risk. This correlation would need to be explicitly dealt with, either by the forecasting bodies, the AER or expert evidence, before these reports could be usefully or validly employed to assist in forecasting the MRP."*

The Tribunal essentially concurred with the comments made by Multinet and SP AusNet in a joint submission to the review of gas access arrangements in Queensland and South Australia. Multinet and SP AusNet stated that the AER had failed to establish a connection between the outcomes for real economic variables (such as the growth in investment and gross domestic product, and the change in unemployment) and the premium required by investors in Australian equity markets[14].

On the subject of the use of surveys of market participants, the Tribunal was similarly circumspect, and expressed reservations about the merits of such information. The AER had claimed that surveys of market practitioners and academics are reflective of the forward-looking MRP applied in practice. However, Envestra had criticised the use of surveys, relying upon a report from NERA which showed that there were large numbers of non-respondents to two of the surveys that had been considered by the AER[15]. The Tribunal noted that the survey evidence on which the AER had sought to rely had been criticised for not providing an adequate real world context that might enable the survey results to have any real meaning. The Tribunal then concluded that:

> *"Surveys must be treated with great caution when being used in this context [of estimating the MRP]. Consideration must be given at least to the types of questions asked, the wording of those questions, the sample of respondents, the number of respondents, the number of non-respondents and the timing of the survey. Problems in any of these can lead to the survey results being largely valueless or potentially inaccurate.*
>
> *When presented with survey evidence that contains a high number of non-respondents as well as a small number of respondents in the desired categories of expertise, it is dangerous for the AER to place any determinative weight on the results."*

6. Arithmetic and geometric averages

In its recent final decision for Envestra (South Australia), the AER set out its view that a ten-year horizon is appropriate when estimating the MRP[16]:

> *"The AER considers it appropriate to calculate the MRP with the assumption of a 10-year investment horizon."*

Presumably, the interpretation is that investors are prepared to commit equity to an average firm for a period of about 10-years, and therefore also consider the MRP over the same timeframe.

The AER's final decision then links the 10-year horizon with the method of averaging that should be applied to historical data when estimating the MRP[17]:

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[14] Letter to Mr Chris Pattas re: Envestra Draft Decision, Market Risk Premium; a response to the Draft Decision, Envestra Ltd., access arrangement proposal for the SA gas network, 1st July 2011 to 30th June 2016; prepared by Multinet Gas and SP AusNet, 2nd May 2011.

[15] NERA (2011a), The market risk premium: A report for Multinet Gas and SP AusNet; prepared by NERA Economic Consulting, 29 April 2011. This report was submitted in response to the AER draft decision for Envestra (South Australia).

[16] AER (2011f2), Final Decision. Envestra Ltd., Access Arrangement proposal for the SA gas network, 1 July 2011 – 30 June 2016. Australian Energy Regulator, June 2011,page 185.

> *"Arithmetic mean estimates of realised annual excess returns are likely to overstate realised excess returns over a 10-year time horizon because they do not take account of the cumulative effect of returns over a 10 year time horizon."*

The AER also explains[18]:

> *"Consistent with the draft decision the AER notes that the arithmetic means of historical excess returns are likely to be overstated to some degree. The best estimate of historical excess returns over a 10 year period is likely to be somewhere between the geometric mean and the arithmetic mean of annual excess returns."*

The AER's final decision for Envestra (SA) does not state precisely how the AER used arithmetic and geometric averages of historical excess return data. The AER simply asserted, without substantiation, that the best estimate of the MRP for a 10-year horizon can be expected to lie somewhere between the arithmetic and geometric averages, and that[19]:

> *"The point estimates calculated on both an arithmetic mean and a geometric mean basis are still relevant and should inform the best estimate of the MRP."*

The Tribunal reviewed the comments made by Envestra (SA), and by the AER, during the appeal hearings, but then considered that there was inadequate information available to enable it to reach a reasoned conclusion[20]:

> *"Once it is accepted that the relevant benchmark is ten-year excess returns, considerable thought and effort should be given to deriving the best estimate of expected ten-year returns. The material before the Tribunal in this matter [on arithmetic and geometric means] does not allow it to decide this issue. Rather, it is a matter that the AER should consider in consultation with service providers and other interested parties."*

SFG (2012b) has presented strong arguments that no reliance should be placed on geometric averages[21]. These arguments are, in part, based on case studies that are taught in leading international business schools. SFG notes that at least some of the examples were developed by Professor Richard Ruback of Harvard Business School. The case studies make clear that while the geometric average can be used to measure the growth rate of an investment, the arithmetic average annual return is the correct measure of the expected annual return on an investment.

There is also an illustrated, but plausible, real-life example that considers a 10-year time horizon. The question that is posed is: If stock market returns over the next 10 years occur with the same frequency as they did over the last 50 years, then what annual compound return would be expected by an investor over the next 10 years? The Harvard case solutions show that the arithmetic average return must be used with a 10-year time horizon. The geometric average should not be used, and nor should any value be chosen from between the arithmetic and geometric averages.

[17] Ibid., page 190.

[18] Ibid., page 191.

[19] Ibid., page 190.

