The AER Approach to Establishing the Cost of Equity – Analysis of the Method Used to Establish the Risk Free Rate and the Market Risk Premium

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[1] Note that the views expressed in this report are entirely my own and should in no way be taken to reflect those of the Xfi Centre, University of Exeter.

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Introduction

I have been asked to prepare an expert report which considers the following issues arising from the AER's recent decision in the Roma to Brisbane Pipeline Final Decision and the Draft Decisions for the Gas Distributors (Envestra, Multinet and SP AusNet) and APA GasNet (together, the Gas Businesses)[2]: (a) Is the AER's approach to estimating the cost of equity in these decisions consistent with the approach adopted by the UK regulator, Ofgem and UK appeals body, the Competition Commission?; (b) In light of the UK regulatory approach, is the AER's approach to estimating the cost of equity for the Gas Businesses likely to result in a rate of return that satisfies the requirements of Rule 87(1) of the National Gas Rules that: "*The rate of return on capital is to be commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services"*; (c) In light of the recent Tribunal findings on the cost of capital, the recent IPART Review of water prices for the Sydney Desalination Plant Pty Ltd, and the implications of UK regulatory practice for Australia, how might the gas businesses best estimate the cost of equity in order to satisfy the requirements of 87(1) and 87(2) of the National Gas Rules? In answering this question, I have been asked to explain the extent to which the UK regulatory approach, including the regulator's objectives, is likely to be relevant in Australia.

Executive Summary

1. In forming my views on the above question, I draw on theory and also contrast the AER position with that in recent UK regulatory cases. I focus on those regulators who make full use of the Capital Asset Pricing Model (CAPM) preferred by the AER, and in particular recent appeals cases to the UK Competition Commission (CC), which is the body to which regulatory pricing appeals are made in the UK.

2. The general summary of the UK process is that a number of different regulators set prices for utilities based upon an expected return (the weighted average cost of capital, WACC) applied to a Regulatory Asset Base (RAB). Prices are then set using an RPI+/-x formula, which in effect governs the timing of the revenue stream, though should not influence its present value. The final price determination is made after conducting a "financeability" test, essentially a forecast of the revenues and costs implied by the allowed WACC. This test is used to determine whether the assumed levels of debt can be serviced whilst the debt remains at investment grade. This is interpreted as an NPV-neutral adjustment, i.e. an adjustment to the "glide path" of revenues rather than to the present value of revenues.

[2] I am aware that the report will also be used by Envestra for the AER's review of Envestra's Access Arrangement for its Albury Distribution Network.

3. The relevant utilities and their regulators are: Electricity and Gas networks, regulated by Ofgem; Regulated Airports (Heathrow, Gatwick and Stansted), currently regulated by the CAA but with automatic referral to the CC; the communications industry, where price regulation is concerned with access to BT networks and mobile telephone termination charges, regulated by Ofcom; the water industry, consisting of water only companies (WoCs) and water and sewerage companies (WaSCs), regulated by Ofwat. In addition, Network Rail is regulated by the Office of the Rail Regulator (ORR).

4. In summary, my view is that the AER is in error in its assessment of the cost of equity capital for the Gas Businesses and has significantly under-estimated that cost of equity.

5. It has made such an error because it has been inconsistent in its approach to estimating the market risk premium (MRP) and in doing so has combined two different measures of the risk free rate into its Capital Asset Pricing Model (CAPM) estimate of the cost of equity. In my view, combining such different measures is illogical and is therefore "unreasonable", in the sense set out in paragraphs 50-55 of the Australian Competition Tribunal's Decision of 11th January 2012.

6. In more detail, it has combined an MRP that has been largely derived from historical observation with a current spot rate estimate of the risk free rate. In doing so, it has assumed that the MRP is constant, and has made no allowance for any possible inverse relationship between the risk free rate and the MRP. Other regulators, both in the UK and in Australia (IPART) are aware of this potential relationship and have made due allowance for it.

7. The AER could have adopted one of two consistent approaches that would have avoided this error. It could either have estimated the expected return on the market directly, and used this estimate with its preferred risk free rate in the CAPM. As I explain below, this would have been in line with the approach recommended to UK regulators in the Smithers' Report, 2003.

8. Alternatively, it could have made allowance for the exceptional conditions in global government bond markets, following the global financial crisis and international quantitative easing programmes, and used an estimate of the risk free rate determined largely from historically observed rates. This would then have been consistent with its use of an MRP based largely on historically observed MRPs.

A Comparison of the AER treatment of RF and MRP in the Case Compared with Theory

9. I note that the AER judgement is delivered in nominal terms. In the Gas Distribution and APA GasNet cases, the AER starts with the use of the current yield on the ten year Commonwealth Government Securities (CGS) as the proxy for the risk free rate (RF). This yield is 2.98%. The forecast inflation rate for the

period under consideration is 2.5% which implies the real risk free rate is 0.47%.[3] Two questions arise with regard to this rate. First, is this an adequate proxy for RF in the context of the CAPM? Second, is the RF proxy consistent with the other elements used in the CAPM as applied in this case?

10. Second, the MRP is taken as 6% nominal. The implication is that the expected return E(RM) on the Australian market in nominal terms is 8.98% nominal, or 6.32% in real terms.[4]

11. At this point it is worth emphasising exactly what asset pricing theory tells us that the basic CAPM relationship is, in terms of deriving the expected return on any asset (R_i):

$$R_i = RF + \beta_i(E[RM] - RF) \quad (1)$$

12. The term in parentheses is often abbreviated to the "equity risk premium" or "market risk premium", but writing the equation out in its original form serves as a reminder that the precise definition of MRP is the expected return on the market (E[RM]) minus the risk free rate, RF. As Jenkinson (1993) points out, the important point is that there is only *one* RF term on the right hand side of the CAPM, not two.

13. A very common error, which has been discussed in recent UK regulatory appeals, is to implicitly assume the two RF terms are different. An example would be where a current estimate of the risk free rate (say the yield on a government bond) is combined with an historically derived estimate of the MRP. In such a case, the version of the CAPM being employed is actually:

$$R_i = RF_{current} + \beta_i(RM_{historic} - RF_{historic}) \quad (2)$$

14. This simply illustrates Jenkinson's point that two different RF terms have been employed, and there is no theoretical validity in such a model. In general, the correct model to apply is:

$$E(R_i) = RF + \beta_i(E[RM] - RF) \quad (3)$$

Where $E(R_i)$ and $E(RM)$ denotes the expected return on the equity of firm *i* and the market respectively.

15. A central question is how best to estimate the common components in (3), namely *RF* and *E(RM)*. As The Smithers & Co Report, 2003, ("The Smithers Report") makes clear, given the problem is to estimate expected returns, it is important that in assessing long run averages of RM and RF, the data are treated consistently. Second, if long run averages are to be used, then it is important to select a long enough period so that expectations errors cancel out.

16. Clearly, if long run historical returns are the best guide to expected returns, RM expectations could, in principle, be estimated by adding some historical estimate of

[3] The precise calculation is that (1 + real rate) = (1 + nominal rate)/(1 + expected inflation rate)
[4] See footnote 1.

the MRP to the estimate of RF, but only if the risk-free rate is stable over time, implying that the market risk premium is also stable. Alternatively, RM expectations can be estimated directly from the historical estimate of the RM series itself. Doing so implies that it is the return on equities that is stable, and places no constraint on the stability of either RF or MRP.

17. The Smithers Report is absolutely unequivocal on this point, and by examining the international cross-section of realised returns from Dimson, Marsh and Staunton (2001) shows that the return on equities is more stable than the MRP. The real risk free rate does *not* have a stable mean, based on both the international evidence on the cross-section of real risk free rates, and on a very long run analysis that uses Siegel's (1998) US data set. As the real RF is not stable, the authors conclude that the MRP is less statistically reliable.[5] Note that this has particularly serious implications for Australia, as the evidence in Brailsford, Handley and Maheswaran (2008, 2012), which the AER appear to rely on at pp 67-69 of the Roma to Brisbane Pipeline case and which forms the basis of the Handley data cited at pp 106-107 of the SP AusNet Draft Decision, makes it clear that there are structural changes in their bond series at several points. So if the problem of a non-stable mean is found in the international data, it is not likely to be less of a problem in Australia where the underlying bonds used to compute the series change through time.

18. An updated illustration of the international cross-sectional data is provided in Figure 1.[6] The chart clearly shows that the volatility of the real MRP is greater than the volatility of the real RM (precisely, the respective standard deviations are 1.66% and 1.26% respectively). As can be seen the "risk free" return shows considerable cross-sectional volatility, a problem in part caused by inflation risk.

19. Fortunately, as The Smithers Report makes clear, the solution to this problem is straightforward. As the return on equities series does appear to have a stable mean, one can simply use that series directly to obtain estimates of *E(RM)* in the CAPM (i.e. in [3] above).

20. Had the AER used this (statistically valid) approach in establishing the parameters in its estimate, still using the data it draws upon in Table 2.2, then the Brailsford et al (2008, 2012) data underlying Table 2.2 of The Roma Pipeline case (see footnote 146) and Table 4.3 is the APA Gasnet case, suitably updated, would have shown that the arithmetic average of the *real* RM of 8.6% for the Australian market over the period for which the authors regard reliable data as having been available (1958-2011), assuming that gamma is 0.25.[7] Coupled with the assumed inflation rate of 2. 5% in the Gas Business cases, this implies a nominal estimate of the expected return on the market of 11.31%, or 11.03% with zero adjustment for imputation credits. This contrasts with the AER's implied estimate of this same

[5] See also the 2006 Smithers & Co report for Ofgem.
[6] The figures underlying this chart are from Dimson, Marsh and Staunton (2012), Tables 2, 5 and 10.
[7] The equivalent estimate of the real Government bond return over this period was 2.7% whilst the mean real MRP was 5.90%. If $\gamma = 0$, i.e. the value of tax credits is assumed to be zero, the equivalent real RM is 8.33% and the real MRP is 5.63%.

E(RM) of 8.98%, which represents a baseline cost of equity for the market of 233 basis points lower than would appear to be justified by the historical data series in Brailsford et al (2012).

21. We can anchor this 1958-2005 estimate by using the most widely-cited international evidence of Dimson, Marsh and Staunton (2012), henceforth DMS. They show that for 1900-2011, the real mean realised RM for Australia is 8.9% (arithmetic).[8] The mean long run real bond rate is 2.4% (arithmetic). Again applying the forecast inflation rate of 2.5%, were one to use these historical estimates of real RM as an estimate the expected RM, the arithmetic average implies an *E(RM)* of 11.62%. Note that the DMS figures assume that the value of imputation tax credits is zero.

22. As the Smithers Report makes clear, the appropriate way to derive a market risk premium is to calculate it as the difference between the *E(RM)* and RF estimates. At an RF of 2.98%, this implied MRP is 8.33% on an arithmetic average basis, using the Brailsford et al (2011) data and a γ value of 0.25, and 8.64% using DMS data and a γ value of zero. The APA GasNet proposed E(RM) estimate of 8.5% is between these two estimates.

