March 2009

The Cost of Capital for Dublin Airport

A Report for Dublin Airport Authority

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Confidential

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Executive Summary

In September 2009 the Commission for Aviation Regulation (CAR) will set a cap on average revenue per passenger at Dublin Airport that may be charged by Dublin Airport Authority (DAA) for the next price control period, commencing in 2010. An important component of this review is the cost of capital. NERA has been commissioned by DAA to prepare a report on the cost of capital for Dublin Airport as an input to the upcoming price control review.

This report presents our analysis of the cost of capital and our best estimate of the cost of capital at this time. In preparing this report we have reviewed a wide range of data and evidence and consulted extensively with DAA. The key conclusions of this report based on the available data at this time are:

- Dublin Airport's (post-tax) cost of equity lies in the range of 10.0-12.5%, reflecting uncertainty around the risk-free rate and the asset beta;
- We calculate a cost of debt for Dublin Airport by weighting historic benchmark yields and forward-looking costs of debt according to the proportions of historic and new debt required over the regulatory period. Using this approach, our overall estimate of the real cost of debt for Dublin Airport is 4.6%. This takes into account:
  - The cost of new debt to Dublin Airport has increased sharply during the credit crisis. We estimate a forward-looking cost of debt of 5.7% that should be allowed for any new or re-financed debt.
  - For debt that will be retained over the next review period the appropriate allowance is 4.3% based on historic benchmark debt costs.
- The appropriate pre-tax WACC for Dublin Airport is 8.0-9.4% based on available data at this time. We do not conclude on a "point" estimate of the cost of capital at this time due to the ongoing volatility in financial markets. We recommend revisiting these estimates closer to the price determination;
- The cost of capital for Dublin Airport should be estimated, and tests of financial viability should be performed, on the assumption of an A / A2 credit rating. Assuming a lower investment grade rating would not ensure continued access to capital markets in the event of an unanticipated (but plausible) credit rating downgrade. This would amount to a failure by the CAR to meet its statutory obligations.

The remainder of the Executive Summary expands upon these key conclusions.

Cost of Equity

The CAPM offers the basic conceptual framework for understanding the determinants of the cost of equity. It is also parsimonious in its data requirements, involving few explanatory variables and parameters, each with a clear economic interpretation. In addition, the CAPM has been widely adopted by regulators, including CAR, in the past. We also note that the CAR has signalled that it is likely to retain the CAPM at this review. Taking these factors into account we estimate the cost of equity for Dublin Airport via the CAPM.

Table 1 summarises our estimate of the (post-tax) cost of equity. We conclude on a range of 10.0-12.5%, taking into account uncertainty around the risk-free rate and the asset beta.

Table 1
Real Cost of Equity

	Min	Max
Real Risk-free Rate	2.8%	4.1%
Equity Risk Premium	6.0%	6.0%
Gearing	50%	50%
Asset Beta	0.6	0.7
Equity Beta	1.2	1.4
Real Cost of Equity (post-tax)	**10.0%**	**12.5%**

We briefly summarise our analysis of each of the CAPM parameters below.

Risk-Free Rate

We estimated a Eurozone real risk-free rate of 2.0-2.8% based on long-term historic averages of deflated German government bonds. This is the approach favoured by Irish regulators in the past including the CAR at the last review.

We also note that over the past 12-18 months market data indicates that investors have come to regard the Irish government as considerably more risky than the German government. This evidence, based on both government bond yields and CDS premiums, strongly suggests that an Irish country risk premium needs to be added to the Eurozone real risk-free rate in order to ensure investors are properly compensated for the risk borne. We estimate this country risk premium to be in the range of 80-130 bps based on both CDS and bond data over the past 3-6 months[1]

Adding our estimate of the country risk premium to the Eurozone real risk-free rate produces our best estimate of the Irish real risk-free rate of 2.8-4.1%, as shown in Table 2.

Table 2
Irish Real Risk−Free Rate

	Minimum	Maximum
Eurozone Real Risk-Free Rate	2.0	2.8
Irish Country Risk Premium	0.8	1.3
Irish Real Risk-Free Rate	2.8	4.1

[1] This country risk premium was estimated over the period to the end of February 2009. At the time of finalising this report, in end March, Ireland's credit rating was actually lowered one step to AA+ from AAA with a "negative outlook," by S&P. We have not factored the implications of this downgrade into the country risk premium assumptions but suggest that the CAR must revisit the figures in the light of developments in the intervening period before making its final decision.

Equity Risk Premium

In relation to the ERP we note:

- Our preferred method for estimating the ERP is to use historical returns of very long-dated returns data. The arithmetic average of the ERP over the past 108 years suggests an ERP of 6.1% for the Eurozone.
- We cross-checked our estimate of the ERP based on historic means by calculating an ex ante ERP based on the DGM. Our analysis of an ex ante DGM derived ERP broadly confirms our preferred estimate of 6.1% over 2006-2008. However the data since September 2008 suggests that the ERP may be higher than this at the very current time. If market volatility remains high, there may therefore be a need to increase our overall estimate of the ERP by the time of the price decision.
- Irish regulatory precedent has generally estimated the ERP to be in the range of 5.0-6.0%. The most recent Irish decision, by Comreg for Eircom, settled on an ERP of 6.0%.

At the last review, CAR used an estimate of the ERP of 6.0%. Based on all of the available evidence there does not appear to be any objective basis for a reduction in the ERP at this review. Indeed, very recent evidence suggests the ERP is likely to have increased. We conclude on an estimate of the ERP of 6.0%, but note that this will need updating closer to the final price decision in 2010 to reflect the continuing impact of the credit crunch on investor risk premiums.

Beta

We estimated Dublin Airport's beta in a variety of ways. Table 3 summarises the results of these approaches. We note the following:

- Vienna Airport is the closest listed comparator for Dublin Airport;
- Mooted changes to Dublin Airport's regulatory framework have increased its systematic risk since the last review;
- Dublin Airport is at least 20% riskier than BAA, which implies an asset beta of at least 0.59;
-
- A review of European and Australian regulatory precedent suggests an asset beta of 0.6-0.65 and 0.6-0.7 would be appropriate for Dublin Airport, respectively.

Overall, we conclude on an asset beta for Dublin Airport of 0.6-0.7.

Table 3
Summary of Results: Asset Beta

Method	Estimate
Market Evidence from Listed Comparator Airport Companies	0.50 – 0.70
Comparison to CAR 2005	0.61 +
Comparison to UK Competition Commission for BAA 2007	0.59 +
Comparison to UK Competition Commission for Heathrow, Gatwick and Stansted 2007-08	0.59 – 0.70
European Regulatory Precedent	0.6 – 0.65
Australian Regulatory Precedent	0.6 – 0.7
Asset Beta for Dublin Airport	**0.6 – 0.7**

Cost of Debt

Since DAA finances all of its airports and operations at a Group level we estimate Dublin Airport's cost of debt by reference to DAA's cost of debt, noting that this should provide a reasonable estimate of the cost of debt for a notional stand-alone Dublin Airport.

In our assessment of the cost of debt, we consider:

- The costs of the different types of funding used by DAA, i.e. bonds, EIB loans and bank facilities;
- Transaction costs including bank, legal, trustee and agent fees; and
- Pre-funding costs relating to the (necessary and efficient) arrangement of funding before it is required.

We consider each of these elements of the total cost of debt on a historic and forward-looking basis. Data supplied to us by DAA shows that DAA will need to raise significant new incremental debt finance and refinance significant existing debt over the next price control period. Based on this data, we calculate that average future new debt (including refinanced debt) will constitute a minimum of [redacted] total debt over the price control period.
We emphasise that the appropriate weighting will need to be re-considered closer to the Final Price decision to take account of updated forecasts.

We therefore calculate the total cost of debt by weighting [redacted] of the total cost of debt to the benchmark historic cost of debt, with the remaining [redacted] determined by benchmark costs of new debt.

Table 4 summarises our estimate of the cost of debt.

Table 4
Cost of Debt

	Historic Benchmark	Current Benchmark Cost
Weighted Real Cost of Debt	4.05%	4.52%
Transaction costs	0.09%	0.14%
Pre-funding costs	0.19%	1.06%
Total Real Cost of Debt	**4.33%**	**5.72%**
Weight	80%	20%
Overall Real Cost of Debt		**4.61%**

Source: NERA analysis.

We estimate the benchmark real cost of debt is around 4.3% on a historic basis and 5.7%, prospectively, including transaction and pre-funding costs. Weighting these together we estimate that the appropriate cost of debt allowance for Dublin Airport over the next control period is around 4.6%.

Cost of Capital

Taking into account all of the available evidence our best estimate of the pre-tax WACC for Dublin Airport at this time is 8.0-9.4%. Noting the uncertainty around some of our estimates and the ongoing volatility in financial markets we have not concluded on a "point" estimate of the cost of capital at this stage.

Table 5 summarises our estimates of the cost of capital for Dublin Airport and presents the CAR's final determination at the last review for comparative purposes. We note our cost of capital range of 8.0-9.4% is somewhat higher than CAR's 7.4% settlement at the last review, reflecting higher estimates of both the cost of equity and the cost of debt. These increases are, however, fully justified based on an objective assessment of the available data. In particular, we note that the cost of new debt achievable by Dublin Airport has increased substantially in recent months, while the increased cost of equity reflects heightened perceptions of risk associated with both Dublin Airport and with Ireland more generally.

Table 5
Dublin Airport Cost of Capital

	NERA Estimate 2009 (%)	CAR Final Determination 2005 (%)
Gearing	50	46
Real Pre-Tax Cost of Debt	4.6	3.7
Real Post-Tax Cost of Equity	10.0 – 12.5	9.2
Tax Rate	12.5	12.5
Pre-tax WACC	**8.0 - 9.4**	**7.4**

Due to the recent volatile nature of international capital markets we recommend that this cost of capital range will need to be reconsidered closer to 2010 Price Determinations. Updated data during 2009 will assist in determining the likely long run impacts of the current financial crisis. We have not concluded on a "point" estimate of the cost of capital at this stage.

Financial Viability

The CAR has a statutory duty to "enable DAA to operate and develop Dublin Airport in a sustainable and financially viable manner". In the 2005 Review the CAR interpreted this duty as requiring it to enable DAA to maintain an investment grade credit rating (i.e. BBB- / Baa3 or better). In the 2007 Interim Review, the CAR interpreted this duty as requiring DAA to maintain an FFO:Debt ratio of a minimum of 15%.

In light of the change in debt market conditions that has now persisted for nearly 18 months, DAA's own credit ratings position and the large refinancing requirements in the next regulatory period we argue that at this review the CAR's statutory duty requires it to enable DAA to maintain an A / A2 rating rather than the investment grade rating assumed at the last review. In reaching this conclusion we note that:

- DAA's credit rating has recently been downgraded by S&P from A to A- and put on Negative Outlook which implies that there is a high probability of DAA being downgraded to BBB+. Evidence in the bond and bank markets indicates that a BBB+ (or lower) credit rating is likely to impair Dublin Airport's ability to raise debt.
- Prima facie, this may imply that a credit rating of A- would be sufficient. However, the CAR must also consider the implications of an unexpected (but plausible) downside scenario producing a one notch rating downgrade. If Dublin Airport is rated A in the event of a one notch downgrade, the implications will be much smaller than if it is rated A- (or even lower) at the outset of the scenario. Therefore, to ensure that Dublin Airport retains sufficient headroom to ensure continued access to capital markets in the event of plausible negative scenarios resulting in a credit rating downgrade (to A-), the CAR should set the cost of capital to enable Dublin Airport to retain an A rating.
- The other arguments advanced by the CAR at the last review are, for the most part, no longer valid. In particular, access to alternative types of debt such as project finance bank loans has been heavily curtailed as banks withdraw from long term lending and wrapped bond markets have been shut for nearly 2 years with little prospect of recovery as all major monoline insurers have been downgraded and are closed for new business.
- In the current environment and for the foreseeable future, as banks are reducing balance sheets and governments are issuing more debt, the outlook is that only corporates with an A or higher rating will be in a position to issue significant new debt as the supply is likely to exceed demand.
- The required cost of capital is lower at an A rating than at an A- (or lower) rating. This would directly translate into lower airport charges which means that an A rating should be preferred by the CAR and airport users.

The financeability test should target a level of ratios consistent with the credit ratings underpinning the WACC. The CAR should also test its regulatory settlement by applying a financeability test, as it did at the last review. We would, however, encourage the CAR to

more rigorously stress test its modelling, particularly through plausible downside scenarios. These scenarios should incorporate credit rating downgrades and the associated difficulties with accessing debt markets, as well as any increase in the cost of debt.

We set out the ratio requirements we believe DAA should be able to satisfy in Table 1 below. We focus upon FFO : Debt and FFO : Interest ratios as it is clear from S&P's rating reports on DAA and airport companies in general that these two ratios are its primary focus. We further note that DAA and one of its partner banks have indicated that other ratios are not considered by the rating agencies or by banks. These recommended thresholds for these ratios are similar to the requirements CAR stated were consistent with an A rating at the last review, but require a more robust FFO : Interest Cover consistent with our analysis of past and present S&P ratings, ratios and reports.

Table 1
Financial Ratios and Threshold Values Consistent with an A Rating

Ratio	Threshold Value
FFO : Debt	20%
FFO : Interest Cover	3.5x

Source: NERA analysis.

1. Introduction

In September 2009 the Commission for Aviation Regulation (CAR) will set a cap on average revenue per passenger at Dublin Airport that may be charged by Dublin Airport Authority (DAA) for the next price control period, commencing in 2010. An important component of this review is the cost of capital. At the last review CAR's approach to estimating the cost of capital relied primarily on the traditional CAPM, supplemented by market evidence on the cost of debt. In October 2008 CAR released "Maximum Levels of Airport Charges at Dublin Airport: Issues Paper", which indicated that its methodology for the upcoming review was likely to be quite similar to the approach at the last review.

The remainder of this report is structured as follows:

- Section 2 presents our analysis of the risk-free rate;
- Section 3 presents our analysis of the equity risk premium;
- Section 4 presents our analysis of beta;
- Section 5 summarises our analysis of the CAPM cost of equity;
- Section 6 presents evidence on the cost of debt;
- Section 7 sets out our current estimates of the WACC;
- Section 8 considers Dublin Airport's financial viability and its relationship to the cost of capital; and
- Section 9 discusses optimal capital structure i.e. the relationship between credit rating and the cost of capital.

The Appendices provide various pieces of supporting information.

2. The Risk-Free Rate

The real risk-free rate is the price that investors demand to exchange certain current consumption for certain future consumption. In part it is determined by investors' subjective preferences and in part by the nature and availability of investment opportunities in the economy.

This section is structured as follows:

- Section 2.1 discusses regulatory precedent regarding the real risk-free rate;
- Section 2.2 considers Eurozone nominal government bonds as a basis for estimating the real risk-free rate;
- Section 2.3 considers estimating a real risk-free rate from Eurozone inflation-protected government bonds;
- Section 2.4 describes and discusses estimating the Eurozone real risk-free rate based on swap rates;
- Section 2.5 presents and summarises estimates of the Eurozone real risk-free rate based on nominal and inflation-protected government bonds and on risk-adjusted swap rates;
- Section 2.6 presents evidence that shows Ireland is regarded as a riskier investment than the Eurozone; and
- Section 2.7 concludes on our best estimate of the Irish real risk-free rate.

2.1. Regulatory Precedent

At the last review the CAR settled on a real risk-free rate of 2.6%, based on its consultants' analysis of German 10-year bonds deflated for actual ex-post inflation over the period 1988-2004. The 2.6% verdict was the same as that reached in the preceding review in 2001.

Other Irish regulatory precedent, presented in Table 2.1, suggests a real risk-free rate broadly in the range of 2.0-3.0%. Most recently, however, Comreg (May 2008) decided that the nominal risk-free rate for Eircom's fixed line business was 4.75%. This is higher than almost all prior nominal risk-free rate decisions in Ireland, and – if deflated by medium-term inflation expectations, which for the Eurozone are around 2% - implies a real risk-free rate of around 2.75%.

Table 2.1
Risk–Free Rate: Irish Regulatory Precedent

Regulator	Year	Category	Description	Nominal RFR	Real RFR
Comreg	2008	Telecoms	Review of Eircom's cost of capital - fixed line business	4.75%	
CER	2007	Utilities	Gas Distribution	3.97%	2.00%
CER	2007	Utilities	Gas Transmission	3.97%	2.00%
CAR	2007	Aviation	Aviation Terminal Service Charges - IAA		1.84%
CER	2006	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2007	5.53%	2.86%
CER	2005	Utilities	Direction to ESB Power Generation on Allowable Costs 2006/07		2.38%
CAR	2005	Aviation	Dublin Airport Authority		2.60%
CER	2005	Utilities	2006-2010 Transmission	4.30%	2.38%
CER	2005	Utilities	2006-2010 Distribution	4.30%	2.38%
CER	2005	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2006	4.63%	2.38%
CER	2003	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2004	4.10%	2.20%
CER	2003	Utilities	Gas Distribution (Bord Gas Eirann)	4.50%	2.50%
CER	2003	Utilities	Gas Transmission (Bord Gas Eirann)	4.50%	2.50%
CER	2002	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2003	4.72%	2.82%
CAR	2002	Aviation	Aviation Terminal Service Charges - IAA		2.60%
CER	2001	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2002	4.52%	2.62%
CAR	2001	Aviation	Aer Rianta		2.60%
Average				**4.5%**	**2.4%**
Range				**3.97% - 5.53%**	**1.84% - 2.86%**

Source: NERA analysis of regulatory decisions shown. Where a range was given we have presented the mid-point.

We note that a real risk-free rate of 2.6-2.75% is somewhat higher than the 2007 decisions for gas distribution and transmission by the CER, and the CAR's decision for the IAA. However, the CER specifically placed reliance on the decrease in yields that had been witnessed in the period up to their decision noting that "real risk-free rates have fallen since 2003".[2] This trend has subsequently reversed, suggesting these decisions by the CER would be quite different if taken today. With respect to the CAR's decision for the IAA we note that the relevance of this decision is somewhat limited by the European Commission's requirement that the risk-free rate be determined by reference to the national government bond rate. This led to the unusual methodology adopted by the CAR (and its consultants) which estimated the real risk-free rate by adjusting Irish government bonds for Eurozone inflation expectations. Interestingly, the consultants stated that their preferred estimate of the risk-free rate,

[2] See CER (2007) "Bord Gas Networks Revenue Review 2007/8-2011/12", p34, August 2nd.

disregarding the EC's requirements, was "within the range of 2.00-2.45%".[3] Overall, there are good reasons to disregard these decisions which settled on lower risk-free rates.

Internationally, we note that the UK Competition Commission decided that the real risk-free rate was 2.0% in its review of Stansted airport. This decision should not be given undue weight by the CAR given the differences between UK and Eurozone (and Irish) markets, and given that the CC's methodology placed too much emphasis on yields on index-linked gilts, which are biased by inelastic demand from pension funds (among others).

2.2. Eurozone Nominal Government Bond Yields

As noted above, at the last price review the CAR estimated the risk-free rate by deflating German bunds for *actual* inflation. A more widely adopted methodology derives the real risk-free rate by deflating nominal yields by inflation *expectations*. A *real* risk-free rate can be obtained by deflating nominal yields using the Fisher formula:

(2.1) $$1 + r = \frac{1 + n}{1 + \pi_e}$$

Where r is the real rate, n is the nominal rate and π_e is expected inflation.[4] We use the ECB's Quarterly Survey of Professional Forecasters' forecasts of Eurozone HICP inflation as our preferred measure of inflation expectations.[5]

It should be noted that simply deflating nominal government bonds for inflation expectations will be insufficient if nominal bonds include an inflation risk premium. In theory, an inflation risk premium exists where investors require more or less than just expected inflation to compensate them for the exposure to inflation associated with fixed nominal (but variable, depending on inflation, real) debt repayments. Indeed, we note that at the last review the CAR implicitly accepted its consultant's recommendation to adjust the real risk-free rate estimate for an inflation risk premium.[6] While we do not disagree with the theoretical requirement to adjust for an inflation risk premium, we note that our analysis of the existing academic literature suggests that the inflation risk premium is somewhat lower than that recommended by Hutson and Kearney (2005). In particular, in Appendix A.1 we review the literature on the inflation risk premium in the EU, UK and US. Overall, the evidence appears to suggest that the inflation risk premium tends to be positive, varies across countries and across maturities, but has been very small in recent years.[7] In contrast, the CAR's consultants concluded on a risk premium equal to 40% of the long-term average yield on government

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3 See Hutson and Kearney (2007) "The Irish Aviation Authority's Cost of Capital: Report to the Commission for Aviation Regulation", pp19-20, March.

4 Throughout this report real rates (such as for the cost of debt) are derived from nominal rates through the Fisher formula.

5 We discuss the possible sources of inflation expectations measures and their merits in Appendix A.2.

6 See Hutson and Kearney (2005), "Dublin Airport Authority's Cost of Capital: Report to the Commission for Aviation Regulation", May, p9. The consultants concluded on a risk premium equal to 40% of the long-term average yield on government bonds. We note that, somewhat inconsistently, the figure of 40% was based on two studies of UK data, but applied to German bonds data.

7 We note that the inflation risk premium is not necessarily non-negative. While the majority of academic research concludes on either a positive or zero premium, some studies suggest the premium is negative – e.g. Evans (2003).

bonds.[8] Perhaps one explanation for the seemingly high estimate obtained was that the figure of 40% was based on two studies of UK data, but applied to German bonds data. The lower recent estimates in the academic literature may be consistent with theory which suggests that because of policies like inflation-targeting there is less inflation risk. Further, we note that there are theoretical reasons for a negative inflation risk premium if the covariance of consumption growth with inflation is positive. [9] Overall, for the reasons given, we assume that the inflation risk premium is negligible and make no adjustment for it as a result.

2.3. Eurozone Inflation Protected Government Bonds

Inflation-protected bonds are a natural starting point for estimating the real risk-free rate. However, it is well recognised that inflation-protected bonds have been a biased measure of the risk-free rate due to pension and accounting regulations introduced over the past decade (or so). For example, in the UK a steep decline in ILG yields from 1997 onwards has been recognised by commentators – including the Bank of England - to be mainly associated with the introduction of the pension fund regulations such as the Minimum Funding Requirement (MFR) and subsequent further pensions' regulations such as FRS17 and IAS19.[10] Likewise, similar institutional factors have affected the French (which is the largest and most liquid in the EMU) and US markets. In particular, pension fund demand may have strengthened as international accounting standards, requiring pension funds to state deficits in their financial accounts, approach implementation stage.[11] Further, the OECD observed in early 2006 that undersupply of the bonds demanded by pension funds was a global phenomenon.[12]

Overall, for these reasons inflation linked bonds should not simply be assumed to provide a reliable measure of the risk-free rate. Nevertheless, we note that the UK Competition Commission has for some time considered yields on UK inflation-protected bonds (index-linked gilts) the best source of evidence for the risk-free rate. In their recent recommendations for Stansted, the CC rely on evidence from short-dated maturity ILGs, having noted that yields on long-dated maturities are biased. Given the CC's preference, and

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8 See Hutson and Kearney (2005), "Dublin Airport Authority's Cost of Capital: Report to the Commission for Aviation Regulation", May, p9.

9 Prices of nominal assets, such as nominal bonds, will depend in part on the covariance of consumption and inflation. It is the sign of this covariance that determines the sign of the inflation risk premium: if, for instance, consumption growth tends to be low when inflation is low (i.e. the covariance is positive), then holding nominal assets will in part hedge negative shocks to consumption, and investors would be willing to do so for a lower expected return, implying a negative inflation premium. For more discussion, see for example Hordahl (2008) "The inflation risk premium in the term structure of interest rates", BIS Quarterly Review, September, p24.

10 See for example Bank of England (1999) *Quarterly Bulletin*, May and Bank of England (2008) *Quarterly Bulletin*, May). See also UK Competition Commission: (2000) "Mid Kent Water Plc: A report on the references under sections 12 and 14 of the Water Industry Act 1991", p125 (para 8.13) and UK Competition Commission (2003) "Vodafone, O2, Orange and T-Mobile: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Vodafone, O2, Orange and T-Mobile for terminating calls from fixed and mobile networks", p188.

11 In the US, the Pension Protection Act was enacted in August 2006, mandating stricter funding requirements on defined benefit plans. The influence on yields of pension fund demand in the US has been noted by the Federal Reserve: see Investment Week (11/09/06) "Economic slowdown in US to benefit long-dated bonds"

12 The OECD stated: *"Very long-dated and IL bonds seem to be currently undersupplied relative to perceived or expected demand" a*s reported in Dow Jones International News (30 January 2006) *"Euro Yield Curve is Unlikely to Invert".* See also *"The increased issuance of long-dated bonds by different European governments is not enough to meet investor demand for these instruments"* and Financial Times (01/02/06) "Financial Times Mandate: News & Analysis: Products and Strategies - Clients call for more long-bonds."

because of the theoretical appeal of inflation-protected securities, we present evidence on yields on French OATis below (noting that the French market is the largest in the Eurozone).

2.4. Eurozone Risk-Adjusted Swap Rates

An alternative approach to the risk-free rate advanced by several academics including Fleming (2000), Hull, Predescu, and White (2004), Choudhry (2005), Feldhutter and Lando (2007) and Schaefer (2008), among others, uses interest-rate swaps as the foundation for their estimates.

Typically, a swap rate will exceed the rate on a risk-free (i.e. AAA rated) government bond even abstracting from any distortions in the government bond market since the swap rate is related to European inter-bank lending rates (i.e. EURIBOR). Therefore, to obtain a risk-free rate from swap rates it is necessary to remove some measure of inter-bank credit risk. It is important to note, however, that the aim is to remove the difference in risk between the swap rate and the government bond rate. Historically, it has been plausible to assume that the default risk of an AAA-rated government was close enough to zero that it could be ignored in most instances. However, the market has recently started to price in some probability of the German government defaulting. This government risk needs to be taken into account in deriving a measure of the risk-free rate.