[20] Application by Envestra Ltd (No 2), ACompT3, decision of 11th January 2012; paragraph number 155.

[21] SFG (2012b), Market Risk Premium: Response to selected issues arising out of the AER final decision for Envestra (South Australia); prepared for APA Group, Envestra, Multinet and SP AusNet by SFG Consulting (Strategic Finance Group), 25th March 2012.

The mistake that is made by using the geometric average is to confuse the expected return with the return from the median scenario. The MRP in the CAPM is an expected return, rather than a median return, and so the arithmetic mean should be used in place of the geometric mean.

SFG has further stated that to the extent that the AER has relied upon geometric mean estimates in its recent decisions, then it is in error, and its estimates must be corrected upwards to what they would have been had there been no reliance on geometric means.

NERA (2012b) has provided additional evidence about the merits of using arithmetic averaging[22]. NERA explained that the arithmetic mean of a sample of returns will provide an unbiased estimate of the unconditional expected return to an asset over a single period, while acknowledging that the use of arithmetic means and the use of geometric means can provide biased estimates of unconditional expected multi-period returns[23]. NERA undertook simulation analysis to examine the properties of estimators of the expected excess return to the market portfolio, where the estimators use either the arithmetic mean of a sample of annual excess returns, or the geometric mean.

The simulations were calibrated to the annual data that has been provided in an appendix to the journal article by Brailsford, Handley and Maheswaran (2011)[24]. The objective of the simulations was to determine the importance of the biases when computing estimates of the MRP for use in the regulation of Australian utilities. In particular, the simulations were constrained by the distribution of the returns to a portfolio, adjusted for the value that the market places on distributed franking credits. The portfolio was said to be made up of non-interest bearing cash, and all of the stocks quoted on the ASX All Ordinaries index (the market portfolio). A further assumption made was that borrowing had been undertaken at the risk-free rate, with the interest rate determined by the yield on 10-year bonds.

The results that were based on the full 129 years' of data provided by Brailsford, Handley and Maheswaran (2011) showed that the arithmetic mean of the sample of annual returns was an unbiased estimator of the expected return over one year. The expected value of the return to the market portfolio over one year was exactly equal to 6.1%, which is the mean of the historical data. In contrast, the geometric mean was shown to be a downwardly biased estimator over one year. The downward bias associated with the geometric mean estimated using 129 years' of simulated data, was significant, at 130 basis points. The downward bias that results from measuring expected returns over one year was calculated as the parameter value less the simulation result (6.1% minus 4.8%, which equals 1.3%). There is strong evidence, therefore, that the geometric mean gives a very biased result.

NERA (2012b) has noted that although revenue must be forecast for each of the several years of a typical regulatory period, the WACC is not compounded over more than one year. Thus, a WACC that is based solely on the arithmetic mean of a sample of annual excess returns to the market portfolio will produce an unbiased estimate of the revenue that the utility is expected to earn in anyone year.

An important consideration is that a regulated utility is not necessarily given the opportunity to invest all of the return that it receives on its capital at the WACC. The utility can only earn the WACC on the regulated asset base, and the evolution of the regulated asset base does not, in the main, depend upon the WACC.

The simulations performed by NERA (2012b) also provide insightful results over longer time periods such as five years and ten years. In particular, the extent of bias in the results is significantly greater for expected, multi-period returns calculated using a geometric average of long term values. After ten years, the downward bias that results from using the geometric average (of 4.8%) to forecast returns is 2,010 basis points (calculated as 80.8% minus

[22] NERA (2012b), Prevailing conditions and the Market Risk Premium, A report for APA Group, Envestra, Multinet and SP AusNet, prepared by NERA Economic Consulting, 15th March 2012.

[23] Ibid., chapter 2.

[24] Brailsford, T., J. Handley and K. Maheswaran, The historical equity risk premium in Australia: Post-GFC and 128 years of data, Accounting and Finance, 2011.

60.7%). In contrast, the upward bias that results from using an arithmetic average (of 6.1%) to forecast returns over 10-years, is much less severe, at 150 basis points (calculated as 80.8% minus 82.3%).

These results are of academic interest, however, because there is no compounding of annual returns using the WACC, and because the AER does not use 10-year returns to equity. In the post-tax revenue model used by the Victorian gas distribution businesses, the return on capital is calculated on a year-by-year basis.

7. Leading indicators of the MRP

There are a number of indicators that have been found to forecast the *MRP*. Included amongst them are:

- The spread between the yields on BBB bonds and AAA bonds (the default spread)
- The volatility of the return to the market portfolio implied by option prices.

NERA Economic Consulting[25] referred to the relevant literature which shows support for the argument that default spreads have a positive influence on the *MRP*. SFG provided data showing that the default spread remains very high by historic standards, even though the yield differential between AAA and BBB bonds has fallen from the peak values achieved during the global financial crisis[26]. The value of the default spread suggests very strongly that the amount of risk involved in holding a broad portfolio of equities, and the price of that risk, (being the additional return required in relation to each unit of risk) are currently at elevated levels. Consequently, the turmoil in financial markets which occurred during the GFC continues to exert a lingering effect on risk premiums.