23. Note that the authors of the Smithers Report see a considerable advantage to regulators in focusing on the relative stability of the market return: *"The relatively greater importance of the market return is fortunate for the regulators, since we argue that there is considerably more uncertainty about the true historic risk-free rate, and hence the equity premium, than there is about the market return itself. The historic size of the equity premium is still the subject of considerable puzzlement and controversy amongst academics; but this is largely due to the historic behaviour of the risk-free rate (proxied by the short-term interest rate). In contrast, we summarise a range of evidence that the equity return has, over reasonably long samples, been fairly stable both over time, and across different markets"*

24. This is "fortunate" because the derivation of expected return from the CAPM given by (3) above can be re-written as:

25. $E(R_i) = (1 - \beta_i)RF + \beta_i E(RM)$ (4)

26. So provided the beta is greater than 0.5 (which is the case for most utilities in general, and is the case here where the Gas Businesses' beta is 0.8), then greater weight is placed on the second component of (4), the E(RM), for which estimates are less uncertain.

27. The appropriate proxy for the risk free rate is the subject of some debate. Both the Smithers Report 2003 and the 2006 Smithers & Co report argue that the lack of evidence for a stable mean lends some weight to the case for using current estimates rather than historical averages. However, they then draw attention to the

[8] Dimson, Marsh and Staunton (2012) Credit Suisse Global Investment Returns Sourcebook (Table 13, p.57)

need to take account of distortions to bond markets, and so anchor their RF estimates using a "Taylor Rule".[9] This leads them to recommend a 2.5% real RF.

28. However, the conclusion of the Smithers Report[10] with regard to regulatory estimation using the CAPM is worth stressing: *"we regard the standard approach to building up the cost of equity, from estimates of the safe rate and the equity premium, as problematic. We would recommend, instead, that estimates should be derived from estimates of the aggregate equity return (the cost of equity for the average firm), and the safe rate."*

29. This message has been heeded by UK regulators and is explicitly referred to in recent regulatory cases and in regulatory appeals to the UK Competition Commission (see below).

30. The question in this case is therefore whether the AER has consistently applied version (3) of the CAPM in this case, or whether it has, however inadvertently, committed the error described in (2). In this regard, I note that the AER at no point discussed an expected RM. In effect, it simply assumes that adding an MRP to its chosen RF will give the correct estimate of RM.

31. At 2.3.1 in the Roma to Brisbane Pipeline case the AER makes clear that its chosen estimate for RF is an average of 10 year CGS yields for the period 25th June to 20th July 2012, whilst in the Gas Businesses Case the average is for the 20 business days ended on the 10th of August. To consistently apply the CAPM it should, therefore, have used an estimate of the expected RM on a reasonable basis, and subtracted from that the same average of 10 year CGS yields. The evidence in 2.3.2 of the Roma to Brisbane Pipeline case and in the Gas Business cases suggest that they have not done so. Table 2.2 in the Roma to Brisbane Pipeline case and, for example, Table 4.3 (p.87) in the APA GasNet case shows estimates of the historically derived MRP. For the reasons set out above, whilst it would have been correct to use these historical data series to measure historic RM directly, it is not valid to take an MRP from this historical data series and match it with an RF derived from forward looking data.

32. Had they adopted the approach recommended in the Smither's Report (2003), then the estimated cost of equity for the firm (following 20 above) would have been 2.98% + 0.8 x (11.31% - 2.98%) = 9.64%.

33. It would, however, have been consistent to estimate the CAPM on the basis of both an historical averages of RF and the MRP. Given that the estimates are made in *nominal* terms, a consistent approach would have been to calculate the real return, based upon the arithmetic means from the Brailsford et al (2012) updated data of a 2.7% real RF and a 5.9% MRP, then uplift these to allow for the compounding effect of the estimated inflation rate.

[9] To quote from a Federal Reserve working paper by Orphanides (2007)"Taylor rules are simple monetary policy rules that prescribe how a central bank should adjust its interest rate policy instrument in a systematic manner in response to developments in inflation and macroeconomic activity." See: http://www.federalreserve.gov/pubs/feds/2007/200718/200718pap.pdf

[10] P.48

34. This would have resulted in a real cost of equity in the case of 2.7% + (0.8 x 5.9%) = 7.42%, and a nominal cost of equity of 10.10%.[11]

35. Note that the consistently estimated approaches in 32 and 34 give cost of equity for the firm that are within 46 basis points of each other, whilst both are clearly some way in excess of the allowed cost of equity in this case of 7.78%.

36. The substantial point is that in not treating the historical data consistently, the AER has *either* under-estimated the cost of capital implied by under-estimating the MRP, or it has under-estimated the cost of capital by under-estimating the RF component of (3). Either interpretation is equally valid, but the key point is that the AER's approach is producing an error as indicated by (2).

37. A curiosity is that the AER apparently recognise that the MRP and the RFR may be negatively correlated at several points. For example, in Appendix B, pages 4-5 of the Multinet case, the AER states "a flight to quality *changes investor expectations and perceptions of the relative value of a risk free asset* and would not undermine the risk-free nature of the asset".[12] It is making this point to underscore why it believes that the current CGS yield is the appropriate measure of RF, but in doing so it is blind to the corollary, which is that if investors' perceptions of the *relative* risk of the risk free asset changes, either equity prices themselves will fall, implying an increase in the E(RM), or, if equity prices are unaffected, then E(RM) will stay the same. The implication of either outcome must be that the MRP, measured as the difference in expected return between the risk free asset and a risky one, will increase. This possible linkage is explicitly recognised by other regulators, both in the UK and in Australia, as I discuss further below.

38. Similarly, when discussing the spread between CGS yields and other debt yields, at Appendix B, p7 of the Multinet case "The AER accepts that the spread between the yield on CGS and other debt securities has increased since the onset of the GFC". It seems logically inconsistent to recognise that the MRP on corporate bonds has increased, yet refuse to acknowledge that the MRP on equities has increased.

39. At p.103 (attachment 4) in the Multinet case, the AER acknowledges "a possible negative relationship between the risk free rate and the MRP in certain circumstances". It then cites Associate Professor Lally as describing such a relationship as "plausible" before observing Australia is not in depressed economic conditions, which fails to acknowledge that Australia is part of a globally integrated capital market (see also 43 below). He also fails to acknowledge that the subsequent correction in the ten year MRP he speculates upon could be caused by the RFR rising rather than the E(RM) falling. This observation highlights the importance of consistent measurement approaches for the MRP and RF, which, as already explained, is not achieved by combining a long term average MRP with a current Rf. Lally's dismissal of the importance of the relationship between MRP and RF seems to be almost entirely speculative.

[11] The equivalent cost of equity if γ is assumed to be zero is 9.88%.
[12] Emphasis added.

40. There are other logical inconsistencies in the AER arguments in the Gas Business cases. For example, at Appendix B, page 12 of the Multinet report, it argues against using long run average historical estimates of the risk free rate, and states "This is because...there is limited evidence that the cost of equity is stable though time, a long run average is not consistent with the present value principle".[13] Yet in using an MRP over the CGS yield, the AER assumes that the MRP is more stable than the cost of equity itself. There is no evidence produced anywhere in the cases to justify this position. At page 93 in Appendix B of the Multinet case, the AER cites Goyal and Welch (2008) in apparent support of a stable MRP. There are several problems here. First, Goyal and Welch (2008) do not compare the stability of MRP with that of the return on the market. As noted in 17 and 18 above, when this comparison is made in real terms, there is evidence that RM is more stable than the MRP. Second, Goyal and Welch (2008) specifically examines the stability of a risk premium measured relative to a short term Treasury Bill rate, *not* relative to a ten year government bond rate. Third, Goyal and Welch's findings are challenged by two other papers in the same edition of Review of Financial Studies (Cochrane [2008] and Campbell and Thompson [2008]). The AER has fixed on the Goyal and Welch study to justify its position, but has apparently disregarded the criticisms of their paper expressed in the other two studies published at the same time in the same journal.

41. Furthermore, this issue is explicitly recognised in the recent IPART Review of water prices for the Sydney Desalination Plant Pty Ltd (SDP), where at p.94 they state; "*We acknowledge the argument that there may be greater stability in the sum of the market risk premium and the risk free rate (i.e,, the expected market return) than in the individual components. In the current market circumstances, there is some evidence, as SDP noted, to support the view that expectations for the market risk premium have risen as bond yields have fallen*." Noting that it can be difficult to estimate short term expectation of the MRP, they then say that "*An alternative approach is to look at the long term averages as a reference point for the sum of the market risk premium and risk free rate*". They next go on to explain "*Therefore, to guide our decision-making on the point estimate for the WACC, we estimated the long term averages of the risk free rate, inflation rate and the market risk premium*".

[13] Note that a discussion of the present value principle evidence on which the AER relies is the subject of a separate expert witness report.

42. The fact that the AER choose to ignore this important evidence is extraordinary, given that they themselves cite IPART's recent decisions in support of their chosen level of the MRP, for example at Table 4.29 of the SPAusNet Draft Decision. In citing, inter alia, this IPART decision they justify the relevance of such recent decisions with the following comment at p.110 of that document: "The AER considers the decisions by other Australian regulators are relevant because the MRP is an economy wide measure". It would seem self evident that the risk free rate is also an "economy wide measure" and it is highly misleading to cite one piece of evidence from another regulator without fully acknowledging the context in which that regulator reached its judgement. IPART correctly considered the importance of historical averages in forming its assessment of the WACC. The AER did not.

43. The potential under-estimation of the RF component is given emphasis by considering that the ten-year bond rate itself has two components – an underlying short term risk free rate (the Treasury Bill rate) and a maturity premium. Historically, DMS Table 12 shows that the mean real maturity premium for Australia has been 1.4% p.a.. The Global mean is 1.2%. Inflation uncertainty means that it highly likely that investors would normally require a maturity premium for holding longer maturity bonds. Despite recent market movements, DMS (page 39) estimate a forward real maturity premium of around 1% p.a., globally. The implication is that both the short term risk free rate and the maturity premium are at very low levels, highlighting the unusual conditions that prevail in risk-free asset markets.

44. At Appendix B, page 96 in the Multinet case, the AER makes the statement that the MRP is for a domestic CAPM, so that overseas evidence has limited relevance. This will not be the case in globally integrated markets, since the risk free rate will be determined by the International Fisher equilibrium relationships (with appropriate adjustment for default risk), and the MRP should be related to the relative systematic risk of the Australian market in the context of a global CAPM. The Smithers Report specifically acknowledges the importance of international evidence. In the case of the Gas Businesses, one cannot ignore the importance of global financial forces. I return to this point in 51 below.

45. The AER discusses other regulatory cases in Australia, though not the IPART Review referred to above. At 56-75 below, I set out some recent UK cases, not to draw a contrast with the values of parameters (which one would expect to be different for Australia, as indeed DMS show) but rather to show the way in which the methodologies for setting the common components of the CAPM vary between countries.

46. In its assessment of its judgement of the MRP, the AER cites survey evidence, for example at p.111 of the SP AusNet Draft Decision. The surveys quoted suffer from a number of problems. First, they are not all consistent with the period from which the RF is derived. Clearly there has been downward pressure on Government bond and Treasury Bill rates throughout that period. Second, it is unclear whether these estimates relate to arithmetic or geometric means. Third, it is unclear which measure of RF the MRP relates to. Finally, at least one of these

surveys refuses to accept that many academics recommend the separate calculation of components rather than an MRP. This leads to some academics not responding to the survey and a biased sample may result. But second, it highlights the fact that according to theory and the empirical evidence discussed above, these surveys are simply asking the wrong question, and so cannot be relied upon.

