Review of Risk Free Rate and Cost of Equity Estimates: A Comparison of UK Approaches with the AER

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Objective

I have been asked to consider the following questions, in relation to the Australian Energy Regulator's (**AER**) recent decision in the Roma to Brisbane Pipeline Final Decision for APT Petroleum Pipeline Pty Ltd (**APTPPL**) and the Draft Decisions for APA GasNet (Australia) Operations Pty Ltd (**APA GasNet**) and SPI Networks (Gas) Pty Ltd (**SP AusNet**):

1. Is the AER's methodology for 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 (**CC**)?

2. 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*"

   In answering this question, I was also asked to explain the extent to which the UK regulatory approach, including the regulator's objectives, is likely to be relevant in Australia.

Please note that I have also been asked to comment, in a separate report, on two reports provided to the AER by Professor Martin Lally. In both reports I shall refer to this report as W1, and the companion report as W2. Since the content of both reports overlap in various places I shall at various points, in the interests of brevity, refer directly to more detailed discussion in W2.

Expert Witness Status

I have read, understood and complied with the guidance on expert witnesses in Practice Note CM7.

I am a Professor of Economics at Birkbeck College, University of London. I have been a full-time academic since 1991, holding academic positions at the University of Cambridge and at

Birkbeck. I previously worked at the Bank of England; and alongside working as an academic have maintained regular links with the private sector, most notably with Smithers & Co Ltd, advisers to the fund management industry. My academic work involves both teaching and research: I have published regularly in respected journals, specialising in macroeconomics and finance. I have carried out two major studies relating to the cost of capital for regulated industries, both commissioned by UK regulators (see Mason, Miles & Wright, "A Study in to Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K." (February 2003), and Baskaya, Hori, Mason, Satchell and Wright, "Report on the Cost of Capital provided to Ofgem" (September 2006)), both of which have been widely quoted in subsequent discussions of the cost of capital. Additionally I have acted as a consultant to Ofgem on estimation of CAPM betas, and as an expert witness to the UK Competition Appeal Tribunal.

I have been assisted in preparing this report by my colleague Kenjiro Hori, Lecturer in Economics at Birkbeck, who was a co-author on the second of the reports cited above.

My Curriculum Vitae is appended to this document.

Overall Conclusions

In answer to **Question 1**: my conclusion is that the AER's approach to estimating the cost of equity has been substantively different from the approach of UK regulators, in two key ways.

First, and crucially, both Ofgem and CC have consistently worked on the assumption that the real market cost of equity (i.e., for a firm with a CAPM β of one) is stable over time; in contrast, AER's methodology of assuming a constant market risk premium (MRP), coupled with a market-based estimate of the risk-free rate, has resulted in very significant reductions in the implied market cost of equity.

Second, and of more minor importance, in recent decisions Ofgem and CC have used estimates of the risk-free rate that have not fully adjusted downwards in line with market rates. This difference is quantitatively much less important, because, for any company with a β close to one (as the AER assume), the assumption on the risk-free rate, *per se*, is much less important than the assumption on the market cost of equity (which, by construction, must equal the risk-free rate plus the MRP).

In answering **Question 2**, my conclusions rely on my own personal analysis, albeit informed by my observations of UK regulators. My views can be summarised as follows:

i. Both the real market cost of equity and the MRP are inherently unobservable. But of necessity regulators have to commit themselves to a particular set of *assumptions* about these unobservable magnitudes. My view, in line with the UK regulators, is that regulators should work on the assumption that the real market cost of equity is constant. This approach is supported by quite strong evidence. For any firm with β reasonably close to one, the assumed real market cost of equity is by far the most important figure affecting the cost of capital for regulated companies. Thus this methodology has the added advantage of providing a stable regulatory regime. I believe this has proved its worth in the UK.

ii. Any other assumptions should be consistent with this core assumption. As a direct implication, *whatever* assumption is made on the risk-free rate, the implied equity premium must move point by point in the opposite direction.

iii. The AER, by assuming that the risk premium is constant, and hence that the cost of equity capital has simply followed the risk free rate down point by point, has in my view made a clear error.

iv. This behaviour is particularly inappropriate in the Australian context. By assuming a lower cost of capital, the AER is imposing a lower return on capital for the regulated company, at a time when profitability, and hence returns of *un*regulated companies are at a cyclical high, which is in turn inducing very strong investment. This puts regulated companies at a potentially severe disadvantage compared to unregulated companies, and implies the serious risk that regulated companies will under-invest.

v. Whilst point ii) necessarily applies that in my approach (and that of UK regulators), the (estimated) MRP and the risk-free rate must move in opposite directions, this phenomenon cannot be directly observed, since the true MRP is inherently unobservable. However there is a considerable body of academic research that would suggest *indirect* evidence of this negative relationship, both by looking at economic determinants of the MRP, and at the properties of implied risk premia on other assets, such as corporate and government bonds.

vi. In a world of internationally integrated capital markets, it would be absurd to assume that Australian companies are only raising capital from domestic investors. Thus international evidence and practice is highly relevant, especially for the cost of equity.

vii. While I believe that the AER has got it wrong on the (crucially important) cost of equity, I have no significant criticisms of the assumptions the AER has made on the risk-free rate *per se*. The risk-free rate is observable (more or less), and to the extent that a regulated company has lower systematic risk than the market, this should in principle be taken into account. However, the *combination* of this methodology for the risk-free rate and the assumption of a constant risk-premium *does* cause major problems, by introducing instability into the assumed figure for the real cost of equity (as under point iii) above). My preference would be for the AER to adopt the approach followed by UK regulators, of assuming a constant real market cost of equity (as in point i) above). But if the AER continues to assume a constant MRP based primarily derived from realised returns, a possible compromise approach would be to combine this with a historic average risk-free rate. For a firm with β equal to one this would give an identical answer to my preferred approach; but even for a firm with β less than one it would result in an outcome that would be markedly superior to what the AER currently proposes.

1. The Approach to the Cost of Equity of Ofgem and the Competition Commission

Background

In its recent review of price controls, Ofgem "reaffirmed its commitment to a CAPM based approach to estimating the cost of equity, sense-checked against other approaches."[1] Similarly, CC stated that "As in previous inquiries, we used the CAPM as we considered it was the most robust way to measure the returns required by shareholders."[2]

The familiar CAPM model is,

$$E(R_i) = R_f + \beta_i \left(E(R_m) - R_f \right) \qquad (1)$$

where $E(R_i)$ is the expected return for firm *i*. In the regulatory context firm *i* is the regulated firm, and hence $E(R_i)$ is the cost of equity. β_i is the CAPM beta for the regulated firm, R_f is the risk-free rate and $E(R_m - R_f)$ is the market risk premium MRP.

Ofgem's approach to cost of capital estimation in recent years has referred extensively to the analysis of Mason, Miles and Wright (2003) in their study of the cost of capital, commissioned by a consortium of UK regulators in the early 2000s.[3] As correctly noted in AER (2012, p60),[4] "the MRP cannot be directly observed". In fact, a fundamental problem in practical applications of the CAPM is that *none* of the terms in (1) can be directly observed without error.

Mason *et al* noted however that a simple rearrangement of the CAPM equation gives

$$E(R_i) = E(R_m) + (\beta_i - 1) MRP \qquad (2)$$

thus the cost of capital to regulated companies will only differ from the expected market return to the extent that β_i differs from unity. Furthermore the MRP (and hence the risk-free rate) will only affect the firm's cost of equity via this second term.

By decomposing the realised return as

$$R_m = E(R_m) + \varepsilon \qquad (3)$$

where $\varepsilon = R_m - E(R_m)$ is an expectational error, Mason *et al* noted that on the assumption that (over sufficiently long samples) expectational errors should average out close to zero, then the average realised aggregate return provides an estimate of $E(R_m)$, the crucial first term in

[1] FTI Consulting, *Cost of capital study for the RIIO-T1 and GD1 price controls: Report by FTI Consulting*, 24 July 2012

[2] Competition commission, *Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991, Report*, presented to Ofwat, 4 August 2010

[3] Mason, R., Miles, D and Wright, S (2003), *A Study into certain aspects of the cost of capital for regulated utilities in the UK*, Smithers & Co Ltd report to a consortium of UK regulators

[4] AER, *APT Petroleum Pipeline Pty Ltd, Access arrangement final decision: Roma to Brisbane Pipeline, 2012-13 to 2016-17: Final Decision*, August 2012

(2). Furthermore, Mason *et al* noted, there was strong evidence (drawing on the research of Siegel, 1994; Dimson, Marsh & Staunton, 2001[5]) that the realised real aggregate stock market returns and by implication, from (3), the expected real market return, $E(R_m)$, has been remarkably stable, both over long historical samples, and in a wide range of markets.

By comparison, Mason *et al* also noted, there was very much weaker evidence of stability of the risk-free return (at any horizon), and hence of the MRP. In more recent work commissioned by Ofgem, Wright (2004)[6] also noted strong evidence of parameter instability in estimates of β_i for a range of regulated companies in the UK. Thus there are distinctly greater measurement problems associated with the second term in (2), compared to the first; but, in many contexts, as long as β_i does not differ too much from unity, these problems should be relatively less important in their impact on the estimated cost of equity. Furthermore, the relative stability of the expected real market return suggests there has been a historical tendency for offsetting movements in the risk-free rate and the MRP. (For a more detailed review of this evidence, see my companion report, W2).

Since equations (1) and (2) are mathematically identical, as long as we take a consistent approach to the various components of the equation, it should not matter which we use; however if (1) is used, and the approach does not take into account the stability of the market return, this may lead to significantly different answers. This provides an explanation of the differences in approach between AER and both Ofgem and CC.