The logic applied by the AER in setting the MRP is incongruous with the approach that it has taken to setting the debt risk premium. As noted by CEG, the DRP has been estimated by drawing upon information provided by independent financial market participants and information providers[27]. The parties do not endorse the particular method chosen by the AER, but recognise that the Regulator has at least attempted to make use of current market data. The value of the DRP settled upon by the AER is above the long-run average and pre-GFC levels.

Professor Bruce Grundy has calculated that if a firm has 60% debt financing, and if the asset pricing model does not imply an equity risk premium of at least 2.66 times the observed debt risk premium, then the asset pricing model is under-estimating the true cost of equity for the firm[28]. The AER, drawing upon advice from Associate Professor Handley, has interpreted the calculations by Grundy as demonstrating that debt and equity may be priced in segmented markets, with the result that the Modigliani and Miller theorem cannot be used to imply that equity is mispriced relative to debt[29]. In this regard, we support the conclusion reached by CEG which is that if capital markets are segmented in the manner described by the AER, then not only is the Modigliani and Miller theorem inapplicable, but the CAPM also becomes redundant[30]. Consequently, the argument by the AER that there might be disintermediation between debt and equity markets is incorrect. Instead, the markets for debt and equity are integrated, and the equity risk premium has been set at too low a level by the AER.

[25] NERA (2011a), The market risk premium: A report for Multinet Gas and SP AusNet; prepared by NERA Economic Consulting, 29 April 2011; page 8.

[26] SFG (2011c), Issues affecting the estimation of MRP. A Report for Envestra by Strategic Finance Group. SFG Consulting, 21st March 2011, page 12.

[27] WACC Estimation: A report for Envestra by Tom Hird, PhD. Competition Economists Group, March 2011, page 29, paragraph 99.

[28] The Calculation of the Cost of Capital. A Report for Envestra, Professor Bruce D. Grundy, 30th September 2010, page 18, paragraph 41.

[29] AER (2011b1), Draft Decision. Envestra Ltd., Access Arrangement proposal for the SA gas network, 1 July 2011 – 30 June 2016. Australian Energy Regulator, February 2011. Page 264.

[30] WACC Estimation: A report for Envestra by Tom Hird, PhD. Competition Economists Group, March 2011, page 29, paragraph 100.

8. The changing properties of the market portfolio

The AER has recognised that the MRP changes over the time. It therefore conceded to an increase in the MRP from 6 per cent to 6.5 per cent, in the final decision of the WACC review[31]. The endorsement of a higher MRP came about because the AER recognised the effects of the global financial crisis. More recently, the AER has decided that the circumstances which gave rise to the GFC have now dissipated, and that the MRP has reverted back to its long-term historical level[32]. However, there is a lack of clarity as to the process which the AER is using to determine when the MRP should be changed, and the amount by which it should be changed when an adjustment is made.

In addition to the uncertainty surrounding processes for changes to the MRP, a related concern is whether the AER should be using an unadjusted MRP estimate that is based in part on a very long time series of returns. The doubts arise because there is evidence which indicates that the properties of the Australian market portfolio have changed substantially over time.

In arriving at an estimate of the MRP of 6 per cent, the AER has drawn upon figures derived by Brailsford, Handley and Maheswaran (2008)[33], and updated in Handley (2011)[34] and in Brailsford et al. (2011)[35].

Table 1: Historical excess return estimates (assuming that the utilisation rate for imputation credits is 0.5)

Period	Historical excess returns	95% confidence interval
1883-2010	6.3%	3.4% - 9.2%
1937-2010	6.0%	1.4% - 10.6%
1958-2010	6.5%	0.3% - 12.8%

Source: Handley, J., *An estimate of the historical equity risk premium for the period 1883 to 2010*, January 2011, page 7.

A comparison of the figures in Table 1, suggests that the MRP was higher after 1958 than before it. The relatively low figures for the periods 1883-2010 and 1937-2010 are produced by a low estimate for the period 1937-1957. A simple calculation indicates that the mean excess return for this period was 4.8 per cent[36].

The AER has acknowledged and Handley has been careful to make clear that the data from before 1958 are of a quality that is inferior to that of the data from 1958 through 2010. For example, Handley states that[37]:

[31] AER, Final Decision, Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters, May 2009

[32] AER, Envestra Ltd. Access arrangement proposal for the Qld gas network, 1 July 2011 – 30 June 2016: Draft Decision, February 2011, pages 91-92.

[33] Brailsford, T.J., J.C. Handley and K. Maheswaran, 2008, Re-examination of the Historical Equity Risk Premium in Australia, Accounting and Finance, 48, pages 73–97.

[34] Handley, J., An estimate of the historical equity risk premium for the period 1883 to 2010, January 2011, page 8.

[35] Brailsford, T.J., J.C. Handley and K. Maheswaran, 2011, The historical equity risk premium in Australia: post-GFC and 128 years' of data, Accounting and Finance, July 2011.

[36] The mean MRP from 1937 through 1957 is: $\frac{6.1\times(2010-1936)-6.6\times(2010-1957)}{(1957-1936)}=4.8\,\text{per cent}$.