47. The AER's consideration of the dividend growth model (DGM) estimates conflates their use in two entirely separate contexts. In the US, the model is used at a *firm* level, using analysts' forecasts. Whether or not the US has "higher quality" data, as suggested in footnote 173 of the Roma to Brisbane Pipeline report, this rather misses the point that the use of DGM models in such a fashion suffers from a potential problem of circularity. In the context in which the model is being presented in Table 2.5 of the Roma to Brisbane Pipeline Report and Table B.4 of the Multinet Report, it is clear that the DGM is being used to estimate a market-wide cost of equity. Although the precise detail of the calculations are not given, it seems clear that the way in which the MRP is being calculated is internally consistent, in that a forward estimate of the E(RM) is being derived, from which is subtracted some current estimate of RF. At page 37 of Appendix B, the AER seems to entirely miss the point in saying "NERA's DGM estimates also illustrated this problem [the problem being that the MRP varies as the risk free rate changes].....This difference was the result of the lower risk free rate". But this, of course, is exactly what one would expect if the E(RM) is stable but the risk free rate is not.

48. Whilst the point about the difficulty of forward projection is well understood, one way of objectifying such projections is to assume mean reversion in the dividend yield. The approach is that of Fama and French (2002) and is described in detail in the appendix. Briefly, the theory behind such a decomposition is that some elements of historical return can be attributed to revision in expectations or higher than expected realisations in firm cash flows. By considering only the mean dividend yield and the historically achieved growth, it is possible to estimate what future returns on the market would have expected at points in the past given mean reversion in these parameters. Using the updated Brailsford et al (2012) data for the period 1958-2011, assuming γ=0.25 once imputation credits start in 1988, and applying the Fama and French (2002) methodology, the implied real expected historical dividend yield and growth series would give an estimated *real* E(RM) of 8.14%.[14]

49. Uplifting this using the AER inflation forecast we obtain a nominal E(RM) of 11.03% which implies that the expected MRP at the AER risk free rate of 2.98% is 8.05% (7.62% assuming γ=0). As a way of anchoring this estimate, an alternative calculation can be made using the approach in Dimson et al (2007), updated using the 1900-2011 data series from DMS 2012. Their approach does not allow for any imputation tax credit value, and uses a log decomposition approach, and gives an arithmetic average implied MRP estimate of 7.45% to 7.97% (see Appendix for detail). Whilst these two alternative estimates are derived from a completely different estimation process, the range of these estimates is nonetheless consistent

[14] See Appendix for details of the calculation.

with the Table B.2 estimates. The fact that these cross-checks agree suggests that the DGM should not be so readily dismissed as a technique for establishing the E(RM). Finally, it should be noted that Professor Lally's comments, quoted at *inter alia*, Appendix B p.37 of the SP AusNet case, seem at variance with the evidence presented above which shows that globally, the E(RM) is more stable than the MRP.

50. A number of further points are made from pages 81-84 in the Roma to Brisbane Pipeline case and the Gas Business cases concerning the estimation of the common parameters in the CAPM. These are fully addressed by the theoretical and empirical discussion above, but to reiterate, besides the theoretical preference for considering the E(RM) and RF components directly, rather than relying on an MRP estimate (for example, the AER's perspective at 4.3.4. in the Multinet case is that MRP is regarded as "an input", whereas theoretically this is not strictly the case), there is evidence that RM is more stable than the MRP. These points have been explicitly recognised in recent UK determinations (see below), and implicitly in the IPART SDP case cited by the AER (as discussed above at 41-41), yet apparently disregarded by the AER.

51. One further point needs to be made concerning the RF estimate. It needs to be borne in mind that the objective is to find a proxy for the unobservable return on a "pure" risk free asset. This cannot be simply assumed to be the return on a 10-year CGS. As discussed at 43 above, this bond carries a maturity premium, which historically has averaged 1.4% p.a.. It seems clear that current yield curves exhibit a maturity premium well below historical averages, and there is a case for considering the impact that mean reversion in this premium would have on the ten year risk free rate estimate. Second, as a nominal instrument the return on such a bond is subject to inflation risk. Third, there is a coupon reinvestment risk. Fourth, insofar as the aim is to try and estimate a ten year RF that is consistent with the AER's objective of estimating a ten year MRP, at least some attention should be paid to the impact of any distortions caused by pension fund funding rules and also by the extraordinary actions of central banks in pursuing quantitative easing (QE). Whilst QE has not been undertaken in Australia, it seems highly likely there will have been spill-over effects on CGS yields from such policies being pursued in other global markets. UK regulators have explicitly recognised the effects of such distortions (see below). Of course, if the UK practice of separately estimating components of the CAPM is followed, any uplift to RF has no impact on the cost of equity for an average (beta equal to one) company. However, it would have a material impact given that the AER's approach is to add a fixed MRP to a spot RF estimate, irrespective of what that spot estimate is.

52. As noted above, these issues have been considered in the recent IPART-SDP Review. Of particular note is IPART's decision to consider long term averages in estimating the risk free rate, which in Table 9.5, p.95 of their review is shown to give an estimated nominal RF (at an inflation rate of 2.5%) of 5.4%. It is clear that the AER are aware of IPART's views on this, given they cite their report, but they simply ignore the importance of the points made in their draft decisions relating to the Gas Businesses. As I set out below, the UK regulatory approach also makes

use of longer run historical averages of gilt and index-linked gilt rates when establishing RF.

53. This issue is of particular importance given the highly unusual circumstances in global financial markets at present. The implied real risk free rate in the AER's decision is, as noted above, only 0.47%, an exceptionally low figure. To set this in context, the updated Brailsford et al (2012) data shows that the long run average real yield on CGRs was 2.45%, with an average since 1958 of 2.7%, since 1988 of 3.84% and an average over the past ten and twenty years of 2.3% and 3.49% respectively.

54. As I note above, consistency demands that if the CAPM is to be applied using historical estimates, then the period over which the MRP is estimated should directly match the period over which RF is estimated. To the extent that the 6% MRP adopted by the AER is largely, but not exclusively, determined by the historical evidence, it is difficult to be prescriptive about exactly which estimate of RF is best combined with this in current market circumstances, but the pragmatic solution of both IPART and UK regulators (described in detail below) is to use a weighted average of the more recent historical averages and the current spot rate, with the majority of the weight being on the former. Given considerable uncertainty exists about both the "true" RF and MRP, such an approach is reasonable, in contrast to the AER's current position which is not.

55. Alternatively, one can accept a spot rate estimate of RF, but recognising that E(RM) will not move in line with RF, employ a direct estimate of E(RM), as described in 20 above. What is clearly invalid is to combine a current spot yield on a CGR, determined in wholly exceptional market conditions, with a largely historically determined MRP. This is the AER's position in the Gas Businesses case.

Recent determinations in the UK

56. Over the past five years, the following price determinations have been made:

    2006 Gas and Electricity Transmission Networks (Ofgem). Due to expire in March 2012, this has been extended for a further year due to the introduction of the new RIIO (**R**evenue using **I**ncentives to deliver **I**nnovation and **O**utputs) framework. RIIO would not appear to have any direct implications for the process by which WACC is set.

    2007 Gas Distribution Networks (Ofgem). Five year review.[15]

    2007 CC/CAA London Heathrow and London Gatwick. Five year review. On cost of capital, the CAA accepted the CC's recommendations in full.[16]

    2008 CC/CAA London Stansted. Five year review. On cost of capital, the CAA accepted the CC's recommendations in full.[17]

[15] See: http://www.ofgem.gov.uk/Networks/GasDistr/GDPCR7-13/Documents1/final%20proposals.pdf

[16] See: http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/rep_pub/reports/2007/fulltext/532af.pdf

[17] For CC report concerning cost of capital see: http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/rep_pub/reports/2008/fulltext/539al.pdf. For the CAA report see: http://www.caa.co.uk/docs/5/ergdocs/081209StanstedProposals.pdf

2008 Network Rail (ORR).[18]
2009 Water Companies (Ofwat). 2010-15 price review.[19]
2009 BT Openreach (Ofcom)[20]
2009 Electricity Distribution (Ofgem)[21]
2011 Mobile Call Termination charges (Ofcom)[22]
2011 Transmission Networks (TPCR4) Roll-over (Ofgem), pending the introduction of RIIO.[23]
2012 BT Local Loop Unbundling and Wholesale Line Rental (Ofcom)[24]

Recent Appeals to CC on Price Determination

57. The following price determination appeals have been referred to the CC:

2009 Hutchinson 3G UK v Ofcom and BT v Ofcom. Mobile Call Termination. Note that there was no direct appeal on WACC in this case.[25]
2009 Sutton and East Surrey Water v Ofwat.[26]
2010 Bristol Water v Ofwat.[27]
2010 Carphone Warehouse Group v Ofcom. Wholesale Line Rental.[28]
2010 Carphone Warehouse Group v Ofcom. Local Loop Unbundling.[29]
2010 Cable and Wireless UK v Ofcom. Leased Lines Charge Control.[30]
2012 BT v Ofcom. Wholesale Broadband Access charge control.[31]
2012 BT v Ofcom; Everything Everywhere v Ofcom; Hutchinson 3G UK v Ofcom and Vodafone v Ofcom. Wholesale Mobile Voice Call Termination.[32]

58. Note also that the Local Loop Unbundling (LLU) and Wholesale Line Rental (WLR) Price Determination is currently the subject of a CC appeal by BT.

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[18] See: http://www.rail-reg.gov.uk/upload/pdf/368.pdf for ORR report and http://www.rail-reg.gov.uk/upload/pdf/pr08-cepacoc-010408.pdf for the CEPA report.
[19] See: http://www.ofwat.gov.uk/pricereview/pr09phase3/det_pr09_finalfull.pdf and http://www.ofwat.gov.uk/pricereview/pr09phase3/rpt_com_20091126fdcoc.pdf
[20] See: http://stakeholders.ofcom.org.uk/binaries/consultations/openreachframework/statement/annexes.pdf
[21] See: http://www.ofgem.gov.uk/Networks/ElecDist/PriceCntrls/DPCR5/Documents1/FP_5_Financial%20Issues.pdf
[22] See: http://stakeholders.ofcom.org.uk/binaries/consultations/mtr/statement/MCT_statement.pdf
[23] See: http://www.ofgem.gov.uk/Networks/Trans/PriceControls/TPCR4Roll-over/Documents1/TPCR4_Rollover_Final_Proposals.pdf
[24] See: http://stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc-2011/statement/annexesMarch12.pdf
[25] See: http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/appeals/communications_act/mobile_phones_determination.pdf
[26] For WACC detail see: http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/rep_pub/reports/2009/fulltext/549_appendices.pdf
[27] For WACC detail see: http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/rep_pub/reports/2010/fulltext/558_appendices.pdf
[28] See: http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/carphone-warehouse-group-plc-wholesale-line-rental-appeals/wlr_determination.pdf
[29] See: http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/carphone-warehouse-group-plc-local-loop-unbundling-appeals/llu_determination.pdf
[30] See: http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/appeals/communications_act/final_determination_excised_version_for_publication.pdf
[31] See: http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/british-telecommunications-plc-appeal/wba_determination.pdf
[32] http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/telecommunications-price-control-appeals/final_determination.pdf

Basic methodology in the above cases

59. In general, all the above cases use some version of WACC (whether pre tax or "vanilla", and whether estimated in real or nominal terms), and all except Ofgem and the ORR make full and detailed use of the CAPM. In the 2007 Gas Distribution Networks review Ofgem states "We continue to take the view that the allowed return on equity should reflect the balance of all risks that will be faced by companies under the price control proposals, including both systematic and non-systematic risk, to provide appropriate incentives to manage these risks effectively and to invest efficiently in maintaining and developing their networks. We therefore propose to continue our approach of basing the allowed rate of return on equity on the estimated equilibrium level of total market returns". This policy seems to be continued in the 2011 "Roll Over" document, where the cost of equity was left unchanged. They stated "Even though the risk-free rate has declined, TPCR4 relied on a 'total returns on equity' approach, and *it is generally accepted that total returns are more stable than the individual components*" (emphasis added). In the 2009 Electricity Distribution Review they provide evidence on equity and asset betas, and discuss the equity risk premium, saying they have considered all this evidence, but ultimately they do not provide a disaggregated cost of equity figure. The ORR in effect follows Ofgem but in a sub-analysis estimated the cost of equity by assuming beta is one (a figure close to the adjusted equity beta in the Ofgem report – see below). It justifies this approach by an Annex on relative risk in which it finds that the most appropriate comparator for the risk of the rail industry is the power industry.

