Private healthcare remittal final report

Appendices and glossary

Shares of supply in central and Greater London

Table 1: Central London aggregate shares of supply, 2011*

%

	Inpatient admissions	*Inpatient revenue*	*Total admissions*	*Total revenue*
HCA	[✂]	[✂]	[✂]	[✂]
TLC	[✂]	[✂]	[✂]	[✂]
BMI	[✂]	[✂]	[✂]	[✂]
The Bupa Cromwell Hospital	[✂]	[✂]	[✂]	[✂]
Aspen	[✂]	[✂]	[✂]	[✂]
Hospital of St John & St Elizabeth	[✂]	[✂]	[✂]	[✂]
King Edward VII's Hospital Sister Agnes	[✂]	[✂]	[✂]	[✂]
Total private hospitals	**85**	**89**	**86**	**86**
Imperial College Healthcare NHS Trust	[✂]	[✂]	[✂]	[✂]
Royal Free London NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
Royal Brompton and Harefield NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
The Royal Marsden NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
King's College Hospital NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
Guy's & St Thomas' Trust	[✂]	[✂]	[✂]	[✂]
Total PPUs	**15**	**11**	**14**	**14**

Source: CC analysis.
*All revenue and admissions figures include international patients. When excluding international patients from our data for central London operators, we obtain similar results: HCA's share of total admissions in central London does not change ([✂]%) and HCA's share of total revenue in central London drops by one percentage point ([✂]).
Note: Total admissions include inpatient and day-case. Total revenue includes inpatient, day-case and outpatient.

Table 2: Shares of capacity of private hospitals in central London, 2011

	Overnight beds (including PPUs)		*Theatres*		*Consulting rooms*		*Critical care beds level 3*	
	Numbers	*%*	*Numbers*	*%*	*Numbers*	*%*	*Numbers*	*%*
Aspen								
Highgate Hospital	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
BMI								
Blackheath	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Fitzroy Square	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
London Independent	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Weymouth	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Total BMI	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
HCA								
Harley Street Clinic	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Lister Hospital	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
London Bridge Hospital	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Portland Hospital	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Princess Grace Hospital	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Wellington Hospital	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
NHS ventures UCLH	[✂]	[✂]						
Total HCA	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
St John & St Elizabeth	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
King Edward VII's Sister Agnes	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
The Bupa Cromwell	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
TLC	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Total private hospitals	**1,318**	**82.8**	**80**		**430**		**85**	
Guy's & St Thomas' Trust	[✂]	[✂]	N/A		N/A		N/A	
Imperial College Healthcare NHS Trust	[✂]	[✂]	N/A		N/A		N/A	
King's College Hospital NHS Foundation Trust	[✂]	[✂]	N/A		N/A		N/A	
Royal Brompton and Harefield NHS Foundation Trust	[✂]	[✂]	N/A		N/A		N/A	
Royal Free London NHS Foundation Trust	[✂]	[✂]	N/A		N/A		N/A	
The Royal Marsden NHS Foundation Trust	[✂]	[✂]	N/A		N/A		N/A	
Total PPUs	**274**	**17.2**						

Source: CC analysis.
Note: N/A = not available.

Table 3: London (inner London and outer London) aggregate shares of supply, 2011

	Inpatient admissions	*Inpatient revenue*	*Total admissions*	*Total revenue*
				%
HCA	[✂]	[✂]	[✂]	[✂]
TLC	[✂]	[✂]	[✂]	[✂]
BMI	[✂]	[✂]	[✂]	[✂]
The Bupa Cromwell Hospital	[✂]	[✂]	[✂]	[✂]
Aspen	[✂]	[✂]	[✂]	[✂]
Hospital of St John & St Elizabeth	[✂]	[✂]	[✂]	[✂]
King Edward VII's Hospital Sister Agnes	[✂]	[✂]	[✂]	[✂]
Spire	[✂]	[✂]	[✂]	[✂]
St Anthony's Hospital	[✂]	[✂]	[✂]	[✂]
The New Victoria Hospital	[✂]	[✂]	[✂]	[✂]
Total private hospitals	**87**	**90**	**88**	**87**
Imperial College Healthcare NHS Trust	[✂]	[✂]	[✂]	[✂]
Royal Free London NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
Royal Brompton and Harefield NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
The Royal Marsden NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
King's College Hospital NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
Guy's & St Thomas' Trust	[✂]	[✂]	[✂]	[✂]
NorthWest London Hospitals NHS Trust	[✂]	[✂]	[✂]	[✂]
EN Hertfordshire Trust	[✂]	[✂]	[✂]	[✂]
Total PPUs	**13**	**10**	**12**	**13**

Source: CC and CMA analysis.
Note: Total admissions include inpatient and day-case. Total revenue includes inpatient, day-case and outpatient.

Table 4: Area within M25 (London and four hospitals outside London) aggregate shares of supply, 2011

	Inpatient admissions	*Inpatient revenue*	*Total admissions*	*Total revenue*
				%
HCA	[✂]	[✂]	[✂]	[✂]
TLC	[✂]	[✂]	[✂]	[✂]
BMI	[✂]	[✂]	[✂]	[✂]
The Bupa Cromwell Hospital	[✂]	[✂]	[✂]	[✂]
Aspen	[✂]	[✂]	[✂]	[✂]
Hospital of St John & St Elizabeth	[✂]	[✂]	[✂]	[✂]
King Edward VII's Hospital Sister Agnes	[✂]	[✂]	[✂]	[✂]
Spire	[✂]	[✂]	[✂]	[✂]
St Anthony's Hospital	[✂]	[✂]	[✂]	[✂]
Ramsay	[✂]	[✂]	[✂]	[✂]
The New Victoria Hospital	[✂]	[✂]	[✂]	[✂]
Total private hospitals	**88**	**91**	**89**	**87**
Imperial College Healthcare NHS Trust	[✂]	[✂]	[✂]	[✂]
Royal Free London NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
Royal Brompton and Harefield NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
The Royal Marsden NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
King's College Hospital NHS Foundation Trust	[✂]	[✂]	[✂]	[✂]
Guy's & St Thomas' Trust	[✂]	[✂]	[✂]	[✂]
NorthWest London Hospitals NHS Trust	[✂]	[✂]	[✂]	[✂]
EN Hertfordshire Trust	[✂]	[✂]	[✂]	[✂]
Total PPUs	**12**	**9**	**11**	**13**

Source: CC and CMA analysis.
Note: Total admissions include inpatient and day-case. Total revenue includes inpatient, day-case and outpatient.

HCA business cases

No.	Date	Facility	Title
1*	[✂]	[✂]	[✂]
2*	[✂]	[✂]	[✂]
3	[✂]	[✂]	[✂]
4*	[✂]	[✂]	[✂]
5*	[✂]	[✂]	[✂]
6*	[✂]	[✂]	[✂]
7	[✂]	[✂]	[✂]
8	[✂]	[✂]	[✂]
9	[✂]	[✂]	[✂]
10*	[✂]	[✂]	[✂]
11*	[✂]	[✂]	[✂]
12	[✂]	[✂]	[✂]
13	[✂]	[✂]	[✂]
14*	[✂]	[✂]	[✂]
15	[✂]	[✂]	[✂]
16*	[✂]	[✂]	[✂]
17	[✂]	[✂]	[✂]
18	[✂]	[✂]	[✂]
19*	[✂]	[✂]	[✂]
20*	[✂]	[✂]	[✂]
21	[✂]	[✂]	[✂]
22*	[✂]	[✂]	[✂]
23	[✂]	[✂]	[✂]
24	[✂]	[✂]	[✂]
25*	[✂]	[✂]	[✂]
26*	[✂]	[✂]	[✂]
27*	[✂]	[✂]	[✂]
28*	[✂]	[✂]	[✂]
29*	[✂]	[✂]	[✂]
30	[✂]	[✂]	[✂]
31	[✂]	[✂]	[✂]
32	[✂]	[✂]	[✂]
33	[✂]	[✂]	[✂]
34	[✂]	[✂]	[✂]
35	[✂]	[✂]	[✂]
36	[✂]	[✂]	[✂]
37	[✂]	[✂]	[✂]
38	[✂]	[✂]	[✂]
39	[✂]	[✂]	[✂]
40	[✂]	[✂]	[✂]
41	[✂]	[✂]	[✂]
42	[✂]	[✂]	[✂]
43	[✂]	[✂]	[✂]
44	[✂]	[✂]	[✂]
45	[✂]	[✂]	[✂]
46*	[✂]	[✂]	[✂]
47	[✂]	[✂]	[✂]
48*	[✂]	[✂]	[✂]
49	[✂]	[✂]	[✂]
50	[✂]	[✂]	[✂]
51	[✂]	[✂]	[✂]
52	[✂]	[✂]	[✂]
53	[✂]	[✂]	[✂]
54	[✂]	[✂]	[✂]
55	[✂]	[✂]	[✂]
56	[✂]	[✂]	[✂]
57	[✂]	[✂]	[✂]
58	[✂]	[✂]	[✂]
59	[✂]	[✂]	[✂]
60	[✂]	[✂]	[✂]
61	[✂]	[✂]	[✂]
62	[✂]	[✂]	[✂]
63	[✂]	[✂]	[✂]
64	[✂]	[✂]	[✂]
65	[✂]	[✂]	[✂]

No.	Date	Facility	Title
66	[✂]	[✂]	[✂]
67*	[✂]	[✂]	[✂]
68	[✂]	[✂]	[✂]
69	[✂]	[✂]	[✂]
70	[✂]	[✂]	[✂]
71	[✂]	[✂]	[✂]
72	[✂]	[✂]	[✂]
73	[✂]	[✂]	[✂]
74	[✂]	[✂]	[✂]
75	[✂]	[✂]	[✂]
76	[✂]	[✂]	[✂]
77	[✂]	[✂]	[✂]
78	[✂]	[✂]	[✂]
79	[✂]	[✂]	[✂]
80	[✂]	[✂]	[✂]
81	[✂]	[✂]	[✂]
82	[✂]	[✂]	[✂]
83	[✂]	[✂]	[✂]
84	[✂]	[✂]	[✂]
85	[✂]	[✂]	[✂]
86	[✂]	[✂]	[✂]
87	[✂]	[✂]	[✂]
88	[✂]	[✂]	[✂]
89	[✂]	[✂]	[✂]
90	[✂]	[✂]	[✂]
91	[✂]	[✂]	[✂]
92	[✂]	[✂]	[✂]
93	[✂]	[✂]	[✂]
94	[✂]	[✂]	[✂]
95	[✂]	[✂]	[✂]
96	[✂]	[✂]	[✂]
97	[✂]	[✂]	[✂]

Source: CMA and HCA.
*Indicates full cases which were submitted and considered during the original investigation.

Minimum episode threshold

Minimum episode threshold for treatments included in the IPA

1. We have used the raw data from Healthcode to form a data set that consists of data at the patient episode level across different treatments and insurers for each year between 2007 and 2011. In the IPA methodology, for a specific treatment for a specific insurer in a specific year, we explain episode prices as a function of several patient characteristics. In order to estimate a regression model, we need a minimum number of observations (episodes of a specific treatment at the insurer-year level), which corresponds to the number of variables in the regression.[1] In this section we discuss our reasoning behind providing results for both a 5- and 30-minimum patient threshold.

2. In the Final Report, we reported results – both for the estimated price differences between HCA and TLC and for the statistical significance testing of these price differences – based on a minimum of 5 episodes per treatment per insurer per year per hospital operator.

3. As set out in the Final Report, we checked the sensitivity of these results using a 30-episode threshold, which, as reported in the Final Report, showed lower price indices for both HCA and TLC compared with using a 5-episode threshold, while the price differences were broadly similar.[2]

4. The Final Report set out briefly the relative merits of using a 5-episode threshold and of using a 30-episode threshold:

    (a) In relation to the 5-episode threshold, the Final Report stated that:

    > … because negotiations between a PMI and a hospital operator focus on all of a PMI's expenditure, we thought it was more appropriate to compare prices over as wide a range of treatments as possible.[3] For the same reasons, we did not separately examine inpatient and day-case treatments. Note that as part of our sensitivity analysis, one analysis considered only those treatments with more than 30

[1] Note that we are talking about a minimum of observations in order to estimate the coefficients in the model.
[2] The results of the 30-episode sensitivity are presented in the Final Report, Appendix 6.12, Annex B, Figure 2 and are compared with the 5-episode results presented in Appendix 6.12, Figure 1.
[3] Looking at those treatments where there are at least 5 episodes per treatment per year per hospital operator provides us with a larger data set than when we restrict this to only those treatments that meet a 30-episode threshold.

patients per operator for a given PMI in a given year, and these results are therefore relevant to the more common treatments.[4]

(b) On the 30-episode sensitivity, the Final Report stated that: '…a higher threshold of 30 patient episodes … allows for a higher number of observations per regression and as a result may mitigate the impact of any outlying or extreme price observations and produce more precise price predictions …'[5]

5. Bearing these points in mind, we have further considered whether we should continue to treat the results based on the 5-episode threshold as our main analysis, while using the 30-episode threshold as a sensitivity check, when coming to a view on any price difference between HCA and TLC. We have decided that we should place reliance on both sets of results in our analysis of the price difference (and not rely on the 30-episode threshold only as a sensitivity as we did in the Final Report). We set out below two main reasons for this decision.

6. First, the 5-episode threshold includes treatments with very low patient volumes, which has the advantage of increasing the number of different treatments included in the common basket. However, this approach has the disadvantage of not allowing us to be as confident as we could that the treatment-level regressions in the IPA precisely identify the relationship between patient characteristics and episode prices.[6] Increasing the minimum number of episodes per treatment increases our confidence that we are getting more precise estimates of the relationship between patient characteristics and prices.

7. Second, increasing the minimum number of episodes per treatment to 30 increases the reliability of our statistical significance testing of any estimated price differences. The more observations that are available for a given treatment, the more information there is about the underlying true distribution of the episode prices for that treatment. This means that we are able to estimate the standard errors of our estimated price differences through the bootstrapping procedure (as set out in Appendix F below) with a higher degree of accuracy.[7] Thus the precision and reliability of our statistical

[4] Final Report, Appendix 6.12, footnote 16.
[5] Final Report, Appendix 6.12, paragraph 25 (c).
[6] Having larger sample sizes – in our case, analysing treatments with higher numbers of patients being treated – leads to better estimates. In technical terms, larger sample sizes improve the consistency of our estimates meaning that the larger the sample, the less risk that the estimates that are produced will be biased.
[7] The principle of the bootstrap assumes that the observed distribution of the data in our sample is the best approximation for the true underlying distribution in the population. This may be a questionable assumption for

significance testing improves when we apply a higher minimum threshold for the number of episodes per treatment.

8. We also recognise that while increasing the threshold to a minimum of 30 episodes increases the precision and reliability of our methodology, it reduces the size of the common baskets considered and the number of insurers we are able to consider. In particular, when increasing the threshold to a minimum of 30 episodes, we are able to conduct the statistical significance test for only 23 out of 36 insurer-year observations. We cannot do so in relation to the price differences for the remaining 13 insurer-year pairs because of insufficient number of observations due to low patient volumes for these smaller insurers.

9. Looking at the issue of coverage – which is relevant both to this issue of the minimum episode threshold and to the issue of the representativeness of the IPA data – we set out below four measures (all in terms of nominal revenue):

   (a) The proportion of the hospital operators' revenue from insured patients that is covered in the Healthcode raw data.

   (b) The proportion of the Healthcode raw data that is included in the final cleaned data set that we use in our analysis.

   (c) The proportion of this final cleaned data set that we use in our IPA – both the 5- and 30-episode analyses.

   (d) The proportion of spend of the two major insurers in the final data set that is included in the IPA – again both 5- and 30-episode analyses.

10. These figures are set out in Tables 1 and 2 below.

11. Looking at 2011, we note that the Healthcode data set accounts for approximately [✂]% of HCA's insured revenue, while for TLC the equivalent figure is [✂]%. The final cleaned version of the data set that we use in our IPA includes invoices accounting for [✂]% (for both HCA and TLC) of the hospital operators' insured revenue covered by the Healthcode data.

12. Our IPA analysis is based on a smaller subset of this data set for two reasons. First, we are comparing the price of HCA and TLC and so can only conduct our analysis on treatments that both HCA and TLC provide – the 'common basket'. Second, our IPA analysis only covers those treatments where at least

treatments in which we observe very small numbers of patient episodes. For the bootstrap, it is, therefore, preferable to use those treatments with a higher number of observations, and thus have a higher threshold, in order to obtain more robust results.

5 episodes are observed per treatment per insurer per year per hospital operator, which reduces the coverage of the sample further.[8]

13. The IPA based on the 5-episode threshold covers episodes accounting for [✂]% of HCA's revenue in the final data set, while for TLC it accounts for [✂]%. Looking at the IPA conducted using the 30-episode threshold, the data set is further reduced, as treatments with lower patient volumes are no longer included. Overall this reduces the activity covered by the common basket, with the data set used in the 30-episode analysis accounting for [✂]% of HCA's revenue in the final cleaned data set and [✂]% of TLC's.

Table 1: Share of insured revenue included in the IPA

		%
	HCA	*TLC*
Healthcode data as a share of insured revenue, 2011*	[✂]	[✂]
Final data set that we use as a share of Healthcode data, 2011	[✂]	[✂]
Data used in the IPA (5-episode) as a share of final data set, all years	[✂]	[✂]
Data used in the IPA (30-episode) as a share of final data set, all years	[✂]	[✂]

Source: CMA analysis.
*HCA's and TLC's insured revenues for 2011 are presented in the Final Report, Tables 3.3 and 3.6 respectively.

14. Table 2 below sets out the share of insurer spend at HCA and TLC in our final cleaned data set that is used in our IPA analysis. Looking at the two main insurers, our IPA (based on 5 episodes) uses data representing, for example, [✂]% of Bupa's spend with HCA that is contained in the final cleaned data set, while for AXA PPP the equivalent share is [✂]%. Applying the 30-episode threshold, the coverage of the IPA falls, as lower volume treatments are no longer included in the analysis.

Table 2: Share of insured revenue included in the IPA, Bupa and AXA PPP

				%
	HCA		*TLC*	
	Bupa	*AXA PPP*	*Bupa*	*AXA PPP*
5-episode IPA as a share of final data set, all years	[✂]	[✂]	[✂]	[✂]
30-episode IPA as a share of final data set, all years	[✂]	[✂]	[✂]	[✂]

Source: CMA analysis.

[8] Our regression approach (see Appendix G) covers a larger proportion of the Healthcode data, as it includes all treatments with at least two episodes.

15. Based on these figures, the IPA covers less than [✂]% of the revenue accounted for by the Healthcode data for both TLC and HCA. We do not consider that this invalidates our analysis, for a number of reasons.

16. First, looking again at the revenue coverage of our IPA, we consider that the most relevant measure of its coverage is to focus on the 'overlap' treatments which both HCA and TLC provide to insured patients. For HCA, the IPA (5-episode version) accounts for [✂]% of the revenue generated by overlapping treatments in the final cleaned data set, while for TLC the equivalent figure is [✂]%. As such, our analysis does cover a substantial proportion of those treatments for which a price comparison between HCA and TLC is meaningful.

17. Second, and more importantly, in order to make a meaningful comparison between HCA and TLC prices we only compare those treatments that are provided by both operators. Given that the range of services that HCA and TLC provide is not identical, there are treatments which HCA provides that TLC does not and vice versa. Therefore, there are many treatments that HCA and TLC provide, and which generate insured revenue for them, which are not relevant to our analysis.

18. We are comparing prices in those treatments where HCA and TLC overlap and, hence, actually or potentially compete for insured patient business. Comparing price differences for those treatments where HCA and TLC do not overlap would be impossible. Furthermore, given that we consider TLC to be HCA's closest competitor, we would expect a comparison of prices in those treatments where they overlap to be, at least, representative of HCA's pricing more generally and to be a reasonable proxy for HCA's relative market power. If anything, such a comparison may underestimate HCA's market power, as HCA is likely to have the ability to exercise its market power to a greater extent when pricing those treatments where it does not face direct competition from TLC.

Conclusion on minimum episode thresholds

19. As presented in Table 1 above, there is a reduction in the coverage of the common baskets used in the IPA when we use the 30-episode minimum threshold. However, this higher threshold has clear advantages in terms of statistical robustness, as set out above. Therefore, we have decided that we should place reliance on both sets of results in our analysis of the price difference (and not rely on the 30-episode threshold as a sensitivity as we did in the Final Report).

Treatment-level regressions

1. In this appendix we outline the R-squared coding error and present our corrected and updated results for the R-squared statistics. We then discuss the coefficient estimates for the regressions at the treatment insurer-year level. We argue that while for a large number of the treatment-level regressions within the IPA the coefficients are not statistically significant, we still have good reasons to believe that our regression model is explaining the majority of the variation in the data.

R-squared

2. In this section we address the R-squared coding error.

3. As noted in paragraph 8.16, we have run a number of regressions that seek to explain the prices that PMIs paid to hospital operators for each treatment in terms of patient characteristics. The R-squared figure of a regression is a measure of how much of the variation in prices is explained by the explanatory variables in the regression model.