Ofgem's recent approach to the cost of equity and the risk-free rate

The analysis of Mason *et al* set out in the previous section has underpinned Ofgem's approach in recent deliberations, summarised below. We consider the following:

Electricity Distribution:

Price Control	Period Applied	Notes
DPCR4	1 April 2005 – 31 Mar 2010	
DPCR5	1 April 2010 – 31 Mar 2015	
RIIO-ED1	1 April 2015 – 31 Mar 2023	Formerly known as DPCR6

Gas Distribution:

Price Control	Period Applied	Notes
GDPCR1	1 April 2008 – 31 Mar 2013	
RIIO-GD1	1 April 2013 – 31 Mar 2021	Formerly known as GDPCR2

Transmission Distribution:

Price Control	Period Applied	Notes
TPCR4	1 April 2007 – 31 Mar 2012	
TPCR4 Rollover	1 April 2012 – 31 Mar 2013	
RIIO-T1	1 April 2013 – 31 Mar 2021	Formerly known as TPCR5

[5] Siegel, J, *Stocks for the Long Run,* McGraw-Hill; Dimson, E, Marsh, P and Staunton, M (2001), *Triumph of the Optimists* Princeton University Press

[6] Wright, S, *Beta Estimates for: Scottish Power, Scottish & Southern Energy, Viridian Group, Centrica, International Power, National Grid Transco, United Utilities, Kelda Group, Severn Trent,* Smithers & Co report to Ofgem (March 2004)

A summary of the decisions on assumptions for the risk free rate, β, and the overall cost of equity is given in Table 1 below. More detailed descriptions of the price control reviews are given in Appendix 1.

Table 1. Assumptions on key cost of equity parameters in recent Ofgem decisions

	DPCR4		GDPCR1	DPCR5		TPCR4 Rollover	RII0-GD1
	Initial (Mar 04)	Final (Nov 04)	Final (Dec 07)	Initial (Mar 08)	Final (Dec 09)	Final (Dec 07)	Initial (Jul 12)
Real risk-free rate	3.00	-	2.50	-	2.00	-	2.00
Equity risk premium	4.5	-	4.75	-	5.25	-	5.25
Equity β	1.0	-	1.0	-	0.9	-	0.9
Cost of Equity	7.50	7.50	7.25	6.5-7.5	6.73	7.00	6.7
Market Cost of Equity (β = 1)	7.5	7.5	7.25		7.25		7.25

The table reveals that, consistent with the analysis in Mason, Miles and Wright, discussed above, Ofgem's assumptions on the implied cost of market equity ($E(R_m)$ in our equations) have shown minimal variation in recent decisions. As documented in Appendix 1, Ofgem has explicitly referred to this analysis on several occasions, as the basis for this stability.

It is also noteworthy that, Ofgem has assumed an equity β either equal to, or very close to one. As a result, as is evident from equation (2), the assumed MRP has had a minimal effect on the assumed cost of equity.

Assumptions on the risk-free rate have shown more variation, albeit that (as documented in the Appendix) Ofgem has explicitly made the decision not to bring the assumed rate down in line with current short-term market rates (thus effectively dampening yet further the already small impact of market changes in the risk-free rate). However, the table reveals that, given the near-constancy of the assumed market cost of equity, the implied market risk premium has moved in an almost precisely offsetting direction to the assumed risk-free rate.

CC's recent approach to the cost of equity and the risk-free rate

We consider the following:

- Stansted Airport Q5 Price Control Review, 2008[7]
- Bristol Water Report, 2010[8]

A summary of the recent decisions included in the above by the CC on the cost of equity is given in Table 2 below. More detailed descriptions are given in Appendix 2.

Table 2. Assumptions on key cost of equity parameters in recent CC decisions

	Bristol Water (Jun 10)	Stansted (Oct 08)	Heathrow (Oct 07)	Gatwick (Oct 07)	Mid Kent / Sutton & East Surrey (Sep 00)
Real risk-free rate	2.0	2.0	2.5	2.5	3.0
Equity risk premium	5.0	3.0-5.0	2.5-4.5	2.5-4.5	4.0
Equity β	0.92	1.00-1.24	0.90-1.15	1.00-1.30	0.7
Cost of Equity	6.6	5.0-8.2	4.75-7.68	5.0-8.35	5.8(*)
Market Cost of Equity (β = 1)	7.0	5.0-7.0	5.0-7.0	5.0-7.0	7.0

(*) CC further added a Small Company Equity Premium (SCEP) of 1.0% to estimate the overall cost of equity.

The table reveals that CC's assumptions on the implied cost of market equity for β=1, (which must equal $E(R_m)$) have been unchanged in recent decisions. The analysis underpinning these decisions is extremely close to the framework set out at the start of this report. It is well summarised by the following extracts taken from the Stansted review:

> "This particular aspect of our calculation attracted more comment and criticism than any other part of our 2007 cost of capital analysis … Some of these comments seemed to us to have been based on a misunderstanding of the underlying approach in that they focused on the equity-risk premium in isolation, without recognizing that the

[7] Competition Commission, *Stansted Airport Ltd: Q5 price control review*, presented to the Civil Aviation Authority, 23 October 2008

[8] Competition Commission, *Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991, Report*, presented to Ofwat, 4 August 2010

risk-free rate and equity-risk premium estimates need to be combined together in order to see the R_m estimate that goes into the CAPM calculation." (Appendix L17)

"We also believed, in the context of this review, that the R_m term in CAPM is unlikely to have been affected significantly by short-term changes in the risk-free rate … the expected return on the market has, if anything, increased slightly during the last 12 months at a time when the expected return on risk-free assets has fallen. It would be illogical for us to have retained our previous range for the equity-risk premium in the absence of any reason to believe that a lower risk-free rate had translated into a lower cost of equity." (Appendix L19)

Summary of UK Regulatory Practice

To summarise, both Ofgem and CC have employed a methodology in which the crucial component is an assumed stability of the real market cost of equity, in line with the analysis of MMW. Of necessity this implies that, with falling risk-free rates, the implied figure for the MRP *must* be assumed to have increased point by point (the quotation from CC above shows that this relationship has been deliberate, and considered). Additionally, for both Ofgem and CC, the combination of assumed βs close to one, and risk-free rate assumptions that have not fully followed market rates downwards, has meant that the implied cost of equity assumed for the companies they regulate has also been stable. As discussed in the next section, this contrasts very markedly with the AER's behaviour.

2. AER's Cost of Equity and Risk-Free Rate Assumptions compared to Ofgem's and CC's Methodology

We consider the following:

- APT Petroleum Pipeline, Roma to Brisbane, Final Decision, 2012[9]
- APA GasNet Australia, Draft Decision, 2012[10]
- SPI Networks (Gas), Draft Decision, 2012[11]. (These comments apply also to the AER's Draft Decisions for Envestra Victoria and Multinet Gas.)

In their April 2012 report, cited above, AER state that, "In the WACC review, the AER considered evidence before it and concluded the appropriate methodology for estimating the risk free rate is using the yield on CGS bonds with a 10 year term and an averaging period commencing as close as practically possible to the start of the regulatory control period." (p.127) In their August 2012 report they further state that "the yield on long term CGS is often used as a proxy for the risk free rate because the risk of the Australian Government defaulting on interest and debt repayments is considered to be low." (p.65) They further state that "recent material from the RBA indicates that 'CGS yields are the most appropriate risk free rate in Australia' in prevailing market conditions" (p.66). The AER therefore use data averaged over the 20 business day period from 25 June 2012 to 20 July 2012.

[9] AER, *APT Petroleum Pipeline Pty Ltd, Access arrangement final decision: Roma to Brisbane Pipeline, 2012-13 to 2016-17: Final Decision*, August 2012
[10] AER, *Access arrangement draft decision: APA GasNet Australia (Operations) Pty Ltd, 2013-17, Part1*, September 2012
[11] AER, *Access arrangement draft decision: SPI Networks (Gas) Pty Ltd, 2013-17, Part1*, September 2012

In their subsequent draft decisions for both APA GasNet and SP AusNet, the AER state that they agree with both firms' proposed method of "adopting the yield on 10 year Commonwealth Government Securities (CGS) as the proxy for the risk free rate". (p34 for APA GasNet, p34 for SP AusNet). The AER however disagrees with SP AusNet's proposal for adopting a 20-year historical average risk free rate, instead suggesting that "the AER adopts a short term averaging period [10-40 business days] sampled as close as practically possible to the commencement of the access arrangement period". (p35)

In principle there is no great inconsistency between the AER's methodology and that of Ofgem and CC, up until the financial crisis. Indeed the approach is very much in line with Baskaya, Hori, Mason, Satchell & Wright's (2006) conclusion, cited recently as background to Ofgem's decision on TPCR4, that "the best current market-based estimate of the forward looking risk free rate was the nominal yield on medium-term government bonds less the Bank of England's inflation target of 2 per cent." The basis for this argument was the assumption that, in the absence of any clear-cut evidence of a term premium, a yield on government bonds over a maturity comparable to the price control could be treated as the best available market forecast of average short-term rates over the life of the price control.[12] Thus whilst this approach appears to differ from Ofgem's, by using long-term rates, it is doing so merely as a means to *estimate* the short-term rate.

More recent experience seems to have persuaded both Ofgem and CC that this approach may not fully reflect market conditions. Ofgem's view, stated in DPCR4, was: "the issue … is the expected risk-free rate going forward. It is therefore important to come to a view whether current low market rates are likely to persist into the future or whether there are factors, which are not expected to persist, which depress rates at present." This view was reflected in all price controls reviewed above where the risk free rate was explicitly estimated: in DPCR4, Ofgem noted that the yields were suppressed by factors such as minimum funding requirements for pension funds and high equity volatility, and so the range was set 60-100bp above the then (real) yield on index linked gilts. CC made similar arguments in their Stansted Price Control Review to justify a risk-free rate assumption above prevailing market rates. In DPCR5, Ofgem concluded that the rates were depressed by the Bank of England's quantitative easing and demand from pension funds and referred to the 10 year trailing average 10 year rate which was 100bp above the current 10 year rate; in TPCR4 Rollover, Ofgem retained the original DPCR4 estimate due to the volatility of the current yields; and in RIIO-GD1, Ofgem viewed it appropriate to focus on longer-term estimates and suggested a rate of 2% despite real index linked gilts rates being negative.