60. A further common feature of the regulatory process in the UK is the use of a range of estimates in arriving at the final allowed rate of return. The asymmetry of consequences (the significant consumer detriment following a lack of investment and innovation on the one hand, against consumer price detriment on the other) is recognised, invariably leading to a point estimate of WACC towards the upper end of the range, as the consequences of under-investment are judged to be more important than those from price detriment.[33] Some debate can be found on whether the adjustment should be made to individual components or to the overall WACC, but the preference seems to be for the latter.[34]

61. I note that this general approach is consistent with that in the recent IPART-SDP Review.

[33] A typical example is from the CC's Stansted Airport price review at Appendix L, p.27, where the CC observes "..that there were asymmetric consequences from setting returns too high and too low. Specifically, there was a significant detriment to users if Stansted was deterred by inadequate financial returns from investing in new facilities which more than outweighed the costs of setting returns too high and asking users to pay higher charges than strictly necessary.

[34] See: http://www.ofwat.gov.uk/pricereview/pr09phase3/rpt_com_20091126fdcoc.pdf pp. 102-107

Common components of the cost of equity – approaches to estimation

The Risk-Free rate

62. A common feature in UK regulatory practice throughout the past five years has been an adjustment to market Gilt yields. This is actually a continuation of a long-standing practice dating back to the 1990s where index-linked gilt yields (usually the preferred base for estimation) were argued to be distorted by pension fund liquidity requirements. Currently the argument is that a mix of such pension fund activity coupled with the Bank of England's "Quantitative Easing" programme is such that market yields are not a reliable indicator of the optimal risk free rate for regulatory purposes, bearing in mind the objectives of that process and the asymmetric consequences of error in any cost of capital estimates discussed at 60 above. In the analysis below only the latest reports from each regulator are discussed, as these are most relevant to current market conditions.

63. For the water industry, Europe Economics (Ofwat's consultants) expressed some reservations about this adjustment practice, pre-QE, although ended up in a position where they still selected an RF above the then current index linked gilt yields. They opted for a point estimate of 1.75% with a range estimate of 1.5% to 2.2%.

64. The ORR-CEPA report adopts a range estimate of 1.7% to 2.35%, whilst Ofgem does not disaggregate the component elements of its cost of equity.

65. In the Stansted inquiry, the CC considered evidence from the forward rates implied by the Index-Linked Gilt (ILG) curve. This led them to move away from the 10 year ILG yield used in the Heathrow/Gatwick study and to put greater emphasis on shorter dated ILG rates. Even so, they opted for an RF of 2% despite the fact that these ILG yields were all less than 2%.

66. In the Bristol Water appeal, the CC discusses the impact of the start of the Bank of England's QE programme on ILG rates, and discusses this plus "other distortions". At the outset, CC notes Ofwat's position on RF (Appendix N, para 60) "Ofwat said that its view was also consistent with *the ten-year long-run historic UK index-linked gilts of five- and ten-year maturity* and consistent with recent regulatory determinations." (sic – this is clearly meant to refer to ten year average yields). The CC then analyses the arguments for various RF proxies at length, noting that "we continue to see merit in the argument that distortions (associated, for example, with pension fund dynamics) continue to affect longer-dated index linked yields" at Appendix N, para. 70. Noting that ILGs remain its preferred benchmark for RF it presents evidence that ILG yields were below 1% across the yield curve and also presents long run (5 year) averages. It is clear that these five year averages were all below 1.5%. It ends by looking at international evidence, bearing in mind credit risk, saying it was "unaware" of any evidence for the real RF exceeding 2%. It still concluded that the range for RF was 1% to 2%, despite ILG yields being considerably less than 1% at that time.

67. Ofcom is the only regulator to have set prices in the past two years, so its judgement on the current value of RF is particularly relevant. In the 2011 Mobile

Termination case Ofcom explicitly recognises the problems caused by QE and argue that more weight should be placed on long run averages. They adopt a slightly different approach to RF estimation compared to the CC, using Bank of England data on the implied real rate on gilts. It is worth considering the detail of this calculation. At A8.39 in this case, Ofcom observes: "The currently high levels of demand for UK gilts look unusual when viewed against long-term data, and we are cautious about attaching too much weight to current very low real rates." Then, at A8.45: "While we would generally tend to give more weight to more recent rates than averages over past years, we are mindful (as in past charge controls) that we do not wish to give too much weight to a rate based on a period of unusual market activity. Therefore we are minded at the present time to give greater weight than usual to longer term averages". In Table A8.5 they then set out a range of average real yields ranging from 1 day through 1-6 months to 1-10 years on 5 and 10 year gilts. The short run real yields range between -0.3% and 0% for the 5 year gilt and 0.5% to 0.8% for the 10 year gilts. The 10 year average yields for both are 1.7%. Whilst the weighting given to these data points is not explicit, implicitly far greater weight must be given to the 10 year average as their final estimate of the real RF is 1.5%. In the 2012 LLU/WLR determination this estimate of RF was reduced to 1.4%, but this determination is currently being appealed to the CC.

68. Note that in all the above cases the approach is consistent with some weight being placed upon past observations. Whilst the weighting scheme is never made explicit, simple calculations show that in recent cases, a weight well in excess of 50% is being placed on long run averages.

The equity risk premium (or expected return on the market)

69. There is a distinction between regulators who work directly with a market (or equity) risk premium (MRP), and those who work with an expected return on the market E(RM). In its Stansted Report, the CC sets out the case for the latter, and this recommendation is accepted by the CAA. Indeed, the CC, at Appendix L paragraph 79 of their report specifically say that they would *not* expect the Rm term in the CAPM to be affected by changes in the short term interest rate, concluding that "It would be illogical for us to have retained our previous range for the [MRP] in the absence of any reason to believe that a lower risk-free rate had translated into a lower cost of equity". More recently, this is the approach adopted in the Bristol Water appeal, where the CC emphasises the need for the RF used in setting the CAPM cost of equity to be consistent with the RF used in deriving the MRP, which, to add further emphasis, it explicitly chooses to set out as (E[RM] - RF).

70. The Bristol Water case is particularly interesting, as the CC sets out in some detail alternative approaches to estimating RM in Appendix N, where it discusses the issue of geometric v arithmetic averages, which is also discussed in Stansted, but here is taken to a new level by explicitly calculating simple return averages for various holding periods, together with the Blume (1974) and Jacquier, Kane and Marcus (2005) estimators for these holding periods. This analysis sets out the

results using both Dimson, Marsh and Staunton (DMS)[35] and Barclays Capital data.[36]

71. It then conducts an analysis of implied expected returns using what it terms the "dividend yield model" following Fama and French (2002), Vivian (2007) and Gregory (2007), and finally concludes with the forward Global MRP estimates obtained in Dimson, Marsh and Staunton (2010). Finally, it examines data for the implied return on equities produced in the Bank of England Q1 2010 report, derived using analysts' forecasts, which it notes are volatile and may suffer from bias in analysts' forecasts. It rejects the use of survey evidence in establishing the E(RM)/MRP.

72. The detailed analysis for Ofwat, in its 2009 Price Review, is found in the appended Europe Economics (EE) Report. Citing the Smithers & Co report, this also notes that the RM has been more stable historically than the MRP itself. They draw attention to the fact that this has implications given their preferred point estimate for RF.

73. As noted above, Ofgem does not disaggregate the cost of equity calculation, but in the 2009 Electricity Distribution Review say: "While we have not disaggregated our cost of equity determination, we have included an additional premium in the ERP to reflect the fact that there is perhaps greater uncertainty in the cost of equity for DPCR5 than at GDPCR". .

74. In the 2009 Openreach Price Review, Ofcom is clear that it places little weight on either forward estimates of the risk premium, or on survey evidence, both of which it regarded as "subjective". They suggested a historical estimate based largely on historical evidence from DMS. Ofcom are explicit that they put more weight on arithmetic averages, rather than geometric ones, before they finally selected a broad range. They then settled on the upper end of this range, because: "Our decision to choose a point estimate at the top of our prior range is in response to increased market volatility and turbulence, which is likely to lead to investors requiring increased returns in exchange for holding equity rather than risk-free assets." This was challenged in the appeal to the CC by Carphone Warehouse (CW), but whilst the CC expressed some sympathy with some of the arguments advanced by CW, it noted that the combined effect of the RF and implied E(RM) estimate were not out of line with CW's own estimates.

75. In the 2011 Mobile Termination charge report, Ofcom cited the Bristol Water Appeal analysis by the CC and explicitly linked its RF and MRP estimates with an implied E(RM), before comparing this to the E(RM) used by the CC in the Bristol Water case.

Comparison with the AER case

76. To summarise, a clear difference with UK regulatory practice with regard to RF is that in the AER Case there is no attempt to estimate the RF using some form of

[35] Note that throughout, DMS is used as the abbreviation of this widely-referenced source, although as it is an annual publication, the precise data cited varies between reports.
[36] Appendix N, Table 4.

historical averaging. Even in the most recent UK case (Ofcom, 2012) the base estimate of the real RF is actually 1.4%, despite the actual yield on ILGs at the time being close to zero or even negative. In the SDP case, IPART clearly recognises that there is a problem with simply using the current yield on CGS in a regulatory context. The implied real RF being used in the AER case is under 0.5%. The Brailsford et al (2012)/Handley data clearly shows that such a real Government bond rate is a long way below any historical average. Over the periods which the Brailsford et al (2012) study regards as of key importance, these *real* yields are 2.45% from the start of the series to the end of 2011, 2.70% from 1988-2011 and 3.84% from 1988 to 2011. The AER's chosen *nominal* rate is below the minimum of any point in the 1958-2011series, which fell to a low point of 3.67% in 2011. Excluding that year, the previous lowest yield figure was 4%. Given current conditions would appear to be wholly exceptional, it is reasonable to at least consider recent UK regulatory precedent when estimating RF in Australia, and indeed there is an Australian precedent (in the IPART-SDP case) for doing so. Clearly, making any allowance for the unusual conditions in global government bond markets would have the effect of raising the underlying risk free rate estimate.