[37] Handley, J., An estimate of the historical equity risk premium for the period 1883 to 2010, January 2011, page 5.

> *"there are sufficient question marks over the quality of data prior to 1958 to warrant [that] any estimates based thereon to be treated with caution."*

Besides the issue of the quality of the data, though, there is a need to know whether the properties of the data have changed. In particular, since there is almost uniform agreement that there should be a positive relationship between risk and return, there is a case for investigating whether the risk of the market portfolio has changed through time. This is because if the risk of the market portfolio computed from the earlier data were to be higher than the risk calculated from the later data, then an estimate of the MRP that ignored this change would overestimate the current MRP. Similarly, if the risk of the market portfolio computed from the earlier data were to be lower than the risk calculated from the later data, an estimate of the MRP that ignored this change would understate the current MRP.

A well-known result is that the risk of the US market portfolio in pre-war data substantially exceeds the risk of the portfolio in post-war data. A less well known outcome is that the risk of the Australian market portfolio, or at least the measured risk prior to around 1970, is substantially lower than the risk of the portfolio after 1970, with the change having been documented by Kearns and Pagan (1993)[38]. Kearns and Pagan do not provide an explanation for the behaviour but speculate that it may stem from the Australian market's relative dependence on commodity prices, which the US market does not share.

In an analysis undertaken for Multinet Gas and SP AusNet, NERA Economic Consulting used monthly without-dividend returns to estimate the variance of the monthly return to the Australian market portfolio[39]. NERA used the Kearns and Pagan (1993) estimates for the five years ending in December 1882 to the five years ending in December 1987, and then updated the series using values computed in an identical fashion for the five years ending in December 1992 through to the five years ending in December 2007. Finally, NERA added in an estimate of the monthly variance computed using data for the three years and three months from January 2008 through to March 2011 so as to complete the series. NERA has reported on the series that were taken from Kearns and Pagan, and has also reproduced the updates to those series in an appendix to its report (Appendix A)[40].

Figure 1 makes clear that the earlier data have properties which differ substantially from those of the later data. Merton (1973) developed a model in continuous time which under certain conditions implies that the *MRP* is proportional to the variance of the return to the market portfolio[41,42]. These same conditions guarantee that the CAPM will hold instant by instant. While theory links the *MRP* to the variance of the return to the market portfolio, a reader can more readily visualise a plot of the annualised volatility of returns against time. A plot of volatility against time is presented below a Figure 2.

The relationship between the variance shown in Figure 1 and volatility, shown in Figure 2, is best explained as follows:

$$\boldsymbol{VOLATILITY} = \mathbf{100} \times \sqrt{(\mathbf{12} \times \boldsymbol{VARIANCE})} \qquad \textbf{(1)}$$

[38] Kearns, P. and A. Pagan, Australian stock market volatility: 1875-1987. Economic Record, 69, 1993, pages 163-178.

[39] Thus if r_t denotes the without-dividend return to the Australian market portfolio from the end of month t-1 to the end of month t, the five-year variance at the end of month t is:

$$\frac{1}{59}\sum_{j=1}^{60}(r_{t+1-j}-\bar{r})^2 \qquad \text{where} \qquad \bar{r}=\frac{1}{60}\sum_{j=1}^{60}r_{t+1-j}$$

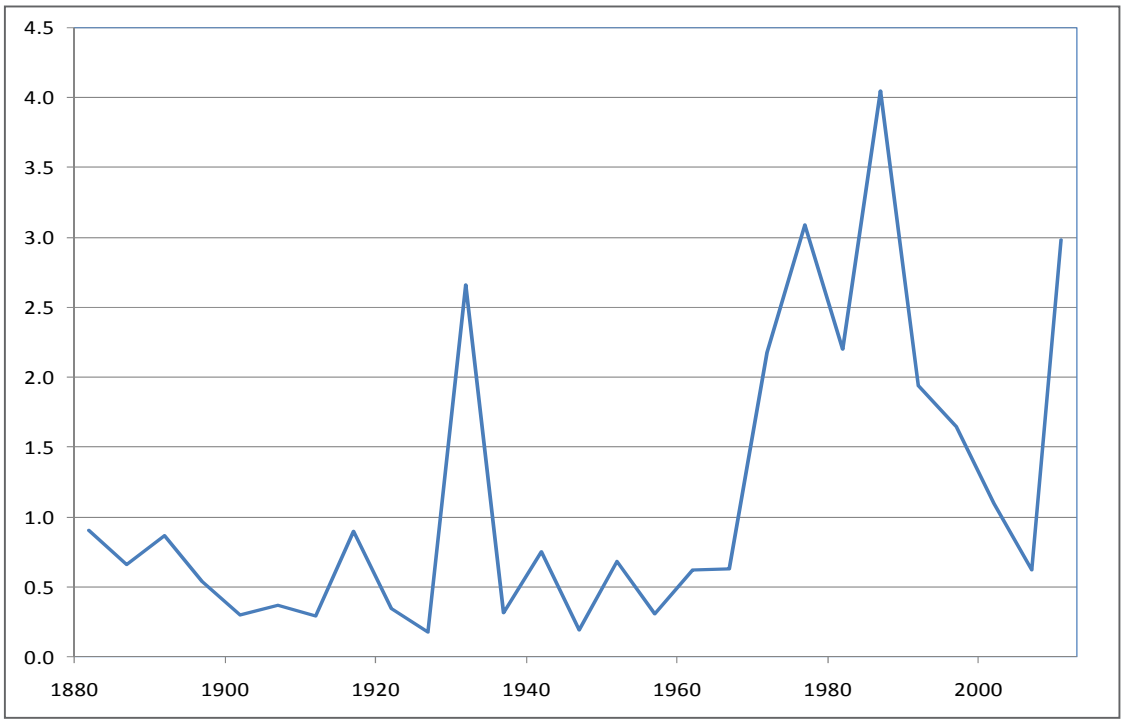
[40] NERA (2011a), The market risk premium: A report for Multinet Gas and SP AusNet; prepared by NERA Economic Consulting, 29 April 2011.