However, in light of the discussion above, it should be evident that the difference in assumptions on the risk-free rate between AER and both Ofgem and CC are not, in themselves, likely to greatly affect the assumed cost of equity, if market equity premium estimates are derived in a consistent manner, taking into account the observed stability in the market cost of equity, as Tables 1 and 2 showed both Ofgem and CC have done. It is in this

[12] Although it should be noted that the context for this original statement was in relation to the expected cost of debt, rather than equity, over the life of a price control system. Note also that this methodology implicitly assumes the Expectations Theory of the term structure, i.e. that the forward interest rate must equal the expected one-year spot rate. While there are strong *a priori* grounds for this assumption, it must be acknowledged that empirically forward rates are a very poor predictor of future interest rates. To explain this alternative theories of term structure have been suggested, such as Liquidity Preference Theory, and Market Segmentation Theory (see, for example, the textbook treatment in Brealey R and Myers, S (2003), p. 680).

respect that AER's methodology parts company from the UK regulators in a much more crucial way.

AER state that they take into account the following evidence in deriving their MRP assumption:

- Long-term historical excess returns of 4.9-6.1% (arithmetic) and 3.0-4.7% (geometric), which have been adjusted to incorporate a value for distribution imputation credits (theta) of 0.35.
- Survey based estimates – claimed to be around 6%.
- Dividend Discount Model based estimates – used for cross-check.
- Consultant advice by Professors McKenzie and Partington, University of Sydney.
- Recent practice among Australian regulators.
- Recent Australian Competition Tribunal decisions.

The estimates of historical excess returns, which appear to have had the primary influence on the assumptions, are derived from arithmetic average realised stock returns relative to the 10 year government bond rate, provided by Handley (2012), in a report[13] prepared for AER (see Appendix 3 for details). These figures are then scaled by β and added to the risk-free rate to derive the cost of equity. Table 3 shows the results, on a comparable basis to Ofgem's shown in Table 1.

Table 3. AER's assumptions on key cost of equity parameters

Parameter	Previous	AER Draft/Final
Nominal Risk-free Rate	5.70%	2.95%
Inflation Rate	3.21%	2.55%
Real Risk-free Rate	2.49%	0.40%
β	1.0	0.8
Market Risk Premium	6.0%	6.0%
Real Cost of Equity	8.49%	5.2%
Real Market Cost of Equity (β = 1)	8.49%	6.4%

Table 3 makes clear that this methodology has resulted in a sharp fall in the implied real cost of equity, by over 300 basis points. For comparability with Ofgem's and CC's methodology, the last line of Table 3 also shows the implied real cost of market equity, which, given the unchanged assumption on the MRP, has simply fallen in line with the risk-free rate figure,

[13] Handley, J. C., "Historical equity risk premium to 2011" (April 2012)

hence by just over 200 basis points. This fall has been accentuated by a shift to a less-than-unit assumption for β, lowering the real cost of equity for regulated companies, relative to the market return, by a further 120 basis points.

A simple comparison between the AER's implied real market cost of equity assumption in Table 3 with the equivalent figure in Table 1 shows that this figure is 80 basis points lower than Ofgem's assumption, and 60 bp lower than CC's most recent figure, shown in Table 2. My remit in this report is limited to providing commentary on the comparison between the *methodologies* used by the AER, compared to the UK. I have not carried out a systematic investigation of what actual figure should be set as an appropriate assumption for the real market cost of equity for the Australian, as compared to the UK market. However on *a priori* grounds it seems plausible that if anything the appropriate figure for Australia should be higher, rather than lower than in the UK, given that Australia's market is relatively small, and disproportionately influenced by the commodities sector. Thus it seems possible that the expected return for the Australian market itself may contain a risk premium relative to other national stock markets. This has implicitly been reflected in past regulatory behaviour. As a result, the fall shown in Table 2 represents an even bigger difference from AER's own past practice, since previously the assumed figure was higher than those used in the UK. Given the historic stability of real market returns in most markets this is a very significant shift, and clearly is at odds with the methodology of UK regulators.

It is worth stressing that it is not the risk-free rate assumption *per se* that is the cause of this difference, but the assumption that the equity premium is constant, and hence the implicit assumption that the market cost of equity must have fallen. Had the AER worked on the assumption of a stable market cost of equity, as Ofgem has done, the risk-free rate assumption would have been more or less precisely offset by a rise in the assumed MRP. In this respect APTPPL and CEG's criticism that "the WACC determined by the AER is biased downward as the AER adopts an MRP that reflects the long term average and uses a risk free rate that reflects the current market environment" appears to have implicit support in UK practice.

Summary of Comparison between AER's methodology and Ofgem/CC

The above comparison provides a clear-cut answer to the first question I was asked to address in this report. There is a very clear inconsistency between the AER's methodology for estimating the cost of equity and that of the two UK regulators, Ofgem and the Competition Commission. The UK regulators have both deliberately worked on the assumption of a stable real market return on equity. Given β estimates close to one, and only partial adjustment of risk-free rate figures in line with market rates, this has resulted in a stable cost of equity for the companies they regulate. In sharp contrast, AER's methodology of assuming a constant market risk premium (MRP) and adding to market-based measures of risk-free rate has resulted in an abrupt fall in the assumed real market cost of equity, by over 200 basis points. This fall has been reinforced by the shift to an assumed β of only 0.8, rather than 1, such that the assumed real cost of equity for regulated companies has fallen by over 300 basis points.

Thus the differences in approach between the UK regulators and the AER are very far from being merely academic: They have had major implications for the profitability of regulated companies. In the final section of this report I now turn to my own assessment of the relative merits of the two approaches.

3. Is the AER getting it right?

I have provided my answer to this question in summary form at the start of this report. I therefore structure my response to this over-arching question in terms of these key summary conclusions, which I restate here, with added explanation.

i. **Regulation should maintain the assumption that the real market cost of equity capital is constant.**

I have already referred to arguments made on this issue in MMW, which have been explicitly supported in the quotations provided by the CC. I discuss the background for this assumption in more detail in W2. In my view it is considerably more firmly grounded in the data than the competing assumption that the MRP is constant. As summarised in W2, the key point is that, while the historic real market return on equity has been stable in most major markets (providing indirect evidence that the *expected* return has been stable), this has *not* been the case for the risk-free rate, which has had no obviously stable historic mean.[14] Since the MRP is the difference between the (stable-mean) market return and the (no-stable-mean) risk-free rate, the MRP in turn does not have a stable historic mean.

Additionally, it should be stressed that, for any company with β reasonably close to one, it is the real market return on equity, not the MRP, that *matters*, since this is what then feeds through into price controls. Stability of the assumed real cost of equity thus also feeds through into regulatory stability.

ii. ***Whatever* assumption is made on the risk-free rate, the implied equity premium must therefore move point by point in the opposite direction.**

This conclusion follows by simple logic. Given that, as under point i) the real market cost of equity is assumed constant, any other assumptions should be consistent with this assumption.

iii. **The AER, by assuming that the risk premium is constant, and hence that the cost of equity capital has simply followed the risk free rate down point by point, has made a clear error.**

Again, this conclusion follows directly from my conclusion, stated above, that the real market cost of equity has been relatively stable. It is also worth stressing the point that, while the UK practice of assuming a stable equity return results in a stable regime for regulated companies, the AER's methodology implies drastic changes in returns (see my next point).

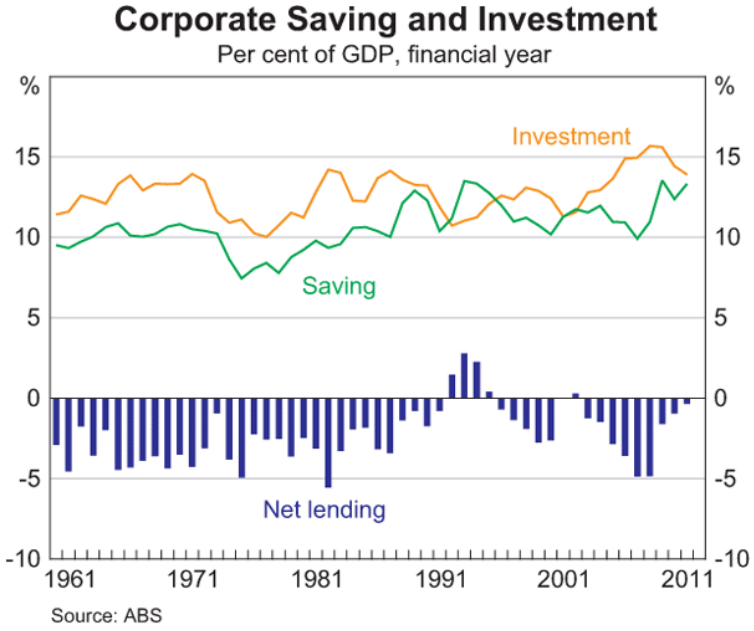
iv. This behaviour is particularly inappropriate in the Australian context.

I do not pretend to have any expertise on the Australian economy. However, there appears to me to be a clear parallel between implications of the AER's methodology and proposals that were made (but, thankfully, subsequently rejected) in relation to regulation of UK companies at the time of MMW's report to a consortium of UK regulators, in the early 2000s. In that report my co-authors and I addressed then-current claims that the cost of equity capital had systematically fallen. We discounted these claims, but noted, that, even if true, there would

[14] In technical terms I am referring here to the "unconditional" mean.

be potentially damaging implications of forcing down regulated companies' profits in line with the lower assumed cost of equities. We noted that *un*regulated companies were at the time earning very high returns, and that any such policy would thus bring about a potentially dangerous asymmetry between profitability in the regulated versus unregulated sectors. We also analysed another dangerous asymmetry, between the costs of over-estimating the cost of capital (which implies too-high profits, and some consequent deadweight losses), and the costs of under-estimating it (which could imply lower investment, or even, in principle, a cessation of operations entirely): we argued that the latter costs were likely to outweigh the former, and thus concluded that there was a particular danger in cutting the assumed cost of capital precipitously.