77. The major difference between most UK regulators and the AER is that with the exception of Ofcom, the discussion on CAPM parameters generally focuses on the E(RM) rather than the MRP. This is at its most explicit in the CC reports, both in its regulatory role with respect to airports, and in its role as a regulatory appeals body, but it is also explicit in the last Ofwat price review. Ofgem prefers to focus directly on the allowed return, and does not decompose the judgement into its CAPM parameters. Only Ofcom forms its estimates in terms of an RF and an MRP, but even then discusses the implied E(RM).

Concluding Comments

78. Theory suggests that the individual components of the CAPM should be estimated directly. These are RF and E(RM), not RF and MRP.

79. Importantly, there is evidence, discussed at 16-17 above, that E(RM) has a stable mean. By contrast, it appears that neither RF nor the MRP have stable means. Of course, there is considerable debate in the academic literature concerning stability, as is evidenced by the differences of opinion expressed in the 2008 special issue of the Review of Financial Studies, where Cochrane (2008) and Campbell and Thompson (2008) taking opposing positions to Goyal and Welch (2008). Critically, though, note that when these authors discuss the "market risk premium" it is specifically in the context of the premium over Treasury Bill rates *not* the risk premium over bonds. The stability of the MRP relative to bond yields has not been analysed in these papers.

80. If the E(RM) has a more stable mean, the consequence is that direct estimates of E(RM) are likely to be more statistically reliable than indirect estimates formed by summing RF and MRP. This may be of particular importance in the present environment of exceptionally low levels of RF.

81. Thus the clear recommendation by prominent UK academics in reports commissioned specifically for UK regulators (The Smithers Report and the follow-up 2006 Smithers & Co Report) is that the CAPM should be implemented by directly estimating the E(RM) and RF components, and specifically *not* by the common practice of indirect estimation using an RF and MRP. It must also be noted that the asymmetry of consequences that flow from mis-estimating the cost of capital highlight the particular danger of under-estimating the cost of equity by that the MRP remains stable in the presence of unusually low CGS yields.

82. It is clear that the UK regulators, and in particular the appeals body, the UK Competition Commission, have heeded this advice.

83. Furthermore, it is clear that within Australia IPART have similarly recognised this issue.

84. Applied to the case of the recent AER judgement, this advice would have a material impact as the direct estimate of the E(RM) and RF components would have resulted in a higher implicit market risk premium. This would be the case whether either historical mean returns had been used to estimate E(RM), or a DGM estimate was used, or some weighting of a combination of these estimates was employed.

85. If one allows for the contentious debate concerning returns predictability and its meaning, an alternative line of reasoning is that historical means may be an efficient predictor of future returns (see, for example, Goyal and Welch, 2008).

86. Following this line of reasoning, the regulator could have used long term averages of both RF and RM components to set the discount rate. As is set out above, recent UK cases have acknowledged the particular difficulty in estimating an RF in current market conditions, as has IPART. As is discussed at 52 and 53 above, it is difficult to be prescriptive about which long run averages should be used in such an approach, but if one chooses an MRP of 6% based largely on historical evidence, it is important to give equal weight to the historical evidence on the RF component.

87. Whether one adopts a pure forward looking approach to estimating the CAPM components (i.e. a direct forward estimate of E(RM) combined with a spot RF), or an approach that uses historical evidence to determine an RF and an MRP, the effect would be to raise the allowed rate of return significantly.

88. It seems clear that the AER's approach has resulted in a likely significant under-estimate of the cost of capital in the case of the Gas Businesses. UK regulatory authorities have explicitly recognised that the consequences of an under-estimation of the cost of capital will be under-investment in infrastructure, which implies a long term consumer detriment.

89. It is clear that this recognition of possible consumer detriment is a feature of Australian gas regulation. The Objective of the National Gas Law states "The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural

gas." My view is that, in contrast to the positions adopted by UK regulators and by IPART, the AER has not considered the full implications of its proposed cost of capital for the long term interests of consumers.

Statement by Alan Gregory

I am Professor of Corporate Finance at the Xfi Centre (Centre for Finance and Investment) at the University of Exeter, and a former Director of the Centre. I was a reporting panel member of the UK Competition Commission from 2001-2009, and am currently an External Advisor to the UK Competition Commission's Finance and Regulation Group. A summary CV is attached setting out my qualifications and publications.

I confirm that I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance that I regard as relevant have, to my knowledge, been withheld from the report.

Signed:

Alan Gregory 5th November 2012

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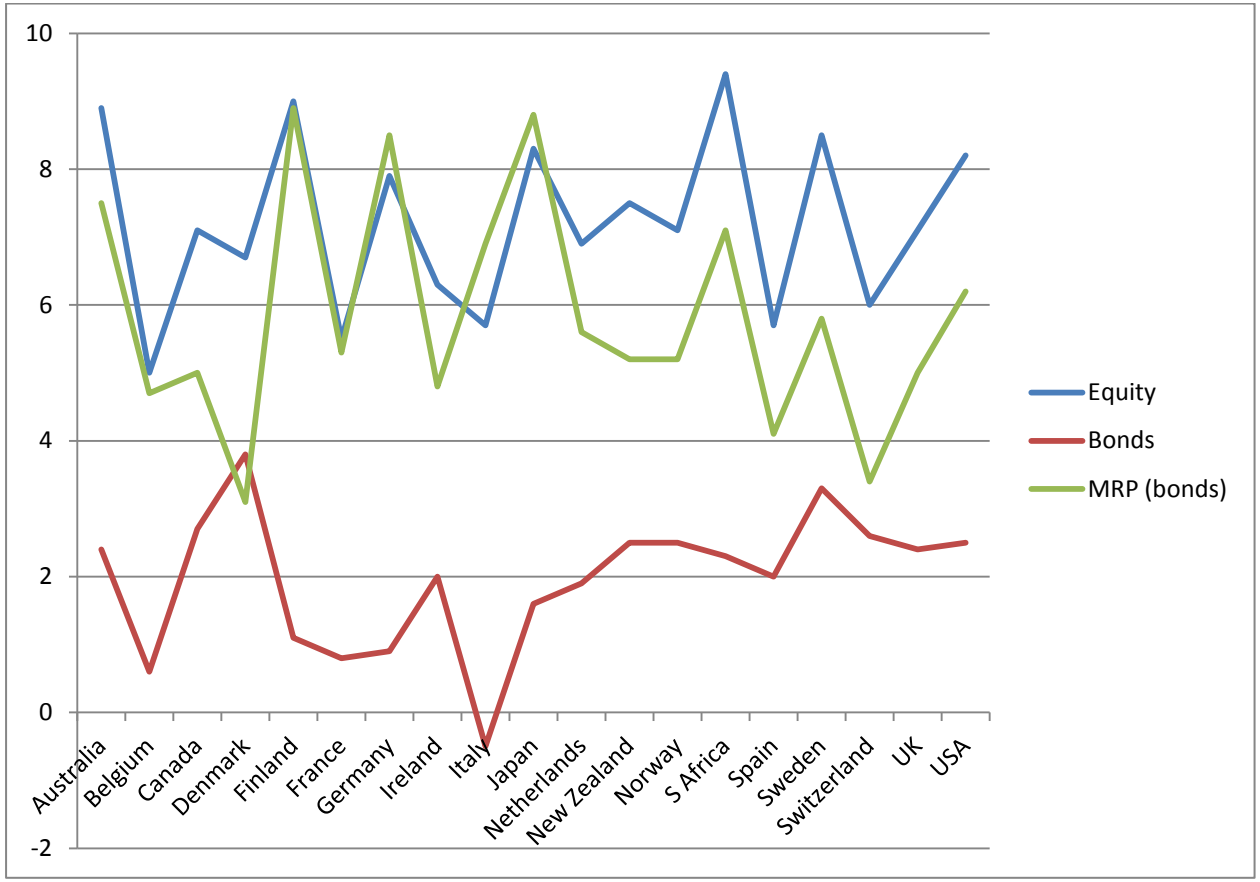
Figure 1: International real returns on equity, government bonds, and the market risk premium, 1900-2011.



Data are from Dimson, Marsh and Staunton (2012) Tables 2, 5 and 10. "Equity" shows the arithmetic mean real return on equities for each country "Bonds" shows the arithmetic real return on government bonds for each country, and "MRP (bonds)" shows the arithmetic mean real market risk premium for equities compared to bonds for each country.

Appendix: Explanation of the Historical Expected Risk Premium Using the Dividend Growth Model

The approach used to model historically expected risk premium is conceptually extremely simple, and relies on the fact that in rational markets, the price of any equity must be the present value of the future dividend stream. Two common approaches to the problem are the Fama and French (2002) model, and the Dimson et al (2007) model.

The Fama and French 2002 Model

The model is developed in Fama and French (2002, hereafter FF) and has also been applied in Vivian (2007) to the UK market. The interest is in the expected return, $E(R_m)$, on a market-wide portfolio, so expressing the standard dividend growth model in terms of returns rather than prices, and assuming constant real growth in perpetuity, expected returns are given by:

$$E_t(R_m) = \frac{E_t(D_{t+1})}{P_t} + E_t(g_t) \qquad \text{(A1)}$$

where D_{t+1} is the real dividend one period hence, and g_t is the long run real growth in prices. The first term on the right hand side of (A1) is the expected dividend yield on the market. Provided the real dividend yield is stationary, long run real price growth will be equivalent to the long run real growth in dividends. As in FF, the assumption is that real dividend growth (GD_t) is simply a function of the most recent period's real dividend growth, where real dividends are defined by $d_t.(CPI_{t-1}/CPI_t)$, CPI_t is the level of the consumer price index at time t, d_t is the nominal dividend at time t, and $GD_t = (d_t/d_{t-1}).(CPI_{t-1}/CPI_t)$. Given this simplifying assumption concerning dividend growth, we can estimate the historical series of expectations as:

$$\overline{R}_{m,t} = \frac{\overline{D}_t}{P_{t-1}} + \overline{G}D_t \qquad \text{(A2)}$$

Alternative specifications are possible. For example, Dimson et al (2002) use the full historical run of data in any year to give an estimate of expected growth, although their approach has the different objective of calculating unexpected dividend growth. Alternatively, one can use earnings growth as is also done in FF. Here, I limit the analysis to dividend growth given earnings growth numbers are not available in the Brailsford et al (2011)/Handley data sets.

FF view the (A2) estimate as the unconditional mean estimate and discuss the adjustment to such an estimate needed to arrive at a simple annual rate for discounting purposes. An unconditional estimate will usually imply a short run change in market prices so that the dividend yield reverts to its long run mean value. As FF show, the estimation of an expected annual simple return requires that the estimates formed from the mean dividend growth model of expected returns are uplifted by half the difference between the variance of the price growth series and the variance of the dividend growth (or earnings growth) model returns.[37]

[37] If one believes that it is the risk premium that is stationary, then as these are historical estimates, the appropriate risk free rate would be the historical real yield on CGRs.