[41] The conditions are that either it is not possible to hedge against changes in the investment opportunity set or that a representative investor does not wish to do so.

[42] Merton, Robert C., *An intertemporal capital asset pricing model*, Econometrica, 1973, pages 867-887.

In Figure 1, the variance of the calculated returns for each month has been measured over non-overlapping five-year periods, and then multiplied by 1,000. The volatility presented in Figure 2 has been derived by multiplying the variance by 12 so as to obtain an annualised figure, and then taking the square root of the result. Volatility has been shown as a percentage.

Figure 1: Stock market variance shown by half decade



Note: The variance of the returns for each month, measured over non-overlapping five-year periods has been multiplied by 10^3. The data are from Kearns and Pagan (1993) before 1992 and are computed from the All Ordinaries Price Index thereafter.

The clear message from the two figures is that the data from before 1958 have very different properties to the data from after 1957. An estimate of the variance of the monthly return to the market computed by averaging the Kearns and Pagan five-year estimates from 1887 through 1957 is[43]:

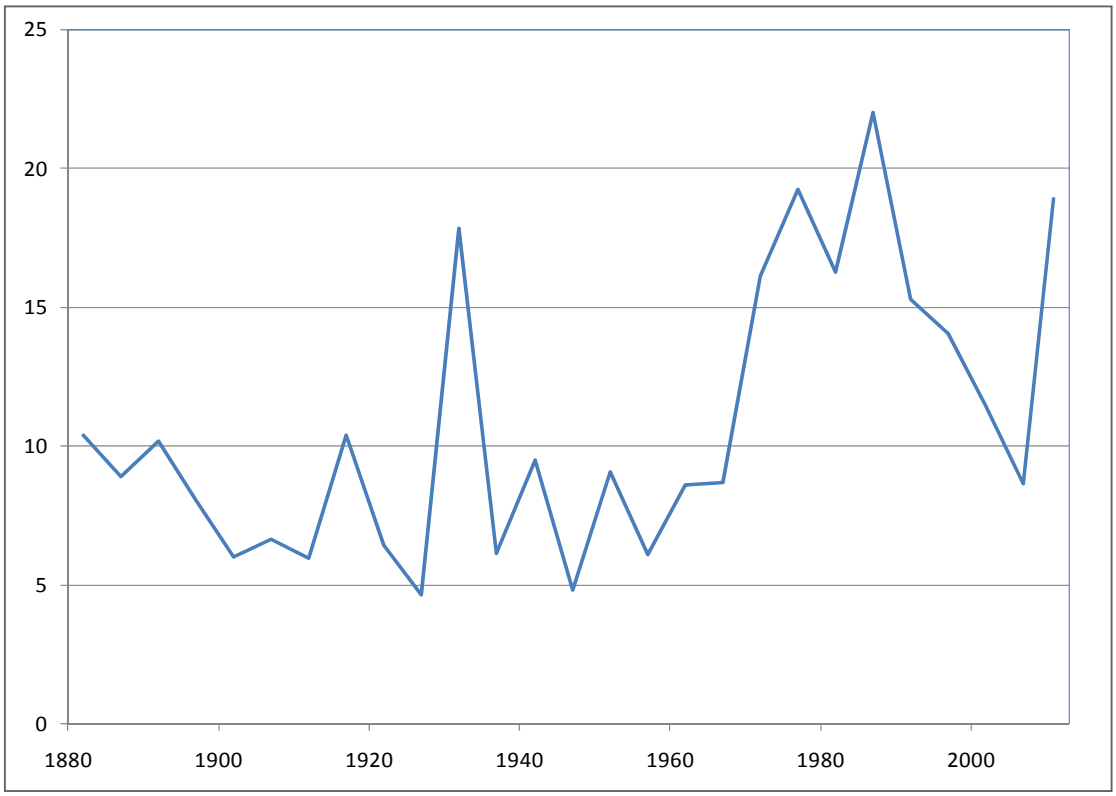
[43] Handley (2011) uses data from 1883 (= 1887 – 5 + 1) to construct estimates of the *MRP*.
Handley, J., An estimate of the historical equity risk premium for the period 1883 to 2010, January 2011.

$$\frac{1}{15}\sum_{j=1}^{15}\hat{\sigma}^2_{1887+5(j-1)} = 0.62\times10^{-3}$$

where

$\hat{\sigma}^2_k$ = the variance of the monthly return to the market portfolio estimated over the five-year period ending in December of year *k*.