Our methodology is summarized in Equation (2.2).

$$r = \frac{1 + s - \rho_{banks} - \rho_{govt}}{1 + \pi^e} - 1 \qquad (2.2)$$

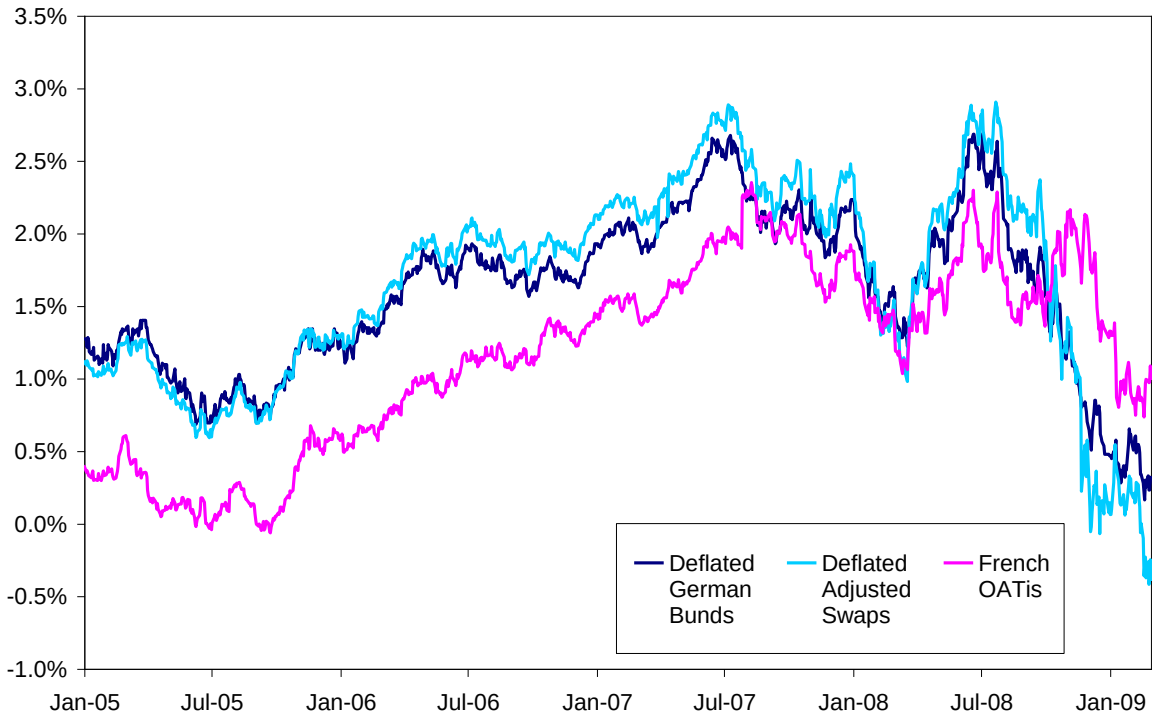
Where r is the real risk-free rate, s is the swap rate, π^e is inflation expectations, ρ_{banks} is a measure of inter-bank risk and ρ_{govt} is a measure of government risk. To implement our methodology we require measures of inter-bank and government risk. These measures are readily obtained from market data on credit default swaps (CDS).[13] Since the swap rate is related to EURIBOR, which is related to Eurozone banking-sector risk, we use a CDS index for Eurozone banks. For government risk we rely on CDS for the German government, noting that the Eurozone swaps curve is priced (at least partially) relative to the German bund curve. Our estimates, therefore, are for a Eurozone real risk-free rate, to which any Irish country risk premium (discussed later) should be added.

[13] We use the iTraxx Senior Financials series, first published in mid-2004 for the Eurozone. The Eurozone series comprises a number of UK banks, which should ideally be excluded. However, the index is based on AA (or better) rated banks which, given that the country risk of the EU and UK are both AAA, we do not expect to vary significantly across markets. We note that, ideally, to match the maturity of the six-month EURIBOR rate (to which Eurozone swaps are related) we would want a CDS index with a six month maturity. No such index is available at this time. We use the first index issued, which matures in June 2009, and so currently reflects around 6 months of risk. Over the period since June 2004 the maturity of the index has averaged 2½ years. This is the best proxy at this time. We note from an examination of individual company CDS curves that the five year premium exceeds the six month premium in all cases, consistent with theory and the rising probability of default with maturity. As such, the five year CDS premium overstates six month default risk, and so as a result our risk-free rate estimate is an underestimate. Prior to the publication of the iTraxx series in mid-2004 we estimate inter-bank risk by the spread between six-month EURIBOR and the six-month general collateral repo rate. CDS for governments are obtained from Bloomberg from early 2008 onward. Prior to this we assume that government risk, proxied by CDS premiums, was zero. This is a conservative approach that reduces our risk-free rate estimates. We select the government CDS with a maturity that corresponds to the years-to-maturity of the iTraxx Senior Financials series to ensure that any additional term premium that may be inherent in a longer-dated CDS is not included.

We note that in recent months CDS markets have been particularly volatile following the bankruptcy of Lehman Brothers (15 September 2008) and the Federal Reserve's announcement of financial assistance for American Insurance Group (AIG) (on 16 September 2008). A key driver of this volatility has been uncertainty surrounding the value of CDS, which is associated with counterparty risk i.e. the risk that the insurance provider will default at the same time as the underlying bond issuer. Our measure effectively eliminates counterparty risk from our risk-free rate provided that the counterparty risk in government CDS is the same as the counterparty risk in banking sector CDS (since we subtract one CDS from the other). While it is empirically difficult to establish the veracity of this claim, it seems intuitively plausible to assume that any remaining counterparty risk is small, if not negligible.

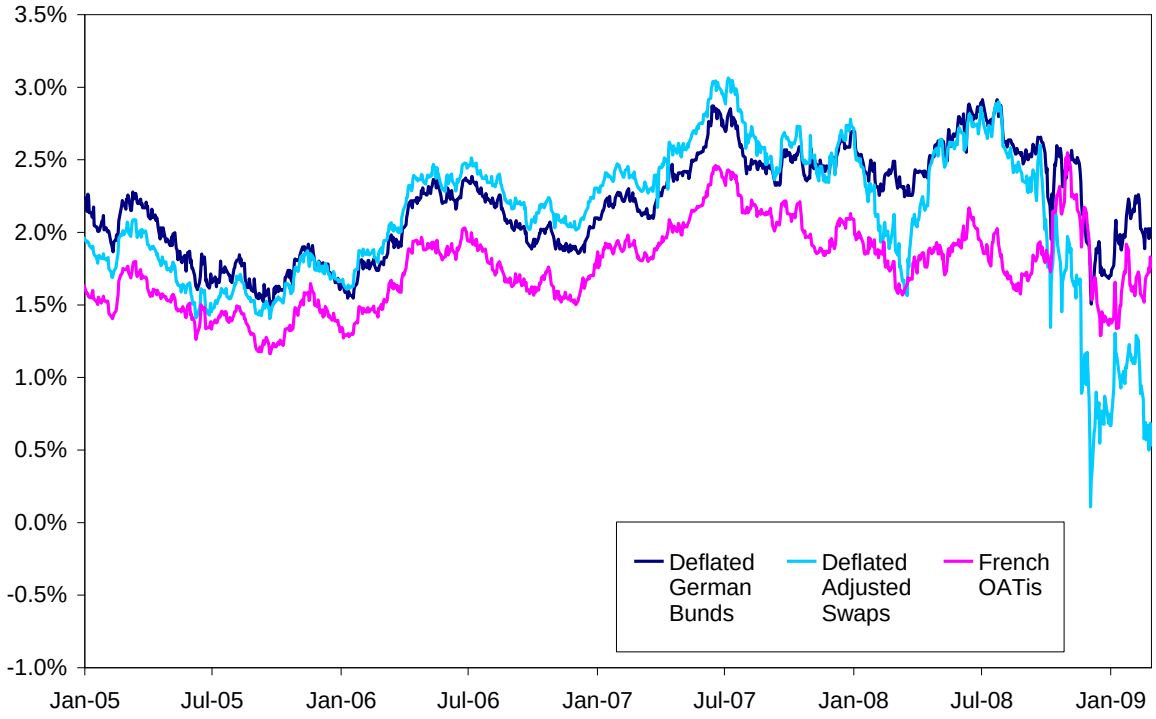
2.5. A Eurozone Real Risk-Free Rate

Figure 2.1
Eurozone Real Risk-Free Rate Measures
(5 Year Maturity)



Source: NERA analysis and Bundesbank, Bloomberg, iTraxx, ECB data until 27th February 2009.

Figure 2.2
Eurozone Real Risk-Free Rate Measures
(15 Year Maturity)



Source: NERA analysis and Bundesbank, Bloomberg, iTraxx, ECB data until 27th February 2009.

Figure 2.1 and Figure 2.2 show the various real risk-free rate measures discussed above for a five-year and 15-year maturity, respectively. The charts show that:

- Deflated German bunds and deflated risk-adjusted swap rates provide similar estimates of the risk-free rate until the past 18 months or so. The swaps-based methodology has generated a slightly higher estimate until recently, potentially due to the special features of government bonds that generate additional demand for these types of securities. That the 15-year swap estimate is somewhat lower than the 15-year nominal bond estimate is because there are some unusual factors currently affecting the long-end of the swap curve. For this reason we rely primarily upon the German bund based estimates and treat the swaps-based method as a cross-check.
- French OATis have, in the past, provided a much lower estimate of the risk-free rate than the alternative measures. We regard this as evidence in support of our earlier assertion that inflation-protected bond markets provide a biased measure of the risk-free rate due to biases induced by pension and accounting rules. As a result, we regard the other two methods as better evidence about the real risk-free rate.
- Estimates of the risk-free rate from all three approaches have decreased sharply in recent months. We ascribe this reduction to the recent round of interest rate cuts by the ECB. Evidence from short-maturity measures of the risk-free rate may be unduly affected by these interest rate fluctuations. To accurately estimate the risk-free rate it may be necessary to rely on longer-maturity evidence, which is less sensitive to interest rate

movements, or to rely on historical averages over a longer period that incorporate evidence across a whole interest rate cycle.

We note that in addition to the practical arguments advanced above for preferring one maturity over another, there are theoretical reasons why one maturity might be preferred to another. In particular, a five-year maturity may be preferable since it more closely matches the length of the next control period. This is theoretically appropriate if there are term or liquidity premiums built-in to longer-maturity interest rates. On the other hand, a fifteen-year maturity can be justified on the basis that much of DAA's investment is long-lived, meaning that the appropriate return on investment should be judged by reference to the life of those investments.

Estimates based on the various methods over both five and fifteen-year horizons are presented in Table 2.2. These estimates confirm the above analysis: French inflation-protected bonds are a downwardly biased estimate of the real risk-free rate, while the swaps and bunds based methods produce similar estimates.

Since short term averages are unduly affected by the recent period of historically extremely low interest rates we favour real risk-free rate estimates based on averages over the past ten years of deflated German bunds. These estimates are shaded gray in the table. We note that by relying on longer time-series evidence our approach more closely corresponds to that taken by the CAR at the previous review.

Our estimates of the real risk-free rate for the Eurozone are 2.0-2.8% based on the reasoning and analysis presented.

Table 2.2
Eurozone Real Risk–Free Rate: Estimates

	5 Year Maturity			15 Year Maturity		
Average Over	**Deflated German Bunds**	**Deflated Adjusted Swaps**	**French OATis**	**Deflated German Bunds**	**Deflated Adjusted Swaps**	**French OATis**
1 month	0.4%	0.0%	0.9%	2.1%	0.9%	1.7%
3 months	0.5%	0.1%	1.2%	1.9%	0.9%	1.6%
6 months	1.0%	0.9%	1.5%	2.2%	1.4%	1.8%
1 year	1.5%	1.5%	1.6%	2.4%	1.9%	1.8%
2 years	1.8%	1.9%	1.7%	2.4%	2.2%	1.9%
5 years	1.6%	1.6%	1.1%	2.3%	2.1%	1.8%
10 years	2.0%	2.0%	1.1%	2.8%	2.7%	2.2%

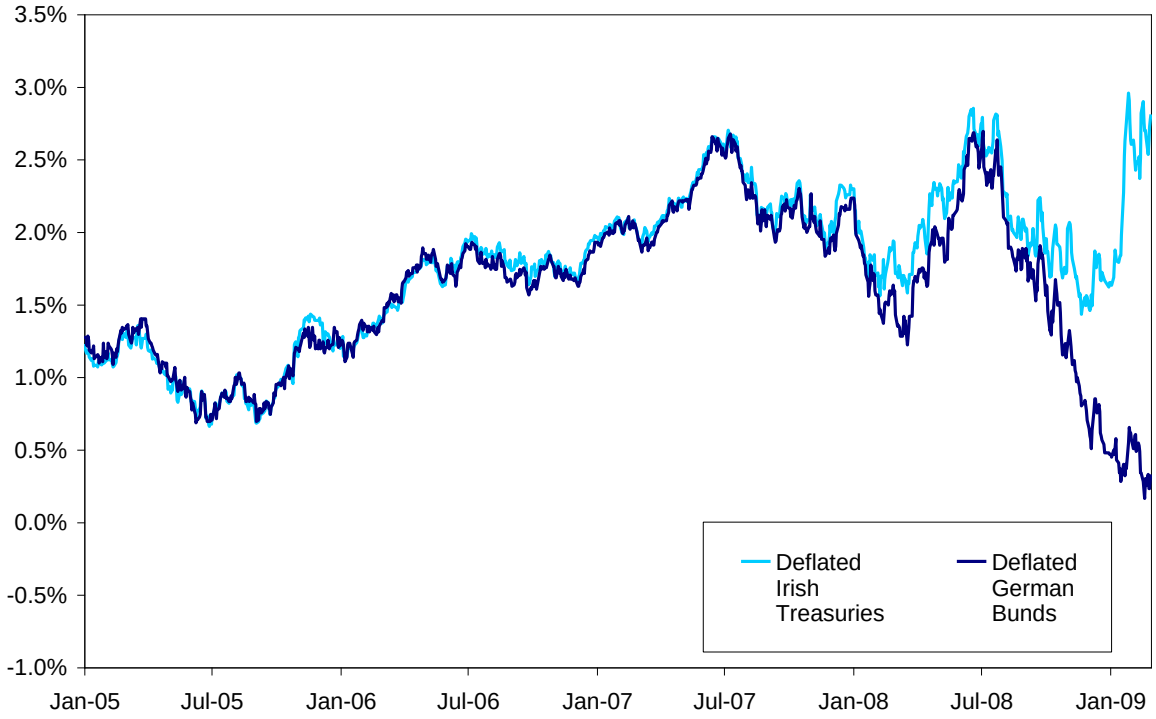
Source: NERA analysis of Bloomberg, Bundesbank, ECB and iTraxx data until 27th February 2009.

2.6. An Irish Country Risk Premium

Figure 2.3 presents deflated nominal yields for the Eurozone, proxied by German bunds, and for Ireland. We rely upon German bunds as our benchmark measure of the Eurozone government bond rate as the market for German bunds is widely regarded as the most liquid and deepest government bond market in the Eurozone. Figure 2.3 shows that there has been little difference between German and Irish government bond yields over most of the past

decade since the introduction of the common currency. However, in recent months during the credit crisis, markets have begun to again price in country-risk. In particular, the market now appears to regard Ireland as considerably more risky than Germany i.e. the higher yield on Irish government bonds reflects the markets belief that the Irish government is somewhat more likely to default on its debt obligations than the German government.

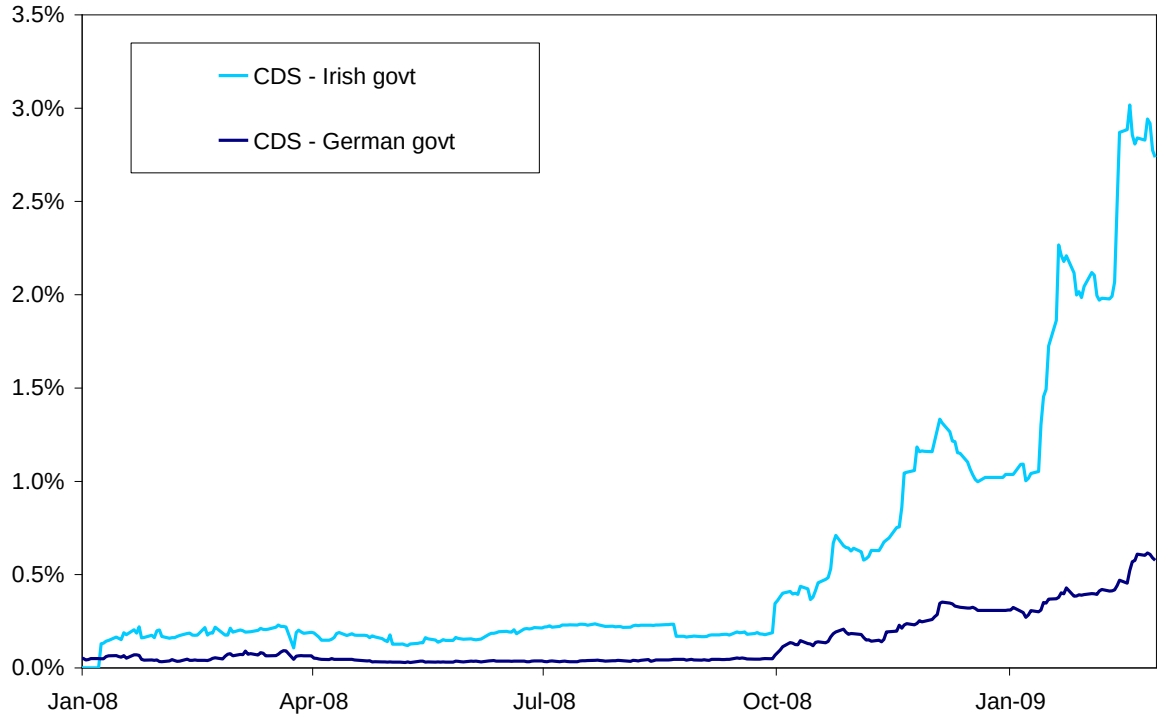
Figure 2.3
Deflated Nominal Government Bond Yields



Source: NERA analysis of Bloomberg, Bundesbank and ECB data up to the end of February 2009. The yields shown are for a five-year maturity.

An alternative basis for this claim can be found in the credit default swap market: as shown in Figure 2.4 CDS on Irish government bonds recently traded above 250 bps, while the corresponding German CDS has been around 50 bps. This difference in CDS premiums means that investors are willing to pay considerably more for insurance against default (since the CDS contract specifies payment of a pre-agreed sum in the event of a default by a particular underlying bond issuer).

Figure 2.4
German and Irish Government CDS



Source: Bloomberg data up to the end of February 2009. CDS premiums presented are for a one year ahead horizon.

These two observations provide the empirical justification for an Irish country-premium over and above the risk-free rate that prevails within the Eurozone.

Table 2.3 summarises various estimates of the Irish risk premium based on the difference between Irish and German government CDS and bonds. We note that the risk premium appears to have increased sharply recently, suggesting an Irish risk premium in excess of 200 bps at the end of February.

There have been actions and statements from all the rating agencies about downgrading Ireland's credit rating in recent weeks that explain this increase in the Irish risk premium.

- On January 19th Ireland was put on credit watch negative by S&P;[14]
- On February 11th, Arnaud Mares, Senior VP of Moody's stated that that there is "(M)ore than 50% chance that Ireland will lose its Aaa rating within 12-18mths";

[14] At the time of finalising this report, Ireland's credit rating was actually lowered one step to AA+ from AAA with a "negative outlook," by S&P. We have not factored the implications of this downgrade into the credit risk premium but suggest that the CAR must revisit the figures in the light of developments in the intervening period before making its final decision.

- In a statement released by Fitch Ratings On Friday 6th March, Fitch Ratings stated that they had "placed the Republic of Ireland's 'AAA' on Rating Watch Negative".

Given the volatility in the CDS premiums, we have estimated the Irish risk premium based upon averages over the past 3-6 months for government CDS. This approach yields estimates of the risk premium of 80-130 bps.

Table 2.3
Irish Risk Premium: Estimates

	Government CDS			Government Bonds: 5 Year Maturity			Government Bonds: 15 Year Maturity		
Average Over	Irish (bps)	German (bps)	Difference (bps)	Irish (bps)	German (bps)	Difference (bps)	Irish (bps)	German (bps)	Difference (bps)
1 month	246	49	198	466	239	227	588	412	176
3 months	172	38	134	414	251	163	530	398	131
6 months	107	25	83	408	305	103	511	427	85
1 year	63	15	49	419	355	63	496	444	52
2 years				418	383	35	472	444	27
5 years				366	352	14	430	425	6
10 years				400	389	10	471	471	0

Source: NERA analysis of Bloomberg and Bundesbank data up to the end of February 2009.

2.7. Conclusion

In this section we have estimated a Eurozone real risk-free rate based on deflated German government bonds, which is the approach favoured by Irish regulators in the past including the CAR at the last review of Dublin Airport's cost of capital. We have considered bonds of both five and fifteen year maturity to reflect (approximately) the length of the next control period or the life of Dublin Airport's assets. Either of these approaches can be theoretically justified. We derive estimates of the real risk-free rate for the Eurozone by averaging these measures over the past ten years. We do this to avoid placing undue weight on estimates that are especially affected by the historically low interest rates currently prevailing. This approach is also consistent with the approach taken by the CAR at the last review which relied on averages over the period 1988-2004. Adopting this approach we estimate the Eurozone real risk-free rate to be between 2.0% and 2.8%. We note that estimates based on a risk-adjusted swaps approach yield similar estimates, while inflation-protected bond yields (derived from the Eurozone's largest and deepest market) generate somewhat lower estimates reflecting institutional factors that have downwardly biased those estimates.

We have also noted that over the past 12-18 months market data indicates that investors have come to regard the Irish government as considerably more risky than the German government. This evidence, based on both government bond yields and CDS premiums, strongly suggests that an Irish country risk premium needs to be added to the Eurozone real risk-free rate in order to ensure investors are properly compensated for the risk borne. We estimate this country risk premium to be in the range of 80-130 bps based on both CDS and bond data over the past 3-6 months.

Adding our estimate of the country risk premium to the Eurozone real risk-free rate produces our estimate of the Irish real risk-free rate of 2.8-4.1%, as shown in Table 2.4. We note that the CAR's conclusion at the last review of 2.6% is below the lower end of this range, while the upper end of this range is somewhat above the general range of Irish regulatory precedent which lies between 2.0% and 3.0%. However, these decisions all preceded the recent increase in Irish country risk.

Table 2.4
Irish Real Risk–Free Rate: Conclusion

	Minimum	Maximum
Eurozone Real Risk-Free Rate	2.0	2.8
Irish Country Risk Premium	0.8	1.3
Irish Real Risk-Free Rate	2.8	4.1

3. Equity Risk Premium

The equity risk premium (ERP) is the difference between the expected return on the market portfolio and the expected return on a risk-free asset (formally stated as $E[r_m] - E[r_f]$). Put differently, the ERP should measure the minimum additional expected return that investors require over and above the risk-free return in order to invest in equities. This section is structured as follows:

- Section 3.1 summarises recent Irish and European regulatory precedent on estimates of the ERP including CAR's approach at the last review;
- Section 3.2 discusses the effect that the current market volatility has on the ERP;
- Section 3.3 details NERA's preferred estimate of the ERP based on long-run historical evidence,
- Section 3.4 cross-checks the historical estimates against a forward-looking ERP estimate for the EuroStoxx and EuroStoxx 50 using a Dividend Growth Model;
- Section 3.5 concludes.

3.1. Regulatory Precedent

At the last review the CAR concluded on an ERP of 6% based on the recommendation of its consultants, who considered evidence from Dimson, Marsh and Staunton (2002) for Germany, UK and USA. While the consultants clearly relied on historical time series data, the precise judgment used in settling on 6% was somewhat less clear.[15]

Most Irish decisions have settled on an ERP in the range of 5-6% as shown in Table 3.1 below. The trend in ERP decisions is hard to discern. For example, the CER (2001) set an ERP of 5.3% in 2002 (Best New Entrant Price),[16] which it subsequently revised up to 5.5% (for Best New Entrant price purposes) from 2005.[17] On the other hand, the CAR set an ERP of 5% for IAA in 2007 based on a report by Hutson and Kearney (2007), which is somewhat lower than its earlier decision for DAA, despite adopting the same methodology albeit updated for more recent evidence.[18] *Prima facie*, the main decisions that point to a lower ERP are those by the CER (2007) which concluded that the ERP lay in the range of 4-5%. This estimate is lower than previous decisions and was justified by the statement that "in an industry where risk is perceived to be low and a general macro-economic situation that has, at a minimum, stayed constant if not improved, it would seem difficult (or even counter-intuitive) to argue that a higher rate of return is appropriate".[19] However, even if one

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[15] See Hutson and Kearney (2005) "Dublin Airport Authority's Cost of Capital: Report to the Commission for Aviation Regulation", May, pp10-12.

[16] See Commission for Electricity Regulation (2001) "Best New Entrant Price 2002", December, p7.

[17] See Commission for Energy Regulation (2005) "Best New Entrant Price 2006", July.

[18] See Hutson and Kearney (2007) "The Irish Aviation Authority's Cost of Capital", p21. The report is available as Appendix 2 of CAR (2007) "Determination and Report on the Maximum Level of Aviation Terminal Service Charges that may be imposed by the Irish Aviation Authority", March.

[19] See Commission for Energy Regulation (2007) "Bord Gais Networks Revenue Review 2007/8-2011/12", August, p34.

does not disagree with the methodology adopted, if it were applied today, a higher ERP would almost certainly be justified. Further muddying the waters we note that the most recent Irish regulatory decision by Comreg for Eircom concluded on an ERP of 6%. Overall, we interpret the evidence from Irish regulatory decisions as supporting an ERP roughly in the range of 5.0% to 6.0%.

Table 3.1
Irish Regulatory Precedent on the ERP

Regulator	Year	Category	Description	ERP
CAR	2001	Aviation	Aer Rianta	6.0%
CER	2001	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2002	5.3%
CAR	2002	Aviation	Aviation Terminal Service Charges - IAA	6.0%
CER	2002	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2003	5.3%
CER	2003	Utilities	Gas Transmission (Bord Gas Eirann)	5.0%
CER	2003	Utilities	Gas Distribution (Bord Gas Eirann)	5.0%
CER	2003	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2004	5.3%
CAR	2005	Aviation	Dublin Airport Authority	6.0%
CER	2005	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2006	5.5%
CER	2005	Utilities	2006-2010 Electricity Transmission	5.3%
CER	2005	Utilities	2006-2010 Electricity Distribution	5.3%
CER	2005	Utilities	ESB Power Generation	5.3%
CER	2006	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2007	5.5%
CAR	2007	Aviation	Aviation Terminal Service Charges - IAA	5.0%
CER	2007	Utilities	Gas Distribution	4.5%
CER	2007	Utilities	Gas Transmission	4.5%
Comreg	2008	Telecoms	Review of Eircom's cost of capital - fixed line business	6.0%
Average				**5.3%**
Range				**4.5% - 6.0%**

Source: NERA analysis of regulatory decisions shown. Where a range was given we have presented the mid-point.

We note that in its recent decision for Stansted airport the UK's Competition Commission decided the ERP for the UK lay in a range of 3.0-5.0%. Notwithstanding differences between the Eurozone and the UK which mean this decision is not directly relevant to the decision by CAR, we note that there were some substantial methodological flaws with this decision. In particular, it placed too much weight upon geometric averages in preference to arithmetic averages, relied too heavily on an untested paper by a member of the panel, relied on selective use of evidence and upon estimates derived from an incorrectly estimated DGM. For these reasons we do not believe this decision should be given any weight by the CAR.