Using the Brailsford et al (2011) data set, suitably updated, the real *E(Rm)* estimate for the period 1958-2011 is 7.63% assuming γ=0.25. As the standard deviation of the real dividend growth is 18.39% over this period, and that of the price growth series is 20.95%, the bias adjustment is 0.50% resulting in a mean expected simple *real E(Rm)* of 8.14%.[38]

The Dimson et al (2007) model

This model takes a slightly different approach to FF, Their approach uses a logarithmic decomposition of the historical risk premium does not allow for any imputation tax credit value, and uses a log decomposition approach to analyse historically realised returns. The theory behind such a decomposition is that some elements of historical return can be attributed to revision in expectations or higher than expected realisations in firm cash flows. By considering only the mean dividend yield and the historically achieved growth, it is possible to estimate what future returns on the market would be assuming mean reversion in these parameters.[39]

In the 2012 Yearbook DMS provide updated estimates of the decomposition of the historical risk premium.[40] Australia appears to be rather different from global averages, and has a higher than average geometric mean dividend yield (5.75%) and higher than average compound growth in the dividend yield (0.99%). Summing these two components gives the implied *geometric* mean real historically expected return of 6.74%. Dimson et al (2007) explain that the uplift required to convert this expected geometric return to an arithmetic one is 1% to 1.5%, from which we might infer that the real expected long run arithmetic mean return would be around 7.74% to 8.24%. Applying the usual Fisher relationships to get the implied nominal E(RM) we have a nominal expected return of 10.43% to 10.95%. At the AER's preferred risk-free rate of 2.98%, this equates to an expected MRP of 7.45% to 7.97%.

[38] 7.72% % if γ=0, i.e. if tax credits have zero value.
[39] See Dimson, Marsh and Staunton (2007)
[40] Dimson, Marsh and Staunton (2012) Credit Suisse Global Investment Returns Sourcebook (Table 11, p.31)

Summary CURRICULUM VITAE for Alan GREGORY

CURRENT POSITION: Chair in Corporate Finance, and Director, Xfi Centre for Finance and Investment, University of Exeter Business School

DATE OF BIRTH: 19.3.1954

PLACE OF BIRTH: Mountain Ash, Wales

ACADEMIC AND PROFESSIONAL QUALIFICATIONS:

MSc in Accounting and Finance (London School of Economics and Political Science, 1983)

Fellow of the Chartered Institute of Management Accountants (CIMA) (qualified in 1974); elected to associate membership 1978; elected to Fellowship 1986)

Certificate in Education (1978).

BACKGROUND:

Alan is Professor of Corporate Finance at the University of Exeter. His research interests are in the general area of market-based empirical research. This interest includes risk pricing, together with returns to, and valuation of, corporate social responsibility agenda. Related work has focused on market reaction to directors' trading activity, the success of initial public offerings, and returns following mergers and acquisitions.

From September 2001 to September 2009 he was a Reporting Panel Member of the UK Competition Commission where he was involved in a number of inquiries, including the two potential European takeover bids for the London Stock Exchange, and most recently the Groceries or "supermarkets" inquiry.

His consulting interests have covered investment portfolio analysis, company valuation and cost of capital, particularly for regulatory purposes, and includes expert witness work. His past clients include fund managers, stockbrokers, large accounting firms, HM Treasury, Ofcom, and the Competition Commission. He is currently External Advisor to the UK Competition Commission's Finance and Regulation Group.

PUBLICATIONS:

Refereed journal articles since 2000:

'Constructing and Testing Alternative Versions of the Fama-French and Carhart Models in the UK' (with Rajesh Tharyan and Angela Christidis) – forthcoming, *Journal of Business Finance and Accounting*

'Exploring the Valuation of Corporate Social Responsibility—A Comparison of Research Methods' (with Julie Whittaker) – forthcoming in *Journal of Business Ethics.*

'Gender Diversity on Corporate Boards: What Can We Learn from Market Reaction to Insider Trades' (with Emma Jeanes, Rajesh Thrayan and Ian Tonks) – forthcoming in *British Journal of Management.*

‘More Than Just Contrarians: Insider Trading in Glamour and Value Firms’ (with Rajesh Tharyan and Ian Tonks) – forthcoming, *European Financial Management*

‘Expected Cost of Equity and the Expected Risk Premium in the UK’. *Review of Behavioral Finance*, 3(1), pp. 1-26, June 2011

‘Stock Market Driven Acquisitions versus The Q Theory of Takeovers – The UK Evidence’ (with X. Bi) *Journal of Business Finance and Accounting* 38, 5 & 6, pp 628-656 (July 2011)

‘UK IPOs: Long Run Returns, Behavioural Timing and Pseudo Timing’ (with C. Guermat and F. Al-Shawraweh), *Journal of Business Finance and Accounting* June/July 2010, 37(5-6), pp 612–647.

‘Industry Cost of Capital: UK Evidence’, (A.Gregory and M. Michou), *Journal of Business Finance and Accounting,* June/July 2009, pp 679–704.

‘Performance and Performance Persistence of Ethical Unit Trusts in the UK’ (A.Gregory and J.Whittaker), *Journal of Business Finance and Accounting,* Sept/Oct 2007, pp 1327-1344.

‘The Long Run Abnormal Performance of UK Acquirers and the Free Cash Flow Hypothesis’, (A. Gregory), *Journal of Business Finance and Accounting,* June 2005, pp. 777-814.

‘A UK Test of an Inflation-Adjusted Ohlson Model’, (A.Gregory, W.Saleh and J.P.Tucker), *Journal of Business Finance and Accounting,* April/May 2005, pp 487-534.

‘Foreign Acquisition by UK Limited Companies: Short and Long-Run Performance’ (Alan Gregory and Steve McCorriston), *Journal of Empirical Finance*, 12, 2005, pp 99-125.

‘Contrarian Investment and Macroeconomic Risk in the UK’ (Alan Gregory, Richard Harris and Maria Michou). *Journal of Business Finance and Accounting,* Jan/March, 2003, pp 213-255.

‘Short-Run Returns around the Trades of Corporate Insiders on the London Stock Exchange’ (S. Friederich, A. Gregory, J. Matatko and I. Tonks). *European Financial Management,* March 2002, pp.7-31.

‘An Analysis of Contrarian Investment Strategies in the UK’ (Alan Gregory, Richard Harris and Maria Michou). *Journal of Business Finance and Accounting,* December 2001, pp 1193-1228.

‘*Discussion of* Acquisition-Related Provision-Taking and Post-Acquisition Performance in the UK Prior to FRS7’ (A. Gregory), *Journal of Business Finance and Accounting*, (November / December 2000)

‘Testing the Robustness of Long-Term Under-performance of UK Initial Public Offerings’ (S. Espenlaub, A. Gregory and I. Tonks), *European Financial Management*, September 2000.

‘Motives underlying the method of payment by UK acquirers: the influence of goodwill’ (A. Gregory), *Accounting & Business Research*, Summer (2000)

Research Grants obtained since 2000:

£284,355 from ESRC for "Cost of Capital and Asset Pricing in the UK" (as Principal Investogator; joint with Christina Dargenidou, Rajesh Tharyan and Penguo Wang). 2012-2015.

£25,000 from ICAEW for £25,000 for "The valuation and long run returns of firms with positive corporate social responsibility (CSR) indicators" (as Principal Investigaor; with Julie Whittaker) 2011-13.

£78,000 from Leverhulme to investigate directors' trading patterns around takeover announcements (2008-2010, I was lead applicant – the bid was joint with Ian Tonks).

EXTERNAL AND PROFESSIONAL LINKS:

1. Appointed to REF Panel 19 as assessor for 2009-2014REF.
2. Member of the Competition Commission (2001-2009). External Advisor to the UK Competition Commission's Finance and Regulation Group, September 2009-date.
3. OECD Round Table panellist on Excessive Pricing and Role of Profitability Testing, October 2011.
4. Member of the Editorial Board of *Journal of Business Finance and Accounting.*
5. Member of the Editorial Board of *Accounting and Business Research.*
6. Director, Exeter Enterprises Ltd (the University of Exeter consulting arm) until August 2007.
7. Former member of CIMA's Management and Professional Development Committee, now CIMA Enterprises Advisory Board.
8. Former consultant to Her Majesty's Treasury on the Government Profit Formula for non-competitive contracts
9. Former consultant to various accounting firms and fund management companies on areas related to cost of capital, risk and return, and equity portfolio construction.
10. External assessor on chair appointments at Edinburgh and Stirling Universities.
11. External examiner on numerous PhDs including Cass, University of Cambridge, Lancaster Management School, Reading University and Manchester Business School.
12. Assessor on a number of AMBA accreditation panels.

PREVIOUS EMPLOYMENT:

Jan. 1996 - Sept 97: Professor of Business Studies, University of Wales, Aberystwyth.

Sept. 1995- Dec. 96: Professor of Accounting, University of Glasgow

Sept. 1989-Sept. 95: Lecturer in Accounting and Finance, University of Exeter.

Sept. 1986-Aug. 89: Principal Lecturer in Accounting and Finance, City of London Polytechnic.

Sept. 1983-Aug. 86: Senior Lecturer in Accounting, Brighton Polytechnic.

Apr. 1978-Aug. 83: Senior Lecturer in Accounting, Luton College of Higher Education.

Sept. 1977-March 78:	Lecturer II, South West London College.
Jan 1977-Aug. 77:	Budgets Controller, Green Shield Stamps.
Jan 1976-Dec. 76:	Manager, Western Region Settlement Accounts Section.
Aug. 1974-Jan 76:	Assistant Development Accountant, British Rail Western Region.
Aug. 1971-Aug. 74:	Management Trainee, British Rail

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Our Ref: A8059
Your Ref:
Doc ID: 62587101.1

25 October 2012

Mr Alan Gregory
Professor of Corporate Finance
Xfi Centre for Finance and Investment
University of Exeter Business School

Dear Sir

Victorian Gas Access Arrangement Review 2013-2017: Envestra, Multinet SP AusNet and APA GasNet

We act for Envestra Limited (**Envestra**), Multinet Gas (DB No. 1) Pty Ltd and Multinet Gas (DB No. 2) Pty Ltd (together, **Multinet**) and SPI Networks (Gas) Pty Ltd (**SP AusNet**) in relation to the Australian Energy Regulator's (**AER**) review of the Gas Access Arrangements for Victoria.

Envestra, Multinet and SP AusNet (**the Distributors**) as well as APA GasNet (Australia) Operations Pty Ltd (**APA GasNet**) (together the **Gas Businesses**) wish to jointly engage you to prepare an expert report in connection with the AER's review of the Victorian Gas Access Arrangements. The report will also be used by Envestra for the AER's review of Envestra's Access Arrangement for its Albury Distribution Network.

This letter sets out the matters which the Gas Businesses wish you to address in your report and the requirements with which the report must comply.

Terms of Reference

The terms and conditions upon which each of the Gas Businesses provides access to their respective networks are subject to five yearly reviews by the AER.

The AER undertakes that review by considering the terms and conditions proposed by each of the Gas Businesses against criteria set out in the *National Gas Law* and *National Gas Rules*.

Rule 76 of the *National Gas Rules* provides that the Gas Businesses' total revenue for each regulatory year is to be determined using the building block approach, in which one of the building blocks is a return on the projected capital base for the year.