4. In the CAT DRR, HCA's economic advisers, KPMG, identified an error in the computer code we had used to calculate the R-squared figures. This coding error resulted in an overstatement of the R-squared figures that were reported in the Final Report.[1]

5. The implication of this error was that the variables included in the regression analysis explained a lower share of the variation in insured prices than we had reported in the Final Report. If the correct R-squared figures were so low that it appeared as if the regression model did nothing to explain the variation in prices then this could call into question these regressions and the 'representative patient' approach that we use to calculate the price indices and the resulting price differences between HCA and TLC.

6. We have corrected this error and we present our corrected R-squared statistics, alongside the R-squared figures as reported in the Final Report (column 1), below.[2] Table 1 presents R-squared statistics in terms of the

[1] The Final Report stated that 'the adjusted R-squared varied… between 60 and 99% … the large majority of regressions have an adjusted R-squared that is above 80%'. See Final Report, Appendix 6.12, paragraph 17(b) and footnote 19.
[2] Note that we report the adjusted R-squared figures. The adjusted R-squared takes a similar approach to the unadjusted R-squared but takes account of the number of explanatory variables in the model, so that adding extra explanatory variables does not automatically increase the adjusted R-squared. The adjusted R^2 is generally lower (or, at least, equal to) the unadjusted R-squared.

proportion of regressions for which the R-squared is above the threshold specified in the first column. Our corrected R-squared statistics in column 2 show that the large majority (69%) of treatment-level regressions have an adjusted R-squared statistic of over 50% and that 46% of regressions have an adjusted R-squared that is 80% or higher.

Table 1: Distribution of R-squared statistics for treatment-level regressions for the HCA and TLC price comparison

		%
R-squared	*CMA adjusted R^2 referred to in the Final Report*	*Adjusted R-squared based on revised data set**
	(1)	*(2)*
90% or above	89	27
80% or above	99	46
70% or above	100	54
60% or above	100	62
50% or above	100	69
40% or above	100	75
30% or above	100	81
20% or above	100	87
10% or above	100	92

Source: CMA analysis, KPMG CAT DRR (Table 9).
*R-squared results presented in this column incorporate the correction of the error in the calculation of adjusted R-squared, and corrections in data cleaning. Because of differences in data error corrections between KPMG and the CMA, as well as due to differences in adjusted and unadjusted R-squared statistics, our corrected results differ from KPMG's corrected results.
Note: Each row in the table shows the proportion of regressions for which the R-squared was at or above the threshold specified in the first column.

7. We accept that the R-squared figures reported in the Final Report were overstated, however, both KPMG's corrected (unadjusted) R-squared figures (75% of regressions with an R-squared above 50%) and our updated figures show that our explanatory variables explain the majority of the variation that we observe in episode prices. We note that there is no absolute benchmark value for the R-squared statistic that we can measure any of the above numbers against. However, the majority of our corrected R-squared values are comparable with, or higher than, those R-squared values typically considered, for example in econometric textbooks (for similar types of regression models to those that we have used),[3] or observed in relevant peer-reviewed academic publications.[4] Thus, while there was an error that resulted in our overstating the R-squared statistics in the Final Report, our corrected R-squared statistics still support the view that the patient characteristics

[3] As one popular postgraduate textbook states, R-squared figures in the region of 50% could be considered relatively high in the context of cross-sectional data, while for cross sections of individual data (as we use here) an R-squared figure of 20% may be noteworthy. See Chapter 3.5.3 of Greene, W, *Econometric Analysis, Seventh edition*, Prentice Hall (2011).
[4] Recent empirical work using comparable data and published in prestigious academic journals reports R-squared figures of between 7% and 25% (Fang, Keane and Silverman, 2008) and 41% (Gowrisankaran, Nevo and Town, 2015).

included in the treatment-level regressions in the IPA explain the majority of the variation in episode prices.

8. In the IPA WP DRR, KPMG made a number of related points in relation to how well our treatment-level regressions within the IPA explain the variation in episode prices. The report pointed to the '[r]elatively low R-squared statistics' and stated that 'there is a substantial amount of variation in episode prices that is not explained by [age, gender and length of stay]'. The report argued that in the context of predicting prices and relying on these results to 'impose extremely intrusive remedies', there is a 'need for a higher R-squared statistic, among other requirements, to demonstrate the robustness of the econometric model'.

9. In KPMG's version of the IPA, where additional information from line-item data is included, the R-squared statistics reported were somewhat higher than in our analysis – 84% of regressions report an R-squared of 50% or more in the price-index approach, compared with 69% in our analysis.[5]

10. On a related point, KPMG argued that its analysis of the average prediction error for each individual regression had suggested that the estimated price differences could not be considered accurate.[6] KPMG concluded from this analysis that the results 'point to the scope for including additional explanatory variables in order to try to more accurately predict CCSD-level prices.'

11. As set out below, for a large proportion of the treatment-level regressions the coefficient estimates in relation to our explanatory variables (patient age, gender and length of stay) were not statistically significant. This implied that, in some cases, our control variables did not explain much of the variation in the data. However, as set out in more detail in that appendix and taking into account our view of the R-squared statistics, above, our analysis does nevertheless explain a large share of the variation in the episode price data.

Coefficient estimates in the treatment-level regressions

12. As part of our analysis we present (above) our recalculated R-squared statistics for the treatment-level regressions in our IPA methodology and show that, generally, our model explains the majority of the variation in episode prices. However, the R-squared statistic is only a descriptive figure that

[5] We have included the count of pathology charges into the IPA and got very similar results.
[6] KPMG suggested that 'the CMA's predicted price difference is smaller than […] the average predicted error and for these regressions, especially, the CMA cannot be confident that its predicted price differences are meaningful.'

summarises the extent to which a regression model explains the variation in the dependent variable (episode prices in our case).

13. We have also reviewed the regression results to confirm that the explanatory variables that relate to patient characteristics – age, gender and length of stay – produce reasonable estimates of the relationship between the patient characteristics and episode prices or 'coefficients'. We have examined both the value of the coefficients which capture the relationship between each explanatory variable and the episode prices, and whether these estimated coefficients were statistically significant. For example, in our regressions the coefficient on length of stay is our estimate of the relationship between the length of stay for patients who have had a specific treatment and the episode price charged for that treatment. A positive coefficient indicates that an additional night as an inpatient is associated with a higher episode price being charged to the insurer.

14. Looking in detail at the results from these approximately 700 treatment-level regressions, we have found that for length of stay we generally estimate positive and statistically significant coefficients, as we would expect.[7] However, many of the treatment-level regressions reported age and gender effects that were not statistically significant. While this is not wholly unexpected – for some treatments we would not expect age or gender to drive cost differences[8] – we are using these patient characteristics to control for differences in patient complexity, so we would generally expect them to play a role in explaining price differences for treatments. As such, we considered whether we had adequately modelled the relationship between these patient characteristics and the episode prices.

15. Having considered the issue, we set out a number of reasons why our methodology is still a robust way to model this relationships:[9]

   (a) First, even if the coefficients on age and gender are not statistically significant, these are still our best estimates of the relationship between these variables and episode prices.

   (b) Second, if these patient characteristics were poor predictors of episode prices then they would potentially have zero (or near-zero) coefficient estimates and therefore would not affect the estimated prices that form the price indices in any case. We have checked this point and found that excluding these coefficients from the regressions does not substantially

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[7] Note that for day-case treatments we would not expect to find any effect at all.
[8] For example, whether a cataract patient is a man or woman may not affect the level of costs involved.
[9] This issue was considered in the Final Report at footnote 18 of Appendix 6.12.

affect our estimated price differences. This indicates that where these coefficients are statistically insignificant they are not introducing significant biases or distortions into our results.

Prediction error

16. On a related point KPMG argued that analysing the average prediction error for each individual regression suggested that the estimated price differences could not be considered accurate. In the IPA WP DRR, KPMG suggested that ‘for 412 of the 700 regressions (59%), the CMA’s predicted price difference is smaller than […] the average predicted error and for these regressions, especially, the CMA cannot be confident that its predicted price differences are meaningful.’ KPMG concluded from this analysis that the results ‘point to the scope for including additional explanatory variables in order to try to more accurately predicted CCSD-level prices.’

17. In the Remittal PFs Data Room Report, KPMG revisited the topic and expanded its testing of he expected prediction error. In particular KPMG ‘have implemented the test suggested by Profs Gaynor and Pakes and have calculated the proportion of expected price differences that cannot be differentiated from the expected prediction error with 95% confidence. We have calculated for the five episode threshold common basket that 88% of the 700 regression cannot be differentiated from the expected prediction error at the 95% confidence level and therefore, […], cannot be distinguished from zero at the standard levels of statistical confidence.’

18. As discussed above, we have acknowledged a similar point on the share of treatment-level regressions that are statistically insignificant.[10] The overall results suggest that we nevertheless explain a large share of the variation in the data.

[10] IPA Working Paper, paragraph 116.

Data-related issues

Data-related issues

1. The data set we have used for the IPA is based on invoice data received from Healthcode, an intermediary between hospital operators and PMIs.[1] The Healthcode data provides information on the hospital visits of insured patients. It includes details of the hospital visited, the treating consultant, the treatment received, and the prices invoiced by the hospital operators to the PMIs.[2] We have cleaned and consolidated the data to produce a cleaned data set for our analysis that covers the period 2007 to 2011. Each row in this data set is an 'episode', which we have defined as a single visit to a hospital by a patient.

2. In this appendix we deal with data-cleaning and other data issues. We address in detail points raised by KPMG in the CAT DRR and the IPA WP DRR. We provide our reasoning for the changes that we have made to the data set and explain our reasoning behind choices in relation to the data cleaning. In addition, we provide a description of the data-cleaning algorithm that we have used to remove duplicate line items from the data set, enabling us to use line-item information in our analysis.

Diagnosis code and the medical specialty of the treating consultant

3. The Healthcode data set includes variables on the diagnosis code for each patient episode, as well as the medical specialty of the treating consultant. In principle, including these variables in the regressions explaining episode prices could add explanatory power (in terms of how well our model explains the variation in prices), because, as KPMG has argued, these variables could play a role in explaining the costs that providers face in treating these patients. KPMG has argued that: 'large price variations within treatments are driven by patient medical need as related to complications and comorbidities. Some patients, for example, may require more or more costly diagnostic procedures, drugs or nursing care at different levels of intensity, and each of these factors would result in a higher episode charge'.

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[1] See Final Report, Appendix 6.12, paragraphs 9–13 and Annex A.
[2] We considered this data, on actual prices paid, to be a better basis for our analysis than the (paper or electronic) contractual agreements between hospital operators and PMIs. The latter were not easily available in a format that was comparable between hospital operators or PMIs, and are typically based on a detailed contract which may span several documents. We noted that PMIs also use the actual prices paid, rather than their contractual agreements, to compare the prices of hospital operators.

4. We have given some consideration to using the diagnosis code variable and we have reconsidered its use in response to the points made by HCA's economic advisers, KPMG, in the CAT DRR.

5. The data provider, Healthcode, stated that: 'the quality of diagnosis coding in the sector is very poor', that the diagnosis codes 'cannot be used as an accurate barometer of patient's condition', and that, for the purposes of including diagnosis codes in our analysis, the 'data [on diagnosis code] is unreliable in this data set'. We therefore consider the diagnosis code variable not to be a reliable source of information in the econometric analysis conducted as part of the IPA.[3]

6. In relation to the consultant's medical specialty, the fact that our regressions in the IPA are already estimated for each treatment separately means that including this variable in our analysis separately would add little explanatory power. For example, when explaining the price of hip replacements adding a variable that indicates when an orthopaedic surgeon has been used is unlikely to add to the accuracy of our analysis if all such procedures are delivered by an orthopaedic surgeon.[4] In addition, adding a variable for the consultant's specialty would complicate the construction of the representative patient; it is not clear what the median medical specialty would be if more than one is relevant for a given treatment. Alternatively, we would have to calculate separate predicted prices for the same treatment when delivered by consultants with different specialties: this would reduce the size of our sample for each treatment further and reduce the accuracy of our results.

7. Healthcode's view was that the treating consultant's medical specialty did 'not provide information on the patient's medical condition'. This means that, for each treatment, there is unlikely to be any meaningful variation in the medical specialty variable that would add useful information in the regressions.

8. For the reasons stated above, we have not used the information on diagnosis code or the consultant's specialty in our treatment-level regressions as part of the IPA.

Multiple-CCSD episodes

9. In cleaning the data for the IPA we defined a treatment by its CCSD code. For example, the CCSD code for a common cataract procedure is C7122.[5]

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[3] From an econometric perspective, measurement error leads to a bias in the estimated coefficient and would therefore lead to a bias in the average price indices.
[4] We note, however, [✀].
[5] C7122 relates to 'Phakoemulsification of cataract, with lens implant - unilateral (including topical or local anaesthetic)'.

However, the data set also includes episodes that are associated with multiple CCSD codes, where more than one treatment has been recorded for the same patient within the same episode. The IPA results presented in the Final Report did not include episodes with multiple CCSD codes.

10. On its webpage, Clinical Coding and Scheduling Development (the organisation that developed and maintains the CCSD system of classification) clarifies that when recording CCSD codes for a clinical procedure 'users should use a single CCSD code to describe the majority of common clinical interventions. This single code will usually fully describe the procedure from start to finish'.[6]

11. We queried with Healthcode whether multiple CCSD codes are comparable across hospital providers. Healthcode stated that multiple CCSD codes were sometimes used by hospital providers, in particular if a single CCSD code did not cover the whole procedure. This was, to a limited degree, accepted practice by PMIs.[7] However, the relationship between the number of CCSDs recorded for an episode and the price charged might not be straightforward, as the extent to which hospital operators were reimbursed fully for each individual CCSD recorded could vary depending on the specific contracts in place between the hospital operator and the insurer. For example, an insurer might pay in full for the main (most expensive) CCSD, but only partially cover the costs of the additional CCSDs.

12. Given the above, especially the risk that episodes with multiple CCSD codes might not be comparable between hospital providers, we have excluded episodes with multiple CCSD codes from our analysis.

13. Nevertheless, we have checked the sensitivity of our results to the inclusion of those episodes with multiple CCSD codes, as set out in Table 1, below.

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[6] See CCSD Single Codes webpage.
[7] Healthcode stated that there were limits to using multiple CCSDs, for example that an insurer might only pay 50% of a second CCSD on the invoice.

Table 1: Insurer-year results with multiple-CCSD episodes – % price differences

		5 episodes				*30 episodes*			
		CMA		*Pathology*		*CMA*		*Pathology*	
		Single	*Multiple*	*Single*	*Multiple*	*Single*	*Multiple*	*Single*	*Multiple*
		(A)	*(B)*	*(C)*	*(D)*	*(E)*	*(F)*	*(G)*	*(H)*
2007	AXA PPP	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2008	AXA PPP	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2009	AXA PPP	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2010	AXA PPP	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2011	AXA PPP	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2011	Aviva	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2007	Bupa	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2008	Bupa	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2009	Bupa	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2010	Bupa	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2011	Bupa	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2007	Bupa Int’l	[✂]	[✂]	[✂]	[✂]	[✂]			
2008	Bupa Int’l	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2009	Bupa Int’l	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2010	Bupa Int’l	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2011	Bupa Int’l	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2007	Cigna	[✂]	[✂]	[✂]	[✂]				
2008	Cigna	[✂]	[✂]	[✂]	[✂]				
2009	Cigna	[✂]	[✂]	[✂]	[✂]				
2010	Cigna	[✂]	[✂]	[✂]	[✂]				
2011	Cigna	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2010	Exeter	[✂]	[✂]	[✂]	[✂]				
2008	PruHealth	[✂]	[✂]	[✂]	[✂]				
2009	PruHealth	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2010	PruHealth	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2011	PruHealth	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2007	SLH	[✂]	[✂]	[✂]	[✂]				
2008	SLH	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2009	SLH	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2010	SLH	[✂]	[✂]	[✂]	[✂]				
2011	SLH	[✂]	[✂]	[✂]	[✂]				
2009	Simplyhealth	[✂]	[✂]	[✂]	[✂]				
2010	Simplyhealth	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2011	Simplyhealth	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2010	WPA	[✂]	[✂]	[✂]	[✂]				
2011	WPA	[✂]	[✂]	[✂]	[✂]				
Total		**[✂]**	**[✂]**	**[✂]**	**[✂]**	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

Table 2: Annual results with multiple-CCSD episodes – % price differences

	5 episodes		*30 episodes*	
Year	*CMA*	*Pathology*	*CMA*	*Pathology*
2007	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]
Average	[✂]	[✂]	[✂]	[✂]

Source: CMA analysis.

14. The estimated overall price differences including multiple CCSDs range from [✂]% to [✂]%, for a 5- and 30-episode threshold respectively. For the insurer-year price differences, the estimated price differences are mostly in line with the results for single-CCSD episodes only. We observe some changes in the insurer-year price indices, for example, for [✂] in 2008 the price difference turns from [✂]% to –[✂]%. We concluded that the estimated

price differences between HCA and TLC were robust to the inclusion of multiple-CCSD episodes.

'Irrational' price predictions

15. In the CAT DRR, HCA's economic advisers (KPMG) identified a number of issues in relation to the 'irrational' price predictions produced by the treatment-level regressions that are used in constructing the price indices in the IPA. These issues were:

    (a) Zero price predictions occurred in four out of the 694 treatment-insurer-year prices that KPMG calculated. This resulted from a coding error, which we have now rectified.

    (b) Negative price predictions occurred in four out of 694 treatment-insurer-year prices. This was not an error, but rather a result of the regression methodology.

    (c) Out-of-sample price predictions occurred in two out of 694 treatment-insurer-year prices, where our representative patient for those particular treatments was not representative of both operators' patients' characteristics.

16. We agree with KPMG that the issue of 'irrational' price predictions should be addressed, however, we disagree with its approach. KPMG addresses this issue by excluding treatments with 'irrational' prices from the analysis on the basis that they produce irrational results for certain years. We do not agree that we should simply exclude treatments on the basis that they produce odd results. As we detail below, we do not encounter this issue when we increase the threshold of minimum number of patient episodes. As set out in Appendix C, this approach has the additional desirable effect that it increases the precision of the estimates in our regressions.

17. In the remainder of this section we deal with each of the 'irrational' price predictions in turn.

Negative price predictions

18. In the CAT DRR KPMG identified four treatment-insurer-year combinations for which negative prices are predicted. Negative price predictions occur as a result of the methodology we have used. In particular, the estimator that we use in our treatment-level regressions in the IPA does not restrict the dependent variable (in this context the predicted price of a patient episode) to

taking only positive values.[8] However, observed prices in this context, as opposed to the predicted prices that our methodology produces, are by their nature only ever positive. The fact that we are not restricting prices to be positive in our methodology is not a problem as such, in particular when prices are predicted using explanatory variables that are within the sample.[9] We therefore do not agree with KPMG that negative price predictions are an error.

19. In addition, when we calculate price differences on the basis of a 30-episode threshold, we do not observe any negative price predictions. The reason is that with a larger number of patients available for the estimation, the estimates are more robust with respect to outlier observations.[10] For example, an outlier may be caused by a patient for a specific treatment who stayed more than 50 days in one of the hospitals, whereas the average length of stay for that treatment is around 5 days. The effect of the outlier is to bias the estimates, and, therefore, to misrepresent the effect of length of stay on prices.

20. Notwithstanding our arguments that negative price predictions are a by-product of our methodology and the fact that they do not arise when we calculate prices based on a 30-episode threshold, we also checked our results based on KPMG's suggested methodology of excluding the treatments which give rise to negative predicted prices from our data. The results suggest that dropping those treatments does not affect the estimated price differences materially.[11]

Zero price predictions

21. In the CAT DRR, KPMG showed that for four out of 694 treatment-insurer-year prices the analysis predicted that one of the hospital operators would have charged a price of zero. We agree with KPMG that zero price predictions should be avoided. We therefore implemented an approach in the computer code for the price index calculation that resolves this issue.[12]

[8] We use an OLS estimator.
[9] In our case explanatory variables are the patient's age, gender and length of stay.
[10] An outlier is classified as a patient with a characteristic that is out of line with the other observations, eg a patient with an excessive number of pathology counts. For a general definition of an outlier see Moore and McCabe (1999).
[11] The notable exception is SLH in 2009. Excluding the corresponding CCSD reduces the price difference by [✂] percentage points.
[12] We use the Stata command '_rmcollright', which excludes collinear variables in the specified order.

22. Zero price predictions occur where Stata deals with collinear variables in the data set by randomly dropping one of them.[13] For example, in our data set we observe that for a small number of treatments a hospital is treating female patients only. If this corresponds with a treatment where the hospital operator is only treating day-case patients, ie patients that have a length of stay equal to zero nights, then both patient characteristics have the same values for all patients and so are perfectly correlated or 'collinear'. Therefore, the relationships between these variables and the episode price cannot be estimated. This can lead to problems when we use our regression results to predict the episode price.[14]

23. In order to calculate the average price per treatment, we use a representative patient, ie a patient with the median characteristics for patients of that specific treatment. The representative patient gives us specific values for the patient's characteristics, that is, age, gender and length of stay. Our regression results generate a 'constant' – in other words, it tells us what the price would be before adding the effects of patient characteristics.[15] However, for some regressions this 'constant' element is incorrectly removed from the regression, while another term assumes the role of the constant.[16] Our methodology then multiplies the patient's characteristic with this term, which is not missing, and so we get a zero price prediction. For example, if patient gender is constant within a treatment as in the above example, we would multiply the median gender – that is female – by the constant term, which results in a zero.