In the US and Australia, the ERP has generally been set at a higher level than in Europe. Recent regulatory decisions on the ERP are all at around 6%. In the US, however, the CAPM is generally not used as the primary method for estimating the cost of equity, which makes an estimate of the ERP unnecessary. The CAPM is, however, used as a check on the primary DGM results, and the most widely quoted source used in US hearings to assess the level of

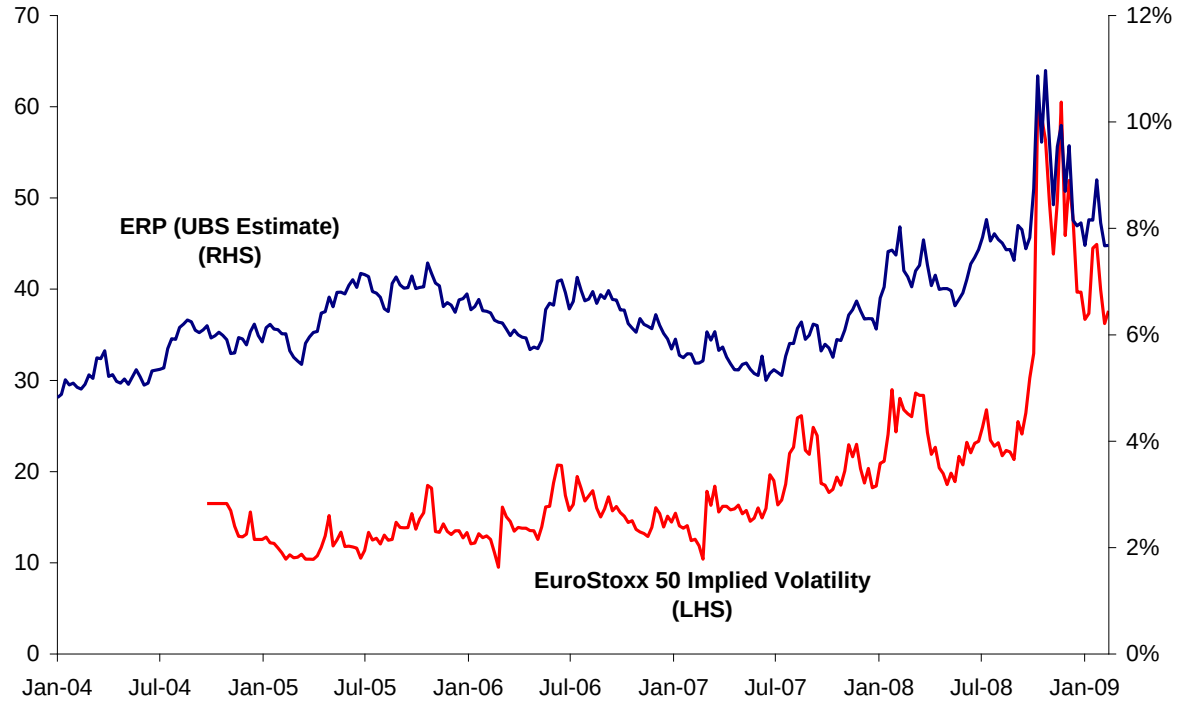
the ERP is the Ibbotson data.[20] The method recommended by Ibbotson is to compute the arithmetic average of stock market returns against long-term Treasury bond yields. This is consistent with the methodology applied by Dimson, Marsh and Staunton, our preferred source for the ERP discussed in Section 3.3 below.

3.2. The Effect of Current Market Volatility

During periods of heightened market volatility investors will require higher rates of return for a given investment since greater risk is borne. In a CAPM framework the additional required returns manifest in the ERP.

Financial markets have been considerably more volatile over the last year or so, relative to previous periods this decade. Figure 3.1 illustrates a series for the 3-month option implied volatility of the EuroStoxx 50 index, which clearly shows a spike in volatility from around the start of September as well as a general increasing trend before this. Implied volatility recently peaked above 50%, compared to 10-20% over the three years to August 2008.

Figure 3.1
3 Month Option Implied Volatility of the EuroStoxx 50 (%)
and ERP Estimates from UBS



Source: Bloomberg and UBS data up to 13 February 2009.

As a result of increased market volatility and greater uncertainty about the macroeconomic environment, investors require greater compensation for taking on risk – that is, they require a larger equity risk premium. This effect has recently been noted by (among others) the Bank

[20] Ibbotson Associates publish data on the ERP every year in a handbook, "Stocks, Bonds, Bills & Inflation".

of England, which suggested that volatility was the reason for a rise in their DGM-based ERP estimates.[21]

Figure 3.1 also presents estimates of the ERP for Europe published by UBS Investment Research.[22] The figure shows that real-time estimates of the ERP have increased over the last year. The ERP began increasing in July 2007, coinciding with a spike in volatility. This evidence is consistent with our assertion that increased volatility raises the ERP.

This evidence suggests that the ERP is currently higher than what it has been during periods of lower levels of market volatility.

3.3. NERA's Estimate of the ERP

Ibbotson and Chen[23] (restated by Song[24]) categorize the methods for estimating the ERP into four groups:

1. *Historical method*. The historical ERP, or difference in realized returns between stocks and the risk-free rate (proxied by bonds, bills or cash), is projected forward into the future. See Ibbotson and Sinquefield (1976), which is updated annually by Ibbotson Associates (now Morningstar), and Dimson, Marsh, and Staunton (2007), which is also updated on an annual basis.
2. *Supply-side models*. This approach uses fundamental information, such as earnings, dividends, or overall economic productivity, to estimate the ERP. The most prominent approach within this group goes back to Gordon and Shapiro's suggestion that a dividend growth model (DGM) can be used to estimate the expected return on equity.
3. *Demand-side models*. This category uses a general equilibrium or macroeconomic model to calculate the expected equity return by considering the payoff demanded by investors for bearing the risk of equity investments. Mehra and Prescott (1985) is the best known example of this approach, and the "puzzle debate" is an attempt to reconcile the results of this approach with the much higher ERP estimates given by the other approaches.
4. *Surveys*. An estimate of the ERP is obtained by surveying financial professionals or academics (e.g., Welch 2000).

In the present study, we have estimated the ERP using the "historical method". Using time series data on actual realised returns to estimate expected returns has theoretical support and is widely used by academics and practitioners. The rationale for this approach is that over long periods of time investors are unlikely to be systematically mistaken in their expectations.

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21 Bank of England (2008), Quarterly Bulletin, Q1, p8.

22 UBS (2008) Global Investment Strategy, Implied Equity Risk Premium, 1 December 2008. UBS produce a weekly series of ERP estimates which is conducive to comparing against a similarly frequent volatility series.

23 Roger Ibbotson and Peng Chen, "The Supply of Stock Market Returns," Ibbotson Associates, 2001.

24 Zhiyi Song, "The Equity Risk Premium: An Annotated Bibliography", The Research Foundation of the CFA Institute, 2007.

We cross check the results of the historical data by analysis of the forward-looking ERP for the Eurozone using dividend growth models. Using these methods, we derive a "current" estimate of the ERP for the Eurozone using forward-looking data over 2006-2008.

We do not use demand side models or survey-based estimates of the ERP in this study. These types of models are not widely used in regulatory contexts due to disputable input assumptions. By contrast, an estimate of the ERP based on historical data is highly objective, easily understood and produces stable results over time which is a key criterion in a regulatory context.

Dimson, Marsh, and Staunton (DMS) provide long-term time series data on returns on stocks, bonds, bills, and inflation for 17 countries over the period from 1900 to 2007.[25] The DMS database comprises annual returns and is widely regarded as the best-quality capital appreciation and income series available for each country.[26] We use DMS' estimate of the ERP based on long-term bonds as our preferred measure of the ERP.[27]

This approach indicates the ERP in the Eurozone is between 3.9-6.1%, depending on whether an arithmetic or geometric mean is used (see Table 3.2).

Table 3.2
ERP based on 108 Years of Equity Returns

	Arithmetic Average (%)	Geometric Average (%)	Standard Error (%)
Belgium	4.5	2.7	1.9
France	6.2	4.1	2.1
Germany	8.6	5.6	2.6
Ireland	5.1	3.5	1.8
Italy	7.7	4.4	2.8
Netherlands	6.1	4.1	2.1
Spain	4.6	2.7	2.0
Eurozone Average	**6.1**	**3.9**	**2.2**
UK	5.4	4.1	1.6
USA	6.5	4.5	1.9
World Average	5.1	4.0	1.4

Source: Dimson, Marsh and Staunton and LBS / ABN Amro 2008 and NERA analysis. The Eurozone average is calculated as a simple average of the countries shown. A weighted average would likely produce a higher estimate as greater weight would be given to Germany, Italy and France and less weight to Ireland and Belgium.

Since historic returns vary over time, the arithmetic mean will always be larger than the geometric mean. The more volatile historic returns are, the bigger the difference. The level of volatility of historic returns will affect the actual returns required by an investor. Hence, in determining an appropriate ex ante ERP, the expected volatility of future returns must be

[25] Dimson, Marsh and Staunton, London Business School / ABN Amro "Global Investment Returns Yearbook 2008", February.

[26] The data sources for DMS database is reported in Dimson, Marsh and Staunton "The Worldwide Equity Premium: A smaller Puzzle", Handbook of the Equity Risk Premium, 2008, Appendix 2, pp.507 – 514.

[27] The use of long-term bonds is justified by academics. For example McGrattan and Prescott (2003) argued that short term bills provide considerable liquidity services and are a negligible part of individuals' long-term debt holdings. As a result, long-term bonds should be used as the riskless asset in equity premium calculations.

adequately captured. The arithmetic average of historic returns is an appropriate measure of the forward-looking ERP if market volatility is expected to be the same in future as it has been in the past.

To derive an ex ante ERP equal to the geometric based ERP would be a highly mistaken representation of the actual ex post returns that were available to an investor. The geometric mean of historic returns assumes that returns have accrued consistently over the estimation window (which using DMS' data is 108 years). However, this would ignore the frequency and timing (volatility) of the benefits of reinvesting positive returns or the costs of volatility associated with absorbing negative returns. A geometric based ERP implicitly assumes that future returns will have zero volatility. This is a highly erroneous assumption.

The application of the arithmetic mean in determining a forward looking ERP is also consistent with the majority of recent academic opinion. For instance Professor Ian Cooper states that the arithmetic historical mean is *"the single statistic that is favoured by many experts*."[28] Other academics that support the use of arithmetic averages include Ibbotson and Goetzmann (2006), Dimson, Marsh and Staunton (2000), Cornell (1999), Holmans (1996) and Morin (1994).

As discussed above and shown in Figure 3.1, the current market conditions have increased the volatility of market returns over and above levels observed prior to the credit crisis. This means even the arithmetic average of historic returns over the very long-term is unlikely to capture the full impact of increased volatility of current market returns. Hence, to the extent current levels of volatility will persist during over the next price control review even the use of an arithmetic mean of historic returns over the very long-term would be a conservative measure of the forward looking ERP. In any case, a geometric based ERP of as low as 3.9%, which implicitly assumes zero volatility, would be highly unjustifiable and would lead to a severe under-estimation of expected returns under current market conditions. Our preferred estimate for the ERP is hence 6.1%, based on the arithmetic mean of historic returns (see Table 3.2).

At the 2005 price control review for DAA, the CAR used an equity risk premium of 6.0%. This was based on the advice of Kearney and Hutson (2004) who also referred to arithmetic averages of historic returns from the Dimson Marsh and Staunton database. Kearney and Hutson state: [29]

> *"Dimson, Marsh and Staunton's (2002) estimates are the most recent, and in many ways the most rigorous to date. These researchers have produced the definitive work on estimating the equity risk premium, using data for 16 countries for the period 1900-2001. They claim that looking at 16 markets around the world – as opposed to the common approach that tends to use only well-established markets such as the US and the UK as benchmarks – addresses the serious problem of survivorship bias. Ignoring other markets that have been less successful or have weathered more economic volatility*

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[28] Cooper, I (2004) "The Equity Market Premium: Comments on the Ofcom consultation document, Ofcom's approach to risk in the assessment of the cost of capital", p3.

[29] Hutson, E ; Kearney, C "Dublin Airport Authority's Cost of Capital: Report to the Commission for Aviation Regulation", May 2005.

than others, they argue, leads to the overestimation of the equity risk premium".

The ERP estimate in this section is therefore based on exactly the same methodology used by the CAR at the price review, using updated data from the DMS database. This leads to an estimate of the ERP of 6.1%, which is slightly higher than the 6.0% used at the 2005 price control.

3.4. A Forward-Looking Estimate of the ERP

In this section we estimate an ex-ante ERP for the Eurozone. The implied ERP is derived from a discounted cash flow model, which equates discounted future streams of cash flows to shareholders (i.e. dividends) to prevailing stock market valuations. The equilibrating factor is the discount rate, which is the sum of the risk-free rate and the ERP. Subtracting the risk-free rate from the discount rate produces the implied ERP. This alternative method of estimating the ex ante (or 'forward-looking') risk premium attempts to capture explicitly investors' expectations. We consider this analysis as a cross-check to our ERP based on the arithmetic mean of historic returns as presented by DMS.

Typically, a company returns cash to shareholders via dividends. We therefore assume that shareholder returns are best proxied by dividends. However, dividends may not fully capture companies' true returns to investors. For example, cash can also be returned to shareholders via share buybacks. Ignoring share buybacks causes our measure of the implied ERP to be an underestimation of the 'true' ERP. However, in the Eurozone context, share buybacks are not likely to be a material problem.[30]

In the following analysis, we perform a dividend growth model (DGM) for each company included in a broad stock market index (i.e. EuroStoxx 50). The expected market return is then calculated as the market cap weighted average of the required rate of returns of all the individual stocks in the index.

Assuming a constant dividend growth rate, the required rate of return for an equity investor, R_t, can be represented in a closed formula as follows:

$$R_t, = D_{t+1} / P_t + g$$

Where:

D_{t+1} is the mean analyst forecast of dividends for year t+1; P_t is the stock price on the dividend ex-date in year t; and g is the long term dividend growth rate.

According to the one-step DGM, the real cost of equity finance is equal to the prospective dividend yield plus the real long term growth rate of dividends.

The one-step DGM assumes that a company will grow at a stable rate into the future, and while this may hold true for sectors such as regulated utilities it may not be representative of

[30] We note if there is a trend towards the use of share buybacks, a better estimate of long run growth in prices may be the earnings growth rather than dividend growth.

the future of the majority of companies. We therefore turn to a more complex two stage model, which breaks the DGM into two different stages of growth. Equity analysts generally forecast dividends 3-5 years into the future. A 'two-step' DGM can be used to take account of explicit dividend forecasts made by analysts. In a 'two-step' DGM, the required rate of return, R_t, can be solved numerically by solving the following equation:

$$P_t = \sum_{n=1}^{N} \frac{D_{t+n}}{(1+R_t)^n} + \frac{D_{t+N}(1+g)}{(1+R_t)^N (R_t - g)}$$

where N is the number of years of analysts' forecasts of dividends.[31]

There is no consensus on how to measure the long-term dividend growth rate, g. The choice of the long-term dividend growth rate remains largely a subjective choice. For example, the CC recently used historic dividend growth and historic per capita GDP growth as the long-term dividend growth rate in their model. We base our analysis on a range of different assumptions regarding the long-term dividend growth rate and present our estimates as ranges. We use the following dividend growth assumption:

- As a lower bound estimate, we use Consensus Economics' long-run real GDP growth forecast for the Eurozone which is equal to 1.9% in 2008.

- As an upper bound estimate, we use analyst forecasts of dividend growth spanning a horizon of up to five years (deflated by expected inflation) as a proxy for the long-term real dividend growth rate. This approach yields an estimate of 4.71% for the EuroStoxx 50 and 5.55% for the EuroStoxx.[32] This estimate is, however, higher than reasonable estimates for long-run nominal GDP growth. Therefore, dividend growth will eventually decay to its long-run equilibrium growth rate, which is proportional to forward-looking estimates for GDP (otherwise profits would gradually absorb all of national income). We therefore consider this estimate as an upper bound.

In order to construct a historical series for the ERP using this alternative methodology, it is necessary to gather information on what investors believed the future would look like at any given point of time in the past. Since March 2007, Bloomberg provides daily data on projected 12-months-ahead dividend yields for the EuroStoxx 50 index. In deriving the ERP at every point in time, we subtract our swap-based real risk-free rate at the same point in time (calculated as the 12 months trailing average). We note we use inflation expectations at any given point in the past to derive our estimate of the risk-free rate. This ensures consistency between expectations of calculating the risk-free rate and long-term equity returns.

Figure 3.1 presents a time series of the forward looking ERP based on a one-step DGM over a historic period from March 2007 to December 2008. The two dotted-lines in Figure 3.1

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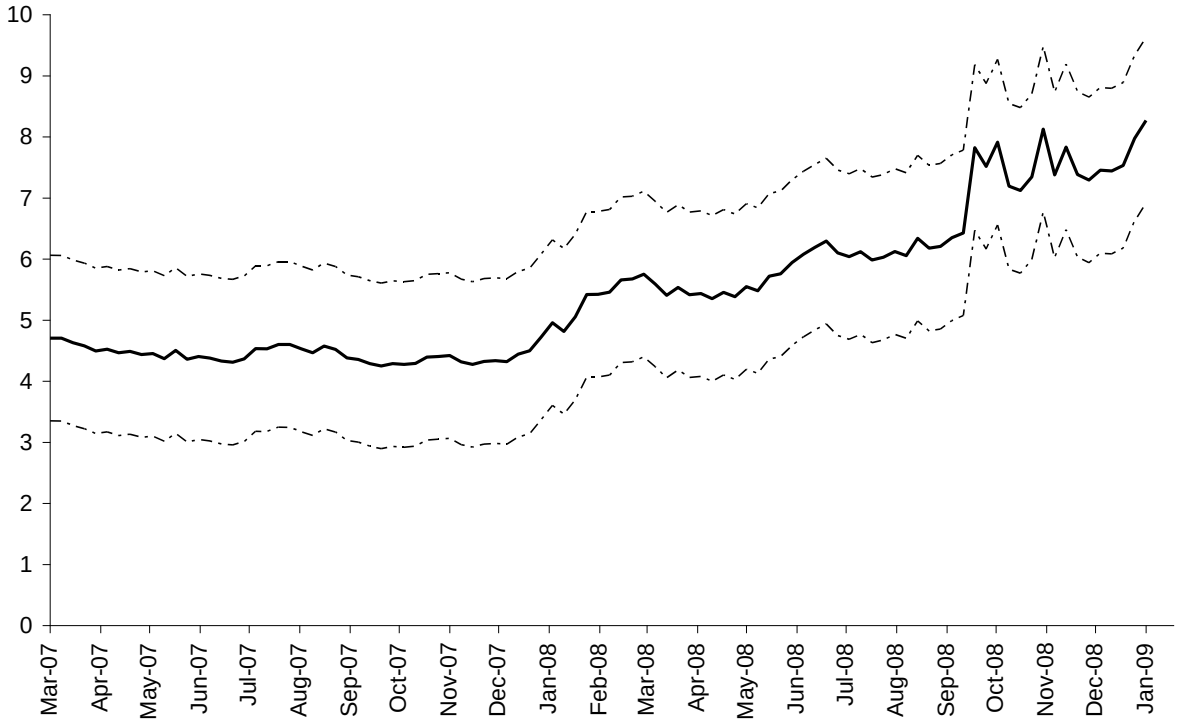
[31] Daily share price data and short term dividend forecasts (deflated for forecast inflation) have been collected from Bloomberg on the final dividend ex-dividend dates. All dividend forecasts and share prices are adjusted for stock splits. The long term growth rate of GDP is assumed equal to the Consensus Forecasts of real GDP growth over 5-10 years. These forecasts are 2.4% per annum for 2008.

[32] These figures are calculated as averages over 2006-2008. We rely upon the 2006-2008 average rather than an estimate from a single year of data as the average is drawn from a larger population of data and should be more representative of analysts' long-term trend dividend growth rate.

represent the upper- and lower-bound of plausible long-term dividend growth rate assumptions. The solid line shows the mid-point, based on the two plausible dividend growth rate scenarios. Based on the mid-point, Figure 3.1 shows that the ERP has been (on average) around 5.0-5.5% prior to October 2008, which is broadly consistent with our ERP based on the arithmetic mean of very long-term historic returns. However, since October 2008 Figure 3.1 shows that the ERP has increased sharply to above 7%. Figure 3.1 shows that the ERP has clearly increased during the recent period of heightened market volatility.

The average ERP over January to December 2008 is around 6.1%, which is in line with our preferred estimate of 6.1%, based on the arithmetic mean of very long-term historic returns.

Figure 3.2
One-Step DGM-Derived ERP
(March 2007 – February 2009)



Source: NERA analysis and Bloomberg data; Market returns are derived using a one-step DGM, using prospective dividend yields for the EuroStoxx 50 index as reported by Bloomberg. We use a swap-based risk-free rate (one-year trailing averages) to derive the ERP. Upper-bound (dotted line) is based on a long-term dividend growth rate of 4.71%; lower bound (dotted-line) is based on long-term real GDP growth rate of 1.9%; solid line is the mid-point of the two dotted lines.

We also applied a more complex two-step DGM to derive an implied ERP, based on explicit analyst dividend forecasts for each of the companies included in the EuroStoxx 50 and EuroStoxx based on our assumption of long-term dividend growth rates (see Table 3.3).

Table 3.3
Two-Step Forward-Looking DGM-derived Estimate of the ERP

	EuroStoxx 50		EuroStoxx	
	Cost of Equity	Implied ERP	Cost of Equity	Implied ERP
2006	6.6% - 9.3%	4.1% - 6.8%	6.2% - 9.7%	3.7% - 7.2%
2007	6.4% - 8.9%	3.9% - 6.4%	5.8% - 9.1%	3.3% - 6.6%
2008	6.8% - 9.3%	4.3% - 6.8%	6.3% - 9.6%	3.8% - 7.1%

Real cost of equity estimates obtained by applying a two-stage DGM to each EuroStoxx 50 and EuroStoxx company on each company's dividend ex-date. The estimates use analysts' forecasts of dividends adjusted, for expected inflation. The number of stages depends upon the availability of analysts' forecasts. The ERP is obtained by subtracting a risk-free rate of 2.5% from the cost of equity. The market return on equity and ERP are market capitalisation weighted averages of company estimates. Data as of 5 January 2009.

Our analysis shows that the expected real rate of return for the market for 2006-2008 is broadly in the range of 6.5 – 9.5%. After subtracting our estimate of the real risk-free rate of 2.5%, we estimate the ERP to be roughly 4.0–7.0%. This range includes the value of 6.1% that DMS data implies for the Eurozone. We note that the upper end of this range is higher than the result from the one-step DGM-derived ERP (see Figure 3.1). This result can be explained by noting that analysts' short-term forecasts of dividends are generally higher than long-term equilibrium growth rates.

We note that the latest estimate of the ERP based on the one-step DGM of around 7% is lower than the latest ERP estimate derived by UBS of around 7.7% (compare Figure 3.1 and Figure 3.2). However, more importantly, both models show a dramatic increase in the ERP in recent months. There are various possible explanations why the UBS model produces higher implied ERP estimates:

- First, the UBS model uses a different methodology: UBS do not use a dividend growth model; instead UBS construct a free cash flow to equity model.[33] The UBS model assumes that all cash flow to equity is being paid out to shareholders. However companies might keep some of their cash as retained earnings, which might be reflected in lower dividend forecasts. To the extent companies invest retained earnings in NPV-positive projects, the company will generate higher future dividend growth (the opposite is true if the company invests in NPV-negative projects). The effect that retained earnings might generate potentially higher dividend growth is captured in our DGM analysis to the extent analysts take it into account in their forecast of dividends. The UBS model prevents this problem by assuming all cash to equity is being paid out.

[33] The UBS model takes the net income and converts it to a cash flow by deducting the reinvestment needs such as capital expenditures and acquisitions. Depreciation as a non cash charge is added back to earnings. The UBS model expresses the cash flows available to equity after meeting all financial commitments, including debt repayments, and after covering capital expenditure and working capital needs. The model assumes (i) net income grows proportionally with earnings forecast; and (ii) net capital expenditures and working capital changes are financed using a constant proportion of debt and equity (the effect on cash flows to equity can be expressed as common equity as a % of total capital). Algebraically, the model defines FCFE as follows: FCFE = Net Income - ((Common Equity % Total Capital) x (Capital Expenditure - Depreciation & Amortisation +(-) Δ Working Capital + Acquisitions)) - Preferred Dividends.

- Second, we do not have information on long-term dividend growth rates underlying the UBS model. Differences in this key parameter have a material impact on the implied ERP calculation.
- Finally, we do not know which risk-free rate the UBS model uses in calculating the ERP. In our model we use a swap-based risk-free rate, which we consider to be reflective of a 'true' risk-free rate. This estimate is higher than government yields over most of the period considered.

3.5. Conclusion

Our preferred method for estimating the ERP is to use historical returns of very long-dated returns data. We relied primarily upon the Dimson, Marsh, and Staunton (DMS) database which is widely regarded as the best-quality capital appreciation and income series available. In particular, we use the arithmetic average of the ERP relative to bonds based on DMS' 108 years of historical returns evidence for the Eurozone as our preferred measure of the ERP. This approach places primary weight on the single statistic that is favoured by the majority of finance academics, namely the arithmetic average of historical returns. As a result, the academically preferred estimate for the ERP is 6.1%.

We cross-checked our estimate of the ERP based on historic means by calculating an ex ante ERP based on the DGM. Our analysis of an ex ante DGM derived ERP broadly confirms our preferred estimate of 6.1%. Estimates over 2006-2008 are broadly in line with this estimate, while a simplified, but more timely, DGM analysis shows that recent estimates of the ex ante ERP have increased dramatically from a level of around 5% to above 7%. The steep increase in the ERP coincides with increased stock market volatility and financial uncertainty. Economic theory suggests that investors demand greater compensation for risk during times of heightened uncertainty. In this regard, we note that the Bank of England also confirms the recent increase in the ex ante ERP with its own estimates, which the Bank attributes to increased market volatility. The recent increase in the ERP may not be entirely captured by our analysis which focuses upon very-long dated historic market returns. As a result, our final assessment of the ERP is conservative.

The above analysis points toward an ERP of around 6.0%. We note that this is broadly consistent with Irish regulatory precedent, which has generally estimated the ERP to be in the range of 5.0-6.0%. We further note that the most recent Irish decision, by Comreg for Eircom, settled on an ERP of 6.0%.

At the last review, CAR used an estimate of the ERP of 6.0%. Based on all of the available evidence there does not appear to be any objective basis for a reduction in the ERP at this review. Indeed, very recent evidence suggests the ERP is likely to have increased. We recommend that due to the recent volatile nature of international capital markets CAR will need to reconsider ERP closer to 2010 price control decision. Updated data during 2009 will assist in determining the likely long run impacts of the current financial crisis on investor risk premiums.

4. Beta

Beta is a measure of the non-diversifiable risk of an asset relative to the risk of the market portfolio. Typically, beta is estimated by reference to the traded equity of a particular company and the major domestic stock market. However, since Dublin Airport is not a quoted company its beta cannot be estimated directly. If its parent company DAA was listed this might provide an avenue for estimating Dublin Airport's beta, but it too is not listed. As a result, we consider two different approaches to estimating Dublin Airport's beta:

- By drawing on market evidence for quoted comparator companies; and
- By reference to Irish and international regulatory precedent.

The first approach is a relatively standard approach which has been widely adopted by regulators including by the CAR at its last review of Dublin Airport. While the approach itself is not particularly controversial, the precise choice of comparator airports necessarily considers numerous airport characteristics. The selection of those characteristics, their relevance and the inferences to be made from comparisons of those characteristics need to be explained clearly.

