

Cost of capital for ROSCOs

Introduction

1. This appendix sets out our approach to, and calculation of, the cost of capital for a hypothetical stand-alone company that leases passenger rolling stock in the UK.
2. First, we set out our proposed approach. Subsequent sections look at each of the components of our cost of capital calculation: gearing,¹ cost of debt, RFR, equity risk premium (ERP), beta and taxation. In each section we summarize and appraise the submissions of the three ROSCOs, and also the work performed by the ORR and the DfT.
3. Some of the components of the cost of capital (ie RFR, ERP) are generic and the CC aims to take a consistent view on these across inquiries. Others, such as beta and gearing, are specific to the industries under consideration.

Approach to measuring cost of capital

4. Our approach to measuring the cost of capital is to obtain the cost of equity by using the Capital Asset Pricing Model (CAPM).² For the cost of debt, we look at the costs faced by companies with similar credit ratings to ROSCOs.
5. The three ROSCOs have made detailed submissions to us on the cost of capital that is faced either by them or by a hypothetical rolling stock leasing company. We consider these submissions, the primary evidence within them (for example, bond spreads and beta information), and the ROSCOs' estimates of cost of capital in

¹In this appendix, 'gearing' is taken to mean debt as a proportion of debt plus equity, expressed as a percentage.

²This is in accordance with the CC's guidelines, [CC3](#), paragraph 3.85.

coming to a view on the values of the variables that determine the cost of capital. We also review the work on cost of capital undertaken by the DfT and the ORR.

6. Our analysis of margins looks at the lifetime returns on the initial investment made in rolling stock assets. Given that lifetime returns may vary as a result of changes at re-lease, we also attempted to reflect changes to the cost of capital between leasing periods. Therefore our comparator is an average of the cost of capital at the time the investment was made and the cost of capital at the signing of each re-lease. For post-MOLA rolling stock, we have taken this to be the date at which the first lease was signed. For MOLA stock, we have estimated a blended cost of capital, taking the average of the cost of capital at the date of each ROSCO's privatization³ (January 1996 for Angel and Porterbrook, February 1996 for HSBC), and the cost of capital at re-lease.
7. The DfT said that our approach of weighting the cost of capital on a time basis as set out above would lead to inaccuracies in our results and that the average WACC should be determined through an IRR calculation. We accepted that our approach involved a degree of simplification compared with an IRR calculation, but considered that the differences between the two approaches would depend on the lease periods and interest rates involved, and would not be significant in the light of the other estimates and judgements involved.
8. Our analysis of whole-company profitability looks at annual profits in the years 2002 to 2007. This is compared with the annual average pre-tax cost of capital in each of those years.

³The cost of capital at privatization has been used because we wish to analyse profitability from privatization. We do not consider the cost of capital at the ROSCOs' subsequent sales to be relevant as there was no change to the lease financial terms at these dates.

9. We usually assume that the cost of capital is being determined for a hypothetical entity which only supplies the reference goods or services. This assumption is made to ensure that the cost of capital cannot be affected by other activities. In the case of ROSCOs, however, the current tax regime (in particular, the exemption of rolling stock from being treated as a long-life asset) means that there is a cost advantage in being owned by a corporate group that has sufficient taxable UK profits to benefit from ROSCO capital allowances. We examine this further in the section on taxation (paragraphs 76 to 79). We have also assumed that the cost of capital does not vary between fleets. We consider that differences in systematic risk between fleets are small enough for this assumption to be reasonable.

10. As a result, a stand-alone ROSCO is likely to have a higher cost of capital than one owned by a group with sufficient tax capacity. For our analysis we will continue to use a stand-alone ROSCO, and a corporation tax rate of 30 per cent.

Summary

11. We estimate that the range of the nominal,⁴ post-tax cost of equity for a stand-alone ROSCO is between 7.5 and 8.2 per cent for the period 2002 to 2007. The range for the pre-tax WACC is 6.5 to 7.7 per cent. We have also estimated WACC for January 1996 (the date of privatization for Angel and Porterbrook) and February 1996 (the date of privatization for HSBC). Our calculation is set out in Table 1.

12. As noted above, we also need to take into account the cost of capital at the time new stock was first leased and MOLA stock was re-leased. Our estimate of RFR and debt premium for each month since privatization is set out in Annex 2.

⁴Unless stated, all figures in this appendix are nominal.

TABLE 1 Summary of CC estimate of cost of capital for a ROSCO

	January 1996 (Angel & Porterbrook privatization)	February 1996 (HSBC privatization)	2002	2003	2004	2005	2006	2007
RFR (%)	7.2	7.5	4.9	4.4	4.9	4.4	4.6	5.1
ERP (%)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Asset beta	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Debt beta	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Beta	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Tax (%)	30	30	30	30	30	30	30	30
								<i>per cent</i>
Cost of equity (post-tax)	10.3	10.6	8.0	7.5	8.0	7.5	7.7	8.2
Cost of equity (pre-tax equivalent)	14.7	15.2	11.4	10.8	11.4	10.8	11.0	11.8
Debt premium	0.9	0.9	1.0	0.8	0.7	0.7	0.8	1.2
Cost of debt (pre-tax)	8.1	8.4	5.9	5.2	5.6	5.1	5.4	6.3
Gearing (D/D+E)	75	75	75	75	75	75	75	75
WACC pre-tax	9.7	10.1	7.3	6.6	7.0	6.5	6.8	7.7

Source: CC analysis.