24. After implementing the solution to our computer code we do not observe any zero price predictions.

Out-of-sample price predictions

25. In the CAT DRR, KPMG showed that for two out of 694 treatment-insurer-year prices the IPA made 'out-of-sample' price predictions based on the characteristics of a representative patient, where one of the hospitals did not treat any patients with these characteristics.[17] We do not agree with KPMG that the out-of-sample price prediction is a mistake, but agree that it potentially raises an issue in relation to the precision of our predicted price

[13] In statistics and econometrics, two variables are described as being 'collinear' when there is a linear relationship between them.
[14] If the variable that is dropped (see paragraph 23) is the variable for the hospital operator, then we do not have this 'constant' available in the data.
[15] For example, the price of a hip replacement might be made up of a 'constant' of £500 plus £10 for every extra year of patient age, plus £1,000 for every additional night spent in hospital, plus £100 more if the patient is male rather than female.
[16] The reason for the omission of the constant term is collinearity.
[17] On one occasion the representative patient is female, while TLC did not treat any female patients. On the second occasion, the average length of stay of the representative patient is positive, while TLC did not treat any inpatients.

estimates. Specifically, the out-of-sample predictions are part of our methodology and are a result of the 'representative patient' assumption. To understand this, one could consider the following stylised example. If, for a specific treatment, patients at one hospital tend to stay for one night and patients at the other hospital are always treated as day cases, then the median patient may be one who stays for zero nights or for one night, depending on which hospital operator treats more patients for that particular treatment. Therefore, using the median patient to calculate the price for the treatment would lead to an out-of-sample prediction for one or other of the hospital operators.

We have tested the sensitivity of our results to out-of-sample price predictions by using alternative definitions of the representative patient (see Appendix G for more detail). Taking again the example from the previous paragraph, using a representative patient based on the mean, rather than the median, characteristics of the relevant patients would give a mean length of stay somewhere between zero and one night. While not fully correcting for the difference between day-case and longer hospital stays, this alternative definition would mitigate the problem. Furthermore, based on a minimum threshold of 30 episodes per treatment, it does not appear that the issue of out-of-sample predictions arises. We present the results of this analysis – using alternative definitions of the representative patient – among the sensitivities and robustness checks presented in Appendix G.

Empirical errors

26. KPMG also questioned whether the IPA took account of all relevant information and was free of empirical errors. In particular, it pointed out that:

(a) [✂], so the invoiced amounts might not be reflective of HCA's revenues;

(b) some PMIs 'shortfall' their patients, that is, they paid only part of the invoiced amount and the hospital operator might not receive the full amount invoiced; and

27. Our view with regard to the above points is:

(c) As stated in the Final Report, rebates represent only a small portion of total fees paid. Furthermore, during the time period considered in the IPA, only a small subset of PMIs received a rebate, and no PMI received a rebate every single year.[18]

[18] Final Report, paragraph 6.369.

(d) While we have not collected data on this issue, based on the evidence available to us in this investigation, 'shortfalling' appears to occur mainly in relation to the consultant fee rather than the hospital charges, so is of limited relevance in this context. Even if this were a material issue in relation to hospital charges, we would not expect this to affect our comparison of prices at HCA and TLC unless one of the providers were systematically more likely to issue invoices that led PMIs to shortfall their customers. No party has suggested that this is the case; a number of PMIs have suggested that HCA's prices are higher than TLCs, but not that HCA invoices are more likely to lead to 'shortfalling' of patients.

Errors identified prior to the Data Room

28. When preparing the CAT Data Room, we identified a number of minor errors in our cleaning and processing of the Healthcode data for the IPA. We corrected all but one of those, and put both the corrected and the uncorrected results (that is, as presented in the Final Report) in the CAT Data Room.

29. We uncovered three errors in our computer code prior to opening the CAT Data Room, which were:

(a) mistakenly pooling patients from King Edward VII's Hospital (KEVII) into the calculation of the representative patient for outside central London;

(b) mistakenly classifying patients with a missing insurer name as self-pay patients, an error which only affected the comparison of insured prices to self-pay prices; and

(c) obtaining differences in the way line items were aggregated to episodes every time the computer code was processed.

30. The impact of the first two errors on the IPA results was negligible, and we noted that we were not able to solve the third issue prior to opening the data room, but explained that the data discrepancies caused by this issue were negligible as well. KPMG acknowledged and did not challenge our corrections of the errors described in paragraphs 29 (a) and (b) above. This is acknowledged in paragraphs 27 to 29, and paragraph 31, of the CAT DRR.

31. In paragraph 32 of the CAT DRR, KPMG suggested a solution to the issue described in paragraph 29(c), above. We agree that this solution is appropriate, and have now implemented this in the processing of the Healthcode data.

Measurement of patient age

32. KPMG found that there was an error in our computer code which meant that patient's age – one of the control variables in the regression analysis – was calculated incorrectly (paragraph 34 of the CAT DRR, and paragraphs 12 to 16 in Annex 2 of the CAT DRR). KPMG explained that the CMA incorrectly subtracted the year of patient's birth from 2012 in order to calculate the patient's age, whereas it should have subtracted the year of birth from the date when the episode took place.[19] KPMG noted that this error affected both the regressions, where age was one of the three control variables, and the characterisation of the representative patient.

33. We agree that this was an error in the computer code. The code calculated each patient's age as of 2012, and not in the year that the patient was treated. This error meant that all patients' ages were overestimated by a constant number of years for each year (eg by two years for the 2010 analysis). However, since our baseline analysis was conducted for each year separately, and since it is patients' age relative to each other that matters in the analysis, this error did not affect our analysis or results in any way.[20]

34. We have now corrected this error such that patient age is correctly calculated by subtracting the year of birth from the year in which the patient was discharged from the hospital for the particular episode.

Inclusion or exclusion of episodes at certain HCA hospitals

35. KPMG made two points in relation to the inclusion or exclusion of episodes at HCA's hospitals. First, it noted that the CMA failed to exclude non-central London HCA hospital episodes from the analysis. HCA operates, in partnership with the NHS, two hospitals outside of central London, and KPMG claimed that data related to these non-central London hospitals should be excluded from the IPA for central London (and it has done so in the analysis presented in its CAT DRR).[21]

36. We do not agree with the approach suggested by KPMG to exclude the non-central London HCA episodes from the analysis. We chose to include these hospitals in the comparison of HCA's and TLC's prices because hospital operators negotiate prices with insurers for their complete portfolio of hospitals

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[19] KPMG gave an example of a patient born in 1980 and treated in 2011: the CMA calculated the age of such patient to be 32, whereas it should have been 31.
[20] KPMG has acknowledged that this error gave rise to a mismeasurement of the age variable in a non-systematic way.
[21] KPMG also stated that including observations for these HCA hospitals slightly increased the common baskets of treatments between HCA and TLC for some insurers and in some years

(see the Final Report, paragraph 6.292). Footnote 237 in the Final Report (as well as footnote 13 in Appendix 6.12 of the Final Report) acknowledges that we have included HCA's units outside London in the analysis, and notes that 'these facilities accounted for less than 1% of the price data that we analysed and are therefore unlikely to have a material effect on our results'.

37. Second, KPMG submitted that, for a small number of episodes, the Healthcode data identified the operator as HCA but did not identify the specific hospital where the episode took place. KPMG has excluded these [✂] episodes from the analysis it presented in the DRR.

38. We disagree with this approach as it unnecessarily removes useful information that can be reliably used in the analysis. We did not exclude these episodes from the data because the IPA compares prices charged by hospital operators, and as such the identity of the specific hospital where an episode took place is not important. As explained above, we deliberately included HCA's patient episodes in the central London analysis even if these took place in one of the hospitals HCA operates outside of London (this is, in any case, a small proportion of its overall business).

39. Thus, we remain of the view that the approach adopted in the Final Report is appropriate – ie we have included both the non-central London HCA hospital episodes and the unknown HCA hospital episodes in the insured price comparison between HCA and TLC for central London for the reasons explained above.

Duplicate line items

40. KPMG stated that it had found 'duplicate line items' in the Healthcode data and decided to exclude such line items. KPMG noted that: 'the duplicate line items have the same invoice ID, Industry Standard Code ... and line item price. They only differed in the diagnosis code associated with them'.

41. We have queried this issue with Healthcode, which clarified that those line items with the same invoice ID, Industry Standard Code and line item price, but with a different diagnosis code were, in fact, likely to be duplicates. It explained that sometimes patients had more than one diagnosis code or CCSD recorded for the same treatment and so an extra line was added in the Healthcode data set to record this. Based on this, we accepted KPMG's suggested change to the data set and excluded from our analysis those line items that appear to be duplicates within the same episode. We have not assessed the impact of this change, although, given KPMG's results, we do not expect it to be material given that it only affect a small number of episodes.

Ancillary fees

42. KPMG stated that, contrary to what paragraph 12 of Appendix 6.12 in the Final Report suggested, the CMA had not removed ancillary fees from the data when calculating episode prices (CAT DRR, Annex 2, paragraphs 31 and 32). KPMG noted that it had already queried this error with the CMA, and the CMA had confirmed, in the course of the CAT appeal, that it did not remove such fees from episode prices. The CMA also noted that it 'has reviewed the data and considers that only a negligible number of charges included in this data relate to ancillary items'.

43. While inaccurately described in the Final Report, the fact that we have not removed ancillary fees from our episode prices is not an error, as such, and either approach could be taken. KPMG stated that it was not able, in the time provided, to exclude such charges from the data (of the CAT DRR, paragraph 44 and Annex 2, paragraph 32) and determine the materiality of this error. We have kept any ancillary fees in the data (ie we have followed the same approach as originally in the Final Report) on the basis that ancillary fees arise in a negligible number of charges and so are extremely unlikely to materially impact our results.

Consultant fees

44. For the IPA in the Final Report, we excluded consultant fees when calculating episode prices.[22] KPMG submitted that the CMA only excluded consultant fees where the industry standard code for a given line item was present within the 'Specialist and Practitioner fees' industry standard category. KPMG claimed that it had identified a number of other industry standard codes that related to consultant fees, and implied that these should have been excluded. However, due to time constraints, KPMG was unable during its period of review to provide a list of these other industry standard codes and an explanation of how these categories could be consistently identified in the data.[23] KPMG stated in its CAT DRR that it had not excluded any such further codes in the course of its analysis.

45. We accept the possibility that the invoices in the Healthcode data may have included a small number of consultant fees that we did not identify. However, we did remove consultant charges to the extent that this was possible, and

[22] The CMA noted that 'for the majority of episodes, the Healthcode data does not include the consultant fee. In cases where the consultant fee is included (eg because a hospital operator bills on behalf of the consultant), we have subtracted this from the episode price.' (Final Report, Appendix 6.12, Annex A, footnote 2.) The CMA, therefore, excluded all consultant fees to the extent that these were clearly identified in the data.
[23] KPMG did describe one such example relating to the identification of additional radiologist fees, and it reported the total number of line items that may have been.

KPMG did not provide an explanation as to how any remaining charges could be identified. Further, based on KPMG's results, we do not anticipate that removing additional consultant fees would have a material impact on the price difference between the hospital operators.

46. In relation to consultant fees, KPMG also claimed that the CMA failed to exclude consultant fees correctly where there were multiple line items having both the same industry standard code belonging to the same invoice and the same price. As set out below, we have looked into this issue and did not find any errors that required correction.

Removing duplicated line-item data

47. We found that in a non-negligible share of the data, the sum of all line-item charges for a given invoice did not add up to the invoice total, ie some line-item charges were duplicated within a given invoice. These duplicated line items occurred in approximately [✂]% of the overall episodes within the whole data set. Were we to use the information on the line-item count, we would introduce significant measurement error through double counting of line items.

48. In order to be able to use the line-item information in our IPA, we have developed a methodology to isolate the duplicated line items, and remove them from the data set. Each invoice lists the number of charge items, which correspond to the medical procedures, tests and so on (for example, pathology tests, X-ray or theatre time) performed on the patient during an episode.[24] If an identical charge item on the invoice is listed more than once, the invoice total may no longer correspond to the reported invoice total. If the invoice total does not correspond to the sum of all charges on the invoice, we found a duplicated line item. In order to extract the charge items information for analysis, we need to eliminate those duplicated charge items. Below we describe our approach to the removal of the duplicated line items in detail.

49. We raised the issue of duplicated line items with Healthcode and it explained that the duplicated line items arose from the procedure Healthcode followed to extract the invoice data from its IT system and provide the requested information on all CCSD codes and diagnosis codes for each invoice. In addition, Healthcode acknowledged that multiple CCSDs were a problematic

[24] Note that this is not an exclusive list of procedures performed. As we have discussed above, due to contractual restrictions, invoices might not list separately the different procedures. For example, consider packages, which comprise several procedures performed on the patient.

area of the data. We confirmed the correctness of our approach of removing duplicated line items with Healthcode.

50. We excluded line items according to the following criteria:

(a) We excluded exact duplicates across all variables, which accounted for about [✂]% of all the line items in the whole data set. For a given invoice, we identified charge items, which were identical to the corresponding charge item in another line of the same invoice. When deleting one of these two lines, the line item charges added up to the invoice total.

(b) We excluded duplicates that were exact duplicates of line items, once some variables were not considered. Those corresponded to about [✂]% of all the line items in the whole data set. We identified charge items in the data set that, for a given episode, were identical to the corresponding entry in another line of the same invoice, but for the value taken by the CCSD code, the diagnosis code or the service item code. Once these variables were not considered, deleting one of the entries resulted in line-item charges adding up to the invoice total.

51. After removing the duplicated line items identified in the above steps, we are left with [✂] episodes, ie less than [✂]% of the line-item data that is part of the IPA common basket, which is still affected by duplicated line items. We opted to keep those episodes in the data set because they still provided valuable information in the original price index approach.[25] To assess whether their inclusion had an effect on the results, we excluded them from the data, calculated the price index and found that this did not affect our results.

[25] Healthcode acknowledged that invoices at the episode level were verified and thus not affected by the issue of duplicates.

Statistical significance testing

1. To test the statistical significance of the price differences that we have estimated, we need to calculate the standard error of the price differences between the two hospital operators – for each insurer-year pair. While we can readily calculate the standard error at the treatment level, it is not straight-forward when we come to test the difference in the insurer-year price indices. We therefore employ a generally accepted statistical technique called a bootstrap, which allows us to calculate the standard error of the difference in the price indices. In this appendix we discuss our approach to statistical significance testing – the 'bootstrap' – and two statistical elements of the bootstrap specification

The bootstrap

2. Our IPA methodology begins by constructing a number of price indices in order to estimate the price differences between HCA and TLC for each insurer in each year. We are then interested in the statistical significance of these price differences. We therefore have to calculate the standard error of the price differences at the insurer-year level, as a high standard error would indicate that our price estimates are imprecise. While we can readily calculate the standard error at the treatment level, it is less straightforward when we come to test the statistical significance of the difference in the insurer-year-specific price indices.[1]

3. The idea behind the representative patient is to compare prices for the hospital operators, based on this 'typical' patient's characteristics, as if the representative patient were choosing between these hospital operators for a specific treatment. We use regression analysis to estimate the effect of the different patient's characteristics on the episode price per treatment. We then use the representative patient, for the specific treatment, to predict the price that this patient would face at HCA and TLC if faced with the choice of these two hospital operators. Because the representative patient has no variation in the patient characteristics we are unable to calculate the standard deviation of this estimated price directly.[2] We therefore employ a statistical technique

[1] Note that the same argument holds for the annual and overall price difference.
[2] Note that, by construction, the representative patient has constant patient characteristics – in our case, the median characteristics for patients within the relevant treatment, insurer and year. The variation in estimated prices is coming from the differences in patients' characteristics used in the regression analysis. If the representative patient also had variation in its characteristics it would not be possible to compare like for like and hence the price indices.

called a 'bootstrap', which allows us to calculate the standard deviation of the difference in the price indices.

4. The 'bootstrap' follows a simple logic:

   (a) based on the original data set, we create a 'new' data set by randomly reshuffling the patient episodes. This new data set has the same number of patient episodes, however, some patient might not be recorded, while others might be recorded multiple times;[3]

   (b) from this 'newly' generated data set, we recalculate the price difference, and

   (c) repeat the reshuffling of the data set and the price calculation a large number of times.[4]

5. Using this logic, we are able to use the repeatedly calculated price differences to establish a standard deviation of the price difference, which we subsequently use for statistical significance testing. While we do not go further into the statistical theory underlying the bootstrap methodology, we note that the bootstrap is a recognised and regularly used method for computing the standard deviation for this type of statistical significance testing.[5]

6. To generate the bootstrap we are able to use a built-in command in our statistical software package, Stata. The program contains an algorithm which automatically resamples the data, and carries out the specified statistical calculation. After repeatedly calculating the prices for HCA and TLC, Stata returns the price difference and the standard deviation of the price difference.

The error

7. In its Re-amended Notice of Appeal, HCA set out its view on the coding error in the bootstrap program and on its impact on the statistical significance testing:

> … a computer coding error had the consequence that the statistical significance tests for each [price] index comparison

[3] The resampling method is 'with replacement'. In other words, once we have recorded the patient's characteristics and the price for a specific episode, we put the episode back into the sample, so that it may be (randomly) drawn again and may be used more than once in generating the bootstrap sample.
[4] Note that our computer program repeats these steps 500 time at maximum. If the programme cannot replicate the underlying correlation in the data, the repetition is discarded and the programme moves to the next repetition.
[5] The bootstrap is an established statistical method to calculate the variance of an estimator, and thus its standard error. See, for example, Wooldridge, J M (2010), *Econometric Analysis of Cross Section and Panel Data*, section 12.8.2.

were performed in relation to the price for only one treatment in the common basket in the insurer-year pair in question rather than for the entire basket… That is, for each insurer-specific price index, the CMA took the estimated price variation of one treatment and interpreted it as the variability of the entire insurer-specific price index, which was in fact composed of multiple treatments differing in nature and price …[6]

8. This statement was supported by section 5.1 of the CAT DRR, where KPMG identified the error in the code in more detail. In particular, the DRR stated that: 'due to an error in the CMA's writing of its bootstrapping code, […], the CMA performed its bootstrapping analysis for each insurer-specific price index making use of the episodes associated with only one treatment'. Further, 'the CMA took the estimated price variation of one treatment and interpreted it as the variability of the entire insurer-specific price index, which was composed of multiple treatments …'

9. This led to an underestimation of the standard deviation of the price indices and thus an overstatement of the statistical significance of the insurer-year price index.

10. We agree that there is a coding error in the bootstrap program. As a result, our estimates of the statistical significance of the price differences were incorrect. We corrected the program, by including the 'nodrop' option as suggested by KPMG in its CAT DRR.

11. The nature of the error is the result of a peculiarity of Stata's bootstrap program. As mentioned above, the program repeatedly resamples the data and performs the calculation of the price index. To avoid statistical problems that can sometimes occur in this process, the bootstrap program drops all missing values from the data set.[7] If missing values are dropped, Stata relies on examining the most recent treatment. In our program we rely on more than one treatment and Stata only considers the most recent one, and does not consider any treatment that may have preceded it. Consequently, Stata deleted all of the data except for a single treatment (the last one in an alphabetical list) and ended up computing the statistical significance for only one treatment.

12. In addition, HCA stated that the error made in the bootstrap was compounded by erroneously multiplying the incorrectly estimated standard error with the weight of the single treatment in the basket. We agree with this point. This

[6] Re-amended Notice of Appeal, 17 October 2014, paragraph 115.
[7] We removed all missing values from the data set prior to running the bootstrapping algorithm.

was a direct outcome of the way our code was written, but not a separate error. Therefore, when correcting the coding error in the calculation of the bootstrap, the aforementioned problem disappears.

The composition of the common basket in the bootstrap

13. In the results presented in the Final Report, the weights of the treatments were kept fixed, while the number of patients per treatment was allowed to be random during the bootstrap procedure. The aim was to reflect the fact that hospital operators do not know in advance how many patients for each treatment they will treat in a given year. However, we have reconsidered our approach to calculating the weights within each iteration of the bootstrap.

14. Our revised approach is to keep the number of observations per treatment, and hence the weight of the treatments, fixed. In particular, we restrict the re-sampling of the bootstrap to the treatment-hospital operator level.[8] In other words, in each iteration of the bootstrap, we allow the computer program to resample such that the number of patients for a given treatment and for a given hospital operator are constant in each iteration of the bootstrap, rather than being randomly drawn in each bootstrap iteration.