The second approach is multi-pronged. One possible approach is to consider whether Dublin Airport has become more or less risky than at the last review and to adjust (if necessary) its beta from that regulatory settlement. Another approach might draw on decisions in other jurisdictions for other airports. At the last review CAR focused heavily upon evidence from the UK for BAA. Since BAA was de-listed in August 2006 (though evidence from 7 February onward should be excluded)[34] any market evidence that CAR might have regard to would be over three years old by the time the CAR sets an asset beta for Dublin Airport. This would represent an overwhelmingly long period given the changes in both BAA and Dublin Airport's risk profiles (addressed later) in that period, and changes in the aviation industry and the global economy more generally. The CAR may, therefore, consider the recent decisions by the UK Competition Commission and Civil Aviation Authority as a reference point for setting Dublin Airport's beta. However, these relatively recent decisions for Heathrow & Gatwick (2007) and Stansted (2008) are of limited direct relevance to the CAR's assessment of Dublin Airport's asset beta because those decisions were directly based upon out-dated market evidence described above. Nevertheless, in recognition that the CAR is likely to consider this evidence closely, we estimate Dublin Airport's beta by reference to both the beta for BAA as a whole, and the betas for each of the three regulated London Airports.

This section is structured as follows:

- Section 4.1 briefly discusses some methodological issues associated with the estimation of beta;
- Section 4.2 estimates Dublin Airport's beta based on evidence from other listed airport companies;

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[34] See, for example, Competition Commission (2007) "BAA Ltd: A Report on the Economic Regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd)", Appendix F "Cost of Capital", F27, para 110.

- Section 4.3 considers the implications of previous regulatory decisions both in Ireland and abroad; and
- Section 4.4 concludes.

A number of appendices relate directly to the estimation of beta. The reader is referred to these appendices at the appropriate points in the text below.

4.1. Methodological Issues

Beta is a measure of the non-diversifiable risk of an asset relative to the risk on the market portfolio. It is defined as the covariance between returns[35] on an asset and returns on the market portfolio, divided by the variance of returns on the market portfolio:

(4.1) $$\beta = \frac{\text{cov}(r_e, r_m)}{\text{var}(r_m)}$$

where:

r_e is the return on a specific stock; and

r_m is the return on the market as a whole.

In theory, since the CAPM is based on expected future returns, the appropriate measure for beta is the current *expected* beta. However, in practice, as forward-looking estimates of returns on particular stocks and on the market as a whole are not available, historic returns are generally used as a proxy for expected future returns.

We make a number of standard adjustments to raw equity betas to derive asset betas which are comparable across companies. These adjustments are discussed in more detail in Appendix B.

We note that our approach does not include any adjustment for a debt beta. Notwithstanding that the UK Competition Commission recently included a positive debt beta in its estimates of the cost of capital for BAA's London airports we note that there is very little other regulatory precedent from Ireland, the UK, or internationally for the use of a non-zero debt beta. Indeed, there has been no regulatory decision in Ireland that we are aware of that has even considered the debt beta. As a result, we assume a debt beta of zero in this report.

[35] Returns should strictly speaking be estimated as total realised returns, i.e. including dividend payments: Returns = $(\text{Price}_t + \text{Dividend}_t - \text{Price}_{t-1})/ \text{Price}_{t-1}$. However, as noted in Patterson (1995), using percentage price change instead of total returns is likely to an unbiased estimate of beta for most firms. Smithers and Co (2003) advocate the use of excess returns (i.e. returns over and above the risk-free rate). However, Patterson (1995) notes that in instances where the return on the risk-free asset is correlated with the return on the market, the bias introduced by ignoring this adjustment will be small except when interest rates are very volatile (in which case, as shown by Roll (1969), if the correlation is positive, the bias will be positive for betas less than one, and negative for betas greater than one). We have disregarded this adjustment to returns in this report.

4.2. Evidence from Listed Comparator Airports

In selecting quoted comparators to Dublin Airport, our aim is to choose comparators which most closely match Dublin Airport's likely exposure to systematic, or beta, risk. As a result there is no reason, *prima facie*, to consider that the comparator airport set should necessarily be constrained to Europe. Therefore, to identify an initial set of listed airport owners or operators from which a set of comparator companies can be drawn, we identified all listed airport services companies within the S&P/MSCI Global Industry Classification System (GICS), which is an internationally acknowledged method for identifying members of sub-indexes.[36] From this initial list we identified those companies that were airport owners and/or operators.

Adopting this approach we identified 22 potential comparator airport owner/operators. The full list of potential comparators is presented in Appendix C. As discussed further in Appendix C we exclude a number of companies due to the absence of data. We also exclude Macquarie Airports Group as it is a multi-national multi-airport operator which means that its beta estimates are unlikely to be indicative of beta at any particular airport. In addition, as discussed in Appendix D we also exclude those companies with highly illiquid stocks as beta estimates based on infrequently traded stocks are likely to be biased downward.

Based on the foregoing analysis we identify 11 listed airport companies that may provide useful evidence about Dublin Airport's beta. These companies and a brief description of their business activities are presented in Table 4.1.

[36] The members of the Airport Services sub-sector within GICS were sourced from Bloomberg.

Table 4.1
Listed Airport Companies: Potential Comparators

Company Name	Country	Description
AERODROM LJUBLJANA	SLOVENIA	Aerodrom Ljubljana operates the Ljubljana Airport.
AUCKLAND INTERNATIONAL	NEW ZEALAND	Auckland International Airport Limited owns and operates the Auckland International Airport.
KOBENHAVNS LUFTHAVNE	DENMARK	Kobenhavns Lufthavne A/S (Copenhagen Airports A/S - CPH) owns and operates Kastrup, the international airport in Copenhagen, and Roskilde airport.
FLUGHAFEN WIEN AG	AUSTRIA	Flughafen Wien AG manages, maintains, and operates the Vienna International Airport and the Voslau Airfield.
AEROPORTO DI FIRENZE SPA	ITALY	Aeroporto di Firenze S.p.A. manages the Amerigo Vespucci Airport in Florence, Italy.
FLUGHAFEN ZUERICH AG-REG	SWITZERLAND	Flughafen Zuerich AG operates the Zurich Airport.
SAVE SPA	ITALY	SAVE SpA operates the Marco Polo Airport in Venice, Italy.
ADP	FRANCE	Aeroports de Paris (ADP) manages all the civil airports in the Paris area.
FRAPORT AG	GERMANY	Fraport AG operates the Frankfurt-Main, Frankfurt-Hahn and other airports in Germany, the airport in Lima, Peru, and the international terminal in Antalya, Turkey.
GRUPO AEROPORTUARIO DEL PACIFICO	MEXICO	Grupo Aeroportuario del Pacifico SAB de CV operates and maintains airports in the Pacific and central regions of Mexico.
GRUPO AEROPORTUARIO DEL SURESTE	MEXICO	Grupo Aeroportuario del Sureste S.A.B. de C.V. holds 50 year concessions, beginning in 1998, to manage airports in Cancun, Cozumel, Merida, Oaxaca, Veracruz, Huatulco, Tapachula, Minatitlan, and Villahermosa.

Source: NERA analysis of Bloomberg data.

There are a number of characteristics of a company's activities, structure and operating environment that will determine its exposure to systematic risk. We must therefore ascertain the nature of these characteristics for Dublin Airport and potential comparators under a robust and objectively verifiable framework, in order to enable the selection of the comparator(s) that will most accurately reflect Dublin Airport's likely exposure to systematic risk. Therefore, to identify those airport companies which most closely match Dublin Airport's exposure to systematic, or beta, risk we examine each of the 11 potential comparator airport owner/operators in more detail. We consider the following airport characteristics:

- Airport size, measured by passenger numbers and aircraft movements;
- Revenue characteristics, including:
  - Non-aeronautical & aeronautical revenues split;
  - The composition of non-aeronautical revenues including retail and car-parking;
  - Customer concentration i.e. dependence on major airline partners;
  - Passenger mix, including origin / destination versus transfer passengers, and long-haul versus short-haul;
- The nature of the regulatory framework;
- Whether the airport is significantly owned by the state or other public bodies; and
- Cost structure, which is measured by operating leverage, proxied by capex to opex ratios.

We note that other characteristics might also be relevant to an evaluation of systematic risk. However, availability of evidence limits a comparison in some cases e.g. leisure versus business travel. Further, some of the characteristics considered may not provide a useful indication of the similarity of airports due to differences in data collection methods (e.g. whether the data is truly like-for-like or whether the data is on a Group versus Company basis).

Table 4.2 summarises our assessment of the various potential comparator airport companies. Based on this assessment we identify Vienna airport as the best comparator for Dublin. We note that the percentage of transfer passengers at the two airports was substantially different, but in all other characteristics considered the two airports are very similar. Zurich and Copenhagen airports also have much in common with Dublin Airport. We do not consider Zurich a very close match for Dublin due to the different regulatory frameworks under which the two airports operate. Likewise, the absence of data for Copenhagen for two of the revenue risk characteristics makes it difficult to conclude that the two airports are very similar.

Table 4.2
Comparator Selection Matrix

	Size		Revenue Risks					Costs
	Pass.	ATMs	Non-Aero % of Revenue	Customer Conc.	Short Haul	Transfers	Reg.	Capex / Opex
A de Paris	X	X	OK		X		OK	OK
Auckland	OK	OK	OK		X	OK	X	X
Copenhagen	OK	OK			OK	X		OK
Florence	X	X			OK		X	OK
Frankfurt	X	X			X	X		
GAd Pacifico	OK	OK	X		X			X
GAd Sureste	OK	OK	X		X			X
Ljubljana	X	X		OK			X	
Venice	X	X	X	X	OK		X	
Vienna	**OK**	**OK**	**OK**	**OK**	**OK**	**X**	**OK**	**OK**
Zurich	OK	OK	OK	OK		X	X	OK

Note: "X" indicates that the airport company is not a good comparator for Dublin Airport for that characteristic; "OK" indicates that it is a good comparator; a blank cell indicates either data was missing or we do not interpret the evidence as decisive either way. Further analysis underlying this summary Table can be provided on request.

Based on the above we regard Vienna as a Tier 1 comparator, while the remaining airport companies are treated as Tier 2.

Table 4.3 presents asset beta estimates for each of the comparator airports. These betas have been adjusted according to Appendix B. We present betas estimated over a variety of historical periods using both daily and weekly data. The estimates based on both daily and weekly data are quite similar for most of the airport companies considered, suggesting illiquidity (as discussed in Appendix D) is not a major factor for the selected airports.

Table 4.3
Comparator Airports: Beta Estimates

Name	Daily				Weekly			Range
	Last six months	Last year	Last two years	Last five years	Last year	Last two years	Last five years	
Vienna	0.52	0.57	0.58	0.64	0.58	0.60	0.69	0.52 - 0.69
Frankfurt	0.52	0.57	0.63	0.67	0.66	0.69	0.72	0.52 - 0.72
Copenhagen	0.35	0.38	0.41	0.40	0.49	0.46	0.43	0.35 - 0.49
Paris	0.75	0.76	0.76	0.72	0.74	0.76	0.73	0.72 - 0.76
Venice	0.41	0.45	0.45	0.48	0.54	0.53	0.56	0.41 - 0.56
Florence Airport	0.43	0.42	0.42	0.46	0.44	0.45	0.48	0.42 - 0.48
Auckland International Airport	0.76	0.77	0.87	0.86	0.83	0.86	0.85	0.76 - 0.87
Ljubljana Aerodrome	1.16	1.16	1.09	1.07	1.17	1.11	1.07	1.07 - 1.17
Zurich Airport	0.36	0.38	0.40	0.32	0.44	0.44	0.36	0.32 - 0.44
Grupo Aeroportuario del Pacifico	0.67	0.70	0.73	0.72	0.75	0.79	0.81	0.67 - 0.81
Grupo Aeroportuario del Sureste	0.68	0.69	0.67	0.65	0.56	0.61	0.63	0.56 - 0.69

Source: NERA analysis of Bloomberg data until 20th February 2009. Note: Betas presented are asset betas, which have been derived from raw equity betas as discussed in Appendix B.

The evidence from Vienna airport suggests Dublin Airport's beta would be roughly in the range of 0.50-0.70.

4.3. Evidence from Regulatory Precedent

4.3.1. Comparison to CAR's 2005 Decision

At the last review the CAR set an asset beta of 0.61 for Dublin Airport. One approach to setting an asset beta at this review would be to use this value as a starting point and consider how Dublin Airport's risk has evolved since the last review. This is precisely the approach the CAR contemplated when it stated in its Issues Paper:[37]

> "*parties are invited to consider whether there are any reasons why the riskiness of operating Dublin airport relative to the market has changed significantly since 2005: is there any reason to expect the beta now to be different to the beta used in 2005?*"

We believe that Dublin Airport's risk has increased since 2005, particularly due to the proposed introduction of unitisation, trigger pricing and a service quality term in the price cap:

- Unitisation of depreciation – as discussed in NERA's (2008) submission to the CAR - which 'back-loads' the recovery of capital expenditure (via the depreciation charge) and ensures recovery is dependent on passenger numbers;[38]

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[37] CAR (2008) "Maximum Levels of Airport Charges at Dublin Airport: Issues Paper", p47, October 24.

[38] See NERA (2008) "Issues for the Next Regulatory Review", July, pp12-13.

- The CAR has proposed to introduce a "service-quality term in the price cap [which] will penalise the DAA if it fails to deliver services to the agreed standards" but which will not make "the DAA eligible for a bonus if it exceeds the quality standards identified in the price cap".[39] Based on a comparison to Stansted's settlement the CAR proposes that 6% of DAA's revenues should be placed at risk. This alteration to the price cap clearly represents an asymmetric risk since it raises the spectre of a significant loss of revenue, but offers no corresponding upside.
- Based on the unitisation approach suggested by the CAR in the 2007 Interim Review passengers must exceed circa 21 million before the cost of T2 is remunerated.
- Trigger pricing that ensures DAA may only recover revenues once major capex projects are completed.[40] For example, revenue allowances for T2 are dependent on passenger numbers – 26% of the costs of T2 are only recoverable once passenger numbers exceed 33m p.a.[41]

These changes to methodology have also increased Dublin Airport's regulatory risk because they introduce greater uncertainty into the regulatory framework. Further, greater customer concentration (measured as the proportion of passengers travelling with the two largest airlines at Dublin Airport) since 2005 has also increased risk, and there is the risk of further increases in customer consolidation in the medium term as evident by recent bid speculation by Ryanair for Air Lingus.[42]

As such, the CAR's allowance of an asset beta of 0.61 in 2005 represents a minimum level for Dublin Airport's current asset beta.

4.3.2. Interpretation of Evidence from BAA Airports

- ***Comparison to BAA***

At the 2005 review the CAR's consultants (at least partially) justified their recommendation of an asset beta of 0.61 based on an assessment that Dublin Airport was 20% riskier than BAA.[43] An alternative formulation of the CAR's consultation questions might, therefore, focus on whether Dublin Airport is still 20% riskier than BAA.

The CAR's consultant's assessment was based on the relative risk of the Irish and UK economies, uncertainty surrounding the completion date of T2 and the possible break-up of DAA. These factors – with the exception of the T2 completion date - remain equally relevant,

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[39] See Commission for Aviation Regulation (2008) "Maximum Levels of Airport Charges at Dublin Airport: Issues Paper", October 24, p11.

[40] This issue is discussed in more detail in NERA (2008) "Issues for the Next Regulatory Review", July, pp15-17.

[41] This risk is explicitly recognised by Standard & Poor's (2008) "Dublin Airport Authority PLC", January 25, pp6-7.

[42] Although Ryanair has abandoned its most recent hostile bid for Air Lingus, there is the possibility that this could be renewed in the medium term.

[43] Hutson and Kearney (2005), p16: "In examining the current and medium-term risk of the DAA, we believe it is approximately 20 percent more risky than BAA."

while as noted above there are several factors that are likely to have increased Dublin Airport's risk since 2005.[44]

In contrast, recent decisions by the UK Competition Commission suggest the asset beta of BAA airports has decreased. In its 2007 review of Heathrow and Gatwick the CC concluded on an asset beta for BAA of 0.52.[45] It should be noted that the CC included a debt beta of 0.1 in its calculations, which (all else equal) increases the asset beta. Re-setting the debt beta to zero, as we believe it should be, the asset beta is reduced to 0.49.[46] At its previous review in 2002 the CC concluded on an equity beta of 0.8-1.0 with gearing of 25%, which implies an asset beta of 0.6-0.75.[47] The 0.6-0.75 is directly comparable to the 0.49 figure.

Overall, it appears likely that DAA is more than 20% riskier than BAA currently. Adjusting the (adjusted UK CC's asset beta of) 0.49 upward implies an asset beta for Dublin Airport of at least 0.59.

Comparison to Heathrow, Gatwick and Stansted

During the most recent reviews of the three regulated London airports the UK Competition Commission decided that the asset betas for Heathrow, Gatwick and Stansted were 0.47, 0.52 and 0.61, respectively.[48] As discussed in the previous section, these asset betas reflect the assumption of a non-zero debt beta. Revising these figures to ensure consistency with a zero debt beta assumption produces asset betas of 0.44, 0.49 and 0.58, respectively.[49] Therefore, another approach to determining Dublin Airport's asset beta is via a comparison to each of the three regulated London airports.

To determine which of the BAA London airports is the best comparator for Dublin Airport we consider a number of the airport characteristics that we discussed in relation to listed airport companies in Section 4.2. We present this analysis in Table 4.4. We focus on averages over the period 2006-07 as this most closely corresponds to the period upon which the individual BAA airport betas were calculated.

The data presented shows that Dublin Airport and Stansted are closest in terms of size, measured by passengers and aircraft movements. We note that Dublin Airport's share of

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[44] Dublin Airport's increased risk relative to BAA in relation to the treatment of work in progress has been explicitly recognised by S & P (2008) "Dublin Airport Authority plc", p6 (January 25) which notes that "unlike the regulatory approach on BAA's Terminal 5, where costs are being recovered during construction, the cost of Dublin Airport's Terminal Two (T2) will only be recouped when the terminal is operational".

[45] See UK Competition Commission (2007) "BAA Ltd – A report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd)", Appendix F, paragraph 117.

[46] The CC calculated an equity beta of 0.74 with gearing of 34%. Setting debt beta to zero, we calculate the implied asset beta as 0.74 x (1 – 34%) = 0.49.

[47] See UK Competition Commission (2002) "BAA plc: A report on the economic regulation of the London airports companies (Heathrow Airport Ltd, Gatwick Airport Ltd and Stansted Airport Ltd)", p171, November.

[48] See UK Competition Commission (2008) "Stansted Airport Ltd: Q5 Price Control Review", Appendix L, paragraph 100, October.

[49] We assume gearing of 34% for each of the airports. We then calculate implied equity betas based on the stated asset beta, a debt beta of 0.1 and our gearing assuming. These equity betas can then be de-levered into asset betas for a debt beta of zero.

non-aeronautical revenues is higher than any of the London airports, but at both Stansted and Gatwick a greater proportion of non-aeronautical revenues are from retail. Overall, the proportion of total revenue from retail is broadly similar at these three airports. Compared to Gatwick and Heathrow, Dublin Airport is more reliant on its two major airline carriers. Finally, we note that Dublin Airport's operational leverage is lower than Heathrow and Stansted, but similar to Gatwick. However, we note that BAA's own analysis for its price control review in 2007 suggested that Heathrow actually had the lowest operational leverage, followed by Stansted and then Gatwick.[50] While at least some of the discrepancy is potentially due to differences in the measurement of operational leverage, BAA's analysis suggests we should not place too much weight on our own assessment of this particular characteristic.

Table 4.4
Comparison to BAA London Airports: 2006-07 Averages

	Size		Revenue Risks				Costs
	Pass. (m)	ATMs (000's)	Non-Aero % of Revenue	Retail % of Non-Aero	Customer Conc.	Short Haul	Capex / Opex
Dublin	22.24	204.22	56.7%	57.3%	71.9%	92.1%	42.5%
Heathrow	67.66	479.15	48.1%	49.8%	48.1%	50.7%	205.3%
Gatwick	34.63	264.95	42.2%	68.8%	37.0%	66.9%	41.2%
Stansted	23.72	207.65	47.3%	78.4%	83.0%	97.6%	81.3%

Source: NERA analysis of DAA info, DAA Annual Report, BAA Annual Reports, Heathrow, Gatwick and Stansted Regulatory Accounts, BAA Website Statistics.

Overall, we interpret the data as indicative that Dublin Airport is riskier than both Heathrow and Gatwick, but of lower risk than Stansted. This suggests an asset beta of 0.49-0.58. However, this range excludes any adjustment for the relative risk of Ireland versus the UK, and for Dublin Airport's greater exposure to the Irish economy than the BAA airports. As noted in the previous section, at the last review the CAR calculated that Dublin Airport was around 20% riskier than BAA airports for these reasons. As a result, it is appropriate to scale the 0.49-0.58 range for the additional "Ireland risk". Making this adjustment produces an asset beta in the range of 0.59-0.70. We regard this range as an appropriate risk-adjusted range for Dublin Airport's asset beta at the upcoming review based on this specific BAA-airports evidence.

4.3.3. European Regulatory Precedent

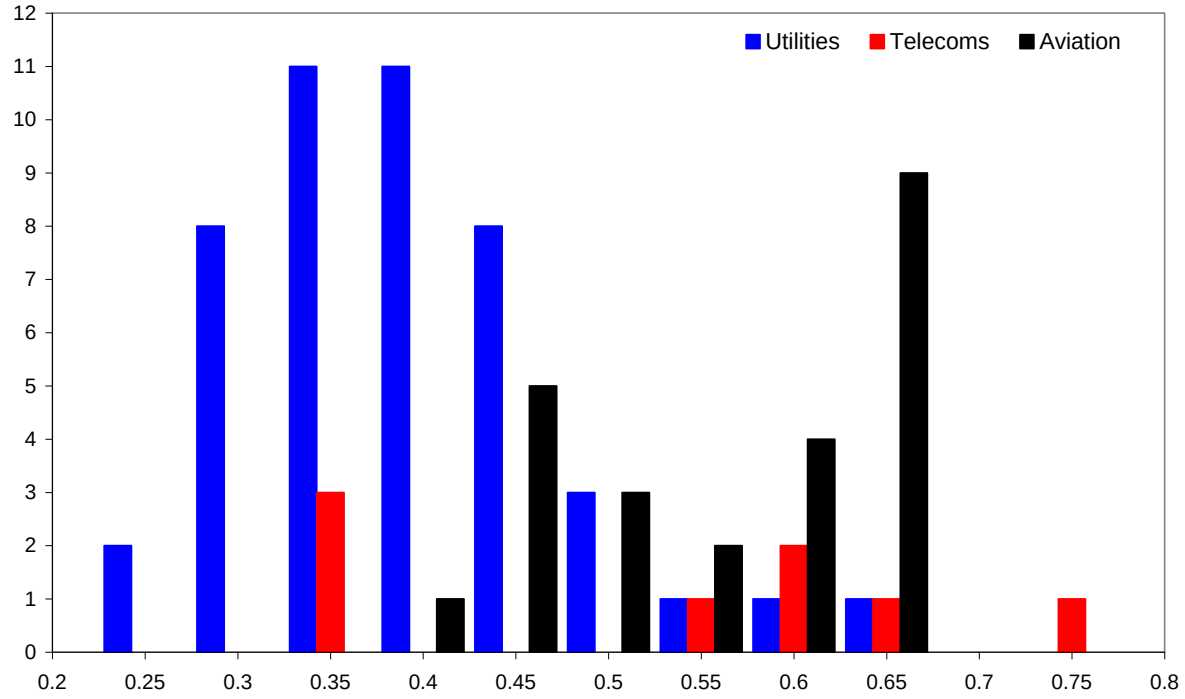
Figure 4.1 summarises European regulatory precedent on asset beta across three sectors: aviation (which includes airports and air traffic services), telecoms and utilities. It is clear from these decisions that utilities are typically regarded as somewhat less risky than either telecoms or aviation. The range of aviation decisions is roughly similar to the range of telecoms decisions presented. This overlap may partially reflect the diversity of telecoms decisions: many of the telecoms decisions at the low end of the range are likely to be for

[50] See UK Competition Commission (2007) "BAA Ltd – A report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd)", Appendix F, paragraph 114.

fixed-line businesses, which would normally be significantly less risky than the remainder of the telecoms business.

Broadly speaking the majority of European aviation decisions have settled on an asset beta of 0.45-0.65, but this range increases sharply if recent UK decisions – which we have criticised to some degree in this report, but which have been subject to extensive criticism more generally – are excluded. Leaving these decisions to one side the preponderance of aviation decisions are in the range of 0.60-0.65.

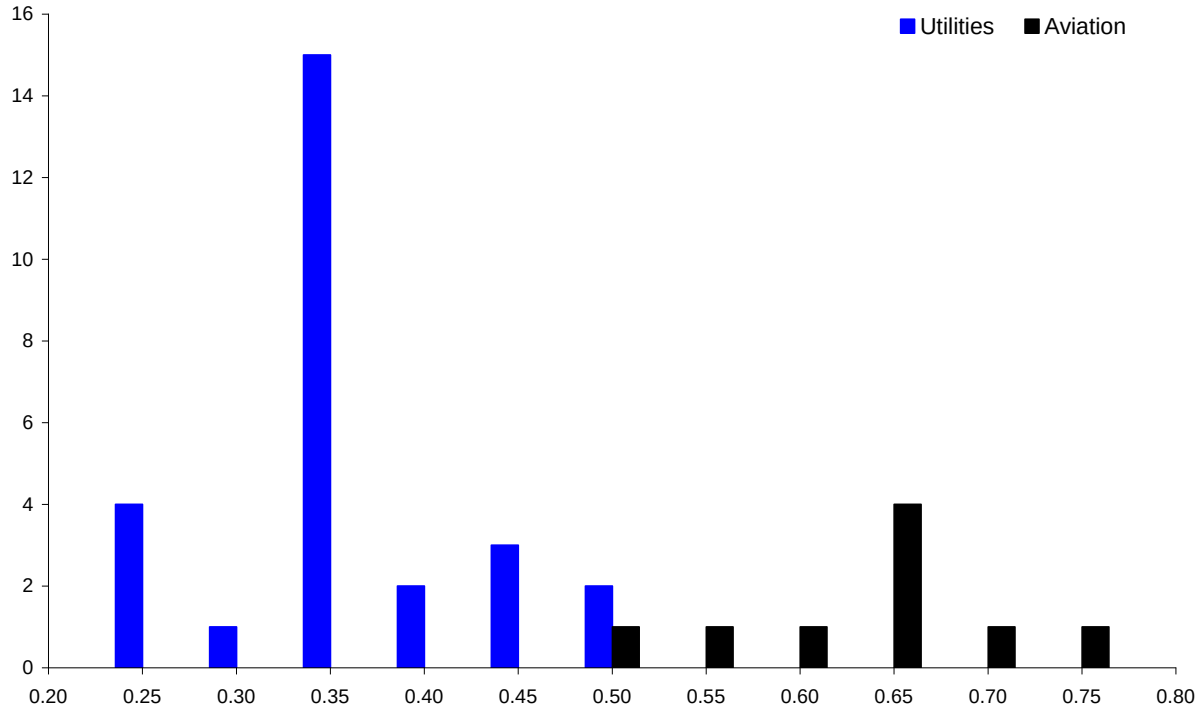
Figure 4.1
European Regulatory Precedent: Asset Beta



Source: NERA analysis of regulatory decisions.

4.3.4. Australian Regulatory Precedent

Figure 4.2
Australian Regulatory Precedent: Asset Beta



Source: NERA analysis of regulatory decisions.

Figure 4.2 presents the distribution of Australian regulatory decisions for the aviation and utilities industries. As with European regulatory precedent, the aviation sector has typically been allowed a much higher asset beta, which is consistent with a much higher level of systematic risk. We note that most aviation decisions give an asset beta of 0.6 – 0.7, though the comparability of Australian airports to Dublin Airport is unclear.