This, of course, is exactly what the AER is currently doing. Moreover, the parallels with the UK in the early 2000s also appear highly relevant, since these cuts in the assumed cost of capital are being applied at a time when the evidence suggests that the typical Australian corporation is enjoying a period of high (and almost unprecedented) profitability, with returns which are currently almost certainly above their assumed costs of equity. As evidence on both points, the chart below is taken from the Reserve Bank of Australia's *Bulletin*, March 2012 (Graph 8).[15] It shows that corporate saving is currently almost at an all-time high, suggesting very strong returns on capital. Furthermore, investment, whilst it has fallen back from its peak of two years ago, remains at an historically very high level, suggesting very strongly that Australian corporations as a whole continue to see prospective returns well above their cost of capital.



In contrast, the AER's proposed cut in the assumed cost of capital implies that for the companies it regulates, the *return* on capital will be drastically lower. This runs a potentially serious risk that regulated companies will be regarded unfavourably as investment opportunities, compared to the unregulated sector, with the implied risk of under-investment.

[15] Downloaded from http://www.rba.gov.au/publications/bulletin/2012/mar/images/graph-0312-2-08.gif

v. Indirect evidence of a negative relationship between the risk-free rate and the MRP

Whilst point ii) necessarily applies that in my approach (and that of UK regulators), the (estimated) MRP and the risk-free rate must move in opposite directions, this phenomenon cannot be directly observed, since the true MRP is inherently unobservable. However, it *is* possible to point to indirect evidence of this negative correlation, on which there is an increasing body of academic research. I provide here a brief summary of the key features of this indirect evidence:

a) Determinants of the risk-free rate.

It would be uncontentious to note that risk-free rates in any given country are determined by two key factors: a) inflationary vs recessionary risks in that country and b) risk-free rates in other major economies. On the first score, it is fairly evident that in a closed economy risk-free rates, set by the central bank, would move pro-cyclically. In a large, nearly closed economy such as the United States, which still dominates global markets, this has historically been by far the dominant factor influencing risk-free rates. In small open economies like Australia, in contrast, the level of rates in other economies will tend to play a much more important role. Thus, in the current conjuncture, risk-free rates in the US and most major economies are (extremely) low because these economies are depressed, and inflationary risks are perceived as low. To a great extent these low rates have been passed through to Australia, despite its distinctly different cyclical position. Thus risk-free rates are also low in Australia, but because the global economy is depressed, rather than the Australian economy.

b) Determinants of risk premia.

While there are a range of competing models of risk premia, they share a number of common features.

The first is that any given asset pricing model should apply across all asset classes. Thus what determines the risk premium on equities should also determine risk premia on any other asset. Specifically, in the benchmark model of modern finance, there should be a common "stochastic discount factor" that applies to all assets; with risk premia on any given asset being determined by its correlation with the discount factor (or, less technically, by how much systematic risk the asset carries). Thus, information about risk premia on one class of assets (eg bonds) should in principle convey some information about risk premia on another class (eg equities).

A second common feature of asset pricing models is that risk premia in general should reflect two factors: the *quantity* of systematic risk (ie, overall market volatility) and the market *price* of that risk. The period immediately after the crisis saw a sharp rise in volatility; but these movements have in large part unwound, which is a common feature of volatility (technically, time-varying volatility has "low persistence"). However, the market *price* of risk can display considerably greater persistence over time. One very common explanation of this greater persistence is that it reflects some measure of the state of the economy, with a weak economy frequently associated with increased risk aversion. As an example, the chart overleaf is taken from John Cochrane's presidential address to the 2011 American Finance Association,[16]

[16] *Journal of Finance,* Vol LXVI (4), pp 1047-1108

which plots the US "surplus consumption ratio"[17] (which is assumed to be negatively related to risk aversion) relative to a measure of US stock market value, the price/dividend ratio. The chart shows that during the crisis surplus consumption fell sharply, and has remained low – Cochrane points out that the chart shows that this was strongly associated with the fall in stock prices, which he thus attributes primarily to a rise in desired returns in the equity market. Given that at the same time, for reasons given above, the risk-free rate was falling sharply, the implication is that the equity premium was rising all the more sharply. (Of course this is only an *implication* – it does not require any claim that the equity premium can be measured directly.)

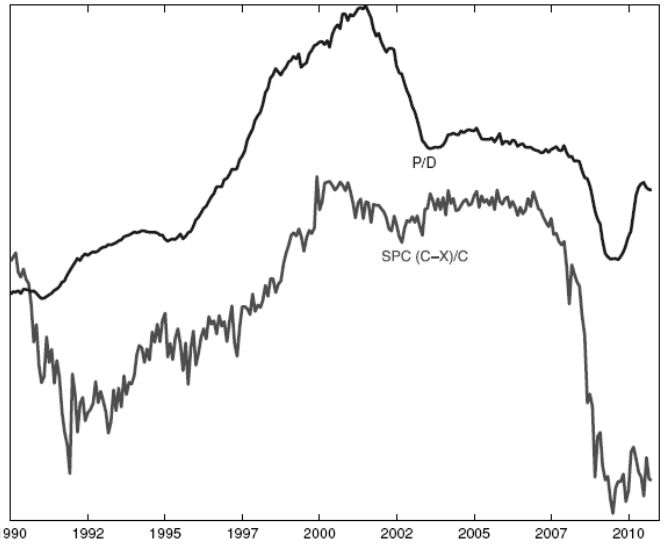


Figure 9. Surplus-consumption ratio and price-dividend ratio. The price-dividend ratio is that of the CRSP NYSE value-weighted portfolio. The surplus consumption is formed from monthly real nondurable consumption using the Campbell and Cochrane (1999) specification and parameters, multiplied by three to fit on the same scale.

c) Evidence of counter-cyclical risk premia in government and corporate bonds

Recent research by Ludvigson and Ng,[18] two highly regarded financial econometricians, provides historical evidence that risk premia on long-dated government bonds have displayed clear counter-cyclical patterns. The chart shown overleaf, taken from their paper, summarises this evidence, showing that there has historically been a strong tendency for risk premia to rise during US recessions (based on NBER data).

[17] This is derived from the "habit formation" model of consumer behaviour, as implemented in Campbell & Cochrane (1999), *Journal of Political Economy*, 107, pp 205-251. It is defined as the gap between actual consumption and some assumed minimum level of consumption – as consumption falls towards this minimum level, measured risk aversion increases. In practice, the implied minimum level is estimated as a slow-moving weighted average of actual consumption.

[18] Ludvigson, S and Ng, S, "Macro Factors in Bond Risk Premia", *Review of Financial Studies*, 2009, pp 5027-5067

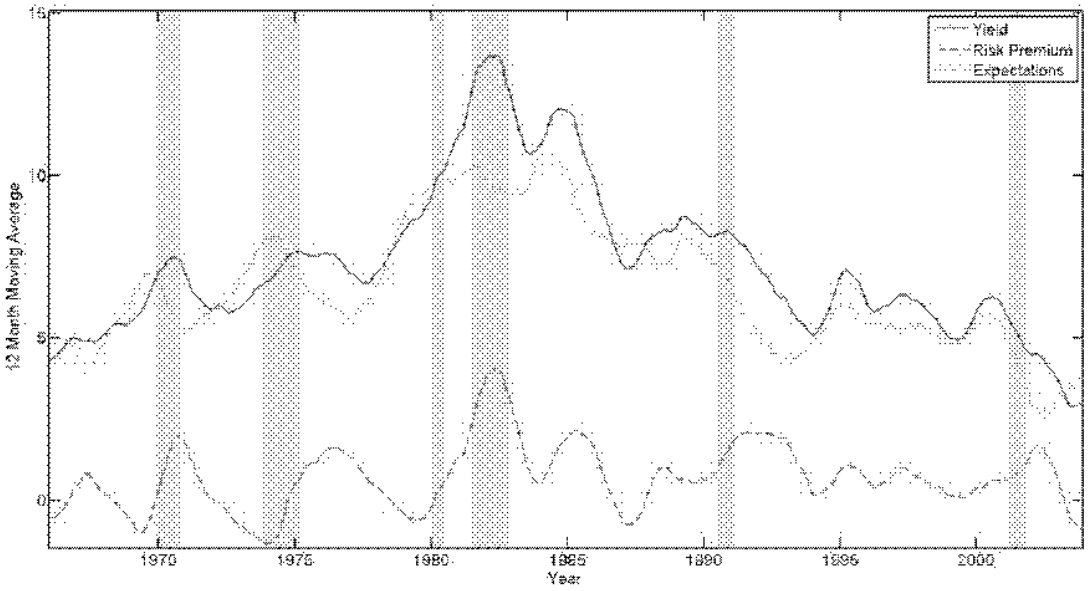


Figure 10
Five-year yield decomposition with factors
Note: Shadings denote months designated as recessions by the National Bureau of Economic Research. The line labeled "Yield" is the yield on the 5-year government bond. The lines labeled "Risk Premium" and "Expectations" are the estimated risk premium and expectations components of the 5-year yield.

There is also a considerable body of evidence suggesting that corporate bond spreads (which are well-known to be counter-cyclical) contain a strong risk premium element (i.e., the fluctuations in the spread cannot be explained by other factors such as default risk, tax differences, or liquidity[19]).

Given the necessary link between risk premia on all asset classes, both of these features of risk premia in other markets suggest strong indirect evidence that the MRP is also likely to be countercyclical. In globally integrated markets, the continuing weakness of the global economy thus makes it probable that the MRP remains at a high level globally.

vi. International evidence and practice is highly relevant.

In a world of internationally integrated capital markets, it would be absurd to assume that Australian companies are only raising capital from domestic investors. The cost of capital faced by Australian companies is set globally. Just as the Australian economy is gaining from falling risk-free rates due to the weak global economy, it can also not be immune to the global determinants of risk premia.