Figure 2: Stock market volatility by half decade



Note: Volatility is in per cent per annum but is based on monthly data. Data are from Kearns and Pagan (1993) before 1992 and are computed from the All Ordinaries Price Index thereafter.

The corresponding estimate, computed using data from 1962 through to 2011 is:

$$\frac{1}{10\times(60-1)+(39-1)}\left[(60-1)\sum_{j=1}^{10}\hat{\sigma}^2_{1962+5(j-1)} + (39-1)\tilde{\sigma}^2_{2011}\right] = 1.88\times10^{-3}$$

where

$\tilde{\sigma}^2_{2011}$ = the variance of the monthly return to the market portfolio estimated over the 39 months ending in March 2011.

Thus, an estimate of the variance of the return to the market portfolio after 1957 is three times an estimate of the variance of the return to the market portfolio before 1958.

NERA(2011a) did not have access to the complete time series of monthly returns used to generate Figure 1 and Figure 2, because the source data had been compiled by Kearns and Pagan (1993). However, NERA was, nonetheless, able to construct a test of the null hypothesis that the variance of the return to the market portfolio after 1957 is equal to the variance of the return to the market portfolio before 1958. In Appendix B of its report, NERA (2011a) demonstrated that if monthly returns to the market portfolio are normally and independently distributed through time, then, under the null hypothesis, the ratio[44]:

$$\frac{\left[(60-1)\sum_{j=1}^{10}\hat{\sigma}^2_{1962+5(j-1)}+(39-1)\tilde{\sigma}^2_{2011}\right]/\left[10\times(60-1)+(39-1)\right]}{\left[(60-1)\sum_{j=1}^{15}\hat{\sigma}^2_{1887+5(j-1)}\right]/\left[15\times(60-1)\right]}$$

will be *F* distributed with 10 ×(60 – 1) + (39 – 1) = 628 and 15 ×(60 – 1) = 885degrees of freedom. The numerator of the expression is an estimate of the variance of the return to the market portfolio computed using the 628 monthly observations after 1957, and the denominator is an estimate computed using the 885 observations before 1958. The ratio is 1.88 ÷ 0.62 = 3.00 and the one per cent critical value for the $F_{628,885}$ distribution is 1.19. The null hypothesis can, therefore, be rejected at all conventional levels of significance. Thus the difference between the risks of the market portfolio from before 1958 and after 1957 is both economically and statistically significant.

NERA (2011a) also computed annualised figures for volatility because these are more intuitive. After 1957, the annualised volatility of the return to the market portfolio is:

$$100\times\sqrt{12\times1.88\times10^{-3}}=15.01\text{ per cent per annum,}$$

while before 1958 the annualised volatility of the return to the market portfolio is:

$$100\times\sqrt{12\times0.62\times10^{-3}}=8.66\text{ per cent per annum.}$$

As Davis (2011) makes clear:[45]

> *"a higher level of market volatility is likely to be associated with an increase in risk which translates into a higher MRP"*

although he cautions that

> *"the strength of the relationship is difficult to assess."*

NERA (2011a) therefore suggested that an upward adjustment should be made to the data from 1883 through 1957 so as to reflect the lower risk of the Australian market portfolio[46]. If an appropriate change to the earlier data were made, then an estimate of the MRP would be computed to be at least 6.5 per cent per annum, if not some way above.

[44]NERA (2011a), The market risk premium: A report for Multinet Gas and SP AusNet; prepared by NERA Economic Consulting, 29 April 2011, page 25.

[45] Davis, K.., Cost of equity issues: A Report for the AER, January 2011, page 20.

[46]Unless one provides reliable evidence that the aversion to risk of a representative investor has fallen.

NERA (2011a) stated that a problem with relying heavily on earlier data is that the evidence indicates that the market portfolio was less risky before 1958 than it has been after 1957. Therefore, a representative investor would have required a lower premium on stocks before 1958 than after 1957. Including the earlier data should, if there is a positive relationship between volatility and the *MRP*, depress estimates computed of the *MRP*.

There is, of course, nothing especially unique about the years 1957 and 1958. NERA (2011a) selected those years because the estimates of the *MRP* that the AER reports use 1958 as a starting point for the most recent sub-period. An alternative possibility is that the data should be allowed to determine where changes in the volatility of the market portfolio occur.

A further consideration is that the Australian economy is not entirely segmented from world capital markets, and the market portfolio of stocks is only part of the market portfolio of all risky assets. Thus, the market risk premium attached to a portfolio of stocks will inevitably be determined not directly by the volatility of the market portfolio of stocks but by the covariance of the return to the portfolio with the return to some other portfolio, that will likely include foreign assets and assets other than stocks. However, there is a strong chance that changes in the volatility of the market portfolio of stocks will be positively correlated with changes in that covariance.