4.4. Conclusion

Table 4.5 summarises the estimates of Dublin Airport's asset beta from the various methods we have employed. The bulk of evidence points to an asset beta range of 0.6-0.7 for Dublin Airport at the upcoming review. Further, we note that the number of different approaches we have taken all point to broadly similar conclusions. As a result, we conclude on an asset beta (at this time) of 0.6-0.7 for Dublin Airport at the upcoming review.

Table 4.5
Summary of Results: Asset Beta

Method	Estimate
Market Evidence from Listed Comparator Airport Companies	0.50 – 0.70
Comparison to CAR 2005	0.61 +
Comparison to UK Competition Commission for BAA 2007	0.59 +
Comparison to UK Competition Commission for Heathrow, Gatwick and Stansted 2007-08	0.59 – 0.70
European Regulatory Precedent	0.6 – 0.65
Australian Regulatory Precedent	0.6 – 0.7
Asset Beta for Dublin Airport	**0.6 – 0.7**

5. Conclusions on the Cost of Equity Based on the CAPM

Table 5.1 presents our indicative conclusions on the cost of equity for Dublin Airport from the CAPM. We have assumed gearing of 50%, which is broadly consistent with the current level of gearing and with a gearing ratio associated with an A rating. The relationship between gearing and credit rating is considered in more detail in Section 9.

Table 5.1
Real Cost of Equity Using the CAPM

	Min	Max
Real Risk-free Rate	2.8%	4.1%
Equity Risk Premium	6.0%	6.0%
Gearing	50%	50%
Asset Beta	0.6	0.7
Equity Beta	1.2	1.4
Real Cost of Equity (post-tax)	**10.0%**	**12.5%**

Source: NERA analysis.

Our estimate of the cost of equity for an A rated Dublin Airport is in the range of 10.0 – 12.5%, reflecting the ranges around the risk-free rate and asset beta parameters.

The Impact of the Credit Crisis

Recent developments in capital markets have increased the cost of equity. The recent increase largely reflects the scarcity of equity - few equity holders are willing to invest at this time, preferring to take safer returns on bonds and other debt instruments that have increased protection through covenants and returns to which are typically higher priority.

The recent volatility in equity markets is difficult, however, to capture in a largely historic-evidence based CAPM framework: our CAPM analysis draws on long-term historic evidence to generate stable statistically robust estimates.

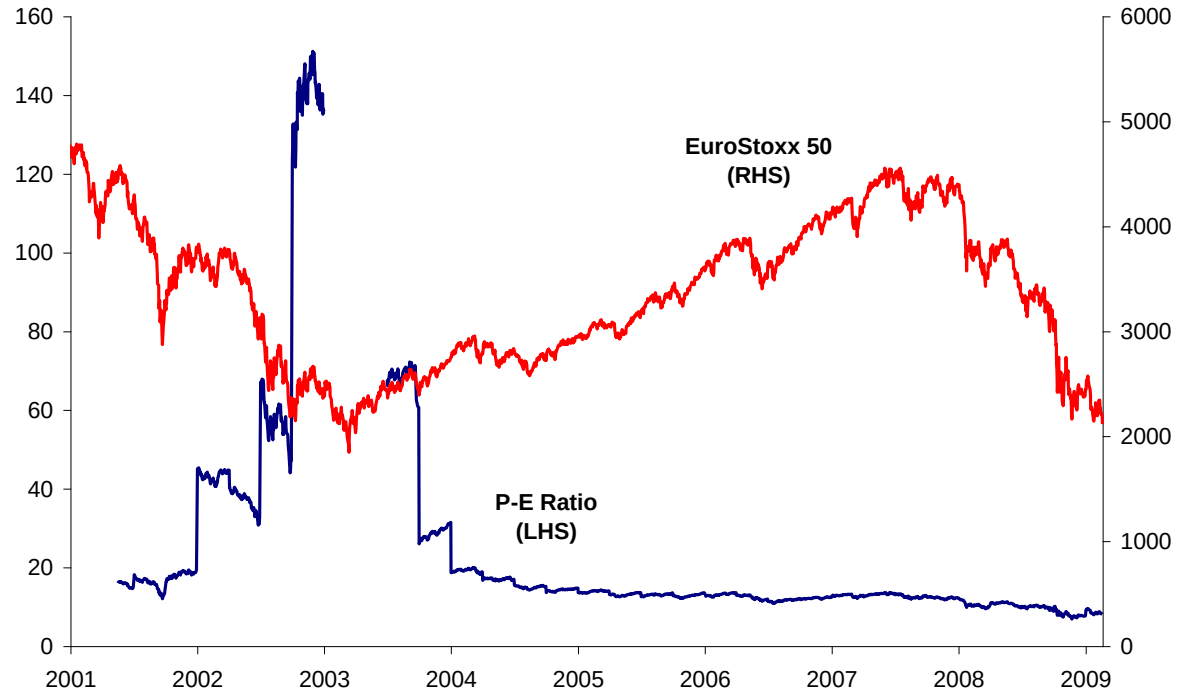
There are indications, however, that equity holders have recently increased their required rate of return. Recent analysts' reports suggest that the cost of equity has risen. For example, UBS research (using a DGM model) concludes that the ERP for the Eurozone has risen from around 6% at the beginning of 2008 to above 10% in November and was around 8% in mid-February.[51] In addition, we note that the Bank of England remarked on this in their first Quarterly Bulletin of 2008, as their DGM-based estimates of the ERP began rising.

One indicative measure of the cost of equity is the price-earnings (P-E) ratio, which reflects the relationship between equity prices and their earnings. Figure 5.1 shows how the P-E ratio of the EuroStoxx 50 has moved relative to the index. The P-E ratio is currently at its lowest level over the period shown, at a time when equity prices (represented by the index) have fallen dramatically. This implies that earnings have not fallen as much as prices. A low P-E ratio usually indicates that equity is under-priced. In this case it may reflect investors' altered preferences away from equities – despite earnings holding up relatively well investors are

[51] UBS (2008) Global Investment Strategy, Implied Equity Risk Premium, February 2009.

less willing to purchase equities. There is a stark difference with the last period in which equity prices fell significantly (2000-2003). In that period P-E ratios rose to very high levels as earnings plummeted. This evidence is consistent with the assertion that investors currently are requiring a higher return to invest in equities, and hence that the cost of equity has increased.

Figure 5.1
EuroStoxx 50 and Price-Earnings Ratio (2001-2009)



Source: Bloomberg data until 18th February 2009.

Overall, the highly unusual market circumstances such as the historically unprecedented low P-E ratios shown in Figure 5.1 or the heightened volatility presented in Figure 3.1 are difficult to capture in a *historic-evidence* based CAPM. It is highly likely that the recent fundamental shifts in the market have increased the cost of equity, but that this increase is only reflected in our estimates to a limited extent. We would therefore caution that the upper limit to our cost of equity estimates is not necessarily a plausible upper bound for a forward-looking cost of equity based on very recent data.

6. Cost of Debt

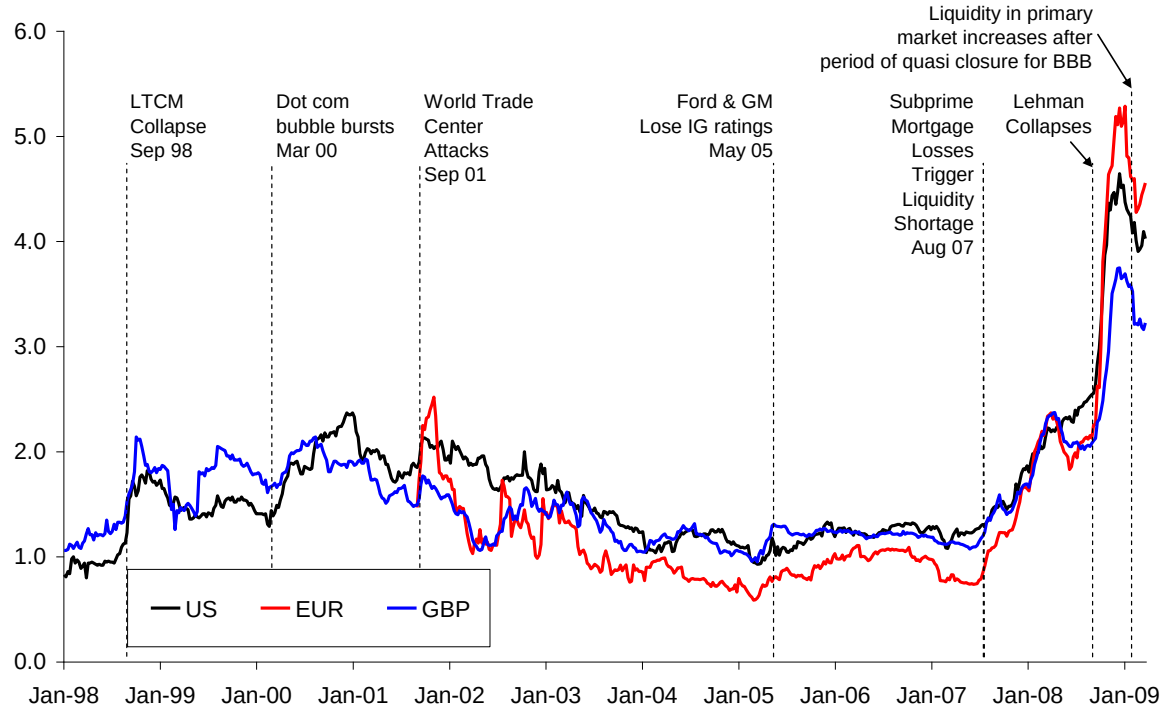
This section discusses the estimation of the cost of debt for Dublin Airport. This section is structured as follows:

- Section 6.1 outlines the impact of the credit crisis on the availability of debt and considers the possible duration of the crisis;
- Section 6.2 details Irish regulatory precedent relating to the cost of debt;
- Section 6.3 sets out our proposed approach to estimating the cost of debt for Dublin Airport;
- Section 6.4 discusses the cost of bond debt;
- Section 6.5 presents evidence on the cost of European Investment Bank loans;
- Section 6.6 presents evidence on the cost of bank facilities;
- Section 6.7 considers the appropriate allowance for transaction and pre-funding costs; and
- Section 6.8 concludes.

6.1. The Impact of the Credit Crisis

The market turmoil triggered in August 2007 by rising mortgage delinquencies in the US has developed into an international economic crisis. Figure 6.1 shows spreads of corporate bonds which are currently at levels far in excess of what we have seen over the past decade. Further, spreads have continued to widen over 2008 despite government bail-outs of several banks and massive injections of liquidity into the financial system by central banks.

Figure 6.1
The Crisis in Context: Industrial BBB Spreads



Source: NERA analysis of Bloomberg, Bank of England and IBOXX data to end February 2009.

6.1.1. Availability of Debt

One important consequence of the credit crisis has been upon the availability of debt in general, and particularly for smaller companies and companies of lower credit quality. In particular, we note that there were relatively fewer BBB rated bond issues in the second half of 2008, as a proportion of total bond issues, compared to previous periods. This reflects the unwillingness of investors to provide funds to lower rated companies in current market conditions. Indeed, at times the availability of finance was very limited to even A rated issuers and access virtually completely prohibited to BBB rated issuers.

Looking ahead, a considerable amount of government bond issuance is expected in 2009 and beyond. Further, issuance by government-backed financial (and other) institutions is also expected to be considerable. As a result, DAA is likely to face stiff competition to attract investment when it attempts to access capital markets. The glut of government and government-backed issuance may, therefore, have the effect of crowding out corporate (including DAA) issuers meaning access to debt markets is likely to remain difficult for some time to come.

The European Central Bank's "Euro Area Bank Lending Survey" has shown that banks' willingness to lend has been severely impaired by the effect of the financial turmoil: lenders have reported a reduced willingness and ability to lend in each quarter (compared to the previous quarter) since 2007 Q3. Likewise, the Survey shows that both price and non-price terms and conditions have tightened quarter-on-quarter throughout the past 18 months. In particular:

- Margins on average and riskier loans have widened significantly;
- Banks have tightened their credit standards by acting on the size of loans and on collateral requirements; and
- Tightening has been more pronounced for long-term loans.
- Country risk for State owned issuer have increased.

Lenders have attributed these developments to concerns about the general and firm-specific economic outlook, access to market finance and because of banks' own capital positions. It is apparent from the Survey results that banks' willingness to lend has been substantially impaired by the crisis and investors have tightened the terms and conditions under which they are prepared to lend.

Evidence from one of DAA's partner banks corroborates this more general evidence. In particular the partner bank noted that the following features are now common place in the bank markets:

- Most banks are reducing their credit lines in order to conserve capital for potential future losses arising from the economic downturn;
- A number of banks are withdrawing to their 'home countries' following state support. This withdrawal limits borrowers' ability to tap a wide syndicate of banks;
- Terms are becoming more expensive with tighter loan covenants and increased collateral and security in order to increase banks' return on capital;
- Banks are typically not lending beyond 3-5 years and many have withdrawn from the long term project finance market which infrastructure companies would typically rely upon in the absence of bond markets;
- Bank syndication markets are closed with most deals done on a 'club' take-and-hold basis; and
- Significant new bank commitments are typically only being made on the basis of a bond take-out i.e. on the assumption that the bank loans can be refinanced in due course through the bond markets. (Indeed DAA's previous bank facilities were executed on this basis.)

Overall, access to finance of all types has been jeopardised by the credit crisis. The availability of bond and bank finance has been severely curtailed, particularly for companies with a credit rating below single A. Credit quality will, therefore, be more important going forward, which has implications for CAR's assessment of Dublin Airport's financial viability over the next review period. We discuss this issue further in Section 8.

6.1.2. Potential Duration of the Credit Crisis

Indications from previous financial crises might be of some guidance in forming a view on the likely duration of the present credit crisis. For example, spreads for corporate debt were high for approximately 26 months after the burst of the Dot-com bubble in March 2000. However, the current crisis appears to be worse than earlier crises. Market commentators

have compared the current financial crisis to the Great Depression of the 1930s or to the prolonged Japanese slump throughout the 1990s.

Overall, the current period of market turmoil is likely to have prolonged effects upon the cost and availability of debt. Our consultation with market participants has shown that the recent developments represent a fundamental shift in the market and are not transitory in nature.

6.2. Regulatory Precedent

At the last price control review the CAR allowed DAA a real pre-tax cost of debt of 3.7% based on its assessment of the risk-free rate and of DAA's debt premium. The analysis of the debt premium focused upon the spread on DAA's (Aer Rianta) (then only) outstanding bond, which the CAR estimated to be around 110 bps. The CAR also placed some weight on the fact that the UK Competition Commission had estimated a similar debt premium for BAA in its 2002 review.

We note that the majority of previous Irish regulatory decisions have also estimated the cost of debt by adding a debt premium to the risk-free rate, as shown in Table 6.1. Notwithstanding that the debt premium will vary across decisions because of differing assumptions about the actual or optimal credit rating of the regulated entity, it is clear that the 110 bps allowance made by CAR at the last review is among the lowest debt premium verdicts reached by Irish regulators. We further note that the CAR's decision for IAA in 2007, which is an outlier at the low end, was the result of a European Commission directive requiring that the CAR use IAA's actual cost of debt in setting the cost of debt. Perhaps the most important lesson to be drawn from this evidence is that the debt premium is very likely to have increased sharply over the past 12-18 months. This is illustrated by a comparison of the relatively recent Eircom decision by Comreg to earlier decisions by CER and CAR. Further illustrating the recent escalation of debt premiums, we note that Comreg ultimately set a cost of debt and risk-free rate that implied a debt premium of 215 bps, well above the upper end of the range of 120-190 bps that it had considered reasonable during the consultative phase of its review.

Table 6.1
Irish Regulatory Precedent on Debt Premium

Regulator	Year	Category	Description	Debt Premium
Comreg	2008	Telecoms	Review of Eircom's cost of capital - fixed line business	2.15%*
CER	2007	Utilities	Gas Distribution	1.10%
CER	2007	Utilities	Gas Transmission	1.10%
CAR	2007	Aviation	Irish Aviation Authority	0.38%
CER	2006	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2007	2%
CER	2005	Utilities	Direction to ESB Power Generation on Allowable Costs 2006/07	1.75%
CAR	2005	Aviation	Dublin Airport Authority	1.10%
CER	2005	Utilities	2006-2010 Transmission	1.35%
CER	2005	Utilities	2006-2010 Distribution	1.35%
CER	2005	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2006	1.50%
CER	2003	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2004	2.50%
CER	2003	Utilities	Gas Distribution (Bord Gas Eirann)	1.40%
CER	2003	Utilities	Gas Transmission (Bord Gas Eirann)	1.40%
CER	2002	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2003	2.50%
CAR	2002	Aviation	Irish Aviation Authority	1.20%
CER	2001	Utilities	Electricity - Wholesale Market - Best New Entrant Price 2002	2.50%
CAR	2001	Aviation	Aer Rianta	1.10%

Source: NERA analysis of regulatory decisions shown. Where a range was given we have presented the mid-point; (*) Calculated as difference between cost of debt and risk-free rate.

6.3. NERA's Analysis of the Cost of Debt

The purpose of this report is to estimate a cost of capital for Dublin Airport. As a result, in this section we ideally wish to estimate a cost of debt for Dublin Airport. However, since DAA finances all of its airports and operations at a Group level it is not possible to directly observe the cost of debt for Dublin Airport. Therefore, we estimate Dublin Airport's cost of debt by reference to DAA's cost of debt noting that this should provide a reasonable estimate of the cost of debt for a notional stand-alone Dublin Airport. In reaching this conclusion we note that the smaller size of Dublin Airport compared to DAA might suggest that its cost of debt would be higher, though its cost of debt may also be lower depending on the relative risk of the various airports and businesses within the DAA group, which might lead to a different credit rating for Dublin Airport if it were rated on a stand alone basis. We note that in its recent review of Stansted Airport the UK Competition Commission based its assessment of the cost of debt at Stansted upon the cost of debt of BAA (its parent company), notwithstanding some obvious differences such as those we have identified.

We present data on the cost of debt for DAA drawing on both current and time series information. We then assess the merits of different approaches to inform our cost of debt based on market evidence over the long-run and the most recent period. In our assessment of the cost of debt, we consider the costs of the different types of funding used by DAA, i.e. bonds, EIB loans and bank facilities. Our estimate is composed of the following elements:

- Funding costs based on yield data drawn from primary and secondary markets;
- Costs of existing debt in DAA's debt portfolios;
- Transaction costs including bank, legal, trustee and agent fees; and
- Pre-funding costs relating to the (necessary and efficient) arrangement of funding before it is required.

Unlike the CAR and other Irish regulators, we prefer to directly estimate the total cost of DAA's debt, rather than attempting to estimate DAA's debt premium, which could then be added to our estimate of the risk-free rate. We prefer this approach since total costs are more easily observed and because our methodology more readily lends itself to an analysis of multiple types of debt in addition to bond debt.

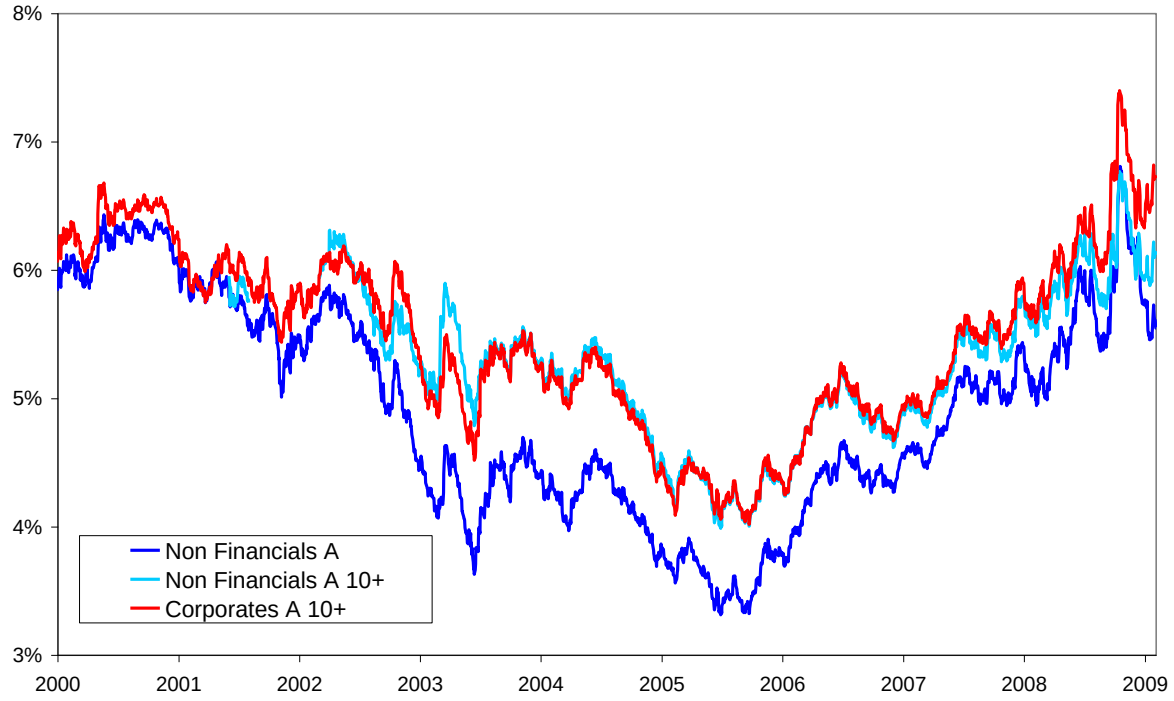
6.4. Evidence from Bond Markets

Under stable market conditions a plausible estimate of the cost of new debt can be derived from the observed yield-to-maturity on existing bonds traded in the secondary market. However, during periods of heightened volatility investors often require a new issuance premium in compensation for the opportunity cost of not investing later at a potentially higher yield.

Having set this scene we consider evidence from the secondary market on A rated yields as a starting point for our analysis of the appropriate benchmark cost of DAA's bond debt. We present yield evidence in Figure 6.2 for three series:

- Non-financials A rated debt;
- Non-financials A rated debt with years to maturity exceeding 10 years; and
- All corporate A rated debt with years to maturity exceeding 10 years.

Figure 6.2
Secondary Market Evidence



Source: NERA analysis of IBOXX data up until February 2009.

We note the following points based on the yield evidence shown:

- The series with 10+ years-to-maturity lie above the series comprising bonds of all maturities over most of the past decade, suggesting that the yield curve has been upward sloping most of the time and that, as a result, it is important to control for the tenor of DAA's bond issues when identifying an appropriate benchmark;
- Until recently the non-financials A 10+ and corporates A 10+ series have closely tracked each other. We treat this as evidence that the financial sector has been more heavily affected by the recent market turmoil and that yields on financial institutions' bonds should be excluded from a benchmark measure over the past 18 months (or so). However, historically, there is no reason to exclude the financial institutions. As a result, it is reasonable to use evidence on all corporate bonds in issue to identify a benchmark in earlier years. This is especially important given that the non-financials A 10+ series is (generally) unavailable prior to March 2002;
- Yields on corporate and non-financial bonds were at very low levels between 2002 and 2007, broadly speaking. The low yields observed have subsequently proved to have been unsustainable. We further note that DAA's bond issues occurred outside of this period. As a result, the 2002-2007 period should be excluded from any benchmark cost of DAA's debt. Indeed, we believe it is appropriate to focus on those periods at or about the time that DAA actually issued its debt when estimating an appropriate benchmark.

Based on the foregoing analysis we estimate that if an appropriate benchmark for DAA's bond costs can be identified from secondary market evidence, that benchmark will:

1. For the February 2001 bond issue rely upon corporate A-rated debt with 10 or more years to maturity; and
2. For the July 2008 bond issue rely upon non-financial A-rated debt with 10 or more years to maturity.

This evidence, shaded gray in Table 6.2, suggests benchmark secondary market yields were around 6% in both 2001 and 2008 when DAA issued. In isolation this evidence would suggest the appropriate benchmark cost of debt is circa 6%.

Table 6.2
Secondary Market Yields: Selected Averages

IBOXX series	Spot rate	Last month	Last 3 months	Last 12 months	Last 2 years	Last 5 years	Last 10 years	2008	July 2008	2001-02	Feb 2001
Non-Financials A 10+	6.15	6.03	6.15	6.01	5.67	5.10	5.25	5.98	6.14		
Non-Financials A	5.55	5.59	5.94	5.70	5.34	4.57	5.05	5.67	5.83	6.08	5.85
Corporates A 10+	6.74	6.61	6.64	6.34	5.88	5.18	5.55	6.26	6.36	6.22	5.90

Source: NERA analysis of IBOXX data up to 3rd February 2009.

We have considered evidence on secondary market bond yields since this is evidence that regulators including CAR may consider. In particular, we note that the UK Competition Commission has specifically examined evidence on secondary market yields in its recent reviews of the regulated London airports. However, as noted at the outset of this section, during periods of volatility it is appropriate to also consider coupons on bonds issued during those periods to ensure that any new issuance premium is also fully reflected. Since both of DAA's bonds were issued during periods of heightened volatility - in 2001 following the LTCM collapse and dot-com bubble burst, and during 2008 following the well documented problems in international capital markets – it is very important to ensure that any new issuance premium is also captured in our benchmark cost of debt. Therefore, in the next section we examine the coupons on bonds issued at similar points in time to DAA's bonds (i.e. February 2001 and July 2008).

6.4.1. DAA's 2001 Bond Issue

DAA issued a €250m 10-year bond at 6.15% in February 2001. To identify an appropriate benchmark cost of debt for this bond issue we have considered:

- Bonds issued in January and February 2001 of various ratings and with various tenors; and
- Bonds issued between July 2000 and June 2001 with similar tenor.

Table 6.3
Bond Issues in January & February 2001

Issuer	S&P Rating	Moody's Rating	Amount €m	Issue Date	Tenor (years)	Coupon Yield
BMW FINANCE NV		A1	750	28/02/2001	5	5.18%
LINDE FINANCE BV	A	A3	100	27/02/2001	3	4.82%
INTERNATIONAL ENDESA BV	A+	Aa3 *-	750	22/02/2001	5	5.26%
PORTUGAL TELECOM INT FIN	A	A2	1000	21/02/2001	5	5.75%
DAA FINANCE PLC	A+		250	16/02/2001	10	6.15%
KONINKLIJKE KPN NV	BBB+	Baa2	1000	13/02/2001	4	6.26%
TOYS R US		A3	500	13/02/2001	3	7.13%
SOL MELIA EUROPE BV	BBB		340	09/02/2001	5	6.28%
ELISA OYJ	A-	A3	300	31/01/2001	5	6.38%
DAIMLERCHRYSLER NA HLDG	A	A2 *-	2750	18/01/2001	3	6.00%
CLEAR CHANNEL COMMUNICAT	BBB-	Baa3	635.63	12/01/2001	4	6.50%
Range			**100 - 2750**		**3 - 10**	**4.82% - 7.13%**
Average			**761**		**4.73**	**5.97%**

Source: NERA analysis of Bloomberg data. Note: Ratings are at date of issue. Bonds selected are fixed coupon with bullet repayment, are not index-linked, not subordinated, non-fungible, not a private placement and not callable. Bonds with tenor of less than three years are also excluded.