Equally, the comparison with regulatory frameworks outside Australia also appears highly relevant.

vii. The AER's assumptions on the risk-free rate

While I believe that the AER has got it wrong on the (crucially important) cost of equity, I have more, only relatively more minor criticisms of their assumptions on the risk-free rate

[19] See, for example, Elton, E, Gruber, M, Agrawal, D and Mann, C (2001) "Explaining the Rate Spread on Corporate Bonds", *Journal of Finance* LVI, pp 247-278. See also my discussion of this issue in W2.

per se. The risk-free rate is observable (more or less), and to the extent that a regulated company has lower systematic risk than the market, and thus to at least some extent resembles a risk-free asset, this should in principle be taken into account. It is the *combination* of this methodology for the risk-free rate and the assumption of a constant risk-premium that does cause major problems, by introducing instability into the assumed figure for the real cost of equity (as under point iii) above).

In an ideal world, my preference would be for the AER to adopt the approach I have advocated in point i) above, and followed by UK regulators, of assuming a constant real market cost of equity. But if the AER continues to assume a constant MRP based primarily derived from realised returns, a possible compromise approach would be to combine this with an historic average risk-free rate. By construction, the historic average market return is made up of the sum of the historic average risk-free rate and the historic average MRP. Thus if *both* historic average figures were used, this would imply an identical figure for the real market cost of equity as in my preferred approach. For a firm with β equal to one this would also give an identical answer; but even for a firm with β less than one it would result in an outcome that would be markedly superior to what the AER currently proposes. (Note that I discuss this issue in more detail in W2.)

Expert witness declaration

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

Appendix 1. Background on assumptions on key parameters in recent Ofgem decisions

Table A1 summarises the arguments used to support the figures shown in Table 1 in the main text

Price Control	Report	Decision on RFR	Decision on MRP
DPCR4	Ofgem Background info, Mar 04	Real yield for 5, 10, 20 year ILGs 1.65-1.99% (Jan 04). Ofgem recognises that the yields are suppressed by other factors (Minimum funding requirements for pension funds, high equity volatility). Given the considerable uncertainty for the expected RFR, suggests adopting a relatively wide range of 2.25-3%.	Based on historical data, cross checked with estimates from DGM and surveys. Notes CC's comment that the historical estimations are sensitive to the holding period assumed.
	Ofgem Final Proposals, Nov 04	Accepts Mason, Miles and Wright's (2003) view that when there is considerable uncertainty with respect to key inputs (in this case beta (see also Wright, 2004) to the CoE, it would be more appropriate to estimate the aggregate return on equity.	
GDPCR1	Ofgem Final Proposals, Dec 07	As above. Thus the expected return on equity is estimated using long-term averages of the realised market return.	
DPCR5	Ofgem Initial Consultation, Mar 08	As above.	
	Ofgem Final Proposals, Dec 09	Individual components of CAPM estimated. The current 10yr ILGs at below 1% while the 10yr trailing average at below 2%. Ofgem recognises that the rates are depressed due to BoE's QE and demand from pension funds and proposes 2%.	Ofgem saw "no reason to believe that there has been a fundamental departure from the long-term trend in equity risk premium which is generally estimated by academics to be in the 3 to 5 per cent range."
TPCR4 Rollover	Report by Europe Economics, Feb 11	Uses Mason *et al*'s (2003) method of deducting inflation from the nominal yield on medium-term government bond yields, but suggests applying the average RPI forecast of 3.1% instead of the target rate of 2%, for the 1yr period. This yields a range from strongly negative to 1%. Then in accepting BoE's view that the 10yr bond yields are downwards biased by around 100bp due to QE, suggests a range of 1-2%.	Quote both Baskaya *et al*'s (2006) arithmetic ERP range of 4-5%, and Dimson *et al*'s recommendation of 4-5% for the world and the long-term arithmetic figure for the UK of 5.2%, suggesting a range of 4.5-5%.

	Ofgem Final Proposals, Nov 11	Decides to leave the CoE assumption unchanged from the original TPCR4 estimate of total equity return, explaining that whilst the RFR has declined total returns are more stable.	
RIIO-GD1	Report by FTI Consulting, July 12	Cites the RIIO Strategy Decision's estimate of 1.7-2.0% where the lower bound was the 10yr trailing average of 10yr ILGs (Mar 11) and the upper bound was the recent UK regulatory precedents. Notes that since then the ILG real yields have turned negative, but that these are affected by QE and the Eurozone crisis. Thus "a parameter based on the current market data could turn out to inappropriately restrict the allowed returns over the price control period."	Use three methods: the historical stock returns, the implied ERP estimated by the BoE and a survey of recent decisions. The first suggest a small fall, the second a significant rise and the third in line with Ofgem's recent estimates. Therefore suggest either maintaining the current range or consider an increase.
	Ofgem Initial Proposals, July 12	States that "it is appropriate to focus on longer-term estimates for the cost of capital when setting controls for an eight-year period" and suggests 2%.	Points out that it is "appropriate to focus on longer-term estimates … when setting controls for an eight-year period", suggesting 5.25%.

Key to acronyms

RFR: risk free rate, CoE: cost of equity, ILG: index-linked gilt, MFR: minimum funding requirement, BoE: Bank of England, QE: quantitative easing, CC: Competition Commission, DGM: Dividend Growth Model

More detailed descriptions of the estimations of risk free rate and the equity (or market) risk premium in the surveyed price control reviews are given below:

DPCR4

March 2004 report on the background information on the cost of capital[20]

For risk-free rate, DPCR3's range adopted by Ofgem was 2.25-2.75%. Ofgem recognise that the real yield for 5, 10 and 20yr index-linked gilts had fallen from 2.3%, 2.3% and 2.2% in June 2002 to 1.65%, 1.92% and 1.99% in January 2004. In its consultation, NERA estimated that the current real risk-free rate was 2.6% as opposed to 3.1% using historic time series. However NERA argued that "the low current real risk-free rate corresponds to the current

[20] Ofgem, *Electricity Distribution Price Control Review: Background information on the cost of capital*, March 2004

high equity market volatility, whereas the higher historic rate is consistent with a lower level of expected market volatility than currently observed." (p.11-12) Ofgem recognise that the UK yield curve was affected by "institutional factors such as minimum funding requirements (MFR) for pension funds and the health of public finances (resulting in low supply of government bonds)", (p.12) and together with the high volatility in the equity market, this has led to suppressing bond yields. Further notes that "the cost of capital is very sensitive to the risk-free rate with the risk-free rate being an important input both in the cost of debt and the cost of equity. Given this sensitivity and given the considerable uncertainty surrounding the *expected* risk-free rate, it seems appropriate to adopt a cautious approach and hence a relatively wide range at this stage." (p.13) Hence proposes a range of 2.25-3.00%.

The estimate of MRP (or ERP) is based mainly on the historical data, including: Wright's (2004) aggregate market return estimates of 4-8% (geometric) and 6-10% (arithmetic); Ofwat refer to CEPA/EE's[21] estimates of 3.5-5.0%; Dimson *et al.*[22] figures of geometric ERPs of 2.3% (UK), 4.0% (US) and 2.9% (world), and arithmetic ERPs of 3.6%, 5.3% and 3.9% respectively. Ofgem note that Competition Commission point out that the ERP historical estimations are sensitive to the holding period assumed, with estimates ranging from 0.4% to 6.8% relative to gilts for different periods in the last century.[23] Figures are cross checked with estimates from Dividend Growth Model and surveys, though both CC and Ofgem consider the "robustness of survey data ... to be an issue" (Ofgem). With the exception of Ofwat, all estimate the ERP range to be 2.5-4.5% (real), while Ofwat adopt a higher range of 4-5%. Outcome: range of 2.5-4.5%, with the final rate of 4.5%.

Final Proposals, November 2004[24]

Ofgem cite Wright's (2004) report (cited above) on beta estimates for a range of companies in the electricity and water sectors, where they found "strong evidence of parameter instability for several of the companies." (p.105) They also adopt the Wright, Mason and Miles (2003) view that, "in situations where there is considerable uncertainty with respect to the key inputs to the cost of equity, an aggregate return on equity approach might be more appropriate." (p.106) This was then estimated by considering historical averages in a wide range of markets, including Wright *et al*'s estimation of "around 5.5% (geometric average), and thus 6.5% to 7.5% (arithmetic average)". (p.106) Outcome: post-tax real cost of equity of 7.5%.

GDPCR1

Final Proposals, December 2007[25]

Ofgem proposed to "continue our approach of basing the allowed rate of return on equity on the estimated equilibrium level of total market returns, as in TPCR and DPCR4." (p.105) The real rate of return on equity was therefore estimated taking into considerations of empirical

[21] Cambridge Economic Policy Associates / Europe Economics
[22] Dimson, Marsh and Staunton (2002), "Global evidence on the equity risk premium", unpublished
[23] Competition Commission, "BAA plc: A report on the economic regulation of the London airports companies (Heathrow Airport Ltd, Gatwick Airport Ltd and Stansted Airport Ltd)", 29 November 2002
[24] Ofgem, *Electricity Distribution Price Control Review: Final Proposals*, November 2004
[25] Ofgem, *Gas Distribution Price Control Review: Final Proposals*, 3 December 2007

data, and the effect of the assumption of a higher gearing (which can be argued to lead to a higher rate of equity return). Outcome: post-tax cost of equity of 7.25%. Note RIIO-GD1 (July 2012) reports that the suggested rates used in GDPCR1 were 2.5% for risk-free rate and 4.75% for ERP, with the beta of 1.0.

DPCR5

Initial Consultation, March 2008[26]

Due to "the difficulty of assessing a stable beta over the long term for utility networks in general", and in fact the difficulty in finding evidence of betas for distribution networks operators "due to the lack of publicly listed stand-alone DNOs in the UK", the aggregate returns approach based on very long-term average rates has again been proposed for the cost of equity estimate. (p.74) The reference "very long-term average rates of returns" quoted to be 6.5 to 7.5%.