ROSCO and other parties' estimates of cost of capital

ROSCOs

13. The ROSCOs presented differing analyses. Angel estimated its own post-tax cost of equity at [redacted] to [redacted] per cent and its pre-tax WACC at [redacted] to [redacted] per cent (assuming [redacted] to [redacted] per cent gearing). HSBC estimated the 'appropriate cost of capital range to apply to the passenger rolling stock leasing industry in the UK'. It arrived at a post-tax cost of equity of [redacted] to [redacted] per cent and a pre-tax WACC of [redacted] to [redacted] per cent (assuming [redacted] to [redacted] per cent gearing). Porterbrook estimated its own cost of capital as a stand-alone entity. It estimated a post-tax cost of equity of [redacted] to [redacted] per cent and a pre-tax WACC of [redacted] to [redacted] per cent (assuming [redacted] to [redacted] per cent gearing). Although these costs of capital have been estimated for slightly different entities, we still consider them to be sufficiently comparable for our purposes.

DfT

14. The DfT submitted a paper commenting on the ORR's cost of capital and providing its own range. It estimated a pre-tax WACC of 5.6 to 7.1 per cent. In its reference document to the ORR it used a pre-tax WACC of 5.5 to 6.6 per cent, which it used as a cross-check against its benchmark market comparator of 1 to 3 per cent above the RFR.

ORR

15. In its referral document,⁵ the ORR put weight both on the DfT's benchmarks and its own estimate of WACC. It used the CAPM to give a post-tax cost of equity of 9.5 per cent. It also used a cost of debt of 7 per cent and a gearing of 85 per cent to give a pre-tax WACC of 8 per cent.

Summary of WACC estimates

16. The estimates of a ROSCO's WACC from the parties and the CC (from between 2002 and 2006) are set out in Table 2 and shown in Figure 1. The total range of post-tax cost of equity is 7.4 to 16.8 per cent, and for pre-tax WACC 5.6 to 10.2 per cent.

⁵*The leasing of rolling stock for franchised passenger services—ORR's reasons for making a market investigation reference to the Competition Commission, 26 April 2007.* The Benchmark rates of return section is at Annex D (p155).

TABLE 2 **WACC estimates**

	<i>HSBC</i>	<i>Angel</i>	<i>Porterbrook</i>	<i>DfT</i>	<i>ORR</i>	<i>CC</i>
Period	2002–2006	2008 forward looking	2006	2007	2006	2002–2006
<i>Cost of debt</i>						
RFR (%)				4–5	5	4.4–4.9
Debt premium (%)				0.7–0.9	2	0.7–1.0
<i>Cost of equity</i>						
RFR (%)				4–5	5	4.4–4.9
Asset beta					0.15	0.3
Equity beta		×		0.85–0.95	1	0.9
Equity Risk Premium (%)				4–5	4.5	3.5
Cost of equity post-tax (%)				7.4–9.8	9.5	7.6–8.0
Gearing (%)				85	85	75
Tax (%)				30	30	30
Pre-tax WACC (%)				5.6–7.1	8	6.6–7.3

Source: The parties, CC analysis.

17. The wide range of estimates, particularly on cost of equity, is due to different assumptions on gearing and equity and asset betas, and the use of different time periods. As the following sections will show, we have taken a position which attempts to provide best estimates of three interrelated variables, and have used quantitative market data and CC precedent to determine the other elements of the WACC.

Calculating the WACC

Gearing and capital structure

18. Assumptions about gearing affect directly the weightings of the cost of debt and cost of equity components of the WACC calculation. They are also important inputs to the calculation of the cost of debt and cost of equity themselves—all other things being equal, a higher level of gearing will increase the risk to both debt and equity holders, causing them to demand a higher return in exchange for making capital available.

19. We assessed the possible gearing of a hypothetical ROSCO by examining evidence from a number of sources. We considered the gearing used by the ROSCOs in their submissions, and also that used by the DfT and the ORR. We also looked at possible

comparator companies and considered the business and operational risks of a ROSCO.

20. An issue in determining the gearing of a hypothetical ROSCO is whether it is considered to have similar characteristics to a bank or to a non-financial company. Banks tend to be very highly geared, with minimum capital ratios set by a regulator. In the Store Cards market inquiry, a gearing of 92 per cent debt and 8 per cent equity was used.
21. In a report prepared for it by Oxera, Angel used two gearing ranges. The first, based on the actual structure of the company, showed gearing between [redacted] and [redacted] per cent. The second, based on a target level of gearing, was between [redacted] and [redacted] per cent debt. Angel has also raised external debt based on gearings of [redacted] to [redacted] per cent at reasonable rates,⁶ suggesting that debt investors at least are comfortable with this level of gearing.⁷
22. We examined rating agency commentary on Angel. A note by Standard & Poors⁸ published in February 2007 calculated Angel's gearing (including non-recourse facilities) at 75 per cent, which it said was 'more typical of the rolling stock leasing sector [than the gearing excluding non-recourse facilities of 65 per cent]'.⁹
23. Porterbrook used a gearing of 40 to 50 per cent as a reasonable range for a stand-alone ROSCO. It took four UK utilities and infrastructure companies¹⁰ and GATX, a US freight rolling stock leasing company, and compared their credit ratings and market gearings. It found that all had gearing between 42 and 49 per cent, and had

⁶[redacted]

⁷The debt issue did not rely on RBS group guarantees or support. However, it is possible that implicit support of RBS was factored in to the debt price.