Table 6.3 presents Euro-denominated bonds issued around the same time as DAA's (Aer Rianta's) February 2001 bond issue. In theory, these bond issues should be a good measure of the coupon DAA would have had to pay provided bonds of similar tenor and credit rating (at the time of issue) can be identified. However, at the time no other bonds were issued with similar (ten year) tenor as DAA's. In particular, we note that since the yield curve appears to have been upward sloping at the time, these other bond issues do not necessarily provide a very good benchmark.

Table 6.4
Long Tenor Bond Issues in 2000-01

Issuer	S&P Rating	Moody's Rating	Amount €m	Issue Date	Tenor (years)	Coupon Yield
TELSTRA CORP LTD	A+	Aa3	1500	29/06/2001	10	6.40%
AXA SA	A+	A1	1000	18/06/2001	12	6.01%
FIAT FINANCE & TRADE		Baa2	1300	25/05/2001	10	6.78%
KONINKLIJKE PHILIPS ELEC	A-	A3	750	16/05/2001	10	6.14%
SAGESS	AAA		300	27/04/2001	10	5.26%
CIE FINAN LOCATION IMMEU	A-		100	25/04/2001	10	5.93%
TELECOM ITALIA FIN SA	BBB+ *+	Baa1 *+	2000	20/04/2001	10	7.56%
PRINCIPAL FIN GLOBAL FND	AA	Aa2	300	11/04/2001	10	5.54%
ENERGIAS DE PORTUGAL	AA *-	Aa3	1000	28/03/2001	10	5.91%
DAIMLER INTL FIN BV	A-	A3	1000	21/03/2001	10	7.03%
ASIF III JERSEY LTD	AAA	Aaa	800	07/03/2001	10	5.52%
DAA FINANCE PLC	A+		250	16/02/2001	10	6.15%
TRAV INS CO INSTIT FUND	AA	Aa3	325	16/02/2001	10	5.76%
VAUBAN MOBILISATION GAR	AAA		500	04/12/2000	11	6.02%
ING GROEP NV	AA-	Aa2	1000	30/11/2000	11	6.05%
HELLENIC SECURITISATION	A-	A2	295	23/11/2000	11	5.90%
FRANCE TELECOM		A1	1400	10/11/2000	10	6.68%
PUBLIC PWR CORP			400	08/11/2000	10	6.30%
TOTAL S.A.	AA	Aa2	100	24/10/2000	10	5.64%
GENERAL ELEC CAP CORP	AAA	Aaa	300	18/10/2000	12	5.92%
GOLDMAN SACHS GROUP INC		A1	350	06/10/2000	10	6.52%
CITIGROUP INC	AA-	Aa2	1000	27/09/2000	10	6.15%
ASSICURAZIONI GENERALI		Aa3	1750	20/07/2000	10	6.17%
MCDONALD'S CORP	AA	Aa2	300	20/07/2000	12	6.26%
DEUTSCHE TELEKOM INT FIN	AA- *-	Aa2 *-	750	06/07/2000	10	7.14%
ELECTRICITE DE FRANCE	AA+	Aaa	1000	03/07/2000	10	5.79%
Range			**100 - 2000**		**10 - 12**	**5.26% - 7.56%**
Average			**760**		**10.35**	**6.17%**

Source: NERA analysis of Bloomberg data. Note: Ratings are at the time of issue. Bonds selected are fixed coupon, bullet repayment, not index-linked, not subordinated, non-fungible, not a private placement and not callable issued between 1st July 2000 and 30th June 2001 with 8-12 years tenor

Since there were no bonds with similar rating and tenor issued close to the date when DAA issued we have expanded our search to incorporate other bonds issued between July 2000 and June 2001 with tenor of around 10 years. We note that two issues in mid-2001 (with ten year tenor at an A+ rating) by Telstra Corp and Axa (highlighted blue in Table 6.4) attracted coupons of 6.01 – 6.40%. By comparison, DAA's bond issue attracted a coupon of 6.15%, which we regard as similar to the coupons obtained by these issues.

Overall, we conclude that DAA's 2001 bond issue was broadly in line with market norms that prevailed at that time. As such, we treat the coupon on the DAA issue as indicative of the benchmark cost of a bond issue at that time by DAA or any similar airport operator.

6.4.2. DAA's 2008 Bond Issue

DAA issued a €600m 10-year bond in July 2008. To identify an appropriate benchmark cost of debt for this bond issue we have considered:

- Bonds issued in June and July 2008 of various ratings and with various tenors; and
- Bonds issued throughout 2008 with similar tenor.

Table 6.5
Bond Issues in June & July 2008

Issuer	S&P Rating	Moody's Rating	Amount €m	Issue Date	Tenor (years)	Coupon Yield
CLEAR PLC	AAA		100	29/07/2008	7	5.74%
SCOTTISH & SOUTHERN ENER	A	A2	600	29/07/2008	5	6.14%
AYT CEDULAS TERRITORIALE		Aaa	450	24/07/2008	3	5.54%
CEZ AS	A-	A2	600	18/07/2008	6	6.04%
DAA FINANCE PLC	A		600	09/07/2008	10	6.59%
BOUYGUES	A-		1000	03/07/2008	7	6.16%
ANGLIAN WATER SERV FIN	A-	A3	500	27/06/2008	8	6.25%
BRITISH TELECOM PLC	BBB+	Baa1	1000	25/06/2008	7	6.51%
CARREFOUR SA	A	A2	1000	13/06/2008	7	5.38%
TELEFONICA EMISIONES SAU	BBB+	Baa1	1250	12/06/2008	5	5.58%
SIEMENS FINANCIERINGSMAT	AA-	A1	1550	11/06/2008	3	5.25%
SIEMENS FINANCIERINGSMAT	AA-	A1	1000	11/06/2008	6	5.38%
SIEMENS FINANCIERINGSMAT	AA-	A1	1600	11/06/2008	10	5.63%
DEUTSCHE TELEKOM INT FIN	BBB+	Baa1	500	10/06/2008	6	5.75%
E.ON INTL FINANCE BV	A	A2	1000	06/06/2008	6	5.28%
Range			**100 - 1600**		**3 - 10**	**5.25% - 6.59%**
Average			**850**		**6.40**	**5.81%**

Source: NERA analysis of Bloomberg data. Note: Ratings are at the time of issue. Bonds selected are issued by non-financial corporations, fixed coupon, bullet repayment, not index-linked, not subordinated, non-fungible, not a private placement and not callable issued between 1st June 2008 and 31st July 2008. Bonds with tenor of less than three years are also excluded.

Table 6.5 shows Euro-denominated non-financial bonds issued around the same time as DAA's July 2008 issue. We note that no bonds of similar tenor were issued at a date very close to DAA's issue, which suggests that the tenor of DAA's bond issue was quite unusual. This makes determining a benchmark cost of debt for DAA's issue very difficult. We note that other issues (such as EOn 5.28% & Carrefour 5.38% in June and Scottish & Southern Energy 6.14% in July) with similar credit rating (highlighted blue in Table 6.5) at shorter tenors attracted lower coupons than DAA (6.59% in July). However, a comparison against issues by utilities companies is unfair as utilities have been the most demanded credit by investors during the credit crisis. On the whole, we do not regard this data as helpful for determining an appropriate benchmark.

Table 6.6
Long Tenor Bond Issues in 2008

Issuer	S&P Rating	Moody's Rating	Amount €m	Issue Date	Tenor (years)	Coupon Yield
VATTENFALL TREASURY AB	A-	A2	650	05/12/2008	11	6.79%
ENBW INTL FINANCE BV	A-	A2	750	20/11/2008	10	6.88%
RWE FINANCE BV	A	A1	1000	20/11/2008	11	6.67%
GDF SUEZ	A	Aa3	1200	24/10/2008	11	6.92%
PREMIUM GREEN PLC	AA-	Aa1	50	22/10/2008	10	6.00%
ART SIX	A-		50	22/09/2008	10	6.05%
RTE EDF TRANSPORT S.A	AA-		1000	12/09/2008	10	5.13%
DAA FINANCE PLC	A		600	09/07/2008	10	6.59%
SIEMENS FINANCIERINGSMAT	AA-	A1	1600	11/06/2008	10	5.63%
ELECTRICITE DE FRANCE	AA-	Aa1	1200	30/05/2008	12	5.41%
FRANCE TELECOM	A-	A3	1550	22/05/2008	10	5.63%
IBERDROLA FINANZAS SAU	A-	A3	750	09/05/2008	10	5.63%
E.ON INTL FINANCE BV	A	A2	1400	07/05/2008	12	5.79%
CORES	AAA	Aaa	500	23/04/2008	10	4.50%
WOLTERS KLUWER NV	BBB+	Baa1	750	10/04/2008	10	6.40%
IBERDROLA FINANZAS SAU	A-	A3	50	26/03/2008	10	5.20%
LA POSTE	AA-		500	27/02/2008	10	4.50%
IBERDROLA FINANZAS SAU	A-	A3	70	27/02/2008	9	5.25%
ELECTRICITE DE FRANCE	AA-	Aa1	1500	04/02/2008	10	5.00%
Range			**50 - 1600**		**9 - 12**	**4.5% - 6.92%**
Average			**798**		**10.32**	**5.79%**

Source: NERA analysis of Bloomberg data. Note: Ratings are at the time of issue. Bonds selected are issued by non-financial corporations, fixed coupon, bullet repayment, not index-linked, not subordinated, non-fungible, not a private placement and not callable issued between 1st January 2008 and 31st December 2008 with 8-12 years tenor.

Since we were unable to identify suitable benchmarks based upon bonds issued at very similar dates to DAA's issue we widened our search to consider other bonds issued in 2008 with tenor of around 10 years. The bonds identified are presented in Table 6.6. Again, however, unfortunately no bonds of similar tenor were issued at a date very close to DAA's issue. Nevertheless, we note that other long-tenored issues by similarly rated entities (i.e. EOn 5.79% in May, and RWE 6.67% & GDF 6.92% in Nov which are highlighted blue in Table 6.6) appear to suggest DAA's coupon (6.59% in July) is broadly in line with other issues over 2008. This comparison is contaminated somewhat by the fact that the RWE and GDF bonds were issued after a large increase in coupons during October / November, and again by the fact that the comparison against utilities is unfair as utility companies have been the most demanded credit by investors during the recent period of market turbulence.

Overall, we conclude that the evidence available does not suggest that DAA's bond attracted a coupon inconsistent with those achieved on similar issues. In particular, this broader analysis combined with our more focused assessment of bonds issued in June and July 2008 leads us to conclude that DAA's 2008 bond issue was broadly in line with market norms that prevailed at that time. As such, we treat the coupon on the DAA issue as indicative of the benchmark cost of a bond issue at that time by DAA or any similar airport operator.

6.4.3. The Cost of New Bonds

In the preceding sub-sections we have considered the appropriate benchmark cost of DAA's existing bond debt. However, the overall cost of debt allowance should also reflect the cost of new debt faced by DAA. In this sub-section, therefore, we consider the likely coupon that DAA would be required to pay in order to issue a new bond in today's market. To determine the likely cost of debt we examine three types of evidence:

1. Recent bond issues by companies with similar (i.e. 'A') ratings;
2. Recent bond issues with long tenor;
3. Indicative pricing by one of DAA's major relationship banks provided to us by DAA.

We focus upon the cost of issuing ten-year bonds as DAA's preference is if possible to issue long dated bonds since longer maturities correspond to DAA's assets' lives.

Table 6.7
Recent 'A' Rated Bond Issues

Issuer	S&P Rating	Amount €m	Issue Date	Tenor (years)	Coupon Yield
SANDVIK AB	A	600	25/02/2009	5	6.88%
E.ON INTL FINANCE BV	A	150	24/02/2009	7	4.39%
GDF SUEZ	A	750	23/02/2009	6	4.90%
RWE FINANCE BV	A	2000	10/02/2009	6	5.00%
RWE FINANCE BV	A	1000	10/02/2009	12	6.50%
NOKIA CORP	A	1250	04/02/2009	5	5.51%
NOKIA CORP	A	500	04/02/2009	10	6.77%
E.ON INTL FINANCE BV	A	1750	28/01/2009	5	4.88%
GDF SUEZ	A	1000	16/01/2009	12	6.38%
E.ON INTL FINANCE BV	A	1500	19/01/2009	7	5.53%
GDF SUEZ	A	1500	16/01/2009	7	5.63%
VERIZON WIRELESS CAPITAL	A	500	18/12/2008	7	8.75%
COCA-COLA HBC FINANCE BV	A	500	17/12/2008	6	7.88%
BELGACOM S.A. DROIT PUB	A	125	19/12/2008	5	5.91%
CARREFOUR SA	A	700	02/12/2008	5	6.63%
BMW FINANCE NV	A	750	19/11/2008	5	8.90%
RWE FINANCE BV	A	1000	20/11/2008	5	5.78%
RWE FINANCE BV	A	1000	20/11/2008	11	6.67%
SCHIPHOL NEDERLAND BV	A	800	19/11/2008	6	6.63%
Range		**125 - 2000**		**5 - 12**	**4.39% - 8.9%**
Average		**914**		**6.94**	**6.29%**

Source: NERA analysis of Bloomberg data from 1st November 2008 to 28th February 2009. Financial corporations excluded; bonds must be bullet repayment, non-callable, not a private placement, fixed coupon only, not index-linked and not fungible. Rating must be A and tenor must be 5 years or more. Ratings are at the time of issue.

The 'A' rated bond issues presented in Table 6.7 indicate that the yield curve is upward sloping and, as a result, that tenor matters. As an illustration of this, consider the two Nokia bond issues on the 4th February: the five year issue attracted a coupon of 5.51%, while the accompanying ten-year issue had a yield of 6.77%.

Given the above, we focus on longer tenor bonds as a better measure of DAA's likely cost of new debt. Recent long tenor bond issues are presented in Table 6.8, which shows that most recently RWE (twice), Nokia and GDF have issued 10+ years at an 'A' rating with coupons of 6.4-6.8%. Prima facie this suggests a new DAA bond issue would be in a similar range. We note, however, that a new DAA bond would likely cost more since utilities and telecoms have been most demanded paper in recent months and these two issues were much larger (€m) in size than any new DAA issue is likely to be. The recent indicative pricing supplied by one of DAA's relationship banks (summarised in Table 6.9) confirms the above analysis: the cost of a ten-year bond issue is likely to be around 7.0% (as of January 2009), somewhat higher than the recent issues by utilities and telecoms. Nevertheless, we assume a conservative forward-looking cost of bond debt of 6.6% which is the mid-point of coupons on recent A rated 10+ issues.

As a final cross-check we note that yields in the secondary market on A rated debt with 10+ years to maturity have averaged around 6.2% over the past three months (see Table 6.2 above). We regard this evidence as supporting our final conclusion noting that the differential between secondary and primary market evidence is likely due to a new issue premium (which theory suggests would prevail during periods of market volatility).

Table 6.8
Recent Long Tenor Bond Issues

Issuer	S&P Rating	Amount €m	Issue Date	Tenor (years)	Coupon Yield
SIEMENS FINANCIERINGSMAT	AA-	2000	20/02/2009	8	5.16%
REFER-REDE FERROVIARIA	A+	500	18/02/2009	10	5.88%
RWE FINANCE BV	Ae	1000	10/02/2009	12	6.50%
NOKIA CORP	A	500	04/02/2009	10	6.77%
KONINKLIJKE KPN NV	BBB+	750	04/02/2009	10	7.50%
METROPOLITANO DE LISBOA	A+e	400	04/02/2009	10	5.77%
ELECTRICITE DE FRANCE	A+	2000	23/01/2009	12	6.25%
GDF SUEZ	A	1000	16/01/2009	12	6.38%
VATTENFALL TREASURY AB	A-	650	05/12/2008	11	6.79%
ENBW INTL FINANCE BV	A-	750	20/11/2008	10	6.88%
RWE FINANCE BV	A	1000	20/11/2008	11	6.67%
Range		**400 - 2000**		**8 - 12**	**5.16% - 7.5%**
Average		**959**		**10.5**	**6.4%**

Source: NERA analysis of Bloomberg data. Note: Ratings are at the time of issue. Bonds selected are issued by non-financial corporations, fixed coupon, bullet repayment, not index-linked, not subordinated, non-fungible, not a private placement and not callable issued between 1st November 2008 and 28th February 2009 with 8-12 years tenor.

Table 6.9
DAA Major Relationship Bank Indicative Pricing (January 2009)

Tenor	5-year	7-year	10-year
[redacted]			

Source: DAA.

6.5. EIB Loans

The DAA target EIB as an indirect source of capital markets funding, longer dated than bond markets, and cost efficient. Bank markets not available for this maturity/other than for shorter term maturities. DAA has previously accessed EIB debt for a variety of projects at a variety of interest rates. Details of DAA's existing EIB loans are provided in Table 6.10.

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[redacted]

We regard the interest rates achieved by DAA on its EIB loans as indicative of the benchmark cost of EIB loans at those times. This is because the EIB does not discriminate between borrowers in the same way that markets and banks would. Rather, the EIB takes its own cost of funds as a starting point, adds on an allowance for its administrative costs and then makes allowance for the credit risk of the borrower. In this way it can be seen that the cost to DAA would be the same as the cost to any other similarly rated borrower. The benchmark cost of existing EIB debt is, therefore, as shown in Table 6.10 above.

Notwithstanding that EIB debt is unlikely to be available to DAA over the next review period, DAA estimated that the [redacted]

6.6. Bank Facilities

DAA currently has a €300m undrawn revolving credit facility with a margin over EURIBOR of [redacted] This facility matures in 2012 and DAA intends to replace it with a similar facility. The terms of any replacement facility would be considerably less favourable to DAA. Estimates supplied to us by DAA suggest that the margin would likely be around [redacted] (as of the end of February 2009) for a 2-3 year facility (and even higher for a longer tenor facility), which is substantially higher than the margin on the existing facility.

Prima facie, these existing undrawn committed facilities appear to be a competitive source of funding, particularly compared to the likely cost of new bond debt. However, it is important to note that the purpose of this facility is to provide liquidity and ensure financial flexibility, both of which are especially important during the ongoing period of market turbulence. For these reasons we exclude the cost of these facilities (outside of transaction and pre-funding costs) from our estimate of DAA's cost of debt.

6.7. Other Costs

Transaction costs

It is important to emphasise that the costs of debt finance considered above exclude transaction costs such as bank, legal, trustee and agent fees.

While it appears clear that the CAR's consultants intended to include an allowance for transaction costs in 2005 it is unclear whether the CAR did actually make an allowance for DAA's transaction costs (i.e. the costs of raising debt, such as agency and legal fees). Either way, we note that the inclusion of transaction costs within the cost of debt is widely made by UK and Australian regulators, such as by the UK Competition Commission (2007, 2008), CAA (2005) and Ofwat (2004).[52] For example, the CC (2007) allowed for transaction costs of 15 bps, which was added to its estimate of the real cost of debt. The CC (2008) subsequently made allowance for only 10 bps though in neither case did the CC provide a full justification for its allowance.

To calculate the appropriate allowance for transaction costs we consider the up-front and ongoing costs incurred in raising debt of all types amortised over the typical life of that type of debt. Table E.1, in the Appendix, sets out our calculation of transaction costs, which draw on consultations with DAA. Our analysis shows that transaction costs historically have been normally around 9 bps, but have increased recently to around 14 bps.[53] We note that these estimates are broadly in line with the CAR's allowance at the last review. However, these estimates are lower than the allowances made by the UK Competition Commission in the recent Stansted case. This primarily reflects the incorporation of debt types – especially EIB loans – which typically incur very low fees within our calculations while the CC focused exclusively on bond costs.

Pre-funding costs

DAA typically "pre-funds" in three ways:

- By arranging finance in advance of when it is needed – the company incurs a cost related to the margin between the cost of the facility and the return on the deposited funds, sometimes known as the 'cost of carry';
- By arranging revolving facilities (alternatively known as undrawn committed facilities), which it can then draw down as required – DAA will typically incur arrangement and commitment fees on any undrawn amounts, and;

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[52] Competition Commission (2007) "BAA Ltd: A report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd)", September, Appendix F, paragraph F43; Competition Commission (2008) "Stansted Airport Ltd: Q5 Price Control Review", October, Appendix L, paragraph L45; CAA (2005) "NATS Price Control Review 2006-10: CAA's Firm Proposals", May, p61; Ofwat (2004) "Future water and sewerage charges 2005-10: Final Determinations", pp224-5. We note that there are also many instances of Australian regulators allowing debt raising costs within the cost of debt.

[53] The 14 bps estimate is based on the assumption that 100% of new debt raised will be via bonds. The estimate is not sensitive to this assumption. For example, assuming a mixture of bonds and EIB loans in line with historic funding would reduce the estimate to around 13 bps prospectively.

- By retaining cash on the balance sheet to meet short term funding requirements – the cost of these funds is again related to the 'cost of carry' via the opportunity cost of retaining the cash.

Since DAA cannot be assured that finance will be available in sufficient quantities when it is required, pre-funding is an efficient and prudent debt-raising strategy. Also, from a cost-benefit point of view, pre-funding is likely to be cost effective: taking out debt incurs fixed costs, such as due-diligence fees charged by banks. It is therefore less costly to take out debt in larger sizes (and incur pre-funding costs) than in a series of smaller facility sizes.

The arrangement of revolving facilities or retention of cash on the balance sheet is an efficient method of ensuring the liquidity requirements of the business are met. Sensible precautionary steps to ensure liquidity needs are met, to ensure the business remains financially viable or to aid financial flexibility, are all efficient financing decisions. As such, the costs of pre-funding should be compensated via the cost of debt. We also note that DAA is not permitted by its shareholder to enter into anticipatory hedges, which increases its pre-funding requirements since its ability to manage risk in some circumstances via standard market practices is reduced.

Recent market turbulence and rating agencies' concerns have prompted many corporations to re-consider their liquidity and pre-funding strategies. The uncertainty about availability of debt and volatility in prices has led many corporations to adopt a 'safety-first' strategy by securing larger amounts of funding further in advance. We have, however, not reflected this trend in our estimate of DAA's pre-funding costs. Rather, we have assumed that cash at bank balances will remain at or around historical levels. The cost of these facilities has been assumed to increase, however, based on information supplied to us by DAA that indicates that margins on bank facilities have increased recently and that commitment fees (as a percentage of the margin) have also increased. On these latter points, DAA indicated to us that the margin on bank facilities was likely to increase to around [redacted] compared to the [redacted] on the existing facility, while commitment fees were likely to ratchet up to above [redacted] of the margin from around [redacted] on the existing facility.

We also note that DAA's costs of pre-funding have increased: the 'cost of carry' on pre-funded amounts has sharply increased over the past 12 months. DAA indicated to us that the cost of carry was around 100 bps historically, but had increased to as much as [redacted] on new bond issues by the middle of February. The likely cost of carry on new EIB debt (notwithstanding its likely unavailability) was around [redacted] at the same time. This suggests a range for the forward-looking cost of carry of [redacted] For the purposes of estimating the cost of pre-funding, the cost of debt and the WACC we assumed a forward-looking cost of carry of [redacted] since we assume all new debt raised will be bond debt. A more detailed explanation of these assumptions can be found in Appendix E.2.

- ***Calculations***

Table 6.11 summarises our analysis of transaction and pre-funding costs: we calculate that pre-funding and transaction costs for DAA amount to:

- [redacted] and
  - [redacted]

The details of these calculations are provided in Appendix E.

Table 6.11
Transaction and Pre-Funding Costs (bps p.a.)

6.8. Conclusion

Our analysis has presented evidence on the cost of debt for both existing and yet-to-be-raised debt for different rating classes. Table 6.12 presents our analysis of the nominal cost of each of DAA's debt tranches, the corresponding inflation expectations (for the tenor of the debt as at the date the debt was issued) and the resulting real cost of debt.

Using these weights and the benchmark costs of the various types of debt (discussed earlier and shown in Table 6.12) we estimate the historic nominal benchmark cost of debt is around 6.1%, while the forward-looking nominal benchmark cost of debt is around 6.6%. After adjusting for inflation expectations – which we note are, given the generally long tenor of the debt, close to medium-term inflation expectations of 2% - the real cost of debt benchmarks are around 4.1% and 4.5%, respectively, on a historic and prospective basis. These estimates, however, do not incorporate transaction or pre-funding costs.

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Table 6.12
Cost of Debt: Summary

In concluding on the cost of debt we propose that Dublin Airport should be allowed a cost of debt which is the weighted average of the following two components:

- The historic benchmark cost of debt applied to that proportion of debt which will not be re-financed over the next review period; and
- The forward-looking benchmark cost of debt for the proportion of debt that will be new or re-financed over the upcoming control period.

We believe that this methodology has the following merits:

- First, our approach recognises that DAA has raised finance efficiently at different points in the interest rate cycle and that it raises finance over periods longer than the price control period. We also note this approach relies on historic benchmark yields (as opposed to actual embedded debt costs), which continues to give DAA an incentive to outperform the average benchmark yield in future. Benefits of out-performance will eventually feed through to customers.
- Second, this approach also mitigates the risk that DAA would not be able to raise new funding in times of market turbulence (as the cost of debt would reflect the higher cost of new and refinanced debt to the extent that new and refinanced debt was required).
- Finally, our new regulatory approach to the cost of debt is transparent and can be updated at future price reviews.

We note that the UK Competition Commission has adopted a very similar approach for Stansted (November 2008)[54] where the cost of debt was weighted by the cost of existing debt and forward looking debt costs, taking into account the maturity profile of existing debt and the funding requirement of new capex.

To determine the appropriate weights to give existing and prospective debt costs we undertook an analysis of DAA's re-financing requirements over the next price review period based on its existing debt maturity profile. For present purposes we conservatively assume that no new debt – beyond re-financing requirements – will be raised over the next review period. These financing requirements are influenced by several factors including DAA's capex programme. Since these factors are yet-to-be finally determined by CAR our analysis of the appropriate applicable historic and prospective debt weightings is based on the assumptions stated, but may change as additional information becomes available.

Table 6.13
DAA's Debt Maturity Profile

In addition to the debt that is refinanced DAA will also need to raise significant new incremental debt finance over the next price control period. Projections supplied by DAA show the following:

[54] NERA proposed this methodology in "Cost of Capital for PR09: Final Report for Water UK", June 2008.

Table 6.14
DAA Incremental Debt Projections

[redacted]

[redacted]

Table 6.15
Cost of Debt: Conclusion

[redacted]

Pulling all the components of our analysis together, including transaction and pre-funding costs, we estimate that the appropriate cost of debt allowance for Dublin Airport over the next control period is [redacted] (see Table 6.15). We note that this estimate draws heavily on evidence relating to DAA, which we believe provides the best evidence about the cost of debt at a notional stand-alone Dublin Airport. We emphasise, however, that in the current volatile market conditions this estimate may be superseded by subsequent developments. It is therefore important that CAR incorporate up-to-date evidence when it makes its assessment of the cost of debt.

7. Weighted Average Cost of Capital

This section sets out our WACC estimate for Dublin Airport. Our WACC range is based on the following assumptions:

Gearing: We assume a notional gearing level of 50% to be consistent with an A rating, which we believe (as discussed in Section 8) provides Dublin Airport with sufficient headroom to retain a credit rating that would enable DAA to continue to access debt markets in the event of a plausible downside shock. We note that our target gearing level is broadly consistent with Dublin Airport's current gearing level.