Final Proposals, December 2009[27]

For the Final Proposals, Ofgem provide individual estimations for the risk-free rate, the beta and the MRP (ERP). For risk-free rate they state that, "In coming to our judgement on the appropriate risk free rate we have largely considered the movement in index linked gilts." They note that the current 10 year index linked gilts was below 1% and the 10 year trailing average was below 2%. However, "we have listened to the arguments that the rates on index linked gilts are currently depressed due to the impact of the Bank of England's Quantitative Easing programme and demand from pension funds" and propose a rate of 2%. (p.52) For MRP they state, "We recognise that the recovery from recession will not be straightforward or entirely predictable but we see no reason to believe that there has been a fundamental departure from the long-term trend in equity risk premium which is generally estimated by academics to be in the 3 to 5 per cent range." (p.53)

TPCR4 Rollover

Phase 2 Final Report by Europe Economics, February 2011[28]

In reviewing a number of key regulatory decisions since 2006, including the London Airports (2007), Ofwat (2009), OpenReach (2009) and the Competition Commissions' judgement on the Bristol Water case (2010), the authors note that "risk-free rate judgements have tended to fall over time, from figures of 2-2.5 per cent in 2005/6 (as per the TPCR4 decision) to figures closer to 1-2 per cent today". (p.2) In contrast they note that the equity risk premium judgements have tended to rise, from around 4.5 per cent (TPCR4) to figures around 5 per cent. The report states that the risk free rate estimate of 2.5% for TPCR4 was derived using the Baskaya, Hori, Mason, Satchell and Wright's (2006)[29] argument that "the best current

[26]Ofgem, *Electricity Distribution Price Control Review: Initial consultation document*, 28 March 2008
[27]Ofgem, *Electricity Distribution Price Control Review: Final Proposals*, 7 December 2009
[28] Europe Economics, *Updating the Cost of Capital for the Transmission Price Control Rollover: Phase 2 Final Report*, 8 February 2011
[29] Baskaya, M., Hori, K., Mason, R., Satchell S. and Wright, S. (2006), *Report on the Cost of Capital provided to Ofgem*

market-based estimate of the forward looking risk free rate was the nominal yield on medium-term government bonds less the Bank of England's inflation target of 2 per cent." They note that since then there have been two significant market developments: (i) significant reduction in bond yields of all maturities, and (ii) considerable spread in the yields across maturities. They also note that the average forecast of Retail Price Index over 2011-2014 was 3.1%. The authors argue that whilst "assuming an inflation rate equivalent to the target rate of 2 per cent may be a perfectly valid approach when considering longer term time periods", "applying this rate to a one year roll over in the context of sustained above target inflation rates would be a considerably less appropriate approach to adopt." (p.6) Then deflating the nominal bonds yields by the average RPI forecast yields an estimate range for risk free rate from strongly negative to around 1%. However the authors also note that "ten year government bonds are likely to be downwards biased by around 100 basis points by quantitative easing (as estimated by the Bank of England)". (p.9) Allowing for this would suggest a spot rate of around 1.5%; the preferred range is suggested as 1-2%.

For ERP the authors quote both Baskaya *et al*'s (2006) arithmetic ERP range of 4-5%, and Dimson *et al*'s recommendation of 4-5% for the world[30] and the long-term arithmetic figure for the UK for 1900-2009 of 5.2%,[31] suggesting a range of 4.5-5%.

Final Proposals, November 2011[32]

In the Final Proposals Ofgem decides to leave the cost of equity assumption unchanged from the TPCR4 estimate, adhering to their argument in the Initial Proposals that "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." (p.37)

RIIO-GD1

Cost of Capital Study by FTI Consulting, July 2012[33]

FTI Consulting was asked to provide advice to Ofgem on the cost of capital for electricity and gas transmission companies and gas distribution companies under the RIIO price controls. They note that RIIO Strategy Decision[34] originally estimated the range of risk free rate to be 1.7-2.0%, where the lower bound was the 10-year trailing average yield on 10-year index linked gilts in March 2011, while the upper bound was based on recent regulatory precedent in the UK. (p.28) However they observe that "there have been material movements in the real risk free rate (based on the yields of Index Linked Gilts ("ILGs")) and the market implied ERP (based on analysis by the Bank of England)." Specifically, "yields on ILGs have decreased significantly since the RIIO Strategy Decision and are currently negative in real terms", while "market implied estimates of the ERP have increased significantly from around 5% in March 2011 to around 7%". (p.10) They note that "there are a number of factors that

[30] Dimson, Marsh and Staunton, "Credit Suisse Global Investment Returns Sourcebook 2010", Credit Suisse Research Institute (p.34)
[31] Dimson, Marsh and Staunton, "Credit Suisse Global Investment Returns Sourcebook 2010", Credit Suisse Research Institute (p.158)
[32] Ofgem, *TPCR4 Rollover: Final Proposals*, 28 November 2011
[33] FTI Consulting, *Cost of capital study for the RIIO-T1 and GD1 price controls*, 24 July 2012
[34] Ofgem, *Decision on strategy for the next gas distribution price control – RIIO-GD1*, 31 March 2011

are likely to have affected the yields on ILGs since March 2011, including the UK's monetary policy (which has recently seen several rounds of quantitative easing), and the ongoing sovereign debt crisis in the Eurozone. The current uncertainty in the capital markets makes it very difficult to assess how yields will change over the upcoming price control period." (p.30) However they argue that "there is also significant uncertainty over the way in which market conditions will develop through to the final proposals", and therefore "it may be premature to make any revisions to Ofgem's assessment of the cost of equity, based on data that could turn out to be unduly influenced by short term fluctuations." (p.10) In particular, "there is a material risk that a parameter estimate based on current market data (which may place undue weight on low/negative real returns that may not persist in the future) could turn out to inappropriately restrict the allowed returns to the network companies over the price control period." (p.33) The authors' recommendation is then that Ofgem "reviews the latest available data in the period up to final proposals to ensure that its final determination does not differ materially from rates in the capital markets." (p.33)

For the ERP the authors consider three methods: the historical stock returns, the implied ERP estimated by the Bank of England and a survey of recent decisions. For the first they refer to Dimson *et al*'s latest report[35] which suggests that the 1900-2011 average return has dropped from its previous report (1900-2010), from 3.9% to 3.6% (geometric) and from 5.2% to 5.0% (arithmetic). However they "consider that the decline in the historical ERP estimated by DMS represents unusual market conditions in 2011, and so would not represent a meaningful update to Ofgem's analysis." (p.35) For the second they note that the Bank of England's market implied ERP (based on its own analysis using a multi-stage DGM) shows a significant increase from 5% in December 2010 to 7% in December 2011 for the FTSE All-Share index. Finally for the survey they observe that the range of ERP estimates used have been 4.4-5%. Given these they suggest that "Ofgem should either maintain its current range for the ERP or update it to reflect the recent increases in the market implie ERP." (p.39) They do also stress that, "Given the evidence that, over the long-run, the market return on equity appears to be relatively stable given the variability in the ERP and risk-free rate any updates to the ERP should be considered alongside movements in the risk-free rate." (p.39)

Initial Proposals, July 2012[36]

Ofgem state, "We consider that it is appropriate to focus on longer-term estimates for the cost of capital when setting controls for an eight-year period. The long-term evidence supports an assumption of 2 per cent risk-free rate and 5.25 per cent market or equity risk premium." (p.37) The risk-free rate estimate is less than the 2.5% estimate in GDPCR1 (2007), but is at the top of the range of 1.7-2.0% proposed in the March 2011 Strategy Document.

[35] Dimson, Marsh and Staunton, "Credit Suisse Global Investment Returns Sourcebook 2012", Credit Suisse Research Institute, Table 66.
[36] Ofgem, *RIIO-GD1: Initial Proposals – Overview*, 27 July 2012

Appendix 2. Background on assumptions on key parameters in recent CC decisions

Table A2 summarises the arguments used to support the figures shown in Table 2 in the main text

Report	Decision on RFR	Decision on MRP
Stansted	CC view that the long-dated ILGs are depressed and so are an unreliable indicator of the RFR. Thus CC look at shorter ILGs which are 2.05 / 1.81 / 1.33% for spot 3 / 5 / 10yr ILGs (12 Sep 2008) with 20 days averages of 1.67 / 1.48 / 1.09%, and decides on 2.0%.	CC stresse that MRP must be estimated in conjunction with the RFR. Thus CC estimate the aggregate R_m using both historical and forward-looking models to conclude on the range 5.0-7.0%, stating that R_m has been stable (or "if anything, increased slightly") despite the fall in RFR.
Bristol Waters	CC recognise that the longer-dated ILGs yields are still distorted, but also the shorter-dated yields are also "affected by action by the authorities to address the credit crunch and recession and are less relevant to estimating the RFR." Thus CC decide on the range 1-2%, noting that "the lower end of this range is well above current short-term real interest rate (which are negative)".	CC stresse that "the correct way to think about the CAPM was by starting with estimates of the market return and RFR." Using the 110 year historical data the average market return is around 6-7% (for both UK and world markets). Other methodologies investigated give similar estimates. Thus CC settle on a range 5-7% for the market return, or 4-5% for MRP.