15. The reason for this approach is that it corresponds better with the economic context in this market, where, as set out in paragraph 6.4 (a), discussions between hospital operators and the insurers typically focus on the price of the overall bundle of a hospital operator's services (ie the associated revenue), with relatively little focus on the price of individual treatments. In particular, in this context, PMIs may not take into consideration how many patients are likely to be treated for each treatment. It is therefore reasonable to assume that a hospital would expect to treat the same number of patients each year. This thinking is reflected in the assumption that hospital operators and insurers assume fixed weights, ie the same number of patients, within a treatment.[9]

16. For its work in the CAT DRR, KPMG used a different approach to the composition of the common basket. While it also fixed the number of treatments in the basket, the number of observations and the weight each treatment receives varies with each iteration of the bootstrap. For the reason set out in the preceding paragraph, we did not pursue this approach.

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[8] Note that for the annual and overall price difference we also restrict the bootstrap at the corresponding levels.
[9] This is also in line with the bootstrapping principle that the number of observations of the sampled distribution should be constant.

17. Table 1 below summarises the differences in the three approaches outlined above: the CMA's original approach; KPMG's methodology used for the CAT DRR; and our current view.

Table 1: Summary of approaches to the 'bootstrapping' methodology

	Original approach in the FR	*KPMG DRR approach*	*Updated approach*
Treatments in basket	Fixed in bootstrap	Fixed in bootstrap	Fixed in bootstrap
Observations per treatment	Random in bootstrap	Random in bootstrap	Fixed in bootstrap
Weights of treatments	Fixed in bootstrap	Random in bootstrap	Fixed in bootstrap

Source: CMA analysis.

18. In the IPA WP DRR, KPMG raised a concern that fixing the weights as described above led to a systematic underestimation of the standard error and thus to an overestimation of the statistical significance levels. The reason provided by KPMG was that this approach excluded 'important sources of variation that the CMA is excluding'. As explained in the preceding paragraphs, we do not agree with this argument: the bootstrapping approach is consistent with the economic model of bargaining between an insurance provider and a hospital provider.

The number of insurers considered

19. In the Final Report, we reported the results of statistical significance tests for 25 insurer-year-specific price differences. This approach was taken in order to focus the statistical significance testing on the larger insurers only. For the insurers that were not considered, we did not have observations for all years, with the exception of [✂].[10] This was a deliberate choice made when testing the statistical significance. For the sake of completeness we now report the results of the statistical significance testing for all insurer-years, in section 8 of this report, although, as pointed out above, a number of smaller insurers have patient volumes such that no treatment meets the 30-episode threshold and so these insurers are not included in these results.

[10] The omitted insurers were [✂] (2010, 2011), [✂] (2011) and [✂] (2009-2011), as well as [✂].

Results and robustness checks

1. In this appendix we present the detailed results on the main specification and the different robustness checks presented or referred to in Section 8.

Results

2. In this section we present the results of the IPA main specifications. We will first present the results on the insurer-year level and then move to more aggregated levels, ie the annual price differences and the overall price difference. We present the results, for both 5- and 30-episode thresholds, for the IPA, both our specification (including patient age, gender and length of stay) and the IPA WP DRR specification, which includes an additional variable for the number of pathology charges in the relevant invoices. The statistical significance of the results are also presented in the relevant tables below.

3. In columns A and B of Table 1 we present the results for the insurer-year price differences based on a 5-episode threshold. These results in column A (that is, excluding the count of pathology charges) suggest that there is a price difference between HCA and TLC of [✄]%, which is statistically significant for [✄] out of 36 insurer-years. When adding the number of pathology charges into the treatment-level regressions, the results suggest that the price differences for most insurer-years reduce considerably, with some insurer-year showing no price difference or even suggesting that TLC may be charging higher prices. [✄] is a notable exception: the price differences fall when the count of pathology charges is included in the IPA, but (with the exception of the 2007 results) the price differences remain substantial, compared with other insurers. Statistical significance testing suggests that [✄] out of 36 insurer-year price indices are statistically significant (column B).

4. In columns C and D of Table 1 we also present the results for the insurer-year price differences based on a 30-episode threshold. The results are consistent with the results for the 5-episode threshold (for the insurer-year price indices we can compare). While we find a positive price difference between HCA and TLC for the baseline specification, the price differences fall substantially for many insurers in many years with the inclusion of the pathology charge variable, with, again, some price results suggesting that HCA prices are no higher or even lower than TLC's for some insurers in some years.

Furthermore, we find that [✂] out of 23 insurer-year price differences are statistically significant.[1]

Table 1: Insurer-year price difference

					%
		5-episodes		*30-episodes*	
		CMA	*Pathology*	*CMA*	*Pathology*
		(A)	*(B)*	*(C)*	*(D)*
2007	AXA PPP	[✂]	[✂]	[✂]	[✂]
2008	AXA PPP	[✂]	[✂]	[✂]	[✂]
2009	AXA PPP	[✂]	[✂]	[✂]	[✂]
2010	AXA PPP	[✂]	[✂]	[✂]	[✂]
2011	AXA PPP	[✂]	[✂]	[✂]	[✂]
2011	Aviva	[✂]	[✂]	[✂]	[✂]
2007	Bupa	[✂]	[✂]	[✂]	[✂]
2008	Bupa	[✂]	[✂]	[✂]	[✂]
2009	Bupa	[✂]	[✂]	[✂]	[✂]
2010	Bupa	[✂]	[✂]	[✂]	[✂]
2011	Bupa	[✂]	[✂]	[✂]	[✂]
2007	Bupa Int'l	[✂]	[✂]		
2008	Bupa Int'l	[✂]	[✂]	[✂]	[✂]
2009	Bupa Int'l	[✂]	[✂]	[✂]	[✂]
2010	Bupa Int'l	[✂]	[✂]	[✂]	[✂]
2011	Bupa Int'l	[✂]	[✂]	[✂]	[✂]
2007	Cigna	[✂]	[✂]		
2008	Cigna	[✂]	[✂]		
2009	Cigna	[✂]	[✂]		
2010	Cigna	[✂]	[✂]		
2011	Cigna	[✂]	[✂]	[✂]	[✂]
2010	Exeter	[✂]	[✂]		
2008	PruHealth	[✂]	[✂]		
2009	PruHealth	[✂]	[✂]	[✂]	[✂]
2010	PruHealth	[✂]	[✂]	[✂]	[✂]
2011	PruHealth	[✂]	[✂]	[✂]	[✂]
2007	SLH	[✂]	[✂]		
2008	SLH	[✂]	[✂]	[✂]	[✂]
2009	SLH	[✂]	[✂]	[✂]	[✂]
2010	SLH	[✂]	[✂]		
2011	SLH	[✂]	[✂]		
2009	Simplyhealth	[✂]	[✂]		
2010	Simplyhealth	[✂]	[✂]	[✂]	[✂]
2011	Simplyhealth	[✂]	[✂]	[✂]	[✂]
2010	WPA	[✂]	[✂]		
2011	WPA	[✂]	[✂]		
Total		[✂]	[✂]	[✂]	[✂]
Positive and significant		23/36	[✂]	[✂]	[✂]

Source: CMA analysis.

Small number of treatments account for much of the price difference

5. In this section we present the graph for the contribution of the price differences to the overall price difference. We have calculated the price differences by taking the average for a given treatment overall price differences on the insurer-year level. In the graph we present the ordered results of this. Figure 1 is based on the original specification with a minimum of 5 patient episodes.

[1] Note that for computational reasons we test the statistical significance of the percentage price difference for the aggregate price index.

Figure 1: Contribution of CCSDs to price difference (5 episodes)

[✂]

Source: CMA analysis.
Note: Price differences on the vertical axis are in percentages.

Alternative definitions of the 'representative patient'

6. To estimate the prices for a specific treatment for a specific insurer in a given year we use a 'representative patient' to ensure that we are making a like-for-like comparison between HCA and TLC. The underlying idea is to compare the price that an insurer would be charged for an identical, and typical, patient (in terms of the characteristics that we observe – age, gender and length of stay) for that specific treatment at each of HCA and TLC.

7. In order to understand whether our results are sensitive to the definition of the representative patient, we checked the robustness of our baseline results to different types of representative patients. In particular we used:

   (a) mean patient;

   (b) the 25th and 75th percentile patient characteristics, meaning that we used the patient characteristics below which 25 and 75% of the patients may be found; and

   (c) the median HCA and TLC patient to understand whether the price difference is affected by the distribution of the patient characteristics.

8. The first sensitivity check we conducted was to define the representative patient as having the mean characteristics of the patients for each treatment in the data set. The advantage of this definition is that it may better reflect the distribution of patient characteristics in the data. The results of our comparison of using the median (our baseline approach that we use in the IPA) and the mean patient are presented in column A and C of Table 2 below, using the 5-episode and 30-episode threshold. The results suggest that the estimated annual price differences are in line with the baseline approach. We also checked the results for the price differences at the insurer-year level. The results suggested increased price differences for some insurers and years and decreases for others. However, overall there were still substantial positive price differences between HCA and TLC, for most insurers, with [✂] being the main exception to this, as it is in the median-based IPA. Looking at the overall price difference, across insurers and years, HCA is [✂]% more expensive compared with TLC when we use a mean representative patient, compared with [✂]% using a median representative patient.

Table 2: Annual price differences for mean representative patient – % price differences

	5 episodes		*30 episodes*	
	(A)	*(B)*	*(C)*	*(D)*
Year	*CMA*	*Pathology*	*CMA*	*Pathology*
2007	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]
Average	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

9. In addition, we defined the representative patient as having the 25^{th} and 75^{th} percentile characteristics. The results for the annual and overall price difference are reported in Tables 3 and 4, below. While there is some variation in the results compared with the baseline median patient, the results suggest that we consistently estimated a positive price difference. We therefore concluded that the results are in line with our median representative patient.

10. The rationale behind using a representative patient defined as the median of either the HCA or the TLC patients, is motivated by the HCA's argument that its patient population may be different to TLC's to the extent that using a single representative patient is not an appropriate way to compare their prices. In particular we are aiming to understand whether a representative patient of HCA's median patient characteristics is more expensive to treat at HCA or at TLC. We also carry out the same thought experiment for a TLC patient. Suppose we find that the price difference between HCA and TLC for treating a TLC-specific patient is negative, while the price difference for treating an HCA-specific patient is negative as well. This pattern would suggest that each of HCA and TLC is relatively more efficient in treating its respective patients. Furthermore this pattern would suggest a selection mechanism allocating patients to the respective hospitals.

11. In Tables 5 and 6 we present the estimated annual and overall price differences for a 5- and 30-episode threshold. Our original approach, presented in columns A and C in these tables, suggests that there is a small change between the two specifications and relative to our main specification, using a median patient over both hospital operators' patient populations in the data. Including the pathology count (columns B and D) suggests there is a larger price difference for the HCA-specific patients compared with the TLC-specific patient. Our results suggest that we do not find evidence based on this robustness check for the selection of patients to the respective hospitals.

Table 3: Annual price differences for 75th percentile patient – % price differences

	5 episodes		*30 episodes*	
	(A)	*(B)*	*(C)*	*(D)*
Year	*CMA*	*Pathology*	*CMA*	*Pathology*
2007	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]
Average	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

Table 4: Annual price differences for 25th percentile patient – % price differences

	5 episodes		*30 episodes*	
	(A)	*(B)*	*(C)*	*(D)*
Year	*CMA*	*Pathology*	*CMA*	*Pathology*
2007	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]
Average	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

Table 5: Annual price differences for median HCA patient – % price differences

	5 episodes		*30 episodes*	
	(A)	*(B)*	*(C)*	*(D)*
Year	*CMA*	*Pathology*	*CMA*	*Pathology*
2007	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]
Average	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

Table 6: Annual price differences for median TLC patient – % price differences

	5 episodes		*30 episodes*	
	(A)	*(B)*	*(C)*	*(D)*
Year	*CMA*	*Pathology*	*CMA*	*Pathology*
2007	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]
Average	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

Alternative charge items

12. In addition to the number of pathology tests, there are additional charge categories, such as theatre or X-ray, in the data that could, in principle, be informative about the characteristics of the patient and the episode.

Therefore, we also analysed whether any of these additional line-item charges had an impact on the overall price difference when these variables were included in the treatment-level regressions in the IPA. We present the outcomes of this analysis in Table 7 below. We begin by presenting the results of our own replication of the KPMG analysis which included the number of pathology tests in the CCSD-level regression in the IPA. The effect of including pathology in the price-index regressions is that the price difference between HCA and TLC reduces considerably to [✂]%.

13. We also included additional charge categories, which, as Table 7 shows, affect the price difference by increasing or decreasing – in all cases within a range of [✂] percentage points. Specifically, the effects range from a reduction to [✂]% to an increase to [✂]% from the 'original' [✂]%. This work suggest that the pathology count is the variable that has by far the most impact on the price difference. That the pathology charges have the strongest effect on the average price difference can be explained by revenue derived from pathology charges representing a large share in the overall costs of the line items (see Table 8.2), while other charge categories occur less frequently.[2]

Table 7: IPA and alternative charge items (30 episodes)

	Path	*CT*	*X-ray*	*MRI*	*ECG*	*Theatre*	*Nursing*	*Prosthesis*
2007	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Average	**[✂]**	**[✂]**	**[✂]**	**[✂]**	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

Pathology outliers

14. We also looked at whether a small number of episodes with an unusually large number of pathology charges could be driving the results. The rule that we used to exclude an episode from the analysis is to do so if the pathology count was, respectively, above one, two or three times the standard deviation of the mean pathology count for a particular treatment.[3] Our analysis dropped those observations that were more than two or three times the standard

[2] Note that the next largest line item, theatre, represents [✂]% and [✂]% of revenue for HCA and TLC for treatments used in the IPA. The largest group of line items is insurer-specific packages, which represents [✂]% and [✂]% for HCA and TLC, respectively.

[3] It is a common procedure used in econometric work to classify outliers by the distance from the mean value for that variable. Assessing outliers in terms of how many standard deviations they are from the mean is often used as an objective measure of the extent to which they are 'out of line' with the data or unusual in the particular context.

deviation.[4] We report the results in Table 8, below. The exclusion of ‘outliers’ increased the price difference by up to one percentage point for the 5-episode threshold, which is a slightly higher price differences than in the KPMG analysis. For the 30-episode threshold (Table 9), the price difference increases by up to [✂] percentage points.

Table 8: Pathology outliers, 5 episodes (in common basket)

Year	*CMA (all)*	*Pathology (all)*	*Pathology (3 standard deviations dropped)*	*Pathology (2 standard deviations dropped)*
2007	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]
Average	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

Table 9: Pathology outliers, 30 episodes (in common basket)

Year	*CMA (all)*	*Pathology (all)*	*Pathology (3 standard deviations dropped)*	*Pathology (2 standard deviations dropped)*
2007	[✂]	[✂]	[✂]	[✂]
2008	[✂]	[✂]	[✂]	[✂]
2009	[✂]	[✂]	[✂]	[✂]
2010	[✂]	[✂]	[✂]	[✂]
2011	[✂]	[✂]	[✂]	[✂]
Average	**[✂]**	**[✂]**	**[✂]**	**[✂]**

Source: CMA analysis.

The regression approach

15. In this section we provide more detail on the regression approach. Our approach is based on modelling the price of each episode as a function of the hospital where the treatment is provided (HCA or TLC), while controlling for the patient mix, using the patient characteristics and any other factors that are specific to the insurer, treatment or year. The aim of this approach is to assess the robustness of the price-index approach, in particular the robustness of the representative patient approach.

16. While in the regression approach we avoid having to make the same assumptions as we do in implementing the IPA and the bootstrapping approach – in relation to the representative patient, statistical distributions, independence of variables and so on – estimating a regression is based on a number of assumptions about the relationship between prices and patient

[4] The lower the multiple of the standard deviation we drop, the more observations we drop and therefore we might lose more useful information.

characteristics, and the relationship between prices and HCA's bargaining power, among others.

17. In addition, calculating the standard error from the regressions on the insurer-year-treatment level, and aggregating them up to the insurer-year level presents a challenge. The reason is that treatment prices might be correlated, which has to be taken into account when calculating the standard error. Hence, we use a bootstrapping approach to calculate the standard error of the price difference between HCA and TLC. We then use the standard error to test the statistical significance of the price differences. However, the bootstrap approach relies on a number of assumptions. For example, the bootstrap approach implicitly relies on, and is sensitive to, the minimum episode threshold that is applied for a given treatment. For example, looking at the price difference [✂] 2009: using a threshold of 5 episodes, the price difference ([✂]%) is not statistically significant. Moving to a 30-episode threshold, the price difference ([✂]%) is statistically significant at the 99% confidence level.

18. Notwithstanding the limitations identified above with the bootstrapping approach, we consider that it produces robust results. However, it is important to understand to what degree the bootstrap might be affected by changes in the assumptions. A simple way to test the results of the bootstrap is to use the regression approach, which provides a test of the statistical significance of the coefficient estimates as part of the regression output.

19. In comparing the regression approach and the price-index approach used in the IPA, we note that, while the two approaches aim to answer the same questions, there are a number of differences:

    (a) Depending on the exact specification of the regression equation estimated, the effect of patient characteristics may be estimated in aggregate (across all treatments) rather than for each treatment and for each of HCA and TLC separately.

    (b) In the regression approach we estimate the effect of being treated by HCA on episode prices directly while simultaneously controlling for patient characteristics and any treatment-, insurer- and year-specific effects, rather than constructing a series of price indices in order to do this.

20. We have used the same cleaned data set for the regression approach as we have for the IPA, although the regression approach uses more of the data. In the IPA we restricted the minimum number of patients treated at a hospital operator for a given treatment, insurer and year – using both 5- and 30-

episode thresholds. We did this because we estimated regressions at the treatment-insurer-year-hospital-operator level, including three explanatory variables, and we therefore needed a sufficient number of episodes, ie at least 5 or 30, in order to be able to estimate the individual treatment-level regressions in the IPA approach. While we still consider patients within the common basket only, in the regression approach we are able to reduce the minimum episode threshold for each treatment to at least two episodes.[5] As a result of being able to include more treatments in our analysis, the number of observations for the regressions approach is about 91,000 episodes compared with around 68,000 episode for the 5-episode threshold version of the IPA.[6]

21. The baseline regression equation we estimate is:

$$\ln p_{tij} = \beta + \beta_1 HCA + \beta_2 X_t + \gamma_t + \gamma_i + \gamma_j + u_{tij},$$

where X is a matrix containing the patients' (logarithm of) age, length of stay and gender. The γ's are treatment (t), insurer (i) and year (j) fixed effects, respectively.[7] HCA denotes an HCA dummy, indicating whether a patient received the treatment at an HCA hospital.

22. In the regression approach we control for the patient mix by including treatment fixed effects (denoted by γ_t).[8] This approach follows Haas-Wilson and Garmon (2009). In addition we include patient characteristics in the regression. The former takes into account all factors that are constant within a treatment group. The latter controls for the severity of the individual patients.

23. Similar to the academic literature on healthcare we use the CCSD code to identify the treatment that a patient receives.[9] The aim of the CCSD codes is to provide a standardised way of recording medical procedure, ie treatments, to hospital operators and insurers.[10] While the CCSD code often provides a detailed indication of nature of the treatment - for example, within the chapter of Chemotherapy (Chapter 18) the CCSD codes are subdivided into 0–7 days,

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[5] Lower patient numbers per treatment means that we are not able to estimate the respective treatment fixed effect. Note that all treatments for which this is the case are subsumed in the constant.
[6] This also means that we are considering a larger share of the hospital operators' revenues.
[7] Note that some treatment fixed effects are dropped if there is an insufficient number of patients for that treatment.
[8] We use similar control variables in the treatment-level regressions that we estimate as part of the IPA.
[9] For details on the CCSD codes please see the CCSD website.
[10] A CCSD code does not provide any guidance on the price a hospital operator is able to charge for the medical procedure, which is determined by the insurer and hospital operator in their price negotiations. The CCSD code also does not provide any indication about costs of a specific medical procedure relative to another medical procedure. This is unlike the Diagnosis Related Group used in academic publication focusing on the US-healthcare market. Because the relative weights are not available to us, we rely on a fixed-effects approach in controlling for the treatment.

1–14 days, 1–21 days and 1–28 days - there could still be differences in patients' severity within a treatment group. We therefore control for additional patient characteristics - age, length of stay and gender.

24. The standard errors are clustered at the treatment level.[11] The reason for clustering at the treatment level is that the error term across patients might be correlated for patients receiving a particular treatment. The standard response in the academic literature is to adopt a clustering approach to estimating the standard error.[12] In addition we explore alternative clustering, for example at the treatment-hospital level. We are conservative in our choice of clustering, reporting clustering with the largest standard errors compared to other reasonable approaches.[13]

25. We also used two further sets of control variables:

(a) We took into account different effects of insurers on the price. Each insurer may possess a degree of bargaining power, which is likely to lead to different prices being charged for different insurers' patients.

(b) We took into account factors that vary across years but do not have different impacts on different insurers, treatments or providers, for example inflation in input costs.

26. We are mainly interested in the sign of the HCA-specific effect, β_1, and whether the coefficient is statistically different from zero. A positive coefficient suggests that HCA is charging a higher price relative to TLC. Based on the price-index approach we employ in the IPA, we would expect a positive price difference.