9. Updates to the analysis of the market portfolio

In August 2011, NERA undertook an analysis of the volatility of stock market returns using the data that had been made available by Brailsford, Handley and Maheswaran (2011)[47]. The work was reported as NERA (2011b)[48]. The task was performed because, in its final decision for Envestra (South Australia), the AER seemed to suggest that the results obtained by NERA (2011a) were an artefact of the data that had been published by Kearns and Pagan (2003), and the additions to that data series which had been compiled by NERA (2011a)[49].

Figure 3, shown below, is the same as Figure 1 in the note prepared by Brailsford, Handley and Maheswaran. A visual inspection of the graph conveys the impression that the market portfolio has been a lot riskier over the past 50 years than it was in prior decades. From 1883 through to 1957, there were no years in which the return to the market portfolio exceeded 40 per cent while from 1958 through to 2010 there were nine years in which the return to the market portfolio exceeded 40 per cent. From 1883 through to 1957, there was only one year in which the market portfolio lost more than 20 per cent of its value, while from 1958 through to 2010 there were three years in which the market portfolio lost more than 20 per cent of its value.

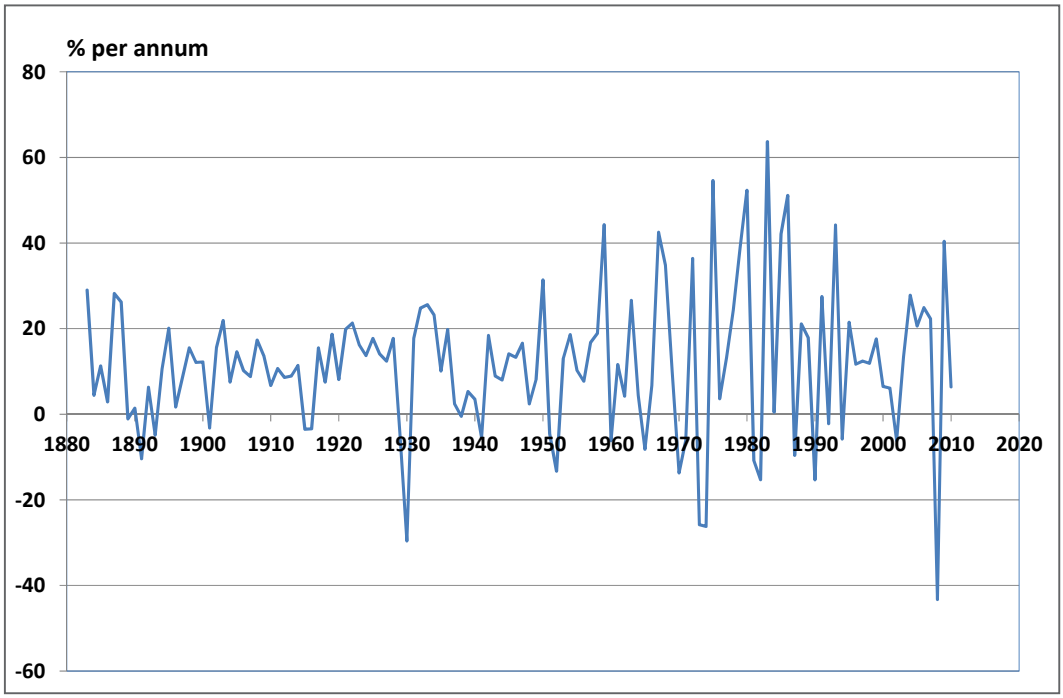
The sample standard deviation of the returns computed using data from 1883 to 1957 is 10.4 per cent, while the sample standard deviation computed using data from 1958 to 2010 is more than double that figure, at 22.8 per cent.

[47] Brailsford, T., J. Handley and K. Maheswaran, The historical equity risk premium in Australia: Post-GFC and 128 years of data, Accounting and Finance, 2011.

[48] NERA (2011b), The Market Risk Premium, A report for Citipower, Jemena Electricity Network, Powercor, SP AusNet, and United Energy, prepared by NERA Economic Consulting, 26th August 2011.

[49] AER, Envestra Ltd Access arrangement proposal for the SA gas network, 1 July 2011 – 30 June 2016: Final Decision, June 2011, pages 185 to 188.

Figure 3: Historic stock returns in Australia: 1883 to 2010



Source: Brailsford, Handley and Maheswaran, The historical equity risk premium in Australia: Post-GFC and 128 years of data, Accounting and Finance, 2011.

NERA (2011b) repeated the type of F-test which had been conducted initially on the Kearns and Pagan (1993) dataset, updated to 2011.

Under the null hypothesis that there has been no change in the risk of the market portfolio over the last 128 years, the ratio,

$$\frac{\hat{\sigma}^2_{1958-2010}}{\hat{\sigma}^2_{1883-1957}} \qquad \textbf{(2)}$$

has an F-distribution with (53 – 1 =) 52 and (75 – 1 =) 74 degrees of freedom. The numerator is an estimate of the variance of the return to the market portfolio computed using the 53 years of data from 1958 to 2010, while the denominator is an estimate computed using the 75 years of data from before 1958. The ratio is [$22.8^2 \div 10.4^2$ =] 4.81, and the p-value associated with the statistic is 5.25×10^{-10}. This p-value is the probability that one would observe a ratio of 4.81 or larger if the risk of the market portfolio had not changed over the last 128 years.