Key to acronyms

RFR: risk free rate, ILG: index-linked gilt

More detailed descriptions of the estimations of risk free rate and the equity (or market) risk premium in the surveyed reports are given below:

Stansted Q5 Price Control Review

<u>October 2008 report presented to the Civil Aviation Authority</u>

CC stress that "there is no mechanistic way of interpreting the data and we are required to exercise a degree of judgement in selecting a precise value of the RFR." (p95) CC mainly base its estimation of risk free rate on the Index-Linked Gilts (ILGs), stating that, "because these securities have negligible default risk and relatively insignificant inflation risk, the yields at which the gilts are currently trading should be a reliable measure of the return that investors require in exchange for holding a risk-free assert." (p94) However they note that "a number of observers, including the Bank of England, have suggested that the market for ILGs is segmented, with different investors buying different types of assets." (p95) Further they state, "a number of observers believe that strong demand from this one specific type of investor [pension funds] has pushed down the yields of long-dated ILGs to the point where

the returns that were on offer were attractive only to other pension funds. This is said to make the long-dated ILG yields an unreliable indicator of the risk-free rate for a typical equity investor and, in particular, for the marginal shareholder whose cost of capital we were trying to measure when estimating the rate of return that Stansted needs to earn." (Appendix L11) Rather than considering a different asset (for example interest rate swaps, as suggested by NERA), CC's preference is to consider the yields on shorter maturity ILGs, citing that their "reading of forward rates and implied inflation gave us less reason to question pricing at the short end of the market." (L15) As a result where spot rates for 3 / 5 / 10yr ILGs are 2.05 / 1.81 / 1.33% (12 Sep 2008) and their 20 days averages at 1.67 / 1.48 / 1.09%, CC decide that "our judgement, at this time, is that the RFR in recent years has been approximately 2.0 per cent, and that this rate would be an appropriate assumption to use for the rest of Q5." (p95)

For the ERP, CC stress that its estimate must be in conjunction with the estimate of the risk-free rate. They state that "this particular aspect of our calculation attracted more comment and criticism than any other part of our 2007 cost of capital analysis … Some of these comments seemed to us to have been based on a misunderstanding of the underlying approach in that they focused on the equity-risk premium in isolation, without recognizing that the risk-free rate and equity-risk premium estimates need to be combined together in order to see the R_m estimate that goes into the CAPM calculation." (L17) Their belief is, "in the context of this review, that the R_m term in CAPM is unlikely to have been affected significantly by short-term changes in the risk-free rate. … the expected return on the market has, if anything, increased slightly during the last 12 months at a time when the expected return on risk-free assets has fallen. It would be illogical for us to have retained our previous range for the equity-risk premium in the absence of any reason to believe that a lower risk-free rate had translated into a lower cost of equity." (L19) Their conclusion is that, "the expected return on the market portfolio continues to be broadly in the range of 5.0 to 7.0 per cent. Support for the top end of the range can be found in studies that look at long-term historical data, especially when arithmetic averages are used. Support for the bottom end of the range comes from work that uses more recent market data, forward-looking models and/or geometric averages." (p96)

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As with the Stansted review, CC view that the long-term ILGs were still affected by distortions, and therefore reach their judgement on RFR on the basis of medium and shorter-dated ILGs. However, they also note that "at present, shorter-dated index-linked yields are affected by action by the authorities to address the credit crunch and recession and are less relevant to estimating the RFR," (App N19) and that "the RFR may be higher than current gilt yields, which are negative at the short end of the maturity curve." (N20) Thus, while the "current index-linked yields are about 1 per cent … we considered that a range of 1 to 2 per cent for the risk-free rate was appropriate," (p65) recognising that "the lower end of this range is well above current short-term real interest rates (which are negative)". (App N20)

For the ERP, using the average returns over the last 110 years, CC's estimation "suggests an average market return of around 6 to 7 per cent (for both world and UK markets)", implying "an average ERP over Treasury Bills of about 5 to 6 per cent." (N22) Other estimation methodologies investigated include Fama and French's method "to estimate the underlying

return from the sum of average dividend yield and the average rate of dividend growth", which using the full run of UK historical suggests "an underlying return of 5.5 per cent and an ERP over Treasury Bills of 4.4 per cent" (N22), and the Dividend Growth Model suggested by the *Bank of England Quarterly Bulletin*, which suggests a rate around 6.5%. (N24) However CC recognises the problem associated with the DGM of the arbitrariness of its estimation of the dividend growth rate. CC express their reservation for the independent estimation of ERP, stating that "Ofwat said that it was sympathetic to the view that the correct way to think about the CAPM was by starting with estimates of the market return and RFR." (N26) The final decision is a range of 5-7% for the market return, arriving at a range of 4-5% for ERP. Finally they state "as regards the credit crunch, it is important to take into account any downward effect on the RFR as well as any upward effect on the risk premium." (N27)

Appendix 3. AER's methodology in estimating the market risk premium

According to their August 2012 report[37] AER state that they take into account the following evidence when estimating the market risk premium:

- Long-term historical excess returns of 4.9-6.1% (arithmetic) and 3.0-4.7% (geometric), which have been adjusted to incorporate a value for distribution imputation credits (theta) of 0.35.
- Survey based estimates – claimed to be around 6%.
- Dividend Growth Model based estimates – used for cross-check.
- Consultant advice by Professors McKenzie and Partington, University of Sydney.
- Recent practice among Australian regulators.
- Recent Australian Competition Tribunal decisions.

The historical excess returns used for estimation are the realised stock returns over 10 year government bond rate. This is given by Handley (2012)[38], a report prepared for AER. More specifically,

- Stock returns – daily closing values of the All Ordinaries Accumulation Index from the Australian Stock Exchange.
- Bond returns – daily yields on 10yr Commonwealth Government treasury bonds.

The resulting estimates are:

Sampling Period	Arithmetic Mean	Geometric Mean
1883-2011	6.1	4.7
1937-2011	5.7	3.7
1958-2011	6.1	3.5
1980-2011	5.7	3.1
1988-2011	4.9	3.0

The AER "considers that there is no one sampling period that is to be preferred, since each period has a number of strength but at least one weakness. For this reason, the AER consider that all five sampling periods are relevant." (p.69) Together with estimates from other evidence listed above, the AER "remains of the view that the available evidence supports an MRP of 6.0 per cent as the best estimate in the circumstances and commensurate with prevailing conditions in the market for funds." (p.66)

[37] AER, *APT Petroleum Pipeline Pty Ltd, Access arrangement final decision: Roma to Brisbane Pipeline, 2012-13 to 2016-17: Final Decision*, August 2012
[38] Handley, J. C., "Historical equity risk premium to 2011" (April 2012)

STEPHEN WRIGHT: CURRICULUM VITAE

Name:	Stephen Hurst Wright	
Nationality:	UK	
E-Mail	s.wright@bbk.ac.uk	
University Education:	1983-1986	Mature student at Clare College, Cambridge (1st Class Honours, Parts 1 and 2, Economics Tripos; Adam Smith Prize)
Employment:	October 2001 to date	Department of Economics, Birkbeck College, University of London (Lecturer from October 2001, Senior Lecturer from October 2005; Reader from October 2006, Professor from October 2011)
	October 1991 to September 2001	Faculty of Economics and Politics, University of Cambridge (Senior Teaching Associate from October1991; Assistant Director of Research from October 1995; Senior Research associate from October 2000)
	October 1986 to August 1991	Staff Economist, Bank of England. From 1990 to 1991 I led the team responsible for the Bank's macroeconomic modelling and forecasting activities.
Consultancy	January 2000 to April 2004	Director, Smithers & Co, Ltd
	1991-1999; 2004 to date	Part-time consultant, Smithers & Co, Ltd

Research Interests

Theoretical and empirical investigations of key macroeconomic and financial relationships, with a particular focus on stock market valuation and rates of return.

Research Awards

In reverse chronological order

1. Project on the Indian Growth Turnaround (with Chetan Ghate, Indian Statistical Institute) commissioned by the Policy and Planning Research Unit, Planning Commission, Government of India, March 2007 - March 2009 (240,000 Rupees)

2. Project on the cost of capital for regulated industry in the UK, commissioned by Ofgem, (with Robin Mason, Ken Hori and Meltem Baskaya, Birkbeck, and Stephen Satchell, Cambridge), completed September 2006, (£40,000)

3. Project on the cost of capital commissioned by a consortium of UK regulators (with Robin Mason, University of Southampton, and David Miles, Imperial College), completed February 2003, (£35,000)

4. DAE Consultancy Project on Cyclical Indicators and Monthly GDP, awarded jointly by Central Statistical Office and H M Treasury, completed February 1995, (with Martin Weale and Richard Smith) (c. £40,000) (The methodology developed led to the regular production of monthly GDP figures by the National Institute of Economic and Social Research, and to a publication in the *Economic Journal* (see below))

5. University of Cambridge Department of Economics (DAE) Consultancy Project on Measurement of Output of Financial Services, awarded by Central Statistical Office April 1992, completed April 1993 (with Martin Weale and Iain Begg) (c. £40,000)

Outside Activities

I have had a long-standing connection with Smithers & Co, a highly respected research company that provides economics-based advice on international asset allocation to over 100 clients based mainly in Boston, London, New York and Tokyo. My work with them has been regularly cited in the *Economist*, the *Financial Times*, *Barron's*, etc, and has also received considerably attention in the academic world (particularly since the publication of *Valuing Wall Street* (see below), co-authored with Andrew Smithers). While my contributions to their research have been more infrequent in recent years, I still produce occasional reports, and also, with Andrew Smithers, run regular teaching sessions for fund managers on the fundamentals of stock market valuation

In recent years I have provided advice and research to, *inter alia*, the Civil Aviation Authority, Ofgem, NERA Economic Consultants and Frontier Economics. This has been mainly on issues related to the cost of capital for regulated industries , following on from my 2003 study, co-authored with Robin Mason and David Miles. In August 2006 I was again lead investigator on a major research project for Ofgem, with Robin Mason, Ken Hori (Birkbeck) and Steve Satchell (Cambridge and Birkbeck). Both of these studies are widely cited in discussions of cost of capital regulation.

I teach a regular two day course on finance to government economists at H M Treasury. This has recently been adopted as an official course by the Government Economic Service, and is taught under the aegis of the National School of Government.

Teaching and Administrative Responsibilities at Birkbeck

I am Director of the Graduate Diploma Programmes in Economics and in Finance. These are primarily intended as preparatory programmes for students hoping to proceed to one of our MScs, who do not have prior training in economics or finance. On successful completion of the programme (taken over one or two years), our students (all of whom are part-time) can compete with those who have done economics in a full-time undergraduate degree. Given that we have around 120 students on all of our Diploma programmes this means that we are producing as many good-quality students as emerge from many respected UK undergraduate programmes. As well as proceeding on to our own MScs, our best students also go on to respected MSc programmes elsewhere (in recent years we have sent students to Cambridge, LSE, Imperial, Oxford, etc).