Rule 87(1) provides that the rate of return on capital is to be commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services. Rule 87(2) provides that a well accepted approach incorporating the cost of equity and debt (such as the Weighted Average Cost of Capital (**WACC**)) is to be used along with a well accepted financial model (such as the Capital Asset Pricing Model (**CAPM**)) in determining the rate of return on capital.

The Gas Businesses are seeking expert assistance in respect of their proposed estimates of the cost of equity to be used in the calculation of the WACC (through the CAPM) and the approach of the AER in recent decisions and in the Gas Access Arrangement Review Draft decisions for the Distributors and APA GasNet.

In this context the Gas Businesses wish to engage you to prepare an expert report which considers the following issues arising from the AER's recent decision in the Roma to Brisbane Pipeline Final Decision and the Draft Decisions for the Distributors and APA GasNet:

(a) Is the AER's approach to estimating the cost of equity in these decisions consistent with the approach adopted by the UK regulator, Ofgem and UK appeals body, the Competition Commission?

(b) In light of the UK regulatory approach, is the AER's approach to estimating the cost of equity for the Distributors and APA GasNet likely to result in a rate of return that satisfies the requirements of Rule 87(1) of the National Gas Rules that:

The rate of return on capital is to be commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services.

(c) In light of the recent Tribunal findings on the cost of capital, the recent IPART Review of water prices for the Sydney Desalination Plant Pty Ltd, and the implications of UK regulatory practice for Australia, how might the Gas Businesses best estimate the cost of equity in order to satisfy the requirements of 87(1) and 87(2) of the National Gas Rules?

In answering these questions, please explain the extent to which the UK regulatory approach, including the regulator's objectives, are likely to be relevant in Australia.

Use of Report

It is intended that your report will be included by each of the Gas Businesses in their respective responses to the AER's Draft Decisions in respect of their access arrangement revision proposals for their Victorian networks (and in the case of Envestra, Albury network) for the access arrangement period from 1 January 2013 to 31 December 2017. The report may be provided by the AER to its own advisers. The report must be expressed so that it may be relied upon both by the Gas Businesses and by the AER.

The AER may ask queries in respect of the report and you will be required to assist each of the Gas Businesses in answering these queries. The report will be reviewed by the Gas Businesses' legal advisers and will be used by them to provide legal advice to the Gas Businesses as to their respective rights and obligations under the *National Gas Law* and *National Gas Rules*.

If any of the Gas Businesses choose to challenge any decision made by the AER, that appeal will be made to the Australian Competition Tribunal and the report will be considered by the Tribunal. The Gas Businesses may also seek review by a court and the report would be subject to consideration by such court. You should therefore be conscious that the report may be used in the resolution of a dispute between the AER and any or all of the Gas Businesses as to the appropriate level of the respective Distributor's distribution tariffs. Due to this, the report will need to comply with the Federal Court requirements for expert reports, which are outlined below.

Compliance with the Code of Conduct for Expert Witnesses

Attached is a copy of the Federal Court's Practice Note CM 7, entitled "*Expert Witnesses in Proceedings in the Federal Court of Australia*", which comprises the guidelines for expert witnesses in the Federal Court of Australia (**Expert Witness Guidelines**).

Please read and familiarise yourself with the Expert Witness Guidelines and comply with them at all times in the course of your engagement by the Gas Businesses.

In particular, your report prepared for the Gas Businesses should contain a statement at the beginning of the report to the effect that the author of the report has read, understood and complied with the Expert Witness Guidelines.

Your report must also:

1 contain particulars of the training, study or experience by which the expert has acquired specialised knowledge;

2 identify the questions that the expert has been asked to address;

3 set out separately each of the factual findings or assumptions on which the expert's opinion is based;

4 set out each of the expert's opinions separately from the factual findings or assumptions;

5 set out the reasons for each of the expert's opinions; and

6 otherwise comply with the Expert Witness Guidelines.

The expert is also required to state that each of the expert's opinions is wholly or substantially based on the expert's specialised knowledge.

It is also a requirement that the report be signed by the expert and include a declaration that "*[the expert] has made all the inquiries that [the expert] believes are desirable and appropriate and that no matters of significance that [the expert] regards as relevant have, to [the expert's] knowledge, been withheld from the report*".

Please also attach a copy of these terms of reference to the report.

Terms of Engagement

Your contract for the provision of the report will be directly with the Gas Businesses. You should forward to each of the Gas Businesses any terms you propose govern that contract as well as your fee proposal.

Please sign a counterpart of this letter and forward it to each of the Gas Businesses to confirm your acceptance of the engagement by the Gas Businesses.

Yours faithfully

Johnson Winter & Slattery

Enc: Federal Court of Australia Practice Note CM 7, "Expert Witnesses in Proceedings in the Federal Court of Australia"

……
Signed and acknowledged by Professor Alan Gregory

Date ……..

CREDIT SUISSE

February 2012

Research **Institute**

Thought leadership from Credit Suisse Research and the world's foremost experts

Elroy Dimson · Paul Marsh · Mike Staunton

Credit Suisse Global Investment Returns Sourcebook 2012

Table 9: Worldwide equity risk premiums relative to bills, 1900–2011

Country	Geometric mean%	Arithmetic mean%	Standard error%	Standard dev.%	Minimum return%	Min year	Maximum return%	Max year
Australia	6.5	8.0	1.7	17.7	-44.4	2008	49.2	1983
Belgium	2.8	5.4	2.3	24.6	-57.8	2008	130.4	1940
Canada	4.1	5.5	1.6	17.1	-34.7	2008	49.1	1933
Denmark	2.6	4.4	1.9	20.5	-50.3	2008	95.3	1983
Finland	5.5	9.2	2.9	30.3	-53.3	2008	159.2	1999
France	5.9	8.5	2.3	24.5	-43.1	2008	85.7	1941
Germany*	5.7	9.6	3.0	31.8	-44.7	2008	131.4	1949
Ireland	3.0	5.3	2.0	21.4	-66.3	2008	72.0	1977
Italy	5.5	9.5	3.0	32.0	-48.6	1945	150.3	1946
Japan	5.6	8.8	2.6	27.7	-48.3	1920	108.6	1952
The Netherlands	4.1	6.4	2.2	22.8	-51.4	2008	126.7	1940
New Zealand	4.0	5.6	1.7	18.3	-58.3	1987	97.3	1983
Norway	2.9	5.7	2.5	26.4	-55.0	2008	157.1	1979
South Africa	6.2	8.2	2.1	22.0	-33.9	1920	106.2	1933
Spain	3.1	5.3	2.1	21.8	-39.3	2008	98.1	1986
Sweden	4.2	6.5	2.1	22.1	-40.8	2008	84.6	1905
Switzerland	3.3	5.0	1.8	18.9	-37.0	1974	54.8	1985
United Kingdom	4.2	5.9	1.9	19.9	-54.6	1974	121.8	1975
United States	5.2	7.2	1.9	19.7	-44.1	1931	56.6	1933
Europe	3.6	5.7	2.0	20.9	-47.1	2008	76.3	1933
World ex-USA	3.9	5.7	1.9	19.9	-44.0	2008	79.6	1933
World	4.4	5.8	1.6	17.1	-41.2	2008	70.3	1933

* For Germany, statistics are based on 110 years, excluding 1922–23. Source: Elroy Dimson, Paul Marsh, and Mike Staunton, Triumph of the Optimists, Princeton University Press, 2002, and subsequent research.

Table 10: Worldwide risk premiums relative to bonds, 1900–2011

Country	Geometric mean%	Arithmetic mean%	Standard error%	Standard dev.%	Minimum return%	Min year	Maximum return%	Max year
Australia	5.6	7.5	1.9	19.9	-52.9	2008	66.3	1980
Belgium	2.5	4.7	2.0	21.4	-60.3	2008	84.4	1940
Canada	3.4	5.0	1.7	18.4	-40.7	2008	48.6	1950
Denmark	1.6	3.1	1.7	17.5	-54.3	2008	74.9	1972
Finland	5.2	8.9	2.9	30.4	-56.3	2008	173.1	1999
France	3.0	5.3	2.2	22.9	-49.2	2008	84.3	1946
Germany*	5.1	8.5	2.7	28.5	-50.8	2008	116.6	1949
Ireland	2.8	4.8	1.9	19.8	-66.6	2008	83.2	1972
Italy	3.5	6.9	2.8	29.6	-49.0	2008	152.2	1946
Japan	4.7	8.8	3.1	32.8	-45.2	2008	193.0	1948
The Netherlands	3.3	5.6	2.1	22.3	-55.6	2008	107.6	1940
New Zealand	3.6	5.2	1.7	18.2	-59.7	1987	72.7	1983
Norway	2.2	5.2	2.6	28.0	-57.8	2008	192.1	1979
South Africa	5.3	7.1	1.8	19.6	-34.3	2008	70.9	1979
Spain	2.1	4.1	2.0	20.8	-42.7	2008	69.1	1986
Sweden	3.5	5.8	2.1	22.4	-48.1	2008	87.5	1905
Switzerland	1.9	3.4	1.7	17.6	-40.6	2008	52.2	1985
United Kingdom	3.6	5.0	1.6	17.2	-38.4	2008	80.8	1975
United States	4.1	6.2	1.9	20.5	-50.1	2008	57.2	1933
Europe	3.7	5.0	1.6	16.7	-47.4	2008	67.9	1923
World ex-USA	3.5	4.7	1.5	15.6	-47.1	2008	51.7	1923
World	3.5	4.8	1.5	15.6	-47.9	2008	38.3	1954

* For Germany, statistics are based on 110 years, excluding 1922–23. Source: Elroy Dimson, Paul Marsh, and Mike Staunton, Triumph of the Optimists, Princeton University Press, 2002, and subsequent research.

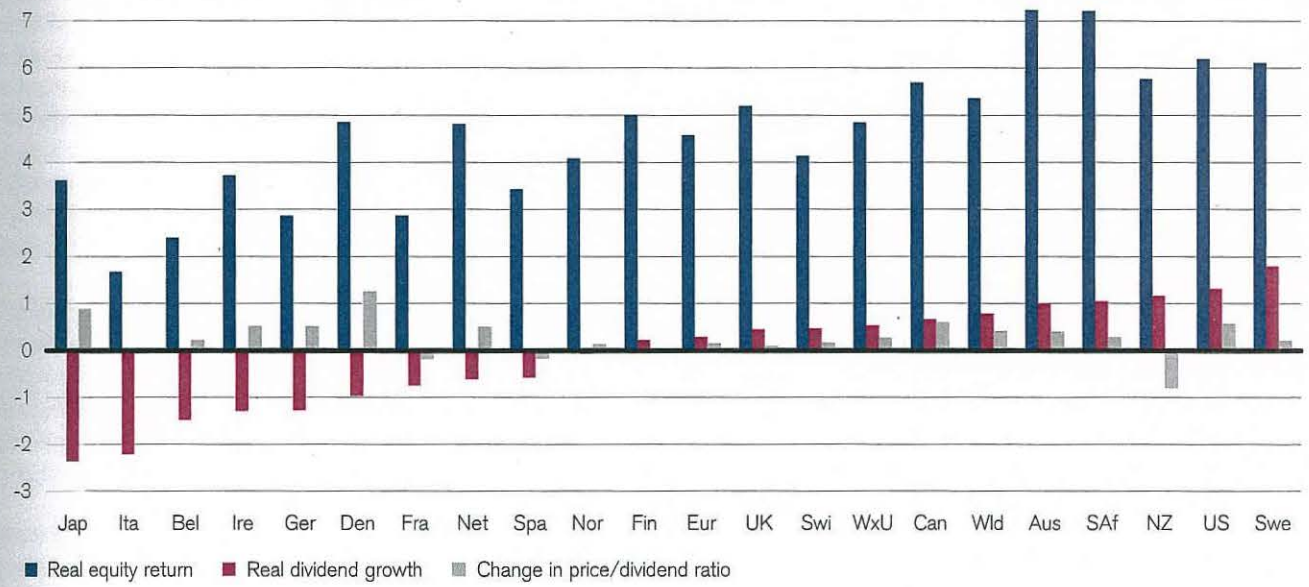
Table 11: Decomposition of the historical risk premium, 1900–2011 (% p.a.)