⁸*Angel Trains Ltd—Major Rating Factors*, published 28 February 2007.

⁹*Ibid* p7.

¹⁰BAA, United Utilities, Severn Trent and National Grid.

credit ratings varying from 'BBB+' to 'A+'. It concluded from this that a stand-alone ROSCO would require a similar level of gearing to achieve those credit ratings.

24. HSBC said that if its rail business was considered as a stand-alone entity, a gearing of [X] to [X] per cent would be appropriate.
25. The DfT used a gearing of 85 per cent in its calculations. The ORR also used 85 per cent in its WACC calculation.
26. We considered the evidence to determine an appropriate level of gearing. We noted in particular that Angel had raised external debt without parent support at a relatively high level of gearing, although we were unsure as to the extent that investors may have considered there to be implicit support by RBS. Angel said it had raised most of its post-MOLA and corporate debt (corporate bond issues, commercial paper back-up facilities) with the use of change of control protection (meaning that the lenders can call for full repayment of debt ahead of any Angel sale). We also noted Standard & Poor's view of a typical rolling stock leasing company gearing. We believe that a stand-alone ROSCO may not be able to gear itself as highly as a bank. However, the nature of the ROSCOs' business, with tangible fixed assets being backed by stable cash flows contractually guaranteed for a number of years, meant that a relatively high gearing for a non-financial company would be possible. We therefore consider a gearing level of 75 per cent debt to be a reasonable estimate and use this in our calculation.
27. One ROSCO (Porterbrook) said that our gearing assumption of 75 per cent appeared to be highly arbitrary and was inconsistent with the debt rating assumption used. It also noted that Ofwat assumed an optimal gearing level for water companies of 55 per cent in its most recent price review in 2004. We consider that water

companies, despite having similar capital-intensive business models from ROSCOs, face different market and regulatory issues which would limit their value as a proxy for ROSCO gearing. We therefore stand by our 75 per cent debt gearing assumption.

28. We performed sensitivity analysis on this gearing estimate, and the results are set out in Annex 1.

Cost of debt

29. The cost of debt can be disaggregated to the risk-free rate and a debt premium which reflects the additional return expected by investors from corporate debt compared with government debt.

The parties' estimates of cost of debt

30. The ROSCOs used various methods of estimating the debt premium. Two ROSCOs (HSBC and Porterbrook) attempted to estimate a credit rating for a hypothetical ROSCO and then used observed premiums of debt issued by companies with similar credit ratings. The other ROSCO (Angel) estimated the cost of debt under the current financing using yields on traded bonds and all-in interest expense. The cost of debt under the target financing structure was cross checked against yields for BBB rated bonds. This produced ranges of [X] to [X] per cent for HSBC and [X] to [X] per cent for Porterbrook. Porterbrook added [X] per cent to this debt premium range to reflect issuance costs.
31. Angel has raised external debt, and Angel Trains Ltd has been assigned an entity credit rating of A+ by Standard & Poors.¹¹ Analysis by Porterbrook showed that ten-year A+ rated corporate debt (UK nominal gilts) has been issued at a premium of

¹¹During 2007, Angel Trains' rating was downgraded by Standard & Poors to single A. Angel said that this was unconnected with the ongoing sale process.

approximately 0.7 per cent. Angel noted that it had issued debt with premiums of [redacted] per cent, [redacted] per cent and [redacted] per cent during the period 1999 to 2001. It used an implied premium of [redacted] to [redacted] per cent in its calculations, with the higher end of the range reflecting the upper end of its target gearing range ([redacted] per cent).

32. The DfT considered that ROSCOs would have an A or AA rating reflecting Angel's capital market transactions and 'the strong characteristics enjoyed by the ROSCOs on account of strong Government support and a limited business risk'. It used a database to show that at April 2006 the yield on this debt was 5.0 to 5.2 per cent, or 0.7 to 0.9 per cent above the DfT's RFR. It also examined evidence from rolling stock debt issues and PFI and utility debt premiums.
33. The ORR based its debt premium on yields of bonds issued by Angel since privatization. This produced a premium of 1 to 2 per cent, and the ORR took the top end of this range for its WACC calculation.

Risk-free rate

34. The RFR is observable from trading in UK Government securities. These are considered to have negligible default risk. Therefore the yields at which the gilts are trading ought to be a reliable measure of the return that investors require in exchange for holding a risk-free asset.
35. We obtained data from the Bank of England showing monthly average yields for five- and ten-year British government securities. The yields are set out in Table 3.

TABLE 3 Risk-free rate, 1996 to 2007

Risk-free rate (average of 5 and 10-year British government securities)

		%
January	1996	7.17
February	1996	7.47
	1996	7.56
	1997	7.02
	1998	5.66
	1999	5.24
	2000	5.56
	2001	4.98
	2002	4.85
	2003	4.39
	2004	4.85
	2005	4.40
	2006	4.57
	2007	5.10

Source: Bank of England.

36. The parties adopted a similar approach to estimating RFR. Angel estimated an average forward-looking RFR of 4.6 to 4.8 per cent. HSBC estimated a range for RFR of 4.4 to 4.8 per cent. Porterbrook estimated a nominal RFR of 4.5 per cent based on 2006 gilt yields.
37. The ORR used an RFR of 5 per cent in its calculation. The DfT used a range for RFR of 4 to 5 per cent.
38. On the basis of the evidence above, we decided to use the figures for RFR set out in Table 3. When looking for a benchmark figure to compare with margins, we used the RFR value at the time each lease was signed, as this would drive the cost of ROSCO funds.
39. One ROSCO (Porterbrook) noted that its current owner had put in place fixed cost long-term funding at the time of acquisition. Another ROSCO (Angel) said that it was potentially uneconomical to raise financing separately for each asset. We noted these comments, but considered that since the ROSCOs' income streams would be

affected by changes in interest rates, it was appropriate to reflect these changes at the initial and subsequent leases of each fleet.