The F-statistic obtained was sufficiently high (and its associated p-value sufficiently low) as to reject the null hypothesis that there had been no change in the risk of the market portfolio over the past 128 years. The null hypothesis was rejected at all conventional levels of significance. Consequently, there is a statistically significant

difference between the risks of the market portfolio during the period from 1883 to 1957, and over the period from 1958 to 2010. The difference is apparent whether one uses the data that Kearns and Pagan (1993) employ or the data that Brailsford, Handley and Maheswaran (2011) supply[50].

NERA (2011b) has also drawn attention to the economic implications of the structural shift in the riskiness of the market portfolio. A method of assessing the significance of the shifts is to ask what portfolio of stocks and bonds would have the same risk from 1958 onwards as the market portfolio from 1883 through 1957. The answer to the question is that a portfolio with a weight of 10.4 ÷ 22.8 = 0.46 in stocks and 0.54 in Treasury notes[51] would have the same estimated risk from 1958 onwards as the market portfolio from 1883 through 1957. The substantial weight that one would have to place in Treasury notes after 1957 to mimic the behaviour of the market portfolio before 1958 is a measure of the economic significance of the shift in the volatility of the market portfolio.

10. Adjusting the historical data for the lower volatility recorded during the earlier period

In its final decision for Envestra, the AER claimed that there was no support for the contention that a shift in the risk of the market portfolio would be accompanied by a shift in the MRP. According to the AER, the lack of substantiation was because no reason had been given for the change in the risk of the market portfolio. The AER stated that[52]:

> *"If NERA's data was segmented at 1958 on an economically justifiable basis, [then] its analysis may be relevant. However, NERA did not posit any economic reason why volatility would be greater after 1958 in particular."*

In its reply submission prepared for the Victorian electricity distributors, NERA (2011b) has again invoked the fundamental principles put forward by Merton (1973), and has argued that the AER's comments are wrong[53].

The relationship shown in equation (19) of Merton (1973) can be written as[54]:

$$\boldsymbol{MRP = \theta\sigma^2} \qquad \textbf{(3)}$$

Where:

$\theta =$ relative risk aversion, a measure of the aversion to risk of a representative investor; and

$\sigma^2 =$ the variance of the return to the market portfolio, that is, the square of the volatility of the return.

Merton's model indicates that there should be a positive relationship between the market risk premium and the volatility of the market, irrespective of the particular factors driving the volatility. NERA (2011b) has therefore deduced that since the market was less volatile before 1958, then the market risk premium should have been lower

[50] Kearns, P. And A. Pagan, Australian stock market volatility: 1875-1987, Economic Record, 69, 1993, pages 163-178.
Brailsford, T., J. Handley and K. Maheswaran, The historical equity risk premium in Australia: Post-GFC and 128 years of data, Accounting and Finance, 2011.

[51] These are short-term, pure discount Commonwealth Government Securities. The rates used for analysis are normally those on three-month Treasury notes.

[52] AER, Envestra Ltd Access arrangement proposal for the SA gas network, 1 July 2011 – 30 June 2016: Final Decision, June 2011, page 189.

[53] NERA (2011b), The Market Risk Premium, A report for Citipower, Jemena Electricity Network, Powercor, SP AusNet, and United Energy, prepared by NERA Economic Consulting, 26th August 2011.

[54] Merton, Robert C., An intertemporal capital asset pricing model, Econometrica, 1973, pages 867-887.

before 1958 than during the period thereafter – irrespective of what was responsible for the change in volatility. Similarly, if Merton's model is true, and if the risk of the market portfolio - computed from the earlier years of the data that Brailsford, Handley and Maheswaran (2011) supply - is lower than the risk calculated from the later years of the data, then an estimate of the *MRP* that ignores the change will underestimate the current MRP[55].

The implication, therefore, is that an upward adjustment should be made to the data from 1883 through 1957 to reflect the lower risk of the Australian market portfolio[56]. Such an approach would maintain the advantages inherent in the use of a long time series of data. A principal advantage is that each year is given less weight in the calculation of the historical MRP, with the result that the addition of data for an extra year will not have a major impact on the overall, assessed value.

Adjusting the earlier data for the lower risk in that period will likely lead to an MRP, amended for the value of imputation credits, which is well above 6.5 per cent per annum. In Section 8.7 of the AAI, a discussion is provided about a regime-switching model which NERA has developed, which is reported as NERA (2012b)[57].

[55] Brailsford, T., J. Handley and K. Maheswaran, The historical equity risk premium in Australia: Post-GFC and 128 years of data, Accounting and Finance, 2011.

[56] Unless reliable evidence can be found to demonstrate that the aversion to risk of a representative investor has fallen.

[57] NERA (2012b), Prevailing Conditions and the Market Risk Premium, a report prepared for APA Group, Envestra, Multinet & SP AusNet, prepared by NERA Economic Consulting, 15th March 2012.