27. We present the results of the baseline regression approach, defined in paragraph 21, in Table 10 below. The results of the main specification are presented in column A. The coefficient on HCA suggests that HCA is on average [✄]% more expensive than TLC. Also, the price difference is statistically significant at the 99% level.

[11] By clustering the standard errors, we take into account the correlation within a group – in this case at the treatment level.
[12] In addition we explore alternative clustering, for example at the treatment-hospital level, for our baseline approach. We chose to report the clustering at the treatment level only, because the standard errors are the largest compared with other reasonable approaches.
[13] We do not explore clustering at the hospital operator level because of too few clusters. Additional clustering we explored was at the treatment-hospital-operator level and heteroscedasticity-robust standard errors.

Table 10: Regression approach

			%
	(A)	*(B)*	*(C)*
	Baseline	*Day-case dummy*	*Treatment patient interaction*
HCA	[✄] [✄]	[✄] [✄]	[✄] [✄]
Male	[✄] [✄]	[✄] [✄]	
Age (log)	[✄] [✄]	[✄] [✄]	
Length of stay	[✄] [✄]	[✄] [✄]	
Day case		[✄] [✄]	
R-squared (adjusted)	[✄]	[✄]	[✄]
Number of observations	[✄]	[✄]	[✄]

Source: CMA analysis.

28. With respect to the patients' characteristics, only the length of stay and the day-case dummy have effects on the episode price which are statistically significant.[14] For length of stay we would expect a positive effect on the price of the treatment. Our regression approach suggests that for each additional night a patient stays in hospital, on average, the price increases by [✄]%. The effect of a patient's gender indicates that male patients incur lower prices, while for patient age the effect is positive, but, as both effects are statistically insignificant we cannot conclude that these variables have explanatory power for the price differences in this specification of the regression.

29. In column B we also use a day-case dummy to understand whether controlling for the differential costs involved in treating day cases affects our estimate of the price difference between HCA and TLC. For day-case patients we would expect the treatment to have a lower price because a day-case patient does not have the added costs of overnight care. We find that, on average, hospital operators charge 50% less for a day-case patient.[15] Compared with the results presented in column A, the HCA effect increases. The results suggest that HCA charges a [✄]% higher price compared with TLC and that this difference is statistically significant.

KPMG's comments

30. [✄][16] [✄]

[14] Which indicates those episodes where the patient was treated as a day-case with no overnight stay.
[15] Again, the coefficient on 'day-case' is roughly equivalent to a percentage difference, but not exactly so, as in we need to exponentiate the estimated coefficient to calculate the percentage difference.
[16] Also, strictly speaking its test suggests that the coefficients are not statistically equal. However, which set of coefficients is statistically preferable is not answered by the test.

31. In response to KPMG's argument we have refined our regression approach and introduced more flexibility in the regression approach for the Remittal PFs.[17] In response to the Remittal PFs, KPMG reiterated its critique of the more flexible regression approach failing statistical tests, using the same statistical approach as outlined in the preceding paragraph.

32. In addition, KPMG also provided evidence that the pooled regression approach discussed above is affected by the top-5 CCSDs. They showed that the overall price difference between HCA and TLC increases from [✂] when focusing on the Top-5 CCSDs only. When focusing on the 'remaining' CCSDs only the price difference falls to [✂]%.

33. Also, KPMG showed that the majority of the insurer-year regressions were positive and statistically significant ([✂] out of [✂] for the pooled and [✂] out of [✂] for the Top-5 CCSDs) and that for the 'remaining' CCSDs insurer-year regressions only [✂] out of [✂] insurer-year price differences were statistically significant.[18] They furthermore stated that about [✂]% of the revenue ([✂]% of admissions) in the common basket was subject to a positive and statistically significant price difference.

Our assessment

34. [✂][19] [✂] estimating a regression where coefficients are allowed to vary for each treatment.[20] In our baseline regression, we deliberately chose a different (less flexible) approach because we wanted to produce a simpler estimate of the price difference between HCA and TLC without making assumptions around, for example, the representative patient. Furthermore, one concern that was raised in relation to the IPA analysis was that it covered relatively few treatments and a small number of episodes. When using the regression approach, where we did not have to estimate the effect of age, gender and length of stay separately for each treatment, each provider, each insurer and each year, we could then include more treatments (those with smaller patient volumes for some insurers) and so considerably increase the coverage of our analysis (by more than one-third in terms of number of episodes).

35. Second, it is unsurprising that the regression approach is driven by the Top-5 CCSDs because it is a reflection of the data not the methodology. In addition, we refer to paragraph 8.106, where we discuss our assessment on the Top-5 CCSDs and their implication for the estimation of a price difference.

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[17] Remittal Provisional Findings, Appendix G, and paragraphs 36-39, below.
[18] The 'remaining' CCSDs are all the CCSDs in the common basket with the exception of the Top-5 CCSDs.
[19] IPA working paper, paragraphs 20–23.
[20] IPA working paper, Table E1, Column E.

Flexible regression specification

36. In this section we provide some detail on the regression specifications that we have estimated. Each of the regressions is estimated at the insurer-year level, because it allows more flexibility of the regression approach. This approach moves the regression approach closer to the IPA without sacrificing the advantages of the regression approach. As a result we focus on the price difference between HCA and TLC at the insurer-year level. In the regression equation we model the price a patient insured with insurer i is charged for receiving treatment t in year j as a function of the patient's characteristics and a HCA dummy. Specifically, the baseline regression equation we estimate is:

$$\ln p_{tij} = \beta_{0\mathrm{tij}} + \beta_{1\mathrm{ij}} HCA + \beta_{2\mathrm{tij}} X_{tij} + u_{tij},$$

where X is a matrix containing the patient's age, length of stay and gender. We observe the estimated variables at the insurer-year level for each treatment. For example, the effect of a patient's age is allowed to be different for every treatment we observe for the insurer and the year in the common basket.[21] HCA denotes a HCA dummy, indicating whether a patient received the treatment at a HCA hospital.[22]

37. We are interested in the HCA-specific effect, $\beta_{1\mathrm{ij}}$; its sign, magnitude and whether the coefficient is statistically different from zero. A positive coefficient suggests that HCA is charging a higher price relative to TLC. In particular we are interested in comparing the coefficients on the HCA dummy with and without the inclusion of the pathology count. We first present the results of our original analysis. We then provide the results when we include the pathology count. This step informs us whether the price effect reduces in response to inclusion of the pathology count, similar to the effect on the IPA results.[23]

38. In Table 11 below, we present the results on this more flexible regression approach. The results for our 'original' approach (shown in column A) suggest that price differences at the insurer-year level are positive. In column B we include the pathology count variable. This results in a clear reduction of the price differences for the majority of the insurer-year price difference (column C).[24] The exception, as in the price-index approach, is the price differences for [✂], where we observe only small decreases in the price differences. Overall,

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[21] Note that for the IPA we would interact each of the treatment-patient characteristics with a hospital dummy as well. We do not do this here otherwise we would have to rely on a representative patient for each treatment.
[22] Note that we do not cluster the standard errors for the insurer-year regressions. The standard errors are robust standard errors.
[23] Note that including the number of pathology charges in the regression approach raises the same issues in relation to the use of this variable as a proxy for patient complexity as are discussed at length in section 8.
[24] Note that for [✂] 2011 we were not able to estimate the effect of the pathology count on the price difference because it is collinear with the HCA dummy.

relative to the IPA, the price differences are reduced less substantially by the inclusion of the pathology count variable.

39. Overall, we conclude that the regression approach is consistent with the IPA results, specifically, that the inclusion of the pathology count variable here also reduces the price differences between HCA and TLC in the majority of cases.

Table 11: Regression results

Year	*Insurer*	*CMA (%) (A)*	*Pathology (%) (B)*	*Difference (C)*
2011	Aviva	[✂]	[✂]	[✂]
2007	AXA PPP	[✂]	[✂]	[✂]
2008	AXA PPP	[✂]	[✂]	[✂]
2009	AXA PPP	[✂]	[✂]	[✂]
2010	AXA PPP	[✂]	[✂]	[✂]
2011	AXA PPP	[✂]	[✂]	[✂]
2007	Bupa	[✂]	[✂]	[✂]
2008	Bupa	[✂]	[✂]	[✂]
2009	Bupa	[✂]	[✂]	[✂]
2010	Bupa	[✂]	[✂]	[✂]
2011	Bupa	[✂]	[✂]	[✂]
2007	Bupa Int'l	[✂]	[✂]	[✂]
2008	Bupa Int'l	[✂]	[✂]	[✂]
2009	Bupa Int'l	[✂]	[✂]	[✂]
2010	Bupa Int'l	[✂]	[✂]	[✂]
2011	Bupa Int'l	[✂]	[✂]	[✂]
2007	Cigna	[✂]	[✂]	[✂]
2008	Cigna	[✂]	[✂]	[✂]
2009	Cigna	[✂]	[✂]	[✂]
2010	Cigna	[✂]	[✂]	[✂]
2011	Cigna	[✂]	[✂]	[✂]
2011	Exeter	[✂]	[✂]	[✂]
2009	Exeter	[✂]	[✂]	[✂]
2008	PruHealth	[✂]	[✂]	[✂]
2009	PruHealth	[✂]	[✂]	[✂]
2010	PruHealth	[✂]	[✂]	[✂]
2011	PruHealth	[✂]	[✂]	[✂]
2009	Simplyhealth	[✂]	[✂]	[✂]
2010	Simplyhealth	[✂]	[✂]	[✂]
2011	Simplyhealth	[✂]	[✂]	[✂]
2007	SLH	[✂]	[✂]	[✂]
2008	SLH	[✂]	[✂]	[✂]
2009	SLH	[✂]	[✂]	[✂]
2010	SLH	[✂]	[✂]	[✂]
2011	SLH	[✂]	[✂]	[✂]
2010	WPA	[✂]	[✂]	[✂]
2011	WPA	[✂]	[✂]	[✂]

Source: CMA analysis.

Assessment of new entry

1. As set out in our Remittal PFs, PDR and Supplemental PDR, in spite of the attractiveness of the growing privately-funded healthcare services market in central London, there has been no large-scale entry or substantial change in the structure of the market over the last ten years or more, and only limited incremental expansion/changes in ownership.[1] However, during the remittal, we have received evidence that there may be future large-scale entry by one or more private hospital operators in central London, together with entry by smaller, more specialised providers.

2. Below, we present the evidence that we have gathered in relation to new entry into the central London market.

Large-scale entry

Cleveland Clinic

3. In late 2015, Cleveland Clinic, a US-based, not-for-profit[2] private healthcare provider, acquired a long-term lease of a 191,000 sq ft site at 33 Grosvenor Place in Belgravia, central London for £[✂] million. Cleveland Clinic has stated its intention to convert 33 Grosvenor Place, which is currently used as office space, for use as a private hospital. The expected capacity of the new facility would be around 215 beds, of which approximately 40 would be intensive care beds.

4. Cleveland Clinic is a well-established hospital operator with 15 hospitals, 11 of which are located in Ohio, with the remaining four in Florida, Nevada, Canada and Abu Dhabi. The only existing hospital outside North America is in Abu Dhabi, which is a multi-specialty hospital with 364 beds and was opened to the public in May 2015. Cleveland Clinic has more than 1,400 beds on its main campus in Ohio and 4,450 beds worldwide. For the year ended December 31, 2014, Cleveland Clinic reported a $467.5 million operating profit on $6.7 billion in revenue. In 2014, it reported 5.9 million outpatient visits and employed over 3,000 physicians and scientists.[3]

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[1] Remittal PFs (10 November 2015), paragraph 23.
[2] Cleveland Clinic is a non-profit multi-specialty academic medical centre that integrates clinical and hospital care with research and education, according to its website.
[3] Cleveland Clinic Facts and Figures.

5. According to the U.S. News & World Report's Best Hospital Rankings, in the USA, Cleveland Clinic is ranked number one in Cardiology and Heart surgery, number two in Gastroenterology and GI surgery, as well as Nephrology, Rheumatology and Urology and number three in Diabetes and Endocrinology, Gynaecology, Orthopaedics and Pulmonology. Cleveland Clinic is ranked in the top 10 hospitals in the USA across its other specialties, with the exception of oncology and paediatric specialties.[4]

6. Cleveland Clinic told us that it had had a long-standing interest in entering the central London market (since 2001) but had previously been unable to identify a suitable location. It had started to pursue entry actively in 2014.

7. In order to verify Cleveland Clinic's plans, we asked for, and were provided with, a number of supporting documents, including internal business plans which have been approved by its board. A meeting was held with the management of Cleveland Clinic in December 2015 followed by a hearing in May 2016. The evidence demonstrated that Cleveland Clinic had invested a considerable amount of time and money in developing its strategy, and laying the groundwork, for entering central London. We have set out below details of Cleveland Clinic's plans, including the services it intended to offer at its new hospital; its proposed customer base and pricing; the discussions it has had with consultants and PMIs; its financing arrangements; and progress with converting the site at Grosvenor Place.

8. Cleveland Clinic has confirmed that it plans to offer a range of tertiary treatments, including 12 of the 16 core specialities on which we have focused our analysis of competitive constraints in Section 4, with a particular focus on heart and vascular care, neurologic care, digestive disease and orthopaedics. In a hearing with the CMA in May 2016, Cleveland Clinic told us that, although it still planned to offer a wide range of specialities, medical oncology[5] would not be offered for 'years or decades', if at all.[6]

9. Cleveland Clinic hired Boston Consulting Group (BCG) and PricewaterhouseCoopers (PwC) to advise it on the commercial aspects of its entry, including advice on the current (approximate) level of healthcare prices in central London. On the basis of the advice received, Cleveland Clinic has developed detailed business plans setting out its strategy for entering the private healthcare market in central London, through the acquisition of the site

[4] US News and World Report – Health, Rankings. U.S. News & World Report publishes a 'Best Hospitals Rankings'. According to its website, U.S. News & World Report 'sifted through data for nearly 5,000 hospitals and results from surveys of more than 140,000 physicians to rank the best centres in 16 adult specialties from cancer to urology. Death rates, patient safety and hospital reputation were a few of the many factors [it] considered.'
[5] Chemotherapy or radiation therapy.
[6] Cleveland Clinic hearing summary, paragraph 13.

in Grosvenor Place. These were approved by its board; however, Cleveland Clinic indicated that these business plans may evolve as it learned more about the market. [✂]

10. Cleveland Clinic told us that it had already retained the services of a number of (medical) consultants in an advisory capacity and that it was working with them to develop its strategy for the central London market. Cleveland Clinic also informed us that it had held some preliminary informal discussions with [✂].

11. Cleveland Clinic's business plan indicated that it would seek to attract customers from among UK insured, UK self-pay and overseas patients. Cleveland Clinic's board paper dated 24 September 2015 showed the value of the private healthcare market in London to be [✂]. [✂]

12. Cleveland Clinic told us that it had engaged Moody's in discussions regarding its financing strategy for entry into the central London market. Cleveland Clinic was Aa2 rated by Moody's and AA– by S&P. The acquisition of 33 Grosvenor Place was completed in part through [✂]. The company told us that it had significant cash flows from its other operations that could be used to finance the works, the investment and its entry into central London.

13. Cleveland Clinic's plans for the site depend on obtaining planning permission to convert the building. Cleveland Clinic indicated to us that it believed that it would take three years from the grant of planning permission until it would be able to treat its first patient. [✂]

14. The application for planning permission for the conversion of 33 Grosvenor Place from office use to hospital use was due to be submitted in March 2016 and, subject to approval, Cleveland Clinic envisaged that refurbishment works would begin during 2016.

15. However, the planning application was not submitted in March 2016 and, at the time of publishing this document, has not been submitted and does not appear imminent (please see Endnote for an update). Cleveland Clinic has told us that there had been delays in completing certain steps, which needed to be resolved before a planning application could be made. In particular, the submission of the planning application is being held up by ongoing negotiations with the freehold owner, Grosvenor Estate Belgravia, regarding the renegotiation of the ground rent to reflect the proposed change of use of

the property. In addition, vacant possession[7] issues have not yet been resolved. [✂]

Spire

16. During our original investigation, Spire told us that it was searching for a suitable site in central London in which to open a hospital.[8] Spire's strategy, as communicated to its investors, was to open two large-scale hospitals in central London.[9] [✂]

17. [✂]

18. [✂].[10]

VPS

19. In July 2015, VPS announced plans to enter the central London market via the purchase of the (currently disused) Ravenscourt Park hospital. VPS manages 16 fully operational hospitals across the UAE, Oman and India, as well as pharmaceutical manufacturing, a pharmacy retail chain, and primary, secondary and tertiary care clinics.

20. In a press release dated July 2015, VPS stated that Ravenscourt Park hospital was expected to have capacity of 150 beds. During the summer of 2015, VPS told us that it planned to open the refurbished hospital in 2017. Its plan for the site was as a full-service, tertiary hospital. VPS told us that it would be the first private hospital in the UK to offer proton beam therapy, a kind of radiotherapy, used in cancer treatment.

21. C&C Alpha Group, the current owner of the tenant company for Ravenscourt Park hospital, told us that after months of active discussions with VPS and Imperial College NHS Trust over a revised Share Purchase Agreement for the company holding the lease of Ravenscourt Park Hospital, no agreement had been reached and negotiations halted after being delayed on a number of occasions. C&C Alpha Group told us that the planning permission for the site had been secured, as shown by a copy of its Certificate of Lawfulness of Use or Development submitted to us. However, we understand from C&C Alpha Group that VPS has abandoned the plans to refurbish and redevelop the site.

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[8] Final Report, paragraphs 3.10–3.14.
[9] See financial investors' reports.
[10] Remittal PFs, paragraph 5.21.

C&C Alpha Group told us that it had handed the property back to Imperial College Healthcare.

Entry/expansion by others

PPU entry

22. In the Final Report, we noted that Barts Health NHS Trust was tendering for a partner to operate a new PPU from its site in east London. Nuffield Health was awarded the contract by Barts Health NHS Trust in 2015 following a competitive dialogue procurement that began in 2014. Nuffield Health is a new entrant to the London PPU market and will be investing, developing, managing and operating the PPU facility located on the St Bartholomew's Hospital site in West Smithfield with a floor area of approximately 78,000 sq ft. The expected capacity is in the region of three theatres, 26 beds, a full diagnostic suite and outpatient services. Barts Health indicated that the facility was expected to focus largely, although not exclusively, on cardiovascular treatments.

23. The PPU is currently expected to open in 2018.

Other entry

24. We are aware of other firms that have opened (or have firm plans to open) specialist private healthcare facilities in central London. In our Remittal PFs,[11] we observed that these facilities were very small relative to the market (offering a handful of inpatient beds or day-case only facilities) and highly specialised, for example Fortius Clinic, Advanced Oncotherapy, the Harley Street Eye Clinic and Optegra.

25. Advanced Oncotherapy announced that it had applied for planning permission for the development of a proton beam therapy centre for the treatment of cancer and had acquired a lease for an 8,000 sq ft. building on Harley Street, which is due to be completed by the end of 2017. This project is a joint venture with Circle Health.[12]

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[11] Remittal PFs, paragraph 5.68.
[12] In the case of Advanced Oncotherapy plc, we noted that the focus of the company was on the development of technology. As the company website states: 'Our sole focus is to develop technologies to maximise the destructive effect of radiation on tumours whilst minimising damage to healthy tissues. Our goal is to help healthcare providers and hospitals expand their repertoire of treatments to ensure clinicians and patients have choices. Advanced Oncotherapy's aim is to cost-effectively deliver the next generation of proton therapy which is clinically superior to the currently available alternative radiation therapies.' We considered that Proton Partners International should be included in this category given the specialist nature of the facilities.

26. During February 2016, Howard de Walden Estates told us that Schön Klinik intended to open a private hospital in central London (on Wigmore Street, in close proximity to Harley Street). Schön Klinik is the fifth largest German private hospital operator and it applied on 11 April 2016 for planning permission to open an orthopaedic and back pain unit in Wigmore Street.

27. Howard de Walden said that the hospital would be 54,500 sq ft., and would specialise in spinal treatments and neurology. However, on its website Schön Klinik mentions that the London hospital will be 16,000 sq ft.[13] According to Howard de Walden, the hospital is expected to take 15 months to establish from the grant of the planning permission.[14]

[13] Schön Klinik homepage *Tailored Medical Care*.
[14] The planning permission application was submitted on 11 April 2016.

Cost of capital

Introduction

1. The approach to assessing profitability, as set out in our Guidelines,[1] is to compare the profits earned with an appropriate cost of capital. In this appendix, we set out our estimate of the nominal pre-tax WACC for a typical private hospital operator in the UK, based on data for the period January 2007 to December 2015.

2. Our estimated range for the industry WACC for this period is 7.6 to 10.5% with a midpoint of 9.0% (see Table 1). We note that this range is similar to that set out in the 2014 Final Report.

Table 1: CMA estimate of UK private healthcare nominal pre-tax WACC

	Low	*High*
Nominal risk-free rate (%)	4.0	4.0
Equity risk premium (%)	4.0	5.5
Asset beta	0.5	0.7
Pre-tax Ke (%)	10.1	14.5
Pre-tax cost of debt (Kd) (%)	5.0	6.5
Gearing (%)	50.0	50.0
Tax rate (%)	26.0	26.0
Pre-tax WACC (%)	**7.6**	**10.5**
Mid-point estimate (%)	**9.0**	

Source: CMA analysis.