Debt premium

40. Having considered this evidence, we decided to use average yields on 'A' and 'AA' rated long-term debt as the basis for our estimate of cost of debt. We obtained bond yield data from Datastream. Table 4 sets out the redemption yields on 'A' and 'AA' rated ten-plus-year corporate debt, and Table 5 sets out the spread over the RFR. This has been calculated by taking the difference between the figures in Table 4 and the figures in Table 3.

TABLE 4 **Redemption yields for corporate bonds**

	5-7 year		7-10 year		per cent
	AA rated	A rated	AA rated	A rated	Average
December 1996	7.83	7.99	7.98	8.31	8.03
1997	7.45	7.66	7.63	7.85	7.65
1998	6.46	6.72	6.47	6.78	6.61
1999	6.35	6.65	6.37	6.65	6.51
2000	6.83	7.14	6.76	7.24	6.99
2001	5.94	6.40	6.12	6.70	6.29
2002	5.53	6.01	5.82	6.24	5.90
2003	4.87	5.23	5.21	5.42	5.18
2004	5.43	5.56	5.57	5.74	5.58
2005	4.92	5.04	5.07	5.23	5.07
2006	5.26	5.38	5.33	5.63	5.40
2007	6.11	6.33	6.28	6.63	6.34

Source: Merrill Lynch via Datastream.

TABLE 5 **Spreads of corporate bonds over UK gilts**

	per cent		
	AA rated	A rated	Average
December 1996	0.35	0.59	0.47
1997	0.52	0.74	0.63
1998	0.80	1.09	0.94
1999	1.12	1.42	1.27
2000	1.23	1.63	1.43
2001	1.05	1.57	1.31
2002	0.82	1.27	1.05
2003	0.65	0.94	0.79
2004	0.65	0.80	0.72
2005	0.60	0.74	0.67
2006	0.73	0.94	0.83
2007	1.10	1.38	1.24

Source: Merrill Lynch via Datastream, Bank of England.

41. We were unable to obtain data on debt yields at the time of privatization. We have therefore estimated that a debt premium of 0.9 per cent at this period. This is slightly above the December 1996 average figure and approximately equal to the 1997 figure.
42. One ROSCO ([REDACTED]) said that it considered that a stand-alone ROSCO with gearing of 75 per cent would have a credit rating no higher than single 'A'. We considered that our use of 'AA' and 'A' rated debt was consistent with the evidence we had received on gearing and debt costs.

Cost of equity

43. Using the CAPM, the cost of equity is determined by the RFR (set out above), ERP and Beta.

Equity risk premium

44. ERP is the additional return investors require for the extra risk of investing in equities rather than gilts. Unlike the RFR, it is not directly observable from market data, and regulators' approaches to ERP have consisted of examining historic returns on equities over the RFR and forward-looking estimates of investors' expectations.
45. The CC recently undertook a substantial review of the ERP as part of its report on the economic regulation of Heathrow and Gatwick airports.¹² The ERP is not specific to a single industry and so no adjustment is necessary for it to be applicable to ROSCOs. The CC recommended a range for ERP of 2.5 to 4.5 per cent in the airports report. This is slightly lower than the range of 3 to 5 per cent used in previous CC market inquiries.

¹²www.competition-commission.org.uk/rep_pub/reports/2007/fulltext/532af.pdf.

46. Angel used an ERP of 3.5 to 5 per cent.¹³ HSBC quoted evidence from historical and forward-looking studies and used a range of 4 to 6 per cent. Porterbrook used evidence from UK regulatory reviews and historical empirical evidence and used an ERP of 5.3 per cent. The ORR used a central estimate of 4.5 per cent, citing regulatory precedent. The DfT used a range for ERP of 4 to 5 per cent.
47. One ROSCO (HSBC) said that the appropriate ERP to use was the one that investors expected at the point in time that the investment was made, therefore an appropriate measure would be one which was advocated by a competition authority at the time and that the CC had used a higher range for the ERP in earlier inquiries. It said that the ERP range which the CC had now suggested using was based on a recent forward-looking assessment for price regulation purposes, and was inappropriate.
48. We considered these points in turn. While we agree that the appropriate ERP is the one expected by investors, we note that the airports cost of capital report examined historical analyses looking at ERPs over long periods. It is therefore suitable for our purpose as a component of a comparator for historic returns. The range used in the report (2.5 to 4.5 per cent) was identical to the one used on the previous quinquennial report in 2002.
49. Another ROSCO (Porterbrook) said that it did not accept our estimate of 3.5 per cent. It said that in the BAA Airports case, the CC recommended a WACC that was consistent with the upper end of the range (4.5 per cent), that other UK utility regulators use an ERP of around 5 per cent, and that the majority of academic experts support an ERP of around 5 per cent. It also said that serious concerns had

¹³The evidence presented by Angel used the estimate of the long-run ERP over the lifetime of the assets. The evidence, shown in the Oxera cost of capital report, that the short-run ERP seems higher was not taken into account in the estimate of the cost of capital.

been raised with the CC's work on the ERP, including inconsistency over arithmetic and geometric means and selectivity in the academic studies referred to.