Cost of Equity: We have estimated the cost of equity using the CAPM. Our CAPM analysis, presented in Table 7.1, shows the real post tax cost of equity for Dublin Airport is in a range of 10.0-12.5%.

Table 7.1
Cost of Equity at PR09 (%)

	Min	Max
Real Risk-free Rate	2.8%	4.1%
Equity Risk Premium	6.0%	6.0%
Gearing	50%	50%
Asset Beta	0.6	0.7
Equity Beta	1.2	1.4
Real Cost of Equity (post-tax)	**10.0%**	**12.5%**

Source: NERA analysis.

Cost of Debt: In our assessment of Dublin Airport's cost of debt we have focused on the cost of debt for DAA, noting that DAA is financed at a Group level and data for a stand-alone Dublin Airport is unavailable. We note that an estimate for DAA is likely to be a plausible estimate for a notional stand-alone Dublin Airport and that the UK Competition Commission recently adopted a similar approach to estimating the cost of debt for Stansted airport.

We have considered the cost of the different debt instruments utilised by DAA, which comprises bonds, EIB loans and bank facilities. Our recommended approach is to take into account both historic time series and current evidence on the cost of debt based on benchmark measures consistent with an A rating. We estimate the historic cost of debt to be 4.3%, but the current – or forward-looking – cost, which is applicable to new and re-financed debt, to be around 5.7%. These estimates include allowances for efficiently incurred transaction and pre-funding costs. Factoring in DAA's likely re-financing requirements over the next review period, but assuming that no new debt will be required, our best estimate of the real pre-tax cost of debt is presently 4.6%. We note, however, that turbulent market conditions may require this estimate to be re-visited in coming months.

Table 7.2
Dublin Airport Cost of Capital: Estimates

	Estimate (%)
Gearing	50
Real Pre-Tax Cost of Debt	4.6
Real Post-Tax Cost of Equity	10.0 – 12.5
Tax Rate	12.5
Pre-tax WACC	**8.0 – 9.4**
Vanilla WACC (Pre-tax debt, Post-tax equity)	**7.3 – 8.6**
Post-tax WACC	**7.0 – 8.3**

Source: NERA analysis.

Table 7.2 summarises our estimates of the cost of debt and equity and our gearing and tax assumptions, and presents our best estimate of the real pre-tax cost of capital for Dublin Airport. Our best estimate of the pre-tax WACC lies – at this time – in the range of 8.0-9.4%.

8. Financial Viability

Most regulators test the regulatory settlement to ensure the regulated entity is able to maintain at least an investment grade credit rating, which regulators have traditionally believed would be sufficient to ensure that the overall price controls allow a company to raise capital efficiently in order to finance its activities. The CAR refers to this assessment as one of "financial viability". More generally, however, if a company is able to raise capital efficiently it is said to be "financeable" and the associated tests are often referred to as a test of "financeability".

If financial projections suggest that a regulated entity is unlikely to remain financeable, then a regulator would typically be expected to take steps to remedy this situation. In general, one of two main factors (or a combination thereof) is often responsible for the financeability problem:

1. A company might face a cash shortfall arising from an inter-temporal mismatch of regulated revenues and its financing costs. Such a mismatch can arise because revenues comprise a real return element plus compensation for inflation (via an inflation-indexed asset base) while the companies' financing costs will involve predominantly nominal debt financing costs. However, assuming positive inflation, this problem would only arise for a company with a high proportion of new (or near new) assets which have not appreciated in value in line with inflation. A company with a high proportion of older assets will usually earn a regulated total return (depreciation plus real interest costs) greater than their nominal financing cost (principal repayment plus nominal interest cost).
2. The allowed rate of return has been set too low i.e. below the true WACC. In this context, the financeability test is an internal consistency test: the CAR (or any regulator) needs to ensure that the projected financial ratios for the company are at least equal to the financial ratios associated with the credit rating that underpins the cost of debt and overall WACC calculation. If this is not the case then the price controls are not internally consistent. In such a case, the original WACC estimate needs to be revised upwards until the outcome financial ratios are consistent with the ratios underpinning the WACC. This aspect of the financeability test is often ignored by regulators.

As we set out in this discussion, regulators should identify the root cause of any financeability problems as this has implications for the solution. The remainder of this section is structured as follows:

- Section 8.1 presents a brief overview of the CAR's approach to financeability at the last review;
- Section 8.2 argues the CAR's financial viability duty requires it to enable DAA to maintain an A rating, rather than simply an investment grade rating;
- Section 8.3 presents evidence on the appropriate ratios and their corresponding threshold levels to use in the financeability test based on analysis of ratios, ratings and reports by S&P and Moody's; and
- Section 8.4 draws conclusions based on the analysis presented.

8.1. Overview of CAR's Approach at the Last Review

At the last review the CAR interpreted its statutory responsibility to "enable DAA to operate and develop Dublin Airport in a sustainable and financially viable manner" as a requirement to enable DAA to maintain an investment grade credit rating. The CAR advanced several arguments for why this did not amount to enabling DAA to maintain an A rating in preference to a BBB rating. These arguments were:[55]

- The requirement to maintain an A rating "underestimates the liquidity and depth of international bond markets for financing investment grade debt below A. … While it is a fact that the community of potential investors decreases as the grade approaches BBB-, the issuance of investment grade debt below A is not insignificant in volume";
- "Several airports are financially viable having credit ratings below A grade";
- Regulators in the UK, such as Ofwat and Ofgem, had assessed financeability "on the basis that companies should be able to maintain 'solid investment grade credit ratings' or ratings 'comfortably within investment grade'"; and
- There are alternatives to public bond markets such as bank debt or credit wrapped bonds, which overcome or negate a lower credit rating.

The CAR also considered that the increase in the cost of debt associated with a BBB rating compared to an A rating was small and fell within the margin of error around its estimate of the allowed cost of debt.

To assess financeability the CAR employed a range of financial ratios. These ratios and the thresholds applied are shown in Table 8.1. It should be noted that the CAR viewed these ratios as consistent with an A rating. It also considered that the FFO : Interest Cover and FFO : Debt ratios were the most important, based on consultation with S&P.

Table 8.1
CAR's Financial Ratios and Threshold Values Consistent with an A Rating

Ratio	Threshold Value
FFO : Debt	20%
FFO : Interest Cover	2.5x
EBITDA : Interest Cover	2.0x
EBIT : Interest Cover	1.5x
AICR	1.5x

Source: CAR (2005), p27.

We note that the CAR did not specifically state what ratios it required in relation to an investment grade credit rating. The CAR did, however, refer to decisions by Ofwat and Ofgem that appeared to show an FFO : Debt ratio of 12-13% was satisfactory.[56] The CAR did not appear to consult further with S&P regarding whether these thresholds were appropriate for DAA.

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55 See CAR (2005) "Maximum Levels of Airport Charges at Dublin Airport", pp33-37, September 29.

56 See CAR (2005) "Maximum Levels of Airport Charges at Dublin Airport", p36, September 29.

Having determined the applicable ratios and thresholds as set out above the CAR tested financeability by modelling DAA's ratios over the upcoming review and beyond. The CAR subjected its financeability modelling to a sensitivity analysis incorporating the impact of different size capex programmes and different accelerated depreciation scenarios. The CAR concluded on the basis of its modelling that DAA would be able to maintain an investment grade rating under the proposed cost of capital, notwithstanding that under some of its scenarios DAA did not satisfy the ratio thresholds the CAR had identified.

8.2. Financeability Tests Should be Based on a Single A Credit Rating

Efficient Cost of Capital is Consistent with Single A

In Section 9 we present evidence to show that the cost of capital for DAA is lower at Single A than at lower credit ratings (A- or BBB+). This is due to the significant increase in the cost of debt associated with each one notch downgrade. Therefore, it is in customers' best interests to set a cost of capital in line with an A rating. A lower credit rating would lead to a higher cost of capital, and hence higher prices.

Access to Debt is Further Restricted at Credit Ratings Less Than Single A

If Dublin Airport was unable to access capital – from either debt or equity markets - the CAR would have failed its statutory duty to enable the financial viability of the Dublin Airport. Therefore, the CAR must consider not only the cost of capital for Dublin Airport in the event of a plausible downside scenario, but also consider whether Dublin Airport would continue to have access to capital markets to finance its activities. We note that due to Dublin Airport's ultimate state ownership, the typical strategies for raising new equity – such as via IPOs or rights issues - may be unavailable. The willingness of the Irish state to provide further capital to DAA is likely to be very limited in the current economic climate. DAA's rating is on a stand alone basis consistent with no equity support. As a result, DAA's ability to access debt capital markets is crucial.

Since the onset of the credit crisis bond market conditions have worsened significantly over time and there have been a number of periods when issuance has stopped completely e.g. post Lehman's bankruptcy. When the markets have been open investors have placed greater emphasis upon (i) credit quality, preferring issuers in defensive sectors such as telecoms and utilities; (ii) credit ratings, with appetite greatest for A- rating or above and coupon step-ups in the event of rating downgrades; and (iii) in recent months name recognition. There has been relatively little bond issuance at BBB ratings throughout 2008 and so far in 2009 with investors preferring issuers with at least an A- rating. As Table 8.2 shows BBB-rated bond issues have accounted for about 20% of non-financial corporations' bond issuance so far in 2009. However, most of these issues have been from large 'mega-cap' recognised names such as BMW and Imperial Tobacco rather than issuers such as DAA.

Table 8.2
Non-Financial Corporations' Bond Issuance: 2009

Rating	EURO (m)	%	Number	%	Average Size
AAA	404.45	0.5%	2	2.2%	202.2
AA	23250	27.3%	12	13.3%	1937.5
A	42411.5	49.9%	49	54.4%	865.5
BBB	19000	22.3%	27	30.0%	703.7
Total	**85065.95**		**90**		**945.2**

Source: NERA analysis of Bloomberg data until 13th March 2009.

The difficulty that DAA would encounter if it attempted to issue at BBB ratings is clearly shown by analysis of BBB rated bond issuance that has occurred as set out in Table 8.3. In particular we note that the majority of BBB rated issuance has been by telecoms and non-cyclical consumer goods and service providers. DAA as an issuer does not fall into this category as it is exposed to the business cycle on passenger volumes and commercial revenues. As a result, a BBB rated DAA would face considerable difficulty in accessing bond markets.

Table 8.3
Non-Financials' BBB-Rated Bond Issuance: 2009

Sector	EURO (m)	%	Number	%	Average Size
Utilities	1000	5.3%	2	7.4%	500.0
Telecoms	8300	43.7%	12	44.4%	691.7
Basic Materials / Industrial	2500	13.2%	3	11.1%	833.3
Consumer Non-Cyclical	5950	31.3%	8	29.6%	743.8
Consumer Cyclical	1250	6.6%	2	7.4%	625.0
Total	**19000**		**27**		**703.7**

Source: NERA analysis of Bloomberg data until 13th March 2009.

We also note - as touched upon above - that investors are placing great emphasis on name recognition; companies that are frequent issuers with large bond programmes e.g. Imperial Tobacco, BMW, Anheuser-Beusch InBev, National Grid and Reed Elsevier are much more readily able to issue than less well known companies. DAA is not a large and frequent issuer in the bond markets and cannot be regarded as falling into this category. As a result it is clear that DAA faces considerable difficulty accessing bond markets currently whatever its credit rating.

We also note that a considerable amount of government bond issuance is expected in 2009. Further, issuance by government-backed financial (and other) institutions is also expected to be considerable. As a result, corporates will face stiff competition to attract investment. The glut of government and government-backed issuance may, therefore, have the effect of crowding out corporate (including DAA) issuers meaning access to debt markets is likely to remain difficult for some time to come.

In combination, the above analysis suggests that a relatively unknown BBB rated DAA would encounter considerable difficulty issuing bond debt and may be unable to issue bond debt at all. Therefore, while CAR and DAA are unable to increase DAA's profile as an issuer, by enabling DAA to attain an A rating the CAR would substantially reduce the probability that DAA would be unable to access bond markets. Not just has maintaining an A become more critical but metrics are more pronounced and higher as evidenced by recent changes in outlook to negative watch and downgrades. Turning to bank markets we note conditions are much more difficult than the bond markets as a result of the credit crisis and its impact on bank balance sheets. The European Central Bank's "Euro Area Lending Survey" has shown that banks' willingness to lend has been severely impaired by the effect of the financial turmoil: lenders have reported a reduced willingness and ability to lend in each of the past four quarters (compared to the previous quarter). Lenders have attributed these developments to concerns about the economic outlook, reduced appetite for risk and decreased availability of wholesale finance. In the most recent survey lenders indicated that a further reduction in maximum credit lines, together with a further strengthening of covenants was expected over the next three months. Evidence from one of DAA's partner banks corroborates this more general evidence. In particular the partner bank noted that the following features are now common place in the bank markets:

- Most banks are reducing their credit lines in order to conserve capital for potential future losses arising from the economic downturn;
- A number of banks are withdrawing to their 'home countries' following state support. This withdrawal limits borrowers' ability to tap a wide syndicate of banks;
- Terms are becoming more expensive with tighter loan covenants and increased collateral and security in order to increase banks' return on capital;
- Banks are typically not lending beyond 3-5 years and many have withdrawn from the long term project finance market which infrastructure companies would typically rely upon in the absence of bond markets;
- Bank syndication markets are closed with most deals done on a 'club' take-and-hold basis; and
- Significant new bank commitments are typically only being made on the basis of a bond take-out i.e. on the assumption that the bank loans can be refinanced in due course through the bond markets. (Indeed DAA's previous bank facilities were executed on this basis.)

In summary, there is clear evidence that DAA's access to debt markets has deteriorated significantly through the credit crisis. This may mean that DAA is unable to access bond markets with a credit rating below A-. To ensure that DAA has sufficient headroom in the event of a plausible downside scenario, which might include a credit rating downgrade, CAR should set the cost of capital sufficiently high to enable DAA to attain an A rating.

Regulatory Precedent Supports Single A Ratings

The UK Competition Commission recently set the cost of capital for Stansted airport on the assumption of an A-/A3 rating, one notch higher than its earlier assessment for Heathrow and Gatwick. The CC's two motivations were (i) the more pronounced impact of the credit crisis

upon BBB rated companies, and (ii) the assessment that Stansted was riskier than Heathrow and Gatwick. Given the CAR's assessment at the last review and our own analysis, we would contend that Dublin Airport is riskier than Heathrow and Gatwick, which points toward a credit rating assumption consistent with the Competition Commission's decision for Stansted. However, it should be noted that debt market conditions have deteriorated further since the Stansted process and that an even stronger credit rating is now required.

DAA's Recent Rating Downgrade

DAA was recently downgraded by S&P from A to A- with a negative watch.[57] The primary reason cited for the downgrade was an anticipated deterioration of DAA's financial profile. The deteriorating profile was attributed to the weakening economic outlook for Ireland's economy, which is expected to "result in a significant decrease in passenger traffic in 2009 and reduced commercial revenues at the company's airports". The fact that DAA was placed on negative watch reflects S&P's view that the reduction in passenger numbers could turn out even greater than currently forecast. Specifically S&P state "the outlook could be revised to stable once traffic stabilizes and visibility is gained on the regulatory determination". The reasons for S&P's decision are important since the inference is that DAA is reasonably likely to be downgraded to BBB+ (or lower) at some stage. Given the emphasis investors are currently placing on credit quality DAA is probably now viewed as effectively rated BBB+. This has important implications for DAA's access to debt markets as discussed above.

We further note that S&P's downgrade and statements above were made against the backdrop of its assessment that "the supportive regulatory framework is likely to increase tariffs by at least 22% from 2010 onward. The current ratings assume tariffs will be raised at least in that sort of magnitude, which should facilitate stronger credit metrics from 2010 onward".[58] It is clear, therefore, that S&P – and by implication the market and investors generally – anticipate a 22% increase in tariffs from 2010, but that even an expected increase of that magnitude was insufficient to avoid downgrading DAA to A-. An increase in tariffs of at least this magnitude is likely to be required in order to enable DAA to achieve an A rating.

8.3. Setting the Appropriate Financial Ratios

In this Section we set out the ratios that should be used in the financeability test.

Our estimate of Dublin Airport's WACC is predicated on an A credit rating, and the comparable cost of debt. This assumption is based on DAA's intention to achieve this rating. We believe targeting an A rating is prudent as it provides some protection against negative revenue and cost shocks.

We note that DAA is currently only rated by S&P. However, we present evidence from Moody's regarding the appropriate ratios it would require to achieve a similar rating.

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[57] See S&P (2009) "Dublin Airport Authority PLC Cut to 'A-' On Expected Financial Profile Weakening; Outlook Negative", March 3.

[58] See S&P (2009) "Dublin Airport Authority PLC", p5, March 20.

8.3.1. Standard & Poor's Approach to Rating Airports

S&P are not particularly specific about the ratios required to achieve particular credit ratings. From their various reports on the sector it is clear that a number of credit metrics are considered, but that FFO : Interest Coverage and FFO : Debt are the most important cash flow coverage ratios.[59] This is consistent with statements attributed to S&P by the CAR at the last review discussed above.

S&P has recently stated – within the context of its downgrade of DAA to A- (and Negative Watch for a potential downgrade to BBB+) – that "we had previously expected that FFO interest cover would fall no lower than 3.5x and FFO to net debt no lower than 15%" and "the outlook could be revised to stable … if we believe the financial profile will remain close to FFO to debt of 15% and FFO to interest of 3.5x during 2009 and 2010".[60] These two statements together suggest that an A- rating (i.e. below A) would require FFO to debt of at least 15% and FFO to interest of at least 3.5x. Therefore, in order to achieve an A rating, it follows that higher target ratios would be required by S&P.

To ascertain the thresholds S&P requires with respect to other credit ratios for particular ratings we examined evidence on ratios and ratings for a number of European airports over the period 2004-2006. Table 8.4 presents the range and average of ratios achieved by A rated companies for a number of credit metrics. We note that S&P has not published FFO : Interest Coverage ratios for these airports, which is less-than-ideal given the emphasis it places upon that metric. However, we note that the published data does suggest an FFO : Debt ratio of around 20% is consistent with an A rating. We note that it also suggests an EBITDA : Interest Coverage ratio of above 3x. This is somewhat higher than the CAR's assessment, presented in Table 8.1 earlier, but is consistent with arguments made by DAA at the time of the last review that the EBITDA : Interest Coverage ratio should be between 3.0 and 4.0x, rather than the 2.0x assumed by CAR.

Table 8.4
S&P Ratios Consistent with an A Rating

	Return on capital (%)	EBIT interest coverage (x)	EBITDA interest coverage (x)	FFO / debt (%)	Free operating cash flow / debt (%)	Debt / EBITDA (x)	Debt / debt plus equity (%)
Minimum	6.30	2.30	3.00	10.80	-11.80	2.20	34.00
Average	9.94	3.86	5.10	21.76	3.06	3.89	47.41
Maximum	14.90	5.60	6.90	33.90	20.60	6.30	72.50

Source: NERA analysis of ratios and ratings presented in S&P (2007) "CreditStats: Airport Services - Europe, Middle East, Africa", September 9th.

[59] See S&P (2003) "Utilities: A Framework for International Airport Ratings", August 27.

[60] See S&P (2009) "Dublin Airport Authority PLC Cut to 'A-' On Expected Financial Profile Weakening; Outlook Negative", p3, March 3.

Overall, the evidence from S&P ratings and ratios including recent statements relating to the downgrade of DAA to A-, suggests that an FFO : Interest Coverage of 3.5x and an FFO : Debt of 20% are required for an A rating. This FFO : Interest Coverage ratio should be preferred to the lower value CAR used in its assessment at the last review. Outside of these two key ratios we note that the evidence from S&P does not contradict CAR's assessment at the last review, save with respect to the EBITDA : Interest Cover ratio, for which we believe a higher threshold is applied by S&P.

8.3.2. Moody's Approach to Rating Airports

Moody's has been very explicit about the ratios it considers and the thresholds it requires to be satisfied in order to achieve a particular credit rating. We note, however, that credit ratios are not the sole criterion by which Moody's determines credit ratings. They are, however, an important aspect of the ratings process. Other factors that Moody's consider include:

- governance and rate setting;
- market position;
- passenger and airline base;
- operating environment and capital programme; and
- stability of business model and financial structure.

The key ratios and the associated thresholds considered by Moody's are set out in Table 8.5 below. To maintain an A rating from Moody's DAA would need to maintain a cash interest coverage of 4.5-6.0x and FFO : Debt of 15-25% (among other ratios and factors). These appear broadly consistent with S&P's approach.

Table 8.5
Moody's Credit Ratios

	Aaa	Aa	A	Baa	Ba	B	Caa
Cash Interest Coverage	> 8.0x	6.0-8.0x	4.5-6.0x	3.0-4.5x	2.25-3.0x	1.5-2.25x	< 1.5x
FFO / Debt	> 40%	25-40%	15-25%	10-15%	6-10%	3-6%	< 3%
Debt Service Coverage Ratio	> 8.0x	6.0-8.0x	4.5-6.0x	3.0-4.5x	2.0-3.0x	1.5-2.0x	< 1.5x
Implied Concession Life Coverage Ratio	< 10%	10-20%	20-30%	30-45%	45-60%	60-70%	> 70%

Source: Moody's (2008) "Operational Airports Outside of the United States: Rating Methodology", p39, April.

8.4. Conclusion

Based on the foregoing analysis we draw the following conclusions:

- The financeability problem can arise due to a mismatch between regulated revenues that are linked to inflation and fixed nominal debt costs, but is often the result of an insufficient allowed rate of return. This can be exacerbated by deferred revenue, unitisation, triggers, and asymmetric adjustment approaches.

- The CAR should test its regulatory settlement by applying a financeability test, as it did at the last review. We would, however, encourage the CAR to more rigorously stress test its modelling, particularly through plausible downside scenarios. These scenarios should incorporate credit rating downgrades and the associated difficulties with accessing debt markets, as well as any increase in the cost of debt.
- The current market conditions mean that the CAR should interpret its statutory duty to ensure the ability of DAA to operate Dublin Airport in a sustainable and financially viable manner as a requirement to enable DAA to achieve an A credit rating. This would represent a more robust rating than the investment grade rating assumed at the last review. In reaching this conclusion we note that:
  - A BBB+ (or lower) credit rating is likely to impair Dublin Airport's ability to raise debt. *Prima facie*, this may imply that a credit rating of A- would be sufficient. However, the CAR must also consider the implications of an unexpected (but plausible) downside scenario producing a one notch rating downgrade. If Dublin Airport is rated A when the hypothetical scenario actually eventuates, the implications will be much smaller than if it is rated A- (or even lower) at the outset of the scenario. Therefore, to ensure that Dublin Airport retains sufficient headroom to ensure continued access to capital markets in the event of plausible negative scenarios resulting in a credit rating downgrade (to A-), the CAR should set the cost of capital to enable Dublin Airport to retain an A rating.
  - The other arguments advanced by the CAR at the last review are, for the most part, no longer valid. In particular, access to alternative types of debt such as project finance bank loans has been heavily curtailed as banks withdraw from long term lending and wrapped bond markets has been shut for nearly 2 years with little prospect of recovery as all major monoline insurers have been downgraded and are closed for new business.
  - The required cost of capital is lower at an A rating than at an A- (or lower) rating. This would directly translate into lower airport charges which means that an A rating should be preferred by the CAR and airport users.
  - The financeability test should target a level of ratios consistent with the credit ratings underpinning the WACC. We have estimated a WACC based on debt costs on the basis of DAA maintaining an A rating. Thus, for internal consistency DAA's financial ratio projections should be consistent with A ratings.

We set out the ratio requirements we believe DAA should be able to satisfy in Table 8.6. We focus upon FFO : Debt and FFO : Interest ratios as it is clear from S&P's rating reports on DAA and airport companies in general that these two ratios are its primary focus. We further note that DAA and one of its partner banks have indicated that other ratios are not considered by the rating agencies or by banks. The recommended thresholds for these ratios are similar to the requirements CAR stated were consistent with an A rating at the last review, but require a more robust FFO : Interest Cover consistent with our analysis of past and present S&P ratings, ratios and reports.

Table 8.6
Financial Ratios and Threshold Values Consistent with an A Rating

Ratio	Threshold Value
FFO : Debt	20%
FFO : Interest Cover	3.5x

Source: NERA analysis.

9. Optimal Capital Structure

Our analysis in Section 8 concluded that the CAR should set Dublin Airport's cost of capital consistent with an A rating. In this section we show that an A rating is not only consistent with CAR's statutory duty to ensure Dublin Airport's financial viability, it also leads to a lower cost of capital than any lower investment grade rating.

Dublin Airport's credit rating may have important implications for the cost of capital. First, the cost of debt is likely to ratchet up as credit quality deteriorates. Second, credit ratings are typically associated with a particular level of gearing: better ratings are usually associated with lower gearing. It is important, therefore, to factor these changes in gearing into the cost of capital calculations including via their impact on the equity beta.

In this section we consider evidence on the cost of new debt from both primary and secondary markets. We then test the sensitivity of the cost of capital to the credit rating assumption.

9.1. Evidence from Recent Bond Issues

Table 9.1 summarises evidence on the cost of recent long-maturity (i.e. ten years or more) bond issues presented in Table 6.8. Based on those recent bond issues we are able (broadly) to identify the cost of debt associated with particular credit ratings.

As Table 9.1 shows, the cost of debt increases as credit quality deteriorates. There are significant differences between the cost of debt for A+ and A ratings, and for A- and BBB+ ratings. The difference between A and A- is less pronounced. This evidence suggests that the ramifications of a downgrade from A- to BBB+ (or lower) are substantially greater than the ramifications of a downgrade from A to A-.

Table 9.1
Cost of New Bond Debt by Credit Rating

Rating	Nominal Cost of Debt (%)	Transaction & Pre-Funding Costs (%)	Inflation Expectations (%)	Real Cost of Debt (%)
A+	6.05	1.20	2.00	5.1
A	6.60	1.20	2.00	5.7
A-	6.85	1.20	2.00	5.9
BBB+	7.5	1.20	2.00	6.6

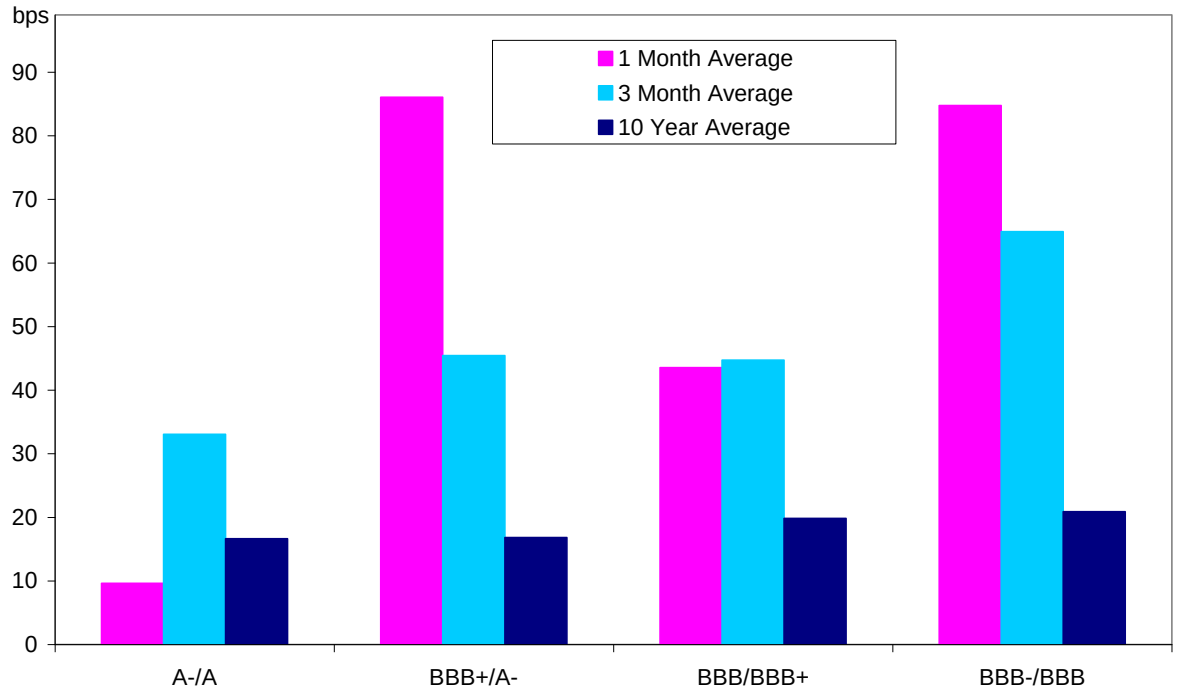
Source: NERA analysis of recent bond issues. The costs presented are mid-points of the range of coupons on recent issues within particular rating classes.