3. For the purposes of assessing the extent to which profits may have exceeded the normal level over the period and for quantifying customer detriment, we have used a range of estimates of between 9.0%, the midpoint of our range, and 10.0%. This reflects the fact that our WACC estimate is not precise and therefore we consider it appropriate to use a WACC towards the upper end of our range.

4. In response to the WACC working paper, we received views on our analysis from several parties. These are summarised and considered in the relevant sections below.

General approach to estimating the WACC

5. There are several factors that we have taken into account in estimating an appropriate benchmark cost of capital for the various activities undertaken within the private hospital sector. These include:

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[1] *Guidelines for market investigations: their role, procedures, assessment and remedies (CC3).*

(a) how to estimate the WACC – use of the capital asset pricing model (CAPM);

(b) which cost of capital provides an appropriate benchmark – specification of the basis of the WACC; and

(c) over which time period should the cost of capital be measured – at the start of the relevant period, or an average for the relevant period?

Capital asset pricing model

6. Our Guidelines highlight that we generally use the CAPM when considering the cost of equity since this is a widely understood technique with strong theoretical foundations.[2]

7. The CAPM relates the cost of equity $E[R_i]$ to the risk-free rate (R_{rf}), the expected return on the market portfolio (R_m), and a firm-specific measure of investors' exposure to systematic risk (beta or β) as follows:

$$E[R_i] = R_{rf} + \beta(R_m - R_{rf})$$

8. If a business were entirely funded by equity, the expected return on equity could be considered to be its 'cost of capital'. However, most firms are funded by a combination of both debt and equity, such that the appropriate cost of capital to consider is the weighted average cost of debt and equity. The WACC is given by the following expression:

$$WACC = E[R_i] \times E/(D+E) + K_d \times D/(D+E)$$ [3]

9. Finally, the cost of capital must take into account the effects of tax on returns to capital providers. The returns to debt holders take the form of interest payments which are usually tax-deductible. The returns to equity holders (dividends), on the other hand, are taxed. Hence, where the cost of capital is expressed 'pre-tax', the cost of equity used must reflect the fact that the actual return to shareholders will be reduced by the rate of tax. We have estimated the cost of capital on a nominal pre-tax basis:[4]

$$\text{Pre-tax } WACC = [(1/(1-t)) \times E[R_i] \times E/(D+E)] + [K_d \times D/(D+E)]$$

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[2] *CC3*, paragraph 116.
[3] Where D is debt, E is equity and K_d is the cost of debt.
[4] This avoids the need to adjust nominal financial information to remove the effects of inflation.

Specification of the basis of the WACC

10. In our analysis, we use the WACC as a benchmark for the level of 'normal' profits that a firm in the industry could expect to earn. As a result, we consider that it is appropriate to use a WACC for a typical stand-alone private hospital operator in the UK as the benchmark, rather than estimating a firm-specific cost of capital for each operator (in this case, HCA).[5] In particular, we have sought to reflect a sustainable level of gearing, cost of equity and cost of debt that a hypothetical stand-alone operator in the UK would incur when undertaking the relevant activities. Where possible, we have used UK benchmarks, although in several cases, we have needed to make reference to international comparator firms due to a lack of comparable (listed) UK firms.

Relevant time period

11. We are analysing the profitability of HCA over the period between 2007 and 2015. When a cost of capital is set for regulatory purposes, it is generally forward-looking. In a market investigation, in contrast, we are looking backwards to understand whether the profits made by the firms have exceeded the cost of capital over the relevant period. We have not sought, therefore, to estimate the WACC at a particular point in time but rather we have considered the average cost of capital for the relevant period as a whole, taking into account the fact that various elements of the WACC estimate will have changed over the period.

CMA estimation of WACC

12. This section sets out the analysis that we have undertaken in order to estimate the components of the WACC calculation, which includes both generic and industry-specific components. The former comprise the risk-free rate (RFR), the equity risk premium (ERP) and the tax rate; the latter comprise beta, cost of debt and gearing.

13. In conducting our cost of capital analysis, we have had reference to our price determinations for Bristol Water, which was undertaken in 2009/10, and for NIE, which was undertaken in 2013, ie during the relevant period for our analysis.[6]

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[5] This approach ensures that all firms in an industry are treated equally.
[6] Competition Commission (CC), *Bristol Water plc: determination on a reference under section 12(3)(a) of the Water Industry Act 1991* (August 2010); *Northern Ireland Electricity (NIE) price determination* (March 2014). We have not made reference to the 2015 Bristol Water determination, since this analysis was undertaken on a

Risk-free rate

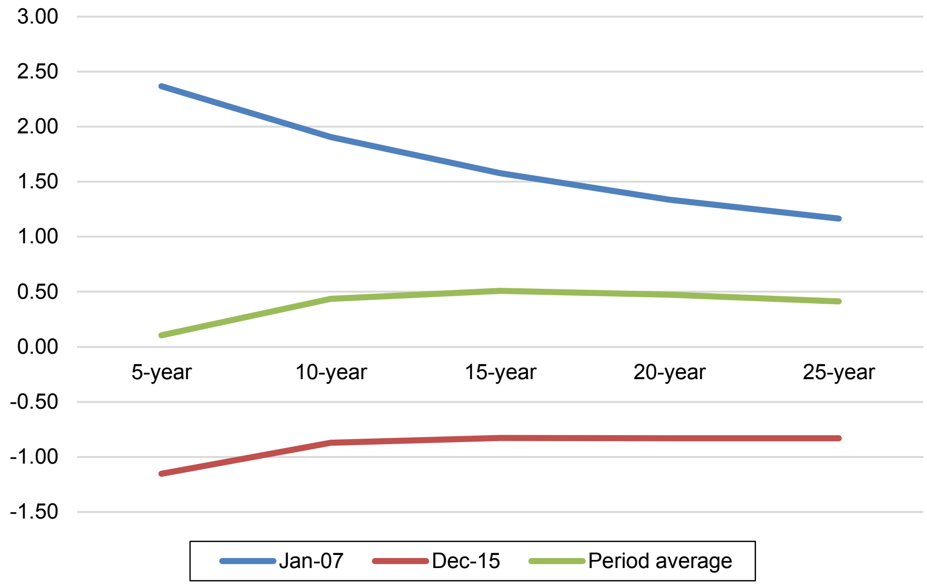
14. In this section, we consider the RFR relevant to calculating the cost of equity. In order to estimate the RFR applicable over the extended period, we have had reference to two sources. The first is index-linked gilt yields, which have negligible default and inflation risk. The second source is nominal gilt yields, which also have negligible default risk but which do have inflation risk (and, therefore, should contain an inflation risk premium).

15. We consider the yields on long-maturity gilts to be most relevant to the RFR in the cost of equity since equities also have long (indefinite) maturity.[7] Figure 1 shows the index-linked yield curve at the start and end of the relevant period, as well as the nine-year average (ie covering the whole period). For maturities of 15 years and more, the yield curves are between –1.0% and 1.5% with an average of just over 0.5%. Shorter-dated yields have fallen significantly over the last nine years, while yields on longer-dated gilts have been more stable over the period.

forward-looking basis at the end of the relevant period for our analysis. We considered, therefore, that it was less relevant to the cost of capital during the 2007–2015 period.

[7] In previous reports in the last ten years, we paid attention to distortions in the index-linked markets that may affect the shape of the yield curve. In Bristol Water (2010), the CC noted that shorter-dated index-linked yields were affected by action by the authorities to address the credit crunch and recession and were therefore less relevant to estimating the RFR. In inquiries prior to 2010 the CC put less weight on longer-dated maturities, noting possible distortion from pension fund asset allocation policies. As we explained in NIE, the effects of monetary policies and pension fund dynamics are increasingly well understood by the markets. Consequently we expect the market prices of index-linked gilts to incorporate effectively expectations of the effects of these factors and therefore to provide a reasonable guide to future returns.

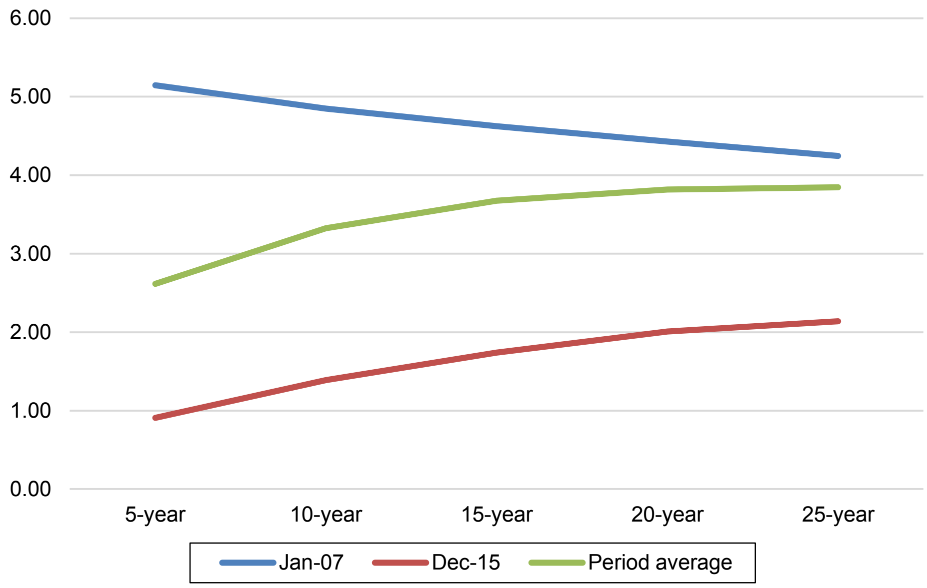
Figure 1: Yield curves on UK index-linked gilts, January 2007 to December 2015



Source: Bank of England, real spot yield curve data.
Note: The three lines show yields on 31 December 2007, 31 December 2015, and the average yields covering the nine year period between January 2008 and December 2015.

16. Figure 2 shows nominal gilt yields at the start and end of the relevant period, as well as the nine-year average (ie covering the whole period). For maturities of 15 years and more, the yield curves are between 2.0 and 4.5% with an average of just under 4%. A similar pattern of declining yields on shorter maturities can be seen on these nominal gilts.

Figure 2: Nominal yield curves on UK gilts, January 2007 to December 2015



Source: Bank of England, nominal spot yield curve data.
Note: The three lines show yields on 31 December 2007, 31 December 2015, and the average yields covering the nine year period between January 2008 and December 2015.

17. Our profitability analysis seeks to compare actual returns achieved in the private healthcare sector with the required cost of capital of investors for the relevant period. The nominal RFR that forms an element of the cost of capital is composed of the real RFR and an allowance for inflation over the period.

18. Bupa told us that we were not using the correct maturity for the nominal RFR. Bupa said that in theory the appropriate maturity of the bond should be in line with the average asset life of hospital assets, in order to reflect the investment horizon of the investor. Bupa also said that for hospitals it might be appropriate to use a ten-year asset life to reflect a balance of short and long life assets – if this is the case, the evidence would point to a much lower nominal RFR of under 3.5% (based on the green line in Figure 2), which would reduce the cost of capital range by around 0.5%.[8]

19. First, we considered Bupa's submission regarding the relevant maturity to consider when coming to a view on the RFR. As set out in NIE[9] we regard long maturities as being most relevant to the RFR in the cost of equity since equities also have long (indefinite) maturity. Therefore, the relevant issue is the maturity of equities, rather than the average life-span of the assets employed within a business. For this reason, we do not agree with Bupa that we should focus on yields on ten-year maturities. Rather, we have placed more weight on longer-dated gilts.

20. Next, we considered which of the yield curves we should rely on in coming to a view on the nominal RFR. In assessing this evidence, we have had regard to the nature of the benchmark that we require, ie a reasonable, nominal return on capital over the nine-year period from January 2007 to December 2015. We observe that an investor at the start of this period would have had regard to a higher gilt yield (real or nominal) than an investor towards the end of the period, although the difference is less material when considering long-dated gilts. On this basis, we consider that a reasonable nominal RFR for the period is 4%.[10]

21. The average yield on long-dated index-linked gilts has been approximately 0.5% over the period. However, in the NIE price determination we used a real RFR of between 1% and 1.5%, which was considerably above rates on long-duration index-linked debt, in order to allow for the possibility that rates might rise during the remainder of the price control period. In this case, we are not seeking to determine an appropriate cost of capital for a future period and

[8] Bupa response to WACC working paper, p4, paragraph 3.3.
[9] NIE Final Determination, 13.120–13.
[10] We note that this is consistent with the upper end of the estimates used for the nominal RFR in both the energy and the aggregates market investigations.

therefore do not face the uncertainties associated with forecasting. We have historical information on which to base our estimates. This could provide a reason for using a lower real RFR.

22. However, we have also taken into account the fact that the yields observed on index-linked gilts are likely to be affected by the imperfections associated with the retail price index (RPI) as a measure of underlying inflation. We note the historical gap between RPI and consumer price index (CPI) measures of inflation of around 0.5% between 2005 and 2013.[11] To the extent that the CPI better reflects underlying inflation, measures of the apparent riskless rate of return taken from index-linked gilt yields may be distorted as a result of that gap. This may be a factor behind negative short-term real yields. In our NIE decision, we noted that, given that the regulated asset base of the company was also indexed by the RPI, we did not need to adjust our estimate of the RFR for this effect. However, in this investigation, the financial performance of HCA is likely to have been affected by the general rate of inflation in the economy, which we consider to be most accurately measured by the CPI.

23. On this basis, we have used a real RFR of 1% in our analysis. This is consistent with taking the average index-linked gilt yield of 0.5% and adding the 0.5% estimate of the difference between RPI and CPI. This is the bottom end of the range that we used in the 2014 Final Report and reflects the persistently lower gilt yields observed in the last few years, compared with earlier in the relevant period.

Equity risk premium

24. The ERP is the additional return that investors require to compensate them for assuming the risk associated with investing in equities rather than in risk-free assets. The ERP cannot be directly observed from market data because the future yields on equities are uncertain.

25. There are two types of approach that can be used to estimate the ERP. Historical methods seek to derive the ERP from a long run of data on realised returns on equities. Forward-looking approaches seek to estimate the expected ERP based on either the reported expectations of market participants or the ERP implied in asset prices at the start of the period.

[11] See *Bank of England inflation report 2014*, p34.

Historical approach

26. The motivation for the historical approach is that expected returns remain constant over time and hence that average realised returns reflect the expected return. Dimson, Marsh & Staunton (DMS) estimated the average ERP for a number of countries, including the UK, on the basis of equity and gilt yields over the last 115 years. These ERPs are estimated as the difference between the real return on equities and the real return on gilts over the period.[12] As DMS explained, 'To understand risk and return, we need to examine long periods of history. This is because asset returns, and especially equity returns, are extremely volatile. Even over periods as long as ten or twenty years, we can still observe "unusual" returns.' On this basis, we have used the full 115-year mean equity returns estimates in our analysis.[13]

27. HCA suggested that the arithmetic mean should be used on the basis that it provided a 'more unbiased means of estimating the average market return since it ignores estimation error and serial correlation in returns and unbiased estimators have been found to be closer to the arithmetic than the geometric mean'.[14] Further HCA told us that the precise weighting placed on the arithmetic and geometric means could be calculated, in theory, for any given holding period. It stated that the correct estimate of the historical premium over the nine years investigated (being the Relevant Period) would be far closer to the arithmetic mean than the geometric mean.[15]

28. We note that the arithmetic mean reflects the returns that an investor could expect to make in any given year, while the geometric mean reflects the compound returns that an investor would have made if they had invested over the full 115-year period covered by the DMS data set. It is usual to quote figures for the average of one-year returns but investors in the equity market usually expect to invest in the market for longer than a year. As the holding period increases, the expected return declines from the arithmetic mean towards the geometric mean. Therefore, in coming to a view on the appropriate market return, we have had reference to the range of mean returns (geometric to arithmetic), ie 5.4 to 7.2%. We note, as HCA submitted,

[12] The formula used to estimate the ERP is: ((1+ Equity rate of return) / (1+ Riskless return)) – 1, which is approximately equivalent to deducting the riskless returns from the returns on equities. DMS categorises 'gilts' into two groups for the purposes of its analysis: shorter-dated 'treasury bills' and longer-dated 'treasury bonds'. The former have maturities of up to ten years, while the latter have an average maturity of 20 years. The difference between 'bond' and 'bill' returns is referred to as the 'maturity premium'.
[13] *Credit Suisse Global Investment Returns Sourcebook* 2016, pp12–15 and p18. The advantage of this approach is also that the larger sample size (ie number of years), increases the accuracy of the estimates – the standard errors of the estimations are reduced, narrowing the confidence interval.
[14] See Ian Cooper (1996), 'Arithmetic versus geometric mean estimators: Setting discount rates for capital budgeting', *European Financial Management*, Vol 2, No 2.
[15] HCA response to Cost of Capital Working Paper, 16 May 2016, paragraph 6.5.

that over a nine-year period, mean returns may be expected to be closer to the arithmetic rather than geometric mean.

29. Table 2 shows the geometric and arithmetic average returns on equities, bonds and bills over the period between 1900 and 2015, together with the historical ERP implied by these returns.

Table 2: Real returns on UK equities and government debt, 1900 to 2015

		%
	Geometric mean	*Arithmetic mean*
UK real returns		
Equities	5.4	7.2
Bonds	1.7	2.6
Bills	1.0	1.2
ERP		
Bonds	3.6	5.0
Bills	4.3	6.0

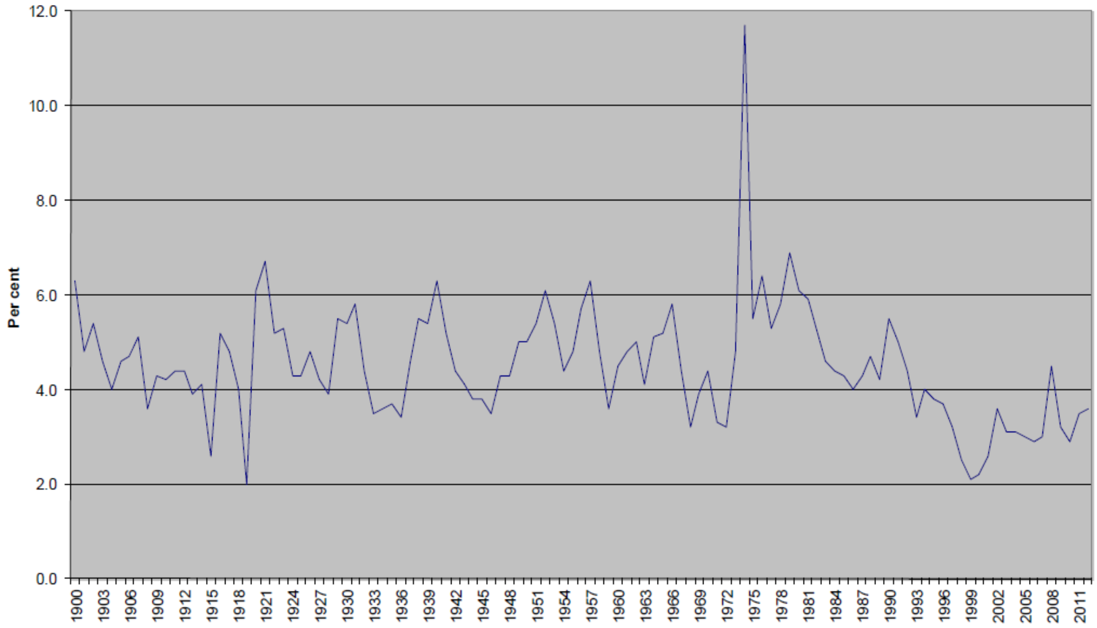
Source*:* Credit Suisse *Global Investment Returns Sourcebook*, 2016, Dimson, Marsh & Staunton.

30. An alternative approach suggested by Fama and French is to estimate the underlying return from the sum of the average dividend yield and the average rate of dividend growth.[16] Using the full run of historical data for the UK, this suggests an underlying market return of 5.5%.[17]

31. Fama and French's work on US securities provides evidence of a fall in expected returns over time, with expected returns being lower since 1950 than before. The statistical evidence for the UK is less extensive[18] but, as illustrated in Figure 3, the dividend yield as of the start of the relevant period (of about 3.5%) was below the historical average (4.5%). Unless future dividend growth is higher than in the past, this would suggest that expected returns are about 1% lower than the past average, implying a market return of about 4.5% (using Barclays data).[19]

[16] E F Fama and K R French (April 2002), 'The Equity premium', *Journal of Finance*.
[17] This result is derived from an average dividend yield of 4.5% and dividend growth of 1% a year (Barclays Equity Gilt Study data).
[18] Two papers that find evidence of a reduction in the expected market return or ERP for the UK (albeit at different times) are N Buranavityawut, M C Freeman & N Freeman, 2006, 'Has the equity premium been low for 40 years?', *North American Journal of Economics and Finance*, 17, pp191–205; and A Vivian (2007), 'The UK equity premium, 1901–2004', *Journal of Business and Financial Accounting*. The first paper suggests that the expected equity premium may have fallen in the 1960s in the UK and other countries, while the second paper suggests that there was a permanent decline in the UK market dividend-price ratio during the early 1990s.
[19] These figures do not take into account payments to shareholders other than dividends, for example share repurchases.