50. We considered each of these points. In the 2007 airports review the CC picked point estimates for WACC which were towards the upper end of its ranges,¹⁴ although it did not 'reverse engineer' an ERP value from these point estimates. We noted that the purpose of the cost of capital work in this case was to provide a forward-looking price control rather than a comparator for returns, and also that our sensitivity analysis showed that changes in ERP produced only small changes in WACC. We noted that the CC's work was both objective and comprehensive, that it had taken into account evidence on ERP submitted by parties, and that the issue of arithmetic and geometric mean, and the reasons for the CC's preference for geometric mean, were set out in the report.

51. As can be seen above, a wide range of estimates can be made for the ERP. However, since the CC's recent work is comprehensive, objective and recent, we decided also to use a midpoint of 3.5 per cent for the ERP. We tested the effect of using the lower and upper bound figures (2.5 and 4.5 per cent) in our sensitivity analysis.

Beta

52. In the CAPM, the beta coefficient is taken as a measure of the market (or non-diversifiable) risk of a particular security. This means that price fluctuations which are uncorrelated with the market are considered to be diversifiable and do not contribute to the beta. The beta coefficient links the return on the security and the total market return. Stocks with betas greater than 1.0 tend to amplify the overall movements of

¹⁴For Heathrow, the range was 4.77 to 6.39 per cent and the point estimate 6.2 per cent. For Gatwick, the range was 4.91 to 6.77 per cent and the point estimate was 6.5 per cent.

the markets. Stocks with betas between 0 and 1.0 tend to move in the same direction as the market, but not so far. This means that, based on past data, if a company has a beta of 2 and the future resembles the past, the return on the company changes on average by 2 per cent for every 1 per cent change in market return.

53. We tried to determine the equity beta for a stand-alone ROSCO. Since none of the ROSCOs is separately listed, and each of them represents only a small part of their parent banks' groups, we were unable to observe betas directly. We therefore considered betas that could be observed from similar companies.
54. The beta is dependent on the level of gearing, with a more highly geared company exposed to more financial risk which will translate to a higher equity beta. We need to ensure that our gearing and beta assumptions are consistent, thus when we are examining similar companies and seeking to apply their betas to a hypothetical stand-alone ROSCO, these betas must be de-gearred to produce an asset beta (which is effectively an equity beta of an ungeared company) and then re-gearred to the gearing level required. Because our required gearing level is high (75 per cent debt) and because it is significantly different from the gearing levels of the proxy companies (40 to 58 per cent debt—see Table 6), we consider that it is appropriate to use a debt beta with a value greater than zero in determining the cost of equity in this case, in order to calculate the cost of equity.

Debt betas

55. A debt beta measures the systematic riskiness of debt relative the market portfolio in the same way that an equity beta measures the systematic riskiness of equity relative to the market as a whole.

56. Debt betas also reflect financial risk, and as for equity we would expect to see debt betas increase as gearing increases. At low levels of gearing it is unlikely that increasing gearing will have much effect on the systematic risk of debt, because the value of debt is low relative to the value of equity. It is therefore appropriate to assign a zero value to debt beta. However, at higher levels of gearing, using a zero debt beta over-rewards equity when increasing gearing by implying that all the additional exposure to systematic risk which gearing brings accrues only to equity.
57. The CC has not considered debt betas in previous market inquiries. The reason for this was usually that a similarly geared proxy company was available from which to obtain the equity beta, or that the levels of gearing used in the WACC were relatively low, meaning that a debt beta value of zero could be assumed. However, in the latest price review for Heathrow and Gatwick airports it was found that at BAA's level of gearing (60 per cent) it was necessary to assign a non-zero value to debt beta.¹⁵
58. Given that we are considering higher gearing levels for ROSCOs, and need to re-gear proxy betas which reflect a lower level of gearing, we also consider using a positive debt beta in the CAPM in this analysis.¹⁶
59. Angel estimated a debt beta of [redacted] to [redacted] under its target financing structure.
60. One ROSCO (Porterbrook) suggested that the CC should use the debt beta of water and electricity companies as a comparator. It also noted that Ofgem and Ofwat used zero-value debt betas in their calculations. They also said that the CC should not use

¹⁵The CC's use of debt beta in the latest Heathrow and Gatwick quinquennial review is set out in its report: www.competition-commission.org.uk/rep_pub/reports/2007/fulltext/532af.pdf.

¹⁶Although we use a debt beta in the CAPM to estimate the cost of equity, we have estimated the cost of debt by direct observation of market yields, and so do not need to use a debt beta in determining the cost of debt.

the debt beta of 0.1 that it used in the airports case if the CC believes that the ROSCO (Porterbrook) is less risky.

61. We considered the debt beta for ROSCOs to be broadly comparable with that estimated in the airports case. However, rather than using a range, we considered a point estimate of 0.1 to be appropriate and this is tested through sensitivity analysis (see Annex 1). Given the relative insensitivity of WACC to changes in asset beta, we did not attempt a more detailed estimate. This debt beta estimate was then used to derive an equity beta.