My recent teaching at Birkbeck:

- Microeconomics (Graduate Diplomas in Economics and in Finance);
- Introduction to Mathematical Finance (Graduate Diplomas in Finance and in Financial Engineering).
- Macroeconomics(Graduate Diploma in Economics)
- Introduction to Finance (MSc Finance/MSc Financial Engineering)

Stephen Wright: Research Output (all categories in reverse chronological order)

A Publications in Refereed Journals

1. "The "V-Factor": Distribution, Timing and Correlates of the Great Indian Growth Turnaround" (with Chetan Ghate) *Journal of Development Economics*, vol. 99 (2012) pp 58–67

2. "Invertible and Non-Invertible Information Sets in Linear Rational Expectations Models" (with Brad Baxter and Liam Graham), *Journal of Economic Dynamics and Control*, vol. 35(3) (2011) pages 295-311

3. "Information, Heterogeneity and Market Incompleteness" (with Liam Graham) *Journal of Monetary Economics*, 57 (2010) 164–174

4. "Miller & Modigliani, Predictive Return Regressions and Cointegration" (with Piergiorgio Alessandri and Donald Robertson), *Oxford Bulletin of Economics and Statistics*, 70, 2 (2008) pp 181-207

5. "Nominal Debt Dynamics and Monetary Policy" (with Liam Graham), *Berkeley Papers in Macroeconomics* (Contributions to Macroeconomics) January 2007.

6. "Permanent *vs* Transitory Components and Economic Fundamentals" (with Tony Garratt and Donald Robertson) *Journal of Applied Econometrics* May/June 2006 21 (4) 521-542

7. "Dividends, Total Cashflows to Shareholders and Predictive Return Regressions" (with Donald Robertson) *Review of Economics and Statistics* February 2006, Vol. 88, No. 1: 91-99

8. "Modelling nominal debt contracts and fixed rate debt" (with Liam Graham) *Economics Letters* Vol 88 No 1, July 2005.

9. "An Indicator of Monthly GDP and an Early Estimate of Quarterly GDP Growth" (with James Mitchell, Richard Smith, Martin Weale and Eduardo Salazar), *Economic Journal* 115 (501) February 2005

10. "Measures of Stock Market Value and Returns for the US Nonfinancial Corporate Sector, 1900-2002" *Review of Income and Wealth*, 50 (4) pp 561-584 (December 2004)

11. "Monetary Stabilisation with Nominal Asymmetries" *Economic Journal* January 2004

12. "Stock Markets and Central Bankers: The Economic Consequences of Alan Greenspan (with Andrew Smithers) *World Economics*, Vol 3 No 1, January 2002.

13. "Monetary Policy, Nominal Interest Rates and Long-Horizon Inflation Uncertainty" *Scottish Journal of Political Economy*, Vol. 40, No. 1, February 2002

14. "The Effects of Uncertainty on Optimal Consumption", (with Robin Mason) *Journal of Economic Dynamics and Control* 25 (2001) 185-212

15. "A Monthly Indicator of GDP" (with Eduardo Salazar, Richard Smith & Martin Weale) National Institute of Economic and Social Research *Economic Review* No. 161, July 1997

16. "Financial Intermediation Services Indirectly Measured: Estimates for France and the UK based on the Approach adopted in the 1993 SNA" (with Iain Begg, Jacques Bournay, Martin Weale) *Review of Income and Wealth*, Series 42, No. 4, December 1996

17. "How to make money in the bond market: international evidence of inefficiency, and what it suggests about the way markets view monetary policy" *The Manchester School* Vol LXIII, June 1995

18. "Measuring the contribution of financial institutions to Gross Domestic Product". *Economic Trends* no. 475, May 1993, pp 146-157, (with Martin Weale and Iain Begg)

19. "Equilibrium Real Exchange Rates" *The Manchester School*, Vol LX, June 1992, pp 63-84

B Books

20. *Valuing Wall Street* (with Andrew Smithers) McGraw-Hill, May 2000 ISBN 0-07-135461-1

C Other Publications

21. "India's Growth Turnaround" (with Chetan Ghate and Tatiana Fic), in *The Concise Oxford Companion to Economics in India*, Oxford University Press, February 2010

22. "Report on the Cost of Capital" (with Robin Mason, Meltem Baskaya, Ken Hori and Steve Satchell), September 2006 (http://www.ofgem.gov.uk)

23. "Beta Estimates and Bond Spread Analysis" September 2005 (http://www.ofgem.gov.uk)

24. "Beta Estimates", March 2004 (http://www.ofgem.gov.uk)

25. "Stock Market Valuation" (with Andrew Smithers), *Practical Investor's Journal* March 2004

26. "A Study into Certain Aspects of the Cost of Capital for Regulated Industries in the UK" (with Robin Mason and David Miles), February 2003 (http://www.oftel.gov.uk/publications)

D. Under Review

27. "The Predictive Space: If **x** predicts *y* what does *y* tell us about **x**? (with Donald Robertson, University of Cambridge) October 2012, submitted to *Journal of Econometrics*

28. "Labour's Record on Financial Regulation" (with Arup Daripa and Sandeep Kapur, Birkbeck) October 2012, to be published in *Oxford Review of Economic Policy*, January 2013

29. "Why was the participation of Indian states in the Growth Turnaround so patchy? Some evidence based on robustness analysis" (with Chetan Ghate, Indian Statistical Institute, Delhi) September 2012, submitted to *Economic and Political Weekly*

E Academic Papers in Progress

30. "Non-Uniqueness of Deep Parameters and Shocks in Estimated DSGE Models: a Health Warning" September 2012

31. "Stambaugh Correlations, Monkey Econometricians and Redundant Predictors" (with Donald Robertson, University of Cambridge), August 2011

32. "The Limits to Stock Return Predictability" (with Donald Robertson) September 2009

F Selected Smithers & Co Publications (www.smithers.co.uk)

33. "Borrowing to Invest in Stocks" (with Andrew Smithers) Report no. 309, June 2008

34. "Are Prospective Equity Returns Independent from Current Bond Yields?" (with Andrew Smithers) Report no. 308, May 2008

35. "An Agnostic Approach to Stock Market Prediction" (with Andrew Smithers), Report No. 301, 18th December, 2007

36. "Is Japan Inc. Bust?" (with Andrew Smithers), Report no. 201, August 2003

37. "The Real Bear Market Hasn't Happened Yet" (with Andrew Smithers), Report no. 199, July 2003

38. "Is it time to buy Wall Street?" (with Andrew Smithers) Report no. 189, January 2003

39. "Will the Real US P/E Please Stand Up?" (with Andrew Smithers) Report no. 174, February 2002

40. "Value, Market Efficiency and Intangibles (with Andrew Smithers & Derry Pickford) Report no 167, October 2001

41. "Economists and Value: Academic Perspectives on Wall Street." (with Andrew Smithers & Derry Pickford) Report no 162, May 2001

42. "`*q*-riouser and *q*-riouser …': The Latest q Data" (with Andrew Smithers) Report no. 149, August 2000

43. "The Equity Risk Premium, or Believing Six Nearly Impossible Things Before Breakfast" (with Andrew Smithers and Derry Pickford) Report no. 145, May 2000

44. "*q* and the Probability of Losses on Wall Street" (with Andrew Smithers and Donald Robertson) Report no 116, March 1998

45. "Stock Options: An Example of Catastrophe Myopia?" (with Andrew Smithers) Report no 110, October 1997

46. "The *q* Debate and the Anti-*q*ues" (with Andrew Smithers) Report no. 99, January 1997

47. "Japan's *q* Ratio and its Inefficient Use of Corporate Capital" (with Andrew Smithers), Report no. 98 January 1997

48. “Lessons from the Great Wall Street Bubbles” (With Andrew Smithers) Report no. 89, May 1996

F Other Papers

49. “Tobin’s Q and Intangible Assets”, April 2006

50. “Tobin's Q, Asymmetric Information and Aggregate Stock Market Valuations" February 2005 (with Donald Robertson)

51. “What does *q* predict?” (with Donald Robertson) May 2002

52. “The Good News and the Bad News about Long-Run Stock Returns (with Donald Robertson) April 2002

53. “Monetary Stabilisation with Nominal Asymmetries: An Extended Model with Endogenous Labour Supply”, January 2001

54. “Inflación, Crecimiento y la Politica Monetaria: Un Modelo de la Macroeconomia Guatemalteca” (Inflation, Growth and Monetary Policy, a Model of the Guatemalan Macroeconomy) (Report to ASIES, Guatemala City, March 1998)

55. “A Monthly Indicator of GDP” (with Eduardo Salazar, Richard Smith & Martin Weale), National Institute of Economic and Social Research *Discussion Paper* no 127, December 1997.

56. “Forecasting the Bond Market”, Department of Applied Economics *Working Paper* no 9515, May 1995 (extended version of paper in *Manchester School* June 1995)

57. “Leading Indicators of UK Output” (with Eduardo Salazar, Richard Smith and Martin Weale), presented to Royal Economic Society Annual Conference and HM Treasury Academic Panel, April 1995.

58. "Monthly National Accounts" (with Eduardo Salazar, Richard Smith and Martin Weale), presented to HM Treasury Academic Panel, 17 June 1994.

59. “The Phillips Curve in empirical macro-models of the world economy” (with James Sefton), National Institute of Economic and Social Research *Discussion Paper* no 64, April 1994.

60. "Measures of real effective exchange rates" Department of Applied Economics *Working Paper* no. 9316, May 1993

61. "The Bank of England Model 1989: recent developments and simulation properties", with F Breedon and A J Murfin, Bank of England *Technical Paper* no. 29, May 1990.