Figure 3: Dividend yield for UK market (Barclays data)



Source: Barclays Equity Gilt study, 2013.

Forward-looking approaches

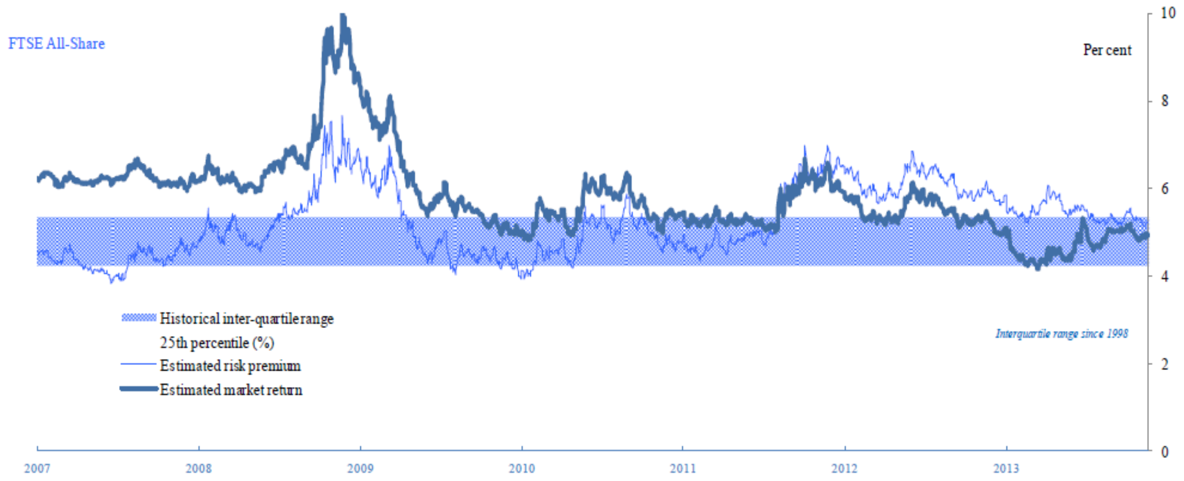
32. The ERP is also commonly estimated using projected dividends from analysts' forecasts (which extend out by four or five years) and a longer-term dividend growth rate. The expected return is then the discount rate at which the present value of future dividends is equal to the current market price. A limitation of this approach is that it is necessary to make an assumption about future long-term growth of dividends (which has a major effect on the calculation since dividends beyond year four or five account for a large part of present value at plausible discount rates).

33. Figure 4 shows estimates of ERP using this methodology published in an article in the *Bank of England Quarterly Bulletin*. These estimates are based on the assumption that the future long-term growth in dividends per share is equal to an estimate of the potential growth of the economy. However, the authors of the article noted that this choice of future long-term growth rate is essentially arbitrary.[20] The estimates in Figure 4 suggest that since 2007 the expected ERP has fluctuated around 5%, towards the upper end of the historical inter-quartile range of between 4.25 and 5.3%.[21] We attempted to calculate the expected market return implied by these estimates of the ERP by adding the yield on zero-coupon ten-year gilts. Calculated on this basis,

[20] M Inkinen, M Stringa and K Voutsinou (2010), 'Interpreting equity price movements since the start of the financial crisis', *Bank of England Quarterly Bulletin*, Q1.
[21] Calculated by the Bank of England based on a longer time series of data between 1998 and 2013.

since the 2008 financial crisis the market return has fluctuated around 6%. It has declined markedly following the financial market turmoil of 2009 to 5% or less. Indeed, the Bank of England's November 2013 *Financial Stability Report* notes rising equity prices, improved earnings expectations, and a fall in equity risk premia towards long-term average levels.[22]

Figure 4: Estimated ERP and approximate implied real market return



Source: Bank of England and CMA calculations.

34. We agree that it is essentially arbitrary to assume future long-run growth in dividends per share equal to potential economic growth. Indeed, we see empirical support for expecting long-run growth in dividends per share to be less than potential economic growth. The historical growth rate in real dividends for the UK from the Credit Suisse/Dimson et al data is only 0.5% and around zero using the Barclays data – this is significantly less than real UK economic growth over the same period (1900 to 2010) of 1.9%.[23] It is also the case that growth in dividends per share has been significantly less than economic growth in more recent periods. Since 1950, growth in dividends per share has been 1.1%, compared with 2.4% for GDP growth, while, since 1980, growth in dividends per share has been 1.6%, compared with 2.3% for GDP growth.[24]

35. Bearing in mind these points and also that analysts' forecasts may be subject to upward bias, we consider that the approximate 5% ERP and 5 to 5.5%

[22] *Financial Stability Report*, p8 and Chart 1.6.
[23] *Credit Suisse Global Investment Returns Sourcebook 2013*, Table 11. SH Williamson (2015), 'Annualized growth rate of various historical economic series'.
[24] A large body of literature suggests that there may be a tendency for analysts' forecasts to overreact to changes and on average to be too optimistic, eg WFM DeBondt and RH Thaler (1990) 'Do security analysts overreact?', *American Economic Review* 80, pp52–57.

market return suggested by Figure 4 are likely to be at the upper end of expected returns.

Our assessment of the ERP

36. HCA argued that an appropriate range for the market return was between 6.0 and 6.5% on the basis that:

(a) the arithmetic mean of 7.2% is more appropriate than a geometric mean of 5.4%;

(b) the CMA is placing too much weight on a low case forecast return of 5.0%; and

(c) the most cited studies, commissioned specifically for regulatory practice, were the so called 'Smithers Reports', the most recent being that of Wright et al, 2006. This most recent Smithers Report suggests an expected EMR range of 6.5% to 7.5% for the Relevant Period.[25]

37. The interpretation of the evidence on market returns remains subject to considerable uncertainty. Historical approaches (ex post and ex ante) indicate a market return of between 4.5 and 7.2%, while forward-looking approaches indicate a market return of between 5 and 6%. In the 2013 NIE determination,[26] we came to the view that the appropriate market return was between 5% and an upper limit of 6.5%. We explained that, in applying the CAPM, we seek to derive the expected return on the market. The 7% upper limit used in previous regulatory inquiries had been based on the approximate historical average realised return. However, we noted that past realised returns were not necessarily the same as the expected return on the market, even over long time horizons, and that attempts to estimate the historical expected ex ante return suggested that this was considerably lower than the realised return.[27] As a result, we concluded that it was appropriate to move away from this 7% upper limit based on historical ex post realised returns and place greater reliance on ex ante estimates derived from historical data that tend to support an upper limit of 6.5%. Therefore, we consider that an

[25] HCA response to WACC working paper, p10, paragraphs 6.4–6.6.
[26] We note that this determination reflects developments in the CMA's approach to estimating WACC over time. We have, therefore, placed more weight on this reasoning than on that set out in the most recent Smithers Report, which was published in 2006.
[27] In addition, we observed that historical returns necessarily incorporate, among others, revisions in expectations for future cash flows and discount rates. DMS (2007) attempted to address this issue directly by decomposing past realised returns. We shared its view that some elements of the return, in particular the historical expansion in valuation ratios, is unlikely to be repeated in the future. Finally, we noted that a forward-looking expectation of a return on the market of 7% did not appear credible to us, given economic conditions observed since the credit crunch in 2008 and lowered expectations of returns.

appropriate range of market returns is between 5 and 6.5%. Together with a real RFR of around 1%, this range implies an ERP of between 4 and 5.5%.

Tax rate

38. The corporation tax rates applicable over the period are set out in Table 3. For the purpose of estimating the WACC, we have used an average of the tax rates over the period of 26%.

Table 3: UK corporation tax rates

%

2006/07	*2007/08*	*2008/09*	*2009/10*	*2010/11*	*2011/12*	*2012/13*	*2013/14*	*2014/15*	*2015/16*
30	30	28	28	28	26	24	23	21	20

Source: HMRC.

Equity beta

39. The beta of an asset measures the correlation between the volatility of the returns on the asset and the returns on the market as a whole, or the exposure of the firm to systematic or 'non-diversifiable' risk. It is in return for assuming this (market) risk that investors require an (equity risk) premium over the risk-free return.

40. The beta value of a listed firm can be directly estimated as the covariance between the stock's returns and the market's returns, divided by the variance of market returns. Within a CAPM framework, changes in gearing affect equity betas. Hence, it is necessary to adjust for gearing differences in order to make comparisons between equity betas. We do this by calculating the asset beta, ie the beta at zero gearing.

41. We have estimated a range of beta values for a stand-alone UK private healthcare operator on the basis of beta information from listed comparable companies (see Annex 1). This group includes some of the parent companies of the private hospital operators active in the UK market. Table 4 provides a summary of our analysis on the beta values of comparable companies.

Table 4: Comparable companies, beta estimates*

Company	*Levered betas*			*Unlevered betas*		
	Weekly	*Monthly*	*Quarterly*	*Weekly*	*Monthly*	*Quarterly*
Netcare	0.66	0.66	0.42	0.44	0.43	0.28
Ramsay	0.46	0.38	0.27	0.37	0.30	0.21
HCA	1.00	1.10	1.51	0.54	0.59	0.81
Lifepoint	0.96	1.06	0.93	0.61	0.68	0.59
Tenet	1.38	2.01	2.76	0.57	0.84	1.15
Rhoen Klinikum	0.44	0.33	0.29	0.35	0.27	0.23
Health Management Associates	0.96	1.05	0.87	0.46	0.50	0.41
Universal Health Services	0.97	1.23	1.12	0.75	0.95	0.87
Community Health Systems	1.38	1.38	1.62	0.47	0.47	0.56
Apollo Hospitals	0.44	0.29	0.46	0.40	0.27	0.41
Fortis Healthcare	0.63	0.78	0.62	0.47	0.58	0.46
Mean	**0.84**	**0.93**	**0.99**	**0.49**	**0.53**	**0.54**

Source: Bloomberg data.
*In response to the WACC working paper, HCA highlighted an error in our calculation of beta values due to the use of incorrect gearing figures. HCA response to WACC working paper, pp7–8, paragraphs 5.2–5.5. We have corrected for this error.
Note: The beta values used were unadjusted (raw) figures calculated in local currencies for the period January 2007 to April 2016. The beta values for HCA, Life Healthcare and Fortis Healthcare were estimated for the (shorter) period from the date of their listing to April 2016. Betas have been unlevered using the statutory tax rates in each jurisdiction.

42. HCA said that in line with recent academic evidence (see Gilbert et al (2014) and Gregory et al (2016)), in HCA's view all weight should be placed on the monthly and quarterly betas, and none on the betas estimated using weekly data. Furthermore, HCA argued that the CMA's data source, Bloomberg, is unreliable as it publishes only the resulting beta estimates and not the underlying analyses that give rise to those estimates.[28]

43. We observe that the frequency of measurement does not, on average, have a significant impact on the beta values, ie the weekly, monthly and quarterly estimates are similar. However, in our analysis, we have placed most weight on the monthly and quarterly beta estimates. This approach follows the research findings of Gilbert et al which show that monthly and quarterly betas are generally more reliable than those estimated on the basis of high-frequency data, ie daily or weekly betas.[29]

44. HCA submitted that the CMA should focus on US-listed comparables as the main source of beta values. HCA put forward the view that a number of these businesses included in Table 4 did not provide suitable beta values for comparison with a stand-alone UK private hospital operator. In particular, HCA argued that:

(a) Netcare, Apollo and Fortis traded in either South Africa or India – HCA argued that these stock exchanges were either thinly traded and/or had a low total market capitalisation and hence were an unreliable source of beta estimates;

[28] HCA response to WACC working paper, p7, paragraphs 5.6 & 5.7.
[29] T Gilbert, C Hrdlicka, J Kalodimos and S Siegal (2014) 'Daily data is bad for beta: Opacity and frequency-dependent betas', *Review of Asset Pricing Studies*.

(b) in countries such as India and South Africa, the ERP was likely to be substantially different from the ERP for the UK. As a result, applying beta estimates from firms listed in India and South Africa to a UK estimate of ERP would not produce reliable results;

(c) the market volatility in these countries demonstrated that the underlying indices used in the beta calculation were highly volatile, suggesting that beta readings for the firms would be misleadingly low; and

(d) for the CAPM to hold in any given market, frictionless market conditions were required. These conditions were unlikely to apply in those emerging markets where significant political risk was present, and where governance and regulatory standards were not the same as in mature markets. This further undermined using firms listed in these markets to estimate beta for a hypothetical, stand-alone UK private hospital operator.[30]

45. HCA told us that our analysis understated the beta for Health Management Associates, which it considered was probably due to the CMA taking beta readings post the acquisition of HMA by Community Health Systems in July 2013.[31] In addition, HCA submitted that we should exclude the quarterly beta estimates for Ramsay and Rhoen Klinikum since these were not statistically robust (ie statistically significant at the 95% level).[32] HCA told us that by excluding emerging market betas, and those which were not statistically significant at the 95% level, the average beta value would be between 0.614 (monthly) and 0.898 (quarterly), with a midpoint of 0.756, ie above the top end of the range set out by the CMA in the WACC working paper.[33]

46. Bupa said that the beta range of 0.5 to 0.7 contained substantial headroom at the top end. Bupa argued that we should have placed more emphasis on the main set of comparable company data presented in Table 4. Bupa said that a more plausible beta range based on the data the CMA present was a range of 0.4 to 0.5. [34]

47. In the 2014 Final Report, we concluded that we should take into account the beta values of all the companies listed in Table 5 of Appendix 6.14 (and in Table 4 above) when coming to a view on the appropriate beta for a stand-alone private hospital operator in the UK.[35] In coming to this view, we noted that we did not agree with HCA's view that the South African and Indian

[30] HCA response to WACC working paper, pp12–14, paragraphs 6.10–6.19.
[31] HCA response to WACC working paper, paragraph 5.9.
[32] HCA response to WACC working paper, paragraph 5.9.
[33] HCA response to WACC working paper, Technical Appendix, p2.
[34] Bupa response to WACC working paper, p4, paragraphs 3.4–3.7.
[35] Final Report, Appendix 6.14, paragraph 44.

markets are too small, illiquid or otherwise underdeveloped to provide reliable beta estimates.[36] Furthermore, we considered that the issue of potential differences between healthcare systems was best addressed by considering a range of operators across a number of countries rather than by focusing exclusively on US-listed stocks, the beta values of which will be influenced by the specific characteristics of the US healthcare market.

48. The updated beta estimates set out in Table 4 give an average asset beta of 0.53 to 0.54 (using monthly and quarterly estimates and including all firms). Excluding HMA's beta values across all estimates (due to its takeover by CHS) and Ramsay's and Rhoen Klinikum's quarterly estimates (as these were not statistically significant), gives a range of asset betas of 0.54 to 0.64. As set out above, we did not agree with HCA that the Indian and South African comparators were necessarily unreliable. However, the range of asset beta values for US firms only (again excluding HMA) is between 0.7 and 0.8. In the 2014 Final Report, we also took into account the beta estimates of the other private hospital operators, which ranged from 0.26 to 0.77, with an average of 0.57.

49. Taking all of this evidence into account, we consider that a range of 0.5 to 0.7 is appropriate for the asset beta in our analysis. The upper end of this range reflects our decision to give somewhat more weight to US firms, which we consider to be a conservative approach.

Gearing

50. In order to come to a view on the appropriate level of gearing for a hypothetical stand-alone UK hospital operator, we have considered the gearing of a number of comparable companies that are listed.

51. Table 5 provides details of the levels of gearing of the listed comparable private hospital operators.

[36] In the Final Report, we observed that the Johannesburg Stock Exchange had an average market capitalisation of US$650 billion over the period, and turned over around 60% of its total market capitalisation each year. Similarly, the Mumbai Stock Exchange had an average market capitalisation of US$550 billion and turned over approximately 26% of its total market capitalisation each year. Appendix 6.14, paragraph 38.

Table 5: Gearing of listed private healthcare businesses

%

	FY07	*FY08*	*FY09*	*FY10*	*FY11*	*FY12*	*FY13*	*FY14*	*FY15*	*AVG*
Netcare	56.2	64.3	55.5	52.5	57.9	55.3	14.1	10.4	14.1	**42.2**
Ramsay	39.9	42.0	37.3	25.6	21.2	18.7	13.4	21.6	18.8	**26.5**
HCA	NA	NA	NA	NA	72.1	67.4	56.0	47.4	51.8	**58.9**
Lifepoint	47.3	54.6	46.5	47.3	48.4	48.3	55.2	40.8	46.6	**48.3**
Tenet	72.4	98.6	65.3	55.7	63.4	62.3	70.6	68.6	73.6	**70.0**
Rhoen Klinikum	24.3	29.1	30.0	33.8	39.6	35.9	21.8	14.1	10.7	**26.6**
Health Management Associates	NA	75.1	88.9	64.6	57.4	67.7	61.5	51.9	51.5	**64.8**
Universal Health Services	25.6	32.1	23.5	46.8	48.0	43.1	28.7	22.6	22.4	**32.5**
Community Health Systems	70.8	85.3	72.4	71.1	82.1	77.0	71.4	72.6	82.5	**76.1**
Apollo Hospitals	19.4	22.1	20.0	14.3	10.3	10.6	9.5	11.5	9.1	**14.1**
Fortis Healthcare	13.2	24.6	64.9	15.9	64.2	54.2	30.4	25.7	17.6	**34.5**
Mean	**41.0**	**52.8**	**50.4**	**42.7**	**51.3**	**49.1**	**39.3**	**35.2**	**36.2**	**45.0**

Source: Bloomberg data.
*N/A = not available.

52. A review of the information on comparable companies indicates that average levels of gearing are between 35 and 55% over the period. Gearing appears to be higher among firms operating in the USA and South Africa than those with activities elsewhere in the world.

53. On the basis of this information, we have used a gearing ratio of 50% in our estimate of the WACC, which is the same as the gearing assumption used in the 2014 Final Report. We note that using a slightly lower level of gearing of 40% does not have a significant impact on our cost of capital estimates.

54. HCA submitted that the gearing ratios set out in our WACC working paper appeared to be incorrect. HCA also made the point that the market value of equity, rather than the book value was the relevant benchmark, since an investor would require a return based on the market value of its invested capital, not the historical book value.[37]

55. We note HCA's point and we have updated our gearing data to reflect the ratio of market value of equity divided by book value of debt.

56. In our analysis we did not allow for debt beta to be greater than zero. We noted that the Bloomberg unlevered betas (see Table 4) were based on a simple formula assuming a debt beta of zero, and for consistency we therefore assumed a debt beta of zero in our calculation of industry WACC. We note also that assuming a small positive debt beta would be unlikely to change materially the industry WACC, providing it was included both in the calculation of unlevered betas for comparator companies and in the calculation of WACC.

[37] HCA response to WACC working paper, p6, paragraphs 5.2–5.4.

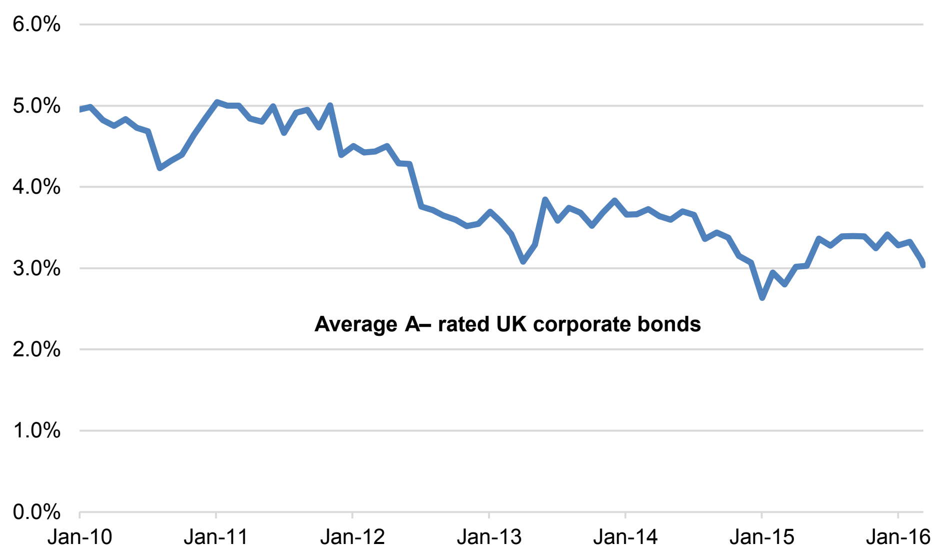
Cost of debt

57. In the 2014 Final Report, we took into account both the effective interest rates paid by the UK-based private hospital operators, which ranged from 5 to 7.5%, and yields on UK corporate bonds, which averaged 6.1% over the 2007 to 2011 period (for a BBB rated bond).[38] On this basis, we concluded that a stand-alone UK private hospital operator would incur a cost of debt of between 5.5 and 7.0%, with the upper end of the range allowing for a stand-alone UK private hospital operator to have a credit rating below BBB.