Country	Geometric mean dividend yield	plus* Growth rate of real dividends	plus Expansion in the P/D ratio	plus Change in the real exchange rate	minus US real interest rate	equals Equity premium for US investors
Australia	5.75	0.99	0.40	0.10	0.92	6.35
Belgium	3.71	-1.48	0.21	0.67	0.92	2.14
Canada	4.37	0.67	0.59	0.06	0.92	4.78
Denmark	4.56	-0.96	1.26	0.53	0.92	4.45
Finland	4.76	0.23	0.01	0.12	0.92	4.17
France	3.83	-0.75	-0.18	-0.08	0.92	1.85
Germany**	3.66	-1.27	0.51	0.27	0.92	2.20
Ireland	4.54	-1.29	0.51	0.28	0.92	3.06
Italy	4.05	-2.21	-0.07	0.17	0.92	0.92
Japan	5.20	-2.36	0.88	0.55	0.92	3.23
The Netherlands	4.93	-0.61	0.50	0.31	0.92	4.17
New Zealand	5.38	1.17	-0.79	-0.21	0.92	4.57
Norway	4.02	-0.07	0.13	0.33	0.92	3.47
South Africa	5.79	1.05	0.29	-0.75	0.92	5.43
Spain	4.20	-0.58	-0.17	0.09	0.92	2.57
Sweden	4.02	1.80	0.21	0.06	0.92	5.20
Switzerland	3.47	0.47	0.17	0.90	0.92	4.10
United Kingdom	4.62	0.45	0.10	-0.05	0.92	4.18
United States	4.22	1.31	0.57	0.00	0.92	5.22
Average	4.48	-0.18	0.27	0.18	0.92	3.79
Standard deviation	0.68	1.22	0.44	0.36	0.00	1.41
World (USD)	4.10	0.79	0.41	0.00	0.92	4.39

* Premiums are relative to bills. Summations and subtractions are geometric. ** For Germany, statistics are based on 110 years, excluding 1922–23. Source: Elroy Dimson, Paul Marsh, and Mike Staunton, The Worldwide Equity Premium: A Smaller Puzzle, in R. Mehra (Ed.), Handbook of the Equity Risk Premium, Elsevier, 2008.

Growth rates varied a lot across countries, ranging from 1.8% in Sweden to –2.4% in Japan. Real dividend growth was lower in the turbulent first half of the last century, when real dividends generally declined, and the real dividend growth rate on the world index was –0.9% per year. From 1900 to 1949, only three countries had positive real dividend growth, the USA, Australia, and New Zealand. But from 1950 to 2011 real dividend growth was positive everywhere except New Zealand. The real dividends on the world index grew by a far healthier 2.2% per year.

Chart 12: Real dividend growth around the world, 1900–2011



Source: Elroy Dimson, Paul Marsh, and Mike Staunton, Triumph of the Optimists, Princeton University Press, 2002, and subsequent research.

One view often expressed is that there is no particular reason to expect a bond maturity premium, since some investors will view short bonds as riskier than long bonds, while others will take the opposite view, depending on the profile of their liabilities. Bondholders with long-term horizons seeking to match long-term liabilities will view long bonds as the lower risk, since if they invest in short-term bills, they will need to reinvest on a regular basis, and there is uncertainty over the reinvestment rate. In contrast, investors with shorter-term horizons and liabilities will view long bonds as the more risky since there is uncertainty about the price at which they will be able to sell the bonds.

While these arguments are valid, they fail to take account of inflation uncertainty. We have seen that inflation has seriously affected long run investment performance, and that investors should be concerned with the purchasing power of their future wealth. At times of inflation uncertainty, short-term bonds become the lower risk investment even for investors with long-term (real) liabilities. A bond maturity premium is therefore required in order to compensate investors for the greater volatility and inflation risk of investing in long bonds. This is borne out by two key observations. First, the yield curve has historically on average been upward sloping; that is, long bonds have typically offered a higher yield to redemption than shorter dated bonds and bills. Second, real bond returns are far more volatile than real bill returns (compare Tables 4 and 5).

As was the case with the equity risk premium, we cannot easily measure investors' ex ante requirements or expectations relating to the maturity premium, but we can measure the bond maturity premiums actually achieved. Table 12 shows bond maturity premiums computed over the entire period from 1900 to 2011 for all 19 our indexes. The formula for the bond maturity premium is 1 + Long bond rate of return, divided by 1 + Treasury bill rate of return, minus 1. The second column of the table shows the geometric mean premiums that investors have earned. Chart 16 shows the same data pictorially, with the blue bars representing the geometric mean premiums. It shows that over the last 112 years, the bond maturity premium has been positive in every country (the premium for Germany excludes 1922–23).

The premium for the European index is zero as it is measured from the perspective of a US investor, relative to US bills, i.e. US holders would have been as well off holding US bills as

Table 12: Worldwide bond maturity premiums, 1900–2011

Country	Geometric mean%	Arithmetic mean%	Standard error%	Standard dev.%	Minimum return%	Min year	Maximum return%	Max year
Australia	0.9	1.4	1.0	10.4	-23.3	1973	48.2	1932
Belgium	0.3	0.7	0.9	9.2	-19.6	1914	34.0	1958
Canada	0.7	1.0	0.8	8.3	-26.4	1915	24.1	1982
Denmark	1.0	1.3	0.8	8.8	-18.5	1994	41.1	1983
Finland	0.3	0.5	0.5	5.3	-17.4	1920	19.2	1993
France	2.8	3.1	0.7	7.8	-18.7	1994	23.4	1927
Germany*	0.6	1.1	1.0	10.1	-38.6	1948	48.3	1921
Ireland	0.3	0.9	1.1	11.4	-26.4	1974	37.2	1932
Italy	2.0	2.3	0.8	8.2	-17.5	1935	52.3	1944
Japan	0.9	1.8	1.3	13.6	-45.6	1953	63.0	1954
The Netherlands	0.9	1.1	0.7	7.4	-18.9	1939	25.2	1982
New Zealand	0.5	0.7	0.6	6.7	-25.2	1984	24.4	1991
Norway	0.6	1.0	0.8	8.3	-30.4	1918	37.3	1940
South Africa	0.8	1.1	0.7	7.7	-18.3	1994	30.4	1933
Spain	1.0	1.4	0.9	9.3	-27.0	1920	46.5	1942
Sweden	0.7	1.0	0.8	8.3	-34.1	1939	24.5	1934
Switzerland	1.4	1.5	0.6	5.9	-13.9	1989	24.1	1922
United Kingdom	0.5	1.1	1.0	10.8	-26.6	1974	36.6	1932
United States	1.1	1.4	0.8	8.6	-15.0	2009	28.2	2011
Europe	0.0	0.9	1.3	13.8	-40.2	1919	66.0	1933
World ex-USA	0.3	1.1	1.2	12.8	-36.4	1919	64.3	1933
World	0.8	1.2	0.8	8.5	-20.4	1920	29.4	1933

* For Germany, statistics are based on 110 years, excluding 1922–23. Source: Elroy Dimson, Paul Marsh, and Mike Staunton, Triumph of the Optimists, Princeton University Press, 2002, and subsequent research.

CHAPTER 5

Australia

The data for equities were provided by the author of Officer (1989). He uses Lamberton's (1958a,b) data, linked over the period 1958–74 to an accumulation index of 50 shares from the Australian Graduate School of Management (AGSM) and over 1975–79 to the AGSM value-weighted accumulation index. Subsequently, we use the Australia All-Ordinary index. Brailsford, Handley and Maheswaran (2008) argue that pre-1958 dividends are overstated by Lamberton, but do not present alternative annual dividend estimates, and we continue to use Officer's dataset.

Bond returns are based on the yields on New South Wales government securities from 1900–14. For the period 1915–49, the yields were on Commonwealth Government Securities of at least five years maturity. During 1950–86, the basis is 10-year Commonwealth Government Bonds. From 1986, we use the JP Morgan Australian government bond index with maturity of over seven years.

For 1900–28, the short-term rate of interest is taken as the three-month time deposit rate. From 1929 onward, we use the treasury bill rate.

Inflation is based on the retail price index over 1900–48 and thereafter on the consumer price index.

The switch in 1966 from Australian pounds to Australian dollars has been incorporated in the Exchange Rate index history.

Table 13: **Returns on Australian asset classes 1900–2011**

		Mean returns % p.a.					Annual returns %				Ten-year returns % p.a.				Current
Return	Asset	GM	AM	SE	SD	SC	Lowest		Highest		Lowest		Highest		year rank
Nominal	Equities	11.3	12.9	1.8	18.5	-0.13	-40.4	2008	66.8	1983	1.7	1974	23.7	1986	102
	Bonds	5.5	6.1	1.1	11.4	0.16	-19.1	1973	53.8	1932	-1.9	1920	17.3	1991	14
	Bills	4.6	4.6	0.4	3.9	0.94	0.7	1951	17.3	1989	0.9	1957	14.3	1990	42
	Inflation	3.9	4.0	0.5	5.2	0.54	-12.6	1921	19.3	1951	-2.2	1933	11.4	1983	54
Real	Equities	7.2	8.9	1.7	18.2	-0.06	-42.5	2008	51.5	1983	-5.6	1978	17.1	1929	101
	Bonds	1.6	2.4	1.2	13.2	0.29	-26.6	1951	62.2	1932	-8.4	1920	14.1	1934	13
	Bills	0.7	0.8	0.5	5.4	0.59	-15.5	1951	18.5	1921	-6.7	1956	6.8	1993	49
	Exchange rate	0.1	0.8	1.1	11.7	0.08	-39.9	1931	46.4	1933	-8.3	1947	7.6	2011	54
Premiums	Equities vs. bills	6.5	8.0	1.7	17.7	-0.11	-44.4	2008	49.2	1983	-3.6	1978	14.8	1959	101
	Equities vs. bonds	5.6	7.5	1.9	19.9	-0.07	-52.9	2008	66.3	1980	-4.4	1996	16.3	1959	109
	Bonds vs. bills	0.9	1.4	1.0	10.4	0.09	-23.3	1973	48.2	1932	-6.6	1982	9.3	1940	10

GM=geometric mean; AM=arithmetic mean, SE=standard error of mean; SD=standard deviation; SC=serial correlation; Ten-year returns to end of given year

Source: Elroy Dimson, Paul Marsh and Mike Staunton, Triumph of the Optimists, Princeton University Press, 2002, and subsequent research.