Equity beta

62. The relationship between equity and debt beta, asset beta and gearing can be shown in the following equation:¹⁷

$$\text{Asset beta} = \text{Equity beta} * (1 - \text{gearing}) + \text{debt beta} * \text{gearing}$$

63. We considered companies that might exhibit similar systematic risk characteristics to a ROSCO. We consider many of the risks faced by ROSCOs (for example, most residual value risk, stranding risk and engineering risk) to be diversifiable, and so should not be reflected in the cost of capital. For example, an investor could diversify away the risk of one ROSCO's fleet being stranded by investing in the equity of other ROSCOs whose fleets would be in use.
64. We also consider that ROSCOs have relatively low exposure to systematic risk as leases are relatively long (and so revenue will not be affected by short-term economic volatility), and because a downturn in economic activity would have to be

¹⁷This formula is consistent with an 'active debt management policy' under which management readjusts debt levels in response to forecast cash-flow changes. For the purpose of this inquiry, we consider this to be an appropriate representation of how a ROSCO would manage debt.

both substantial and prolonged for there to be significant overcapacity in passenger rolling stock. We therefore expected a ROSCO's asset beta to be relatively low.

65. Regulated utilities, such as water and electricity companies, have a similar capital-intensive business model with relatively stable cash flows. We also consider that utilities companies, like ROSCOs, will show limited exposure to systematic risk. The equity and asset betas of five utilities are set out in Table 6.

TABLE 6 Selected UK utility betas

	Equity beta A	Gearing % B	Asset beta =A*(1-B)
Severn Trent	0.57	45	0.31
Pennon Group	0.24	44	0.13
Northumbria Water	0.59	58	0.25
National Grid	0.60	40	0.36
United utilities	0.57	41	0.33

Source: CC.

66. Angel said that the ORR's calculations (which assumed an equity beta of 1 and a gearing level of 85 per cent) implied an asset beta of 0.15. It believed that this figure was lower than that determined for any regulated utilities, and calculated an asset beta of [X] to [X]. At its target gearing levels this produced an equity beta of [X] to [X].

67. Porterbrook used other regulated industries and entities (distribution utilities, transmission utilities, BAA and NATS) as comparators to determine an asset beta. It took the asset betas of these entities and then compared the risks faced by them to those faced by Porterbrook. It then cross-checked the results against asset betas from US leasing firms. It concluded that an asset beta of [X] to [X] was appropriate. At the gearing level used by Porterbrook ([X] to [X] per cent) this gave an equity beta of [X] to [X]. At a higher gearing level (say the 85 per cent used by the ORR), this would give an equity beta of [X] to [X].

68. HSBC used a similar approach to Porterbrook, examining regulated industries and similar companies and industries. It suggested that an appropriate range for the asset beta was [X] to [X]. This translates to an equity beta of [X] to [X] at its suggested gearing levels of [X] to [X] per cent.
69. The ORR said that it was not aware of any other UK companies with similar risk characteristics to ROSCOs. It agreed with the DfT's view that rolling stock leasing was subject to a relatively low level of systematic risk, and considered it 'unlikely that significant fluctuations in the demand for rolling stock ... would arise as a result of changes to systematic (non-diversifiable) risk factors, such as the global economy'.¹⁸ It assumed an equity beta of 1 (with an implied asset beta of 0.15 on its assumed 85 per cent gearing), but noted that it had not expended significant resource in attempting to estimate beta.
70. The DfT used a beta value of 0.9 in its calculation of WACC. It said that the ROSCOs were likely to have low asset betas due to the largely diversifiable risks of their business.
71. One ROSCO (Porterbrook) said that it considered demand risk and operating leverage for ROSCOs to be higher than that for water and electricity companies. It noted Ofwat's use of an equity beta of 1 and an asset beta of 0.45.
72. Another ROSCO (Angel) said that utilities faced lower asset-stranding risk than ROSCOs. It also said that there was a significant risk of overcapacity in passenger rolling stock in the future. It used global asset leasing companies as comparators in determining asset and equity betas.

¹⁸ORR reference document, p162.

73. Another ROSCO (HSBC) also noted the lower asset-stranding risk faced by utilities. It pointed out recent regulators' decisions on asset betas and assessments of current market data which showed a range for asset beta of 0.4 to 0.6.
74. Using the evidence above, we considered what would be the most appropriate asset beta for a ROSCO. We considered that we should put more weight on the evidence of comparator companies set out in Table 6, since their betas derived from observed market data, and because we consider them to have broadly comparable systematic risks to ROSCOs. We also placed weight on our view that factors such as a downturn in the economic cycle would be likely to affect ROSCOs' earnings less than many other companies. We therefore assumed an asset beta of 0.3 in our calculations. At our chosen gearing of 75 per cent, and using a debt beta of 0.1, this produced an equity beta of 0.9. This appeared to us to be a reasonable figure given the low level of market risk referred to above and our gearing assumption. We used sensitivity analysis to test our estimate, and found that if asset beta increased to 0.4, our WACC would increase by 0.5 per cent. This increased asset beta would produce an equity beta of 1.3 which we considered to be high relative to other companies, even taking into account the level of gearing.
75. We assumed that the equity and debt betas have remained constant over the period since privatization. Although we could not observe historic betas and accept that equity betas do fluctuate over time, we noted that systematic risks of ROSCOs had remained broadly similar since privatization.

Taxation

76. The standard rate of corporation tax for the period we are examining is 30 per cent. However, because the ROSCOs benefit from significant capital allowances, the effective tax rate of a ROSCO may be less than this.