9.2. Evidence from the Secondary Market

- Evidence from primary markets is not readily available as few companies have recently issued long-maturity bonds, particularly at lower rating classes like BBB. Therefore, to inform the potential increase in the cost of debt with respect to financial structure, we draw on US corporate benchmark bond data to examine the relative risk (measured as the

difference in yields to maturity) for A, A-, BBB+, BBB and BBB-.[61] This data – presented in Figure 9.1 – shows the difference in the yield to maturity of corporate bond indices for different adjacent rating classes for the most recent three month period and for the long-term 10 year period.

Figure 9.1
Differences in Yield (bps) to Maturity for Adjacent Rating Classes



Source: NERA analysis of Bloomberg Fair Value Indices (15Y maturity) for US Corporate A, A-, BBB+, and BBB benchmark bond series. Averages are calculated over periods until February 2009.

It is immediately clear that differentiation between rating classes has increased substantially recently for most ratings classes. In particular, our analysis shows:

- Yields on A and A- rated bonds are much more similar than yields on any other two adjacent rating classes in the A or BBB rating space;
- Yields on BBB+ rated bonds are substantially higher than those on A- rated bonds; and
- Yields on all rating classes below A- have been proportionately more affected by the credit crisis.

Taken together, we view this evidence as broadly collaborative of our analysis of recent bond issues. In particular, this evidence again clearly implies that the increased cost of debt resulting from a credit rating downgrade is much higher for all ratings below A-. That is, the

[61] It should be noted that this data is specifically for the US and may not be directly applicable to the Eurozone. However, this data provides a useful insight into the likely distinction between rating sub-categories. This is an insight that cannot be made based on Eurozone data since benchmark bond series are not published for rating sub-classes.

ramifications of a downgrade from A- to BBB+ (or lower) are substantially greater than the ramifications of a downgrade from A to A-.

9.3. WACC Sensitivity Analysis

Our analysis above has established that the cost of debt increases as credit quality decreases and that this increase is more pronounced below a rating of A-. However, as mentioned above, the impact on the cost of equity via the gearing ratio assumed must also be considered in order to determine the optimal capital structure.

Therefore, to establish Dublin Airport's optimal capital structure we consider the cost of capital under three scenarios:

- At an A credit rating with 50% gearing;
- At an A- credit rating with 55% gearing; and
- At a BBB+ credit rating with 60% gearing.[62]

We focus our analysis of the WACC sensitivity to capital structure upon current debt costs, since the optimal capital structure will allow new debt to be raised as cheaply as possible. As a result, we inform our analysis using cost of debt estimates presented in Table 9.1.

Table 9.2 shows that the pre-tax WACC range increases slightly from 8.6-10.0% at an A rating to 9.1 – 10.6% for an A- rating. The increase from A- to BBB+ is larger at around 1%, compared to about 0.5% from A to A-. The larger increase in the cost of capital from A- to BBB+ is due to the significant increase in the cost of debt at BBB+ ratings and below and is consistent with our earlier analysis.

Table 9.2
WACC: Sensitivity to Capital Structure

	A	A-	BBB+
Gearing	50	55	60
Equity Beta	**1.20 – 1.40**	**1.33 – 1.56**	**1.50 – 1.75**
Cost of Equity (real, post-tax)	**10.0 – 12.5**	**10.8 – 13.4**	**11.8 – 14.6**
Forward-Looking Cost of Debt (real, pre-tax)	**5.7**	**5.9**	**6.6**
Pre-tax WACC	**8.6 – 10.0**	**9.1 – 10.6**	**10.0 – 11.6**

Source: NERA analysis.

Based on the analysis presented we conclude that the more highly geared financial structures associated with either an A- or a BBB+ rating do not reduce the WACC and hence appear to be sub-optimal (at least relative to an A rating).

[62] Gearing assumptions associated with particular credit ratings are based on NERA analysis of ratios and ratings presented in S&P (2007) "CreditStats: Airport Services - Europe, Middle East, Africa", September 9th. These show that an A rating is consistent with gearing of 50% on average and that a BBB+ rating is consistent with gearing of 60% on average. We infer gearing at an A- rating by linear interpolation.

9.4. Conclusion

In this section we have compared the cost of capital at various investment grade credit ratings. Our analysis indicates that retaining an A rating reduces the cost of capital relative to lower (but still investment grade) ratings.

This conclusion reinforces our earlier assessment that the CAR should set a cost of capital that enables Dublin Airport to maintain an A rating.

Note, we emphasise that the calculations in this section are based on forward-looking capital costs, since the optimal capital structure (credit rating) will allow new debt to be raised as efficiently as possible.

Since the forward-looking cost of debt is higher at the current time than historic costs of debt, the WACC calculations in this section are higher than the WACC calculations in Section 7 that deal with the total costs of capital. We recommend that the allowed rate of return for DAA be set to take account of both historic and forward-looking debt costs, as set out in Section 7.

Appendix A. Risk-Free Rate

A.1. Inflation Risk Premium

In this section we review the literature on the inflation risk premium in the EU, US and UK. We consider evidence from other markets because the inflation-protected bond market - which is needed to effectively estimate the inflation risk premium – is relatively new in the Eurozone: evidence from the US, which is the largest inflation-protected bond market, and the UK, which has had an inflation-protected bond market for much longer than the Eurozone, may provide useful insights.

Eurozone

The evidence for the Eurozone suggests a small, but positive, inflation risk premium. Papers by Hordahl (2008) and Garcia and Werner (2008) suggest an inflation risk premium in the Eurozone of 25-40 bps. Hordahl (2008) shows a time series of the inflation risk premium for the EU at a 10-year maturity: the most recent estimates of the inflation risk premium are around 0.5 for the EU.[63]

US

The evidence for the US suggests the inflation risk premium is close to zero. Papers by Hordahl (2008) and Durham (2006) suggest the inflation risk premium in the US is 20 bps or less. Hordahl (2008)'s time series of the inflation risk premium for the US at a 10-year maturity suggests the inflation risk premium was close to zero (having been negative) for the US.[64]

UK

Because of the relatively long history of index-linked gilts in the UK there is a substantial amount of academic research on the inflation risk premium. Remolona, Wickens and Gong (1998) estimated the inflation risk premium on a two year maturity to have averaged 107 bps between July 1982 and July 1997, though closer to 70 bps for the period post-1990.[65] However, the authors also note that the inflation risk premium is close to zero for bonds with more than six months to maturity. Evans (2003), based on data over 1983-1995, found that the spread between nominal and real gilt yields "overstates the rate of expected inflation by between 0.6% and 1% at the one month horizon. At the ten year horizon, the spread understates the rate of expected inflation by between 1% and 3.5%".[66] Importantly, this evidence implies a negative inflation risk premium at the 10 year horizon. Evans concluded that "the inflation risk premium differs significantly across states at all horizons". We also note that statements by senior members of the Bank of England suggest the inflation risk premium is likely to be lower than it was in the 1990s or earlier. For example, in November

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63 See Hordahl (2008), p32.

64 See Hordahl (2008), p32.

65 See Remolona, Wickens and Gong (1998) "What was the market's view of UK monetary policy? Estimating inflation risk and expected inflation with indexed bonds", Federal Reserve Bank of New York Staff Reports, 57.

66 See Evans (2003) "Real Risk, Inflation Risk and the Term Structure", The Economic Journal, 113, pp345-389 (p348).

2002 Governor King noted that recent changes in the yield curve were "highly suggestive of a fall not just in expected inflation but also in the inflation risk premium".[67] More recently, in March 2005, MPC member Marian Bell noted that a decrease in the natural rate of interest "might be partly associated with reduced risk premia".[68]Overall, while there appears to be no recent estimates of the inflation risk premium in the UK, some historical estimates suggest the premium is actually negative, while it is generally believed to have decreased in recent years. Based on the evidence presented we conclude that the inflation risk premium in the UK is likely to be around zero or negative.

Conclusion

Overall, the evidence for the Eurozone suggests a small, but positive, inflation risk premium. However, the relative immaturity and small size of the Eurozone inflation protected bond market suggests that evidence from other markets might provide a more reliable guide to the 'true' inflation risk premium. As a result, we have considered evidence from the US and UK markets. The literature for these markets suggests the inflation risk premium is close to zero or negative in these markets. Overall, based on this evidence we conclude that the inflation risk premium for the Eurozone is likely to be immaterial for our purposes.

A.2. Inflation Expectations

The value of expected inflation is an important component in the calculation of the real risk-free rate. In this section we set out the criteria we have applied in selecting our choice of the available measures of inflation expectations. We then consider the range of possible sources and methods for estimating inflation expectations and then apply the criteria.

The Selection Criteria

We applied the following criteria to determining the most suitable inflation forecast:[69]

- the measure of inflation that is forecast: there are several measures of inflation in the EU including individual country measures as well as Euro-wide CPI and HICP;
- the availability of forecasts, and;
- the horizon of the forecasts (i.e. how far into the future the forecasts apply).
- In relation to the final point we note that our aim was to find an inflation forecast - expressed as an annual average - that corresponds to the maturity of the bond or swap rate used (e.g. 5 or 15 years). In the event that multiple sources of forecasts met our criteria, the choice between them could be based upon an assessment of accuracy.

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67 See King (2002) "The Inflation Target Ten Years On", Speech to the London School of Economics, November 19.

68 See Bell (2005) "A Matter of No Small Interest: Real Short-term Interest Rates and Inflation since the 1990s", Speech to The Institute of Directors (South East Midlands) & Milton Keynes and North Bucks Chamber of Commerce at Cranfield University, March 2.

69 The forecaster must be reputable, insofar that they have made a genuine and thorough attempt to forecast their chosen measure of inflation. However, there is no reason to believe that any of the forecasters considered in this memo are anything but reputable.

The Possible Sources and NERA's Choice

To our knowledge there are several possible publicly available sources of inflation expectations for the EU:

- the IMF;
- the OECD;
- Consensus Economics, and;
- the ECB's Quarterly Survey of Professional Forecasters.

We note that it is also possible, in theory, to construct inflation expectations by comparing yields on index-linked and nominal government bonds of the same maturity. Since Eurozone government inflation-protected bonds are linked to Eurozone HICP (with the exception of some older French OATis that are linked to French CPI excluding tobacco), a comparison between inflation-protected bonds and nominal bonds provides an estimate of expected Eurozone HICP inflation. However, distortions in the inflation-protected bond market mean that the implied inflation expectations may be currently biased.

Another alternative is evidence provided by inflation swaps. The Eurozone inflation swap rate is linked to Eurozone HICP, and is therefore a direct measure of inflation expectations (leaving the issue of inflation risk premiums to one side) since it is the fixed rate that must be paid to be guaranteed inflation payments in return – since the contract must be NPV neutral when entered, the fixed rate is the expected annually compounded HICP inflation rate. There are a limited number of participants in the inflation swaps market within the Eurozone which may mean the swap rate is not representative of the market's 'true' expectations.

The appropriate measure of inflation for current purposes is Eurozone HICP since this is a pan-European inflation measure and, therefore, provides the best indicator of real returns required by European investors. Having considered the alternatives presented we rely upon the ECB's QSPF since these forecasts are published more frequently than the other options, rely on multiple forecasters rather than a single forecaster which should help to avoid subjectivity, and relies on forecasts supplied by market participants which is ultimately what we are trying to estimate. These forecasts are available on a quarterly basis since 1999.

Estimates

We estimate medium-term inflation expectations by:

1. Generating a series of one-year-ahead inflation forecasts for each year of the forecast horizon (e.g. for a ten year forecast horizon we have ten annual inflation forecasts).

2. Taking a simple arithmetic average of these inflation forecasts over the forecast horizon.

The first step ensures evidence on the expected trend inflation rate and short-term fluctuations in inflation expectations (as the business cycle unfolds) are both incorporated into our medium-term inflation forecast.

Table A.1 presents average inflation expectation measures from a variety of sources. Our preferred measure of medium-term inflation expectations has averaged 1.87% over the past ten years and 1.99% over the past three months.

Table A.1
Medium Term Inflation Expectations

	Past Ten Years	Past Three Months
ECB QSPF[1]	1.87	1.99
Inflation Swaps[2]	2.26	2.03
Breakeven inflation[3]	2.30	1.80

Source: NERA analysis of ECB, Bloomberg and Bundesbank data. Notes: (1) ECB QSPF inflation expectations calculated for a 10-year maturity based on surveys up to and including 2008 Q4; (2) Inflation swaps are linked to Eurozone HICP ex Tobacco (as are French OATis) and based on 10-year maturity using data from 27th April 2004 to 24th February 2009; (3) Break-even inflation calculated using yields on German bunds and French OATis data up to 9th February 2009 with 10-year maturity and the Fisher formula.

Appendix B. Adjustments to Beta

B.1. Adjustments to Raw Equity Beta Estimates

It is standard practice to adjust the raw equity betas (or historical betas, i.e. those betas obtained from the regression of the company's stocks against the market index) according to a simple deterministic formula:

(B.1) $$\beta_{\text{Equity-adjusted}} = (0.67)*\beta_{\text{Equity-raw}} + (0.33)*1.0$$

This is referred to as the Blume adjustment and is widely used, for example by Bloomberg, Merrill Lynch and ValueLine (see Patterson, 1995). The Blume adjustment formula takes account of the tendency of estimated betas to converge towards the market value of one over time.[70]

An alternative adjustment process, the Vasicek or "Bayesian" adjustment process, adjusts betas to take account of differences in the degree of sampling error for individual firm betas rather than applying the same adjustment process to all stocks.[71]

There has not been extensive research into the comparative accuracy of the Blume versus the Vasicek adjustment technique. Klemkosky and Martin (1975) found that the Vasicek technique had a slight tendency to outperform the Blume technique.[72] However, a later study by Eubank and Zumwalt (1979) concluded that the Blume model generally outperforms the Vasicek model over shorter timeframes, with little difference over long time periods.[73] The computational simplicity of the Blume formula may explain why it is often preferred.

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[70] Blume (1971) tested to see if forecasting errors based on historical estimates were biased. Blume demonstrated that a tendency for estimated betas to regress towards their mean value of one. The adjustment formula above captures this tendency.

[71] The Vasicek methodology forecasts beta for security *i* (β_{i2}) as: $\beta_{i2} = \frac{\sigma^2_{\beta i1}}{\sigma^2_{\bar{\beta}1} + \sigma^2_{\beta i1}}\bar{\beta}_1 + \frac{\sigma^2_{\bar{\beta}1}}{\sigma^2_{\bar{\beta}1} + \sigma^2_{\beta i1}}\beta_{i1}$, where β_{i1} is the historical beta for stock *i*, σ^2 is the variance and $\bar{\beta}_1$ is the average beta.

[72] See Elton and Gruber (1995), page 145.

[73] See Patterson (1995), page 127.

B.2. Adjusting Betas for Differences in Capital Structure

The value of the equity beta (i.e. the beta obtained from OLS regression of company returns on returns on the market portfolio, and adjusted according to the Blume adjustment) does not only reflect business risk, but also financial risk.[74] Equity betas have been adjusted for financial risk ("de-levered") to derive asset (or "unlevered") betas throughout this study according to the following formula:[75]

(B.2) Miller formula**:** $\beta_{Asset} = \beta_{Equity-adj} * (1 - g)$

where g is the actual gearing (D/(D+E)) of the company.[76]

In a final step, we re-lever asset betas to reflect the target capital structure. The equity beta consistent with a notional target gearing level is calculated as follows:

(B.3) $$\beta_{Equity@\,g_T} = \beta_{Asset} / (1 - g_T)$$

where g_T is the target gearing of the company.

[74] As a company's gearing increases, the greater the variability of equity returns, since debt represents a fixed prior claim on a company's operating cashflows. For this reason, increased gearing leads to a higher cost of equity.

[75] This formula is attributed to Miller (1977).

[76] Net debt is defined as short-term and long-term borrowings less cash and cash equivalents. In practice, book value of debt is commonly used rather than market value. Book value has been used in this study.

Appendix C. Initial Set of Listed Comparators

Table C.1 presents the full list of 22 potential comparator airport owner/operators that we identified.

We exclude Japan Airport Terminal Co and Grupo Aeroportuario del Centro Norte due to the absence of market data. We also exclude Beijing, Shanghai, Guangzhou, Xiamen, Malaysia Holdings, Airports of Thailand and Tav Havalimanlari due to the absence of information - such as regarding their characteristics, discussed below - about these airports. In addition, we exclude Macquarie Airports Group as it has ownership stakes in a wide range of airports including Sydney, Copenhagen and Japan Airport Terminal Co which makes the identification of relevant airport characteristics on a basis comparable to Dublin Airport prohibitively difficult.

Table C.1
Listed Airport Companies

Company Name	Country	Description
SHANGHAI INTERNATIONAL	CHINA	Shanghai International Airport Co Ltd operates Pudong Airport in Shanghai.
AERODROM LJUBLJANA	SLOVENIA	Aerodrom Ljubljana operates the Ljubljana Airport.
GUANGZHOU BAIYUN INTERNATIONATIONAL	CHINA	Guangzhou Baiyun International Airport Co., Ltd. operates the Guangzhou Baiyun International Airport.
XIAMEN INTERNATIONAL	CHINA	Xiamen International Airport Co., Ltd. operates and maintains Gaoqi Airport.
AUCKLAND INTERNATIONAL	NEW ZEALAND	Auckland International Airport Limited owns and operates the Auckland International Airport.
KOBENHAVNS LUFTHAVNE	DENMARK	Kobenhavns Lufthavne A/S (Copenhagen Airports A/S - CPH) owns and operates Kastrup, the international airport in Copenhagen, and Roskilde airport.
SOCIETA AEROPORTO TOSCANO SP	ITALY	Societa Aeroporto Toscano S.p.A. manages the Galileo Galilei Airport in Pisa, Italy.
AIRPORTS OF THAILAND PCL	THAILAND	Airports of Thailand Public Company Ltd. operates the Bangkok International Airport (Don Muang), the New Bangkok International Airport (Suvarnabhumi) and provincial airports in Chiang Mai, Chiang Rai, Hat Yai, and Phuket.
TAV HAVALIMANLARI HOLDING AS	TURKEY	TAV Havalimanlari Holding AS operates terminals at airports in Turkey and Georgia.
FLUGHAFEN WIEN AG	AUSTRIA	Flughafen Wien AG manages, maintains, and operates the Vienna International Airport and the Voslau Airfield.
MALAYSIA AIRPORTS HLDGS BHD	MALAYSIA	Malaysia Airports Holdings Berhad, through its subsidiaries, provides management, maintenance, and operation of designated airports.
AEROPORTO DI FIRENZE SPA	ITALY	Aeroporto di Firenze S.p.A. manages the Amerigo Vespucci Airport in Florence, Italy.
FLUGHAFEN ZUERICH AG-REG	SWITZERLAND	Flughafen Zuerich AG operates the Zurich Airport.
SAVE SPA	ITALY	SAVE SpA operates the Marco Polo Airport in Venice, Italy.
MACQUARIE AIRPORTS	AUSTRALIA	Macquarie Airports is an infrastructure investment company whose portfolio is comprised of airport assets located throughout the world.
BEIJING CAPITAL INTL AIRPO-H	CHINA	Beijing Capital International Airport Company Limited operates both aeronautical and non-aeronautical business in the Beijing airport.
JAPAN AIRPORT TERMINAL CO	JAPAN	Japan Airport Terminal Co., Ltd. constructs, manages and maintains passenger terminals and airport facilities at Haneda and Narita airports.
ADP	FRANCE	Aeroports de Paris (ADP) manages all the civil airports in the Paris area.

Company Name	Country	Description
FRAPORT AG	GERMANY	Fraport AG operates the Frankfurt-Main, Frankfurt-Hahn and other airports in Germany, the airport in Lima, Peru, and the international terminal in Antalya, Turkey.
GRUPO AEROPORTUARIO DEL PACIFICO	MEXICO	Grupo Aeroportuario del Pacifico SAB de CV operates and maintains airports in the Pacific and central regions of Mexico.
GRUPO AEROPORTUARIO DEL SURESTE	MEXICO	Grupo Aeroportuario del Sureste S.A.B. de C.V. holds 50 year concessions, beginning in 1998, to manage airports in Cancun, Cozumel, Merida, Oaxaca, Veracruz, Huatulco, Tapachula, Minatitlan, and Villahermosa.
GRUPO AEROPORTUARIO DEL CENTRO NORTE	MEXICO	Grupo Aeroportuario del Centro Norte, S.A.B. de C.V. (OMA) operates international airports in the northern and central regions of Mexico.

Source: NERA analysis of Bloomberg data.

Appendix D. Bid-Ask Spreads Analysis

Stocks which are infrequently traded will produce downwardly biased estimates of beta. To identify relatively illiquid stocks we consider evidence on bid-ask spreads, presented in Table D.1. Bid-ask spreads reflect the difference between prices buyers are willing to pay and prices sellers are willing to accept. A large spread indicates that there are relatively few buyers and sellers in the market. It is, therefore, a proxy for the liquidity of stocks.

Based on the evidence presented we note that the beta of a number of these airports may be affected by illiquidity. These airports are shaded in gray. However, we only exclude Tuscany Airport – which is the least liquid - from our further deliberations.

Table D.1
Listed Airport Companies: Bid-Ask Spreads

	Last 6 months	Last 12 months	Last 2 years	Last 5 years
Vienna	1.18%	0.78%	0.49%	0.45%
Frankfurt	0.87%	0.75%	0.65%	0.98%
Copenhagen	2.83%	2.61%	2.13%	1.23%
Paris (CDG)	0.29%	0.23%	0.20%	0.22%
Venice	2.11%	1.77%	1.34%	0.98%
Macquarie Airports	1.31%	1.09%	0.90%	0.68%
Florence Airport	2.90%	2.38%	1.85%	1.17%
Tuscany Airport	3.48%	3.12%	2.58%	2.58%
Auckland International Airport	0.92%	0.89%	0.73%	0.59%
Lujubljana Aerodrome	1.92%	1.67%	1.45%	1.55%
Zurich Airport	0.72%	0.65%	0.54%	0.57%
Tav Havalimanlari Holdings	0.76%	0.74%	0.81%	0.81%
Shanghai	0.17%	0.13%	0.11%	0.15%
Guangzhou	0.15%	0.16%	0.13%	0.15%
Xiamen	0.12%	0.12%	0.13%	0.18%
Airports of Thailand	0.83%	0.91%	0.90%	0.82%
Malaysia Airports	2.11%	1.67%	1.17%	1.04%
Beijing Airport	0.64%	0.45%	0.38%	0.67%
Japan Airport Terminal Co				
Grupo Aeroportuario del Pacifico	2.03%	1.32%	0.99%	0.92%
Grupo Aeroportuario del Sureste	1.85%	1.28%	0.95%	1.56%
Grupo Aeroportuario del Centro Norte	0.83%	0.63%	0.48%	0.47%
Average	**1.24%**	**1.04%**	**0.90%**	**0.81%**
Range	**0.12-3.48%**	**0.12-3.12%**	**0.11-2.58%**	**0.12-2.58%**

Source: NERA analysis of Bloomberg data up to and including 31st December 2008.

Appendix E. Transaction and Pre-Funding Costs

E.1. Transaction Costs

Table E.1 sets out our analysis of DAA's transaction costs. Up-front and ongoing fees for each type of debt – bonds, bank facilities and EIB loans – are considered. By assessing transaction costs upon various types of debt we ensure that fees and charges ascribed to one type of debt are not unnecessarily (and potentially inaccurately) assumed to be the same for other debt instruments. The fees for each debt source are amortised based on an assumption of the typical tenor of the facility. The figures are then converted to bps p.a. and summed to provide a total annual transaction costs allowance. Our analysis draws on consultation with DAA. We note that our estimates include costs associated with undrawn committed facilities: these costs are associated with the arrangement of facilities that ensure the ongoing liquidity and flexibility of DAA's business and are efficiently incurred as a result, regardless of whether the facilities are actually drawn down or not.

Our assessment of aggregate transaction costs relies on calculations about the proportions of existing and future debt that are comprised by particular types of debt. Since we include transaction costs associated with undrawn committed facilities the sum of the proportions of debt outstanding exceeds 100%.

In aggregate we estimate that transaction costs are around [redacted] per annum historically and [redacted] currently and prospectively. We note that our estimates of transaction costs are not particularly sensitive to the assumed prospective debt composition. In particular, the [redacted] estimate is based on an assumption that all new debt is raised via bond issuance. However, if we assume new debt raised is a mixture of bonds and EIB loans in line with existing debt then the estimate decreases to [redacted]

Table E.1
Transaction Costs

E.2. Pre-funding Costs

The cost of pre-funding can be expressed as follows:

(E.1) $$PFC = \sum_i \%TD_i \times R_i \times HP_i$$

where PFC is the pre-funding cost, $\%TD_i$ is the proportion of total debt pre-funded, R_i is the interest cost of pre-funded debt measured in percentage points (i.e. commitment fees or the 'cost of carry'), HP_i is the holding period as a proportion of one year and i denotes a particular type of debt.

Table E.2 sets out our analysis of pre-funding and liquidity costs based on consultation with DAA and analysis of DAA financial accounts. In aggregate we estimate historic pre-funding and liquidity related costs of [redacted] prospectively. The major drivers of the very substantial increase in pre-funding and liquidity costs are:

- [redacted]
- Increased unutilized bank facilities as DAA seeks to re-assure investors and rating agencies that they have sufficient credit lines in the current difficult climate; and
- Increased cost of unutilized bank facilities as margins on facilities increase and commitment fees increase.

As noted in the Table below we have relied upon DAA estimates of the cost of carry. We note the following points:

[redacted]

We note that elsewhere in this report we have assumed that any pre-funding costs incurred by DAA over the next review period will be related to new bond issues, suggesting an estimate of around [redacted] may be more appropriate. If, however, a mixture of EIB and bond debt is assumed going forward then the mid-point of the range is likely to be more appropriate i.e. [redacted] would be our estimate of the forward-looking cost of carry in such a scenario.

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Table E.2
Pre-Funding and Liquidity Costs

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