77. When calculating the WACC, the post-tax cost of equity (as determined by the CAPM) is usually grossed up by the rate of tax to provide a pre-tax cost of equity which can then be averaged with the pre-tax cost of debt. Using a lower effective tax rate will therefore reduce the pre-tax cost of equity. It is difficult to determine an effective tax rate for a stand-alone ROSCO, as it will depend on the ageing profile of its asset portfolio. This profile will also determine whether the ROSCO has sufficient tax capacity to be able to benefit from capital allowances as they arise.
78. Angel attempted to value the tax capacity provided by a ROSCO and its effect on tax rates. Depending on the price put on tax capacity, it estimated that its effective tax rate was [X] to [X] per cent. This assumed that tax capacity could be used or sold for immediate benefit and incorporated the effect of capital allowances.
79. We believe that the profitability of an individual lease may be substantially lower if the tax capacity generated in the early years of the lease can be utilized immediately, but we are unable to determine the degree of utilization for a stand-alone ROSCO. We have therefore used a tax rate of 30 per cent in any pre-tax estimates of WACC,¹⁹ but recognize that this may not reflect the different capital allowances of MOLA and post-MOLA rolling stock.

¹⁹The difference between our assumed rate of 30 per cent and the actual corporation tax rate of 33 per cent at privatization will not impact our analysis.

Sensitivity analysis

Note: In the following analyses, cost of equity is stated post-tax and WACC pre-tax. Both are in nominal terms.

Gearing

1. The sensitivity of the cost of equity and WACC to changes in gearing is set out in Table 1. We have used an RFR of 5 per cent and a debt premium of 1 per cent in all cases.

TABLE 1 **Sensitivity of WACC and cost of equity to gearing**

RFR (%)	5.00			
ERP (%)	3.50			
Tax (%)	30			
Debt premium (%)	1.00			
Asset beta	0.30			
Debt beta	0.10			
				<i>per cent</i>
	<i>Gearing</i>	<i>Equity beta</i>	<i>Cost of equity</i>	<i>WACC</i>
Current	75.0	0.90	8.2	7.4
High gearing	85.0	1.43	10.0	7.2
Low gearing	65.0	0.67	7.4	7.6

Source: CC analysis.

2. The cost of equity is very sensitive to gearing. This is because of the relatively high gearing levels being used. The 'high gearing' figure produces an equity beta of 1.43, which is higher than many stocks in the FTSE-all share index, so this could be considered to be an unreasonable estimate given our evaluation of the ROSCOs business model.
3. The WACC is very insensitive to changes in gearing, because at the higher levels of gearing we are using, the cost of equity has a lower weight in the WACC calculation.

Asset beta

4. The sensitivity of cost of equity and WACC to the value of the asset beta is set out in Table 2.

TABLE 2 **Sensitivity of WACC and cost of equity to asset beta**

RFR (%)	5.00			
ERP (%)	3.50			
Tax (%)	30			
Debt premium (%)	1.00			
Gearing (%)	75			
Debt beta	0.10			
	<i>Asset beta</i>	<i>Equity beta</i>	<i>Cost of equity %</i>	<i>WACC %</i>
Current	0.30	0.90	8.2	7.4
High range	0.40	1.30	9.6	7.9
Low range	0.20	0.50	6.8	6.9

Source: CC analysis.

5. Both the cost of equity and the WACC are somewhat sensitive to the asset beta, with an increase in asset beta of a third (from 0.3 to 0.4) causing a 1.4 percentage point increase in the cost of equity and a 0.5 percentage point increase in the WACC. Again, using the 'high' value for asset beta (0.4) gives an equity beta which would be higher than many UK stocks, which does not seem to reflect the expected systematic risk of a ROSCO.

Debt beta

6. The sensitivity of cost of equity and WACC to the value of the debt beta is set out in Table 3.

TABLE 3 **Sensitivity of WACC and cost of equity to debt beta**

RFR (%)	5.00			
ERP (%)	3.50			
Tax (%)	30			
Debt premium (%)	1.00			
Gearing (%)	75			
Asset beta	0.30			
	<i>Debt beta</i>	<i>Equity beta</i>	<i>Cost of equity %</i>	<i>WACC %</i>
Current	0.10	0.90	8.2	7.4
High range	0.20	0.60	7.1	7.0
Low range	0.05	1.05	8.7	7.6

Source: CC analysis.

7. When the debt beta is doubled to 0.2, the cost of equity falls 1.1 percentage points and the WACC falls 0.4 percentage points. When it is halved, the cost of equity increases 0.5 percentage points and the WACC increases by 0.2 percentage points.

ERP

8. The sensitivity of cost of equity and WACC to the value of the ERP is set out in Table 4. The range 2.5 to 4.5 per cent is the one chosen in the CC's recent quinquennial report on Heathrow and Gatwick airports.

TABLE 4 **Sensitivity of WACC and cost of equity to ERP**

RFR (%)	5.00		
Tax (%)	30		
Debt premium (%)	1.00		
Gearing (%)	75		
Equity beta	0.90		
		<i>per cent</i>	
	<i>ERP</i>	<i>Cost of equity</i>	<i>WACC</i>
Current	3.50	8.2	7.4
High range	4.50	9.1	7.7
Low range	2.50	7.3	7.1

Source: CC analysis.

9. If the ERP is increased to 4.5 per cent, then the cost of equity increases by 0.9 percentage points and the WACC increases by 7.7 percentage points. If the ERP is

taken at the lower end of the range, then the cost of equity and the WACC fall by similar amounts.

Monthly risk-free rate and debt premium

<i>Date</i>	<i>RFR</i>	<i>Debt premium</i>
1995 Dec	7.22	0.9
1996 Jan	7.17	0.9
1996 Feb	7.47	0.9
1996 Mar	7.79	0.9
1996 Apr	7.82	0.9
1996 May	7.84	0.9
1996 Jun	7.78	0.9
1996 Jul	7.63	0.9
1996 Aug	7.53	0.9
1996 Sep	7.53	0.9
1996 Oct	7.29	0.9
1996 Nov	7.44	0.9
1996 Dec	7.43	0.60
1997 Jan	7.40	0.52
1997 Feb	7.06	0.68
1997 Mar	7.31	0.89
1997 Apr	7.51	0.50
1997 May	7.11	0.71
1997 Jun	7.11	0.62
1997 Jul	7.10	0.56
1997 Aug	7.09	0.65
1997 Sep	6.84	0.29
1997 Oct	6.58	0.75
1997 Nov	6.73	0.68
1997 Dec	6.49	0.65
1998 Jan	6.21	0.70
1998 Feb	6.14	0.81
1998 Mar	6.11	0.69
1998 Apr	5.94	0.76
1998 May	5.97	0.63
1998 Jun	5.98	0.93
1998 Jul	6.05	0.76
1998 Aug	5.76	0.79
1998 Sep	5.30	1.28
1998 Oct	5.03	1.55
1998 Nov	4.97	1.17
1998 Dec	4.55	1.26
1999 Jan	4.32	1.17
1999 Feb	4.47	1.28
1999 Mar	4.70	1.06
1999 Apr	4.66	1.26
1999 May	4.97	1.26
1999 Jun	5.27	1.26
1999 Jul	5.47	1.41
1999 Aug	5.64	1.21
1999 Sep	5.90	1.40
1999 Oct	6.12	1.05
1999 Nov	5.64	1.43
1999 Dec	5.70	1.44
2000 Jan	6.11	1.34
2000 Feb	5.94	1.20
2000 Mar	5.69	1.35
2000 Apr	5.62	1.37
2000 May	5.67	1.43
2000 Jun	5.47	1.64
2000 Jul	5.47	1.63
2000 Aug	5.55	1.63
2000 Sep	5.57	1.35
2000 Oct	5.39	1.47
2000 Nov	5.26	1.28
2000 Dec	5.07	1.45
2001 Jan	4.99	1.42
2001 Feb	4.96	1.46
2001 Mar	4.81	1.45
2001 Apr	4.98	1.47
2001 May	5.16	1.32

<i>Date</i>	<i>RFR</i>	<i>Debt premium</i>
2001 Jun	5.27	1.35
2001 Jul	5.28	1.05
2001 Aug	5.05	1.09
2001 Sep	4.97	1.36
2001 Oct	4.81	1.04
2001 Nov	4.61	1.27
2001 Dec	4.90	1.41
2002 Jan	4.94	1.05
2002 Feb	4.95	1.10
2002 Mar	5.24	1.06
2002 Apr	5.24	0.85
2002 May	5.27	0.88
2002 Jun	5.10	0.90
2002 Jul	4.97	1.00
2002 Aug	4.67	1.07
2002 Sep	4.42	1.13
2002 Oct	4.51	1.30
2002 Nov	4.53	1.29
2002 Dec	4.46	0.94
2003 Jan	4.27	1.00
2003 Feb	4.04	1.01
2003 Mar	4.14	1.00
2003 Apr	4.29	0.83
2003 May	4.05	0.72
2003 Jun	3.93	0.85
2003 Jul	4.20	0.87
2003 Aug	4.49	0.74
2003 Sep	4.61	0.48
2003 Oct	4.84	0.80
2003 Nov	5.01	0.67
2003 Dec	4.82	0.57
2004 Jan	4.72	0.84
2004 Feb	4.74	0.69
2004 Mar	4.66	0.81
2004 Apr	4.91	0.77
2004 May	5.09	0.88
2004 Jun	5.21	0.70
2004 Jul	5.12	0.78
2004 Aug	5.01	0.66
2004 Sep	4.90	0.62
2004 Oct	4.74	0.67
2004 Nov	4.66	0.57
2004 Dec	4.51	0.70
2005 Jan	4.51	0.70
2005 Feb	4.59	0.76
2005 Mar	4.79	0.58
2005 Apr	4.61	0.67
2005 May	4.39	0.69
2005 Jun	4.25	0.64
2005 Jul	4.25	0.72
2005 Aug	4.30	0.52
2005 Sep	4.19	0.76
2005 Oct	4.33	0.73
2005 Nov	4.32	0.66
2005 Dec	4.24	0.63
2006 Jan	4.12	0.83
2006 Feb	4.19	0.81
2006 Mar	4.35	0.86
2006 Apr	4.53	0.91
2006 May	4.69	0.75
2006 Jun	4.71	0.88
2006 Jul	4.71	0.81
2006 Aug	4.73	0.76
2006 Sep	4.65	0.86
2006 Oct	4.73	0.76
2006 Nov	4.68	0.81
2006 Dec	4.75	0.97
2007 Jan	5.01	0.94
2007 Feb	5.03	0.72
2007 Mar	4.95	1.02
2007 Apr	5.16	0.90
2007 May	5.28	1.00
2007 Jun	5.56	1.00
2007 Jul	5.53	1.04

<i>Date</i>	<i>RFR</i>	<i>Debt premium</i>
2007 Aug	5.25	1.32
2007 Sep	5.04	1.53
2007 Oct	4.99	1.50
2007 Nov	4.72	2.00

Source: Merrill Lynch, Bank of England.