58. In order to update our analysis, we have considered information on the redemption yields on corporate bonds up to the end of 2015.

59. Figure 5 shows the yield on an index of UK corporate bonds with an average rating of A– between 2010 and 2015. While yields varied from 5 to 3% over the period, with a monthly average of 3.9%, there is an overall downward trend. We note that these yields will be lower than those on BB or BBB rated bonds but that the basic trend is likely to be similar.

Figure 5: BBGID Index, UK corporate bond redemption yields, 2010 to 2015



Source: Bloomberg. The Bloomberg GBP Investment Grade Corporate Bond Index is a rules-based, market-value weighted index engineered to measure investment grade, fixed-rate securities publicly issued in the European bond market and denominated in GBP. To be included in the index a security must have a minimum par amount of £200 million. The index contains 306 different UK corporate bonds with an average rating of A–.

60. During the original investigation, HCA suggested that a stand-alone private hospital operator in the UK would achieve a B or BB credit rating, on the basis of the credit rating of comparable US companies, and hence that – due to a lack of data relating to B and BB rated companies – an additional (0.7%) yield

[38] Final Report, paragraph 52.

should be added to the cost of debt of BBB rated companies to reflect this lower creditworthiness. Table 6 sets out the (updated) credit ratings of a number of private hospital operators.

Table 6: Credit ratings, private hospital operators

	Credit rating				
Company	*Standard & Poor's*	*Fitch Ratings*	*Moody's*	*Others**	*Credit rating agency*
Netcare	-	-	-	A/A1	
Ramsay	-	-	-	-	
HCA	-	B+	Ba2	BB–	Egan-Jones Ratings
Lifepoint Hospitals	BB–	BB	Ba2	-	
Tenet Healthcare	B	BB	Ba2	B–	Egan-Jones Ratings
Rhoen Klinikum	-	-	WR	-	
Health Management Associates	-	WD	WR	B	Egan-Jones Ratings
Universal Health Services	BB+	BBB–	Ba1	BBB+	Egan-Jones Ratings
Community Health Systems	B+	B+	WR	B	Egan-Jones Ratings
Apollo Hospitals	-	AA+	-	AA	CRISIL
Fortis Healthcare	-	-	-	A+	ICRA and CARE

Source: Bloomberg data.
*CRISIL is a subsidiary of Standard & Poor's.
Note: Ramsay did not have a formal credit rating. WR or WD = Withdrawn.

61. The information that we have collected on the credit ratings of private hospital operators in overseas markets is mixed. While the US operators tend to have a BB or lower rating, the South African and Indian groups tend to have a higher credit rating. We note that this analysis shows little change in credit ratings from our previous analysis, therefore, we have no reason to expect the cost of debt to have moved significantly, for this reason.

62. In our WACC working paper, we noted that this analysis indicated that the cost of debt for a stand-alone UK private hospital operator was likely to have declined in the period from 2012 to 2015 by around 1%. Therefore, in our updated analysis, we used a cost of debt of between 5.0 and 6.5% for the period as a whole, ie 0.5% lower than the original range in order to reflect lower financing costs in recent years.

63. HCA submitted that in placing more weight on the most recent evidence the CMA significantly underestimated the cost of debt in the Relevant Period and that this was evident in the CMA's implied debt premium:

(a) Taking into account the CMA's inflation assumption of 3.0% and its real RFR of 1.0%, HCA stated that the implied debt premium in the CMA's cost of debt estimate was 0.9% to 2.4%.

(b) However, the average debt premium for BBB UK firms from 2007 to 2015 was 2.9%.[39]

[39] HCA response to WACC working paper, p16, paragraph 6.22.

64. We observed that combining an average debt premium of 2.9% for BBB-rated bonds with a nominal RFR of 4% would give a cost of debt of around 7%. However, this was above the average UK corporate bond yield of 6.1% for the 2007 to 2011 period, and at the upper end of the cost of debt reported by the private hospital operators over the 2007 to 2011 period. Moreover, as set out in Figure 5, yields have declined further over the last few years. Therefore, in coming to a view on the appropriate cost of debt, we have placed more weight on observed yields (rather than implied premia) and have used a cost of debt of between 5.0 and 6.5% for the 2007 to 2011 period.

Interpretation of the cost of capital

65. Our estimate of the WACC provides a benchmark against which to assess the profitability of the industry. HCA raised issues of interpretation of the WACC during the original investigation. In particular, HCA put forward the view that a single industry WACC would not reflect the cost of capital for its businesses due to its different mix of customers. HCA also put forward the view that the CMA should have reference to the Fama-French model when interpreting its analysis on the cost of equity. The Fama-French model includes both a size and a value factor in its formula for estimating the cost of equity.

66. In relation to the first of these points, in the 2014 Final Report, we concluded that the systematic risk profile, as measured by the beta value, of one private hospital operator in the UK did not differ materially from that of another private hospital operator. This did not mean that there would not be some variation in risks across local markets and customer types but that all private hospital businesses were exposed to systematic risks to broadly the same extent.[40] In the 2014 Final Report, we noted that Fama-French models fail to describe reliably the cross-section of returns in the UK.[41] In the first instance, we noted that the private hospital operators active in the UK were not particularly 'small'. Second, it was not clear that these businesses would necessarily share any (unknown) general characteristics of small firms that would increase their cost of capital due to higher risk. In line with previous CMA decisions, therefore, we did not apply a small company premium in our estimate of the cost of capital.[42]

[40] Final Report, Appendix 6.14, paragraph 60.
[41] See Gregory, Tharyan & Christidis (2011), *Constructing and Testing Alternative versions of the Fama-French and Carhart Models in the* UK, University of Exeter, and Michou, Mouselli & Stark (2008), *On the Information Content of the Fama and French Factors in the UK*.
[42] HCA also estimated a cost of capital using the Fama-French model and US data and comparable companies. Given the sensitivity of the size and value factors to the market for which they are estimated and the use of a small set of companies in a different market, we do not consider that the estimates produced provide reliable information for our cost of capital calculation. See the Bristol Water decision.

67. During the remittal, we have not received any evidence or argumentation from parties in relation to these issues to give us reasons to revisit the conclusions reached in the 2014 Final Report.

68. In its response to the WACC working paper, Bupa made the point that the CMA presented no evidence in the working paper explaining why we believed a WACC of 10.0% was appropriate as the benchmark. Bupa also said that we presented no argument that the range of WACC estimates in Table 1 was 'asymmetric', with estimates towards the top end being more likely than estimates elsewhere in the range.[43] Bupa also said that the WACC was therefore more likely to be around the midpoint (9.0%) than at the more extreme point estimate of 10.0%.[44]

69. In carrying out our WACC analysis, we have considered a range of evidence on RFRs, market returns, beta values, gearing and the cost of debt. In some cases, the evidence that we have collected suggests a broad range of potential estimates and/or depends on judgements as to the appropriate benchmarks. In particular, we note the wide range of asset beta estimates we collected and the potential difficulties associated with drawing inferences from the betas of overseas firms and applying them to the UK market. In this context, and in light of the intrusiveness of the remedy under consideration (divestiture), we consider that it is appropriate to exercise some caution in selecting a single WACC value from within our range. For this reason, in assessing the potential impact of a divestiture remedy, we have considered a range of values between the midpoint of our WACC range (9%) and a figure towards the top of the WACC range (10%).

Other comments on the cost of capital

70. HCA told us that the ERP should always be calculated as the residual of the EMR less the RFR and that it was important that this principle should be applied when converting the ERP into nominal terms, to ensure that the impact of inflation was calculated correctly. The rationale being that within the EMR, *(a)* investors only needed to be compensated once for the impact of inflation on their returns, but *(b)* the inflation adjustment was not a fixed premium – rather it was dependent on the size of underlying real return, to which the inflation adjustment was applied. Therefore, HCA submitted that we should either uplift the EMR as a whole for compound inflation, before deducting the nominal RFR to get the nominal ERP, or uplift the RFR by compound inflation and multiply the ERP by simple inflation, rather than

[43] Bupa response to WACC working paper, p2, paragraph 1.3.
[44] Bupa response to WACC working paper, p3, paragraphs 2.1–2.6.

simply summing the nominal RFR and the ERP. HCA told us that adjusting for this error would result in an increase in the cost of equity of 0.2 percentage points and an increase in the overall WACC of 0.1 percentage points.[45]

71. We considered HCA's submission regarding the means of calculating the ERP. We observed that its proposed approach would make very little difference to the overall level of the WACC – 0.1 percentage points. In our assessment of HCA's profits and the level of customer detriment, we have used a range of WACC figures which is towards the upper end of the range of figures set out in our WACC calculation. In light of the existing judgements contained within our WACC analysis, making a further adjustment for this issue would not lead us to use a different range (from the 9% to 10% range) in our other analysis. Therefore, we have not made further adjustments in this respect.

[45] HCA response to WACC working paper, paragraphs 5.11–5.15.

Annex 1: Beta estimates

1. The table below sets out the beta values of a number of listed private hospital operators.

Beta estimates for listed private hospital operators

	Levered betas					*Unlevered betas*			*Index*
Company	*Weekly*	*Monthly*	*Quarterly*	*Debt/equity ratio*	*Statutory tax rate (%)*	*Weekly*	*Monthly*	*Quarterly*	*against which betas as estimated*
Netcare	0.66	0.66	0.42	0.73	26	0.44	0.43	0.28	JALSH
Ramsay	0.46	0.38	0.27	0.36	30	0.37	0.30	0.21	AS51
HCA	1.00	1.10	1.51	1.44	40	0.54	0.59	0.81	SPX
Lifepoint Hospitals	0.96	1.06	0.93	0.94	40	0.61	0.68	0.59	SPX
Tenet Healthcare	1.38	2.01	2.76	2.34	40	0.57	0.84	1.15	SPX
Rhoen Klinikum	0.44	0.33	0.29	0.36	30	0.35	0.27	0.23	DAX
Health Management Associates	0.96	1.05	0.87	1.84	40	0.46	0.50	0.41	SPX
Universal Health Services	0.97	1.23	1.12	0.48	40	0.75	0.95	0.87	SPX
Community Health Systems	1.38	1.38	1.62	3.19	40	0.47	0.47	0.56	SPX
Apollo Hospitals	0.44	0.29	0.46	0.16	34	0.40	0.27	0.41	SENSEX
Fortis Healthcare	0.63	0.78	0.62	0.53	34	0.47	0.58	0.46	SENSEX

Source: Bloomberg data.
Note: JALSH is the FTSE/Johannesburg Stock Exchange Africa All Share Index, AS51 is the S&P/Australian Securities Exchange 200 Index, SPX is the Standard & Poor's 500 Index, DAX is the Frankfurt Stock Exchange Deutscher Aktienindex and SENSEX is the Standard & Poor's Bombay Stock Exchange SENSEX.

Net present value analysis of the divestiture remedy

1. The NPV analysis is a tool to help us assess the proportionality of a remedy. It seeks to quantify and weigh up the costs and benefits that might arise as a result of the imposition of a remedy, as compared with the counterfactual situation in which no remedy is imposed. As such, the results of this analysis depend on the assumptions that we make as regards both the direct costs and benefits of the remedy, as well as those regarding the counterfactual situation.

2. As set out in Section 12, there are a number of uncertainties around both the likely costs and benefits of a divestiture remedy and the likely counterfactual situation. Given these uncertainties, we have considered a range of scenarios with varying assumptions to understand the potential range of net benefits and costs of imposing a divestiture remedy and to assess the sensitivity of the outcome to differing plausible assumptions. In particular, we estimated the NPV of the divestiture packages at different levels of price benefit and across a range of entry scenarios (in terms of both the timing and impact of entry).

3. In interpreting the results of the analysis, we were mindful of the uncertainties around the assumptions used.

4. We note that our NPV analysis takes into account only the price benefits of divestiture and does not account for any quality and/or innovation benefits that we might expect to result from the dynamic process of rivalry between competing hospital operators, since such benefits are not amenable to quantification. We have considered these potential benefits qualitatively in our overall assessment of proportionality.

5. In this appendix, we set out the submissions and evidence received from parties during the remittal on several of the key assumptions underlying our NPV analysis, our assessment of these arguments, and the results of our NPV analysis.

6. We have considered parties' comments on:

- HCA's loss of economies of scale;
- HCA's transaction and reorganisation costs; and
- Other aspects of our approach to estimating the NPV of divestiture.

Loss of economies of scale

Parties' views

HCA

7. HCA told us that the estimates of the loss of economies of scale used in our analysis, which were those taken (with some modifications) from the Final Report, were no longer appropriate. HCA submitted that the costs in a number of the categories considered by the CMA had increased.[1]

8. HCA supplied updated figures to the CMA for its estimates of the economies of scale it would lose following the divestiture (see Table 1). Depending on whether the divestiture package comprised one hospital (ie the Wellington) or two hospitals (ie London Bridge and Princess Grace), HCA estimated that the loss of economies of scale would be either [✂], respectively.

Table 1: HCA estimates of loss of economies of scale

£ million

Cause of loss of economies of scale	*Divestiture of one hospital (Wellington)*	*Divestiture of two hospitals (London Bridge and Princess Grace)*
Recharged central costs that would need to be covered by HCA's remaining facilities	[✂]	[✂]
Group costs	[✂]	[✂]
Sarah Cannon Research UK	[✂]	[✂]
HCA laboratories	[✂]	[✂]
Total	[✂]	[✂]

Source: HCA estimates.

9. HCA told us that central costs could not, in general, be scaled back in proportion to the divestitures and there was no guarantee that the economies of scale could be replicated fully by a buyer, particularly where that purchaser did not already have a significant presence in the London market.

10. HCA submitted that its economies of scale had increased over time, as it had [✂]. Previous figures provided by HCA related to its 2011 estimate of the economies of scale it would lose following divestiture.

11. In response to our calculations described in the Remittal Supplemental PDR, HCA submitted that the CMA should have used the actual estimate for the loss of scale economies that it put forward in carrying out its NPV calculations, as it considered these estimates to be the most accurate available. HCA said that it undertook a detailed and thorough review of its business, interviewed

[1] HCA response to the Remittal PDR, p5, paragraph 2.15.

all major department heads, and considered clinical and commercial requirements when developing the estimates. HCA submitted that in modifying those estimates, the CMA was making assumptions that ran against commercial reality. HCA said that we have not provided a reasonable basis for our alternative approach, and, therefore, should adopt as our base case the economies of scale losses estimated by HCA. [2]

AXA PPP

12. AXA PPP submitted that we had afforded too much respect to HCA's claims and that we should not include the economies of scale in our NPV analysis, for a number of reasons:[3]

(a) To the extent that some of the overheads related to the administration of the divested facilities, HCA could voluntarily offer to transfer these to the buyer of the divested assets.

(b) HCA's business (in central London, the UK more generally and elsewhere) continued to expand, and it was therefore likely that resources could be reapplied within the business in a short period of time.

(c) The divestiture remedy itself would result in a reduction of market prices, and might therefore be expected to lead to a corresponding increase in demand (over and above the exogenous market growth trend).

(d) To the extent that scale economies were important, this would be likely to have an impact on the identity of the bidder(s) for the divested assets. In particular, organisations that believed that adding the divested assets to their existing portfolios, whether in the UK or worldwide, would, other things being equal, be likely to have a competitive advantage in any divestiture auction, which would be expected to counteract any deemed effect that reduced the price benefit of the divestiture remedy.

13. AXA PPP told us that our approach to economies of scale results in an 'unreasonable' bias in the NPV analysis. AXA PPP told us that there is no more reason to believe that the most likely purchaser would be a small player or new entrant than a larger established player. In AXA PPP's view, a large overseas operator would be able to replicate the economies of scale.[4]

[2] HCA response to the Remittal Supplemental PDR, Annex 2, p1, paragraphs 5 & 6.
[3] AXA PPP response to the Remittal PDR, p11, factor 9.
[4] AXA PPP response to the Remittal Supplemental PDR, p9, section 2.4.

Bupa

14. Bupa told us that there was a clear risk that HCA's estimates of the loss of economies of scale were biased upwards by the desire to inflate costs to prevent the divestiture.

15. Bupa told us that if economies of scale losses are included in the NPV analysis, their quantum must first be discounted at HCA's own cost of capital (9.0% to 10.0%) not the social cost of capital (3.5%). In Bupa's view, using the social cost of capital to estimate the present value of divestment costs overcompensates HCA, and so overstates the costs of the remedy to society. Bupa stated that the appropriate way to enter the economies of scale losses into the NPV analysis is to first discount them at HCA's discount rate to get the lump sum society would need to, in effect, invest (the cost to society) to release the full benefit. Second, we could spread that lump sum amount across the 20 years as an annuity using the social cost of capital. In Bupa's view, in this way, both the benefits and costs of the divestment would be reflected from the point of view of society (and using the social cost of capital in line with the Green Book) but HCA as a private company would not be overcompensated. [5]

Our assessment

16. We considered the following aspects of economies of scale:

- How to incorporate them in the NPV calculation
- Estimates of HCA economies of scale

17. We consider the parties' submissions on whether any lost economies of scale should be incorporated into our NPV in Section 12.

Incorporating economies of scale in the NPV calculation

18. Having established that economies of scale were a relevant consideration to our proportionality assessment (see Section 12), we considered how they should be incorporated in our NPV calculation, including how they should be treated over time, which discount factor to use, and estimates of relevant costs to include.

[5] Bupa response to the Remittal Supplemental PDR, p19, paragraphs 3.11 & 3.14.

Treatment over time

19. We considered whether any loss of economies of scale should be tapered off over time and whether they would continue after entry takes place in central London.

20. In the first instance, we noted that while HCA's business may continue to expand, with resources 'reapplied within the business' in a relatively short space of time, we did not agree that this would necessarily reduce the impact of the loss of economies of scale from the point of view of our cost-benefit assessment. To the extent that market growth allows HCA (and other operators) to realise further economies of scale in the future, we consider that this effect is independent of our divestiture remedy. Therefore, while future growth might allow HCA to reduce its unit costs to the same level as currently, there would still be an impact as, in the counterfactual situation (of no divestiture remedy), HCA's unit costs (and prices) may have fallen further as a result of this same growth. While we would expect the potential for achieving (further) scale economies to decline at some stage, we do not have any evidence to suggest when this point may be reached. On this basis, while noting the uncertainty, we concluded that any loss of economies of scale should be modelled on a constant basis over the 20-year period, rather than tapering off.

Relevant discount rate

21. We note Bupa's comments in relation to the discount factor that we should use to discount the loss of economies of scale. Although we found that an efficient private hospital operator WACC is between 9.0% and 10.0%, which is higher than the HMT social cost of capital of 3.5%, our analysis takes into account the loss to customers resulting from the loss of economies of scale (in the form of higher prices) rather than the loss to HCA. Therefore, we find it appropriate to discount them at the social cost of capital rather than our WACC estimate.

Estimating HCA economies of scale

22. In terms of the potential size of any loss of economies of scale, we took HCA's estimate of £[✂] a year (which is based on divesting one hospital only) as the starting point of our analysis. We assumed that, faced with the choice whether to divest one or two hospitals, HCA would choose the least costly and least intrusive package. Therefore, we analysed in detail the lower end of the scale proposed by HCA. We carefully considered HCA's assumptions and estimates and we decided that, in certain areas, costs should be further reduced from HCA's assumed levels. Table 2 sets out HCA's views on the

likely loss of economies of scale following a divestiture, as well as our reasoning and conclusions on reasonable values to include in our NPV analysis. Our analysis suggests that divestiture of the Wellington Hospital would be the least costly and least intrusive package, and that the best estimate of loss of economies of scale for this divestiture package is £13.0 million. We have therefore carried out the NPV analysis assuming the divestiture of the Wellington hospital. The costs of divestiture of the London Bridge and Princess Grace hospitals would be higher (estimated by HCA to be £[✂]), thus reducing the estimated benefit of divestiture.

23. We note that the NPV figures would be lower if we were to take into account the upper range of HCA's estimate of economies of scale loss of £[✂] for the London Bridge and Princess Grace Hospitals. The £[✂] loss of economies of scale related to the divestiture of the Wellington Hospital.

Table 2: Loss of economies of scale

<table>
<tr><th>Area/function</th><th>HCA view</th><th>CMA view</th></tr>
<tr><td>Estates</td><td>This category also includes fixed costs relating to Head Office buildings which cannot be reduced following divestiture.</td><td>We agreed that costs relating to the Estates team could not be reduced further post divestiture.</td></tr>
<tr><td>Central services</td><td>The costs of many of these group-level departments are expected to remain unchanged, or could not be fully reduced in proportion to lost revenues, following the proposed divestitures given that the work performed at group level (rather than hospital level) would not significantly change, if at all.</td><td rowspan="3">We agreed that in areas where the business function is performed by a small number of staff (ie 1 or 2) across the whole of HCA, these costs could not be reduced further from HCA’s estimates.

However, where HCA employs larger teams, we would expect that excess administrative staff could be reduced by between 50% and 100% across all the other functions.

Any excess staff relating to group functions, such as Payroll, Administration, Insurance Contracting, Debt Recovery, Corporate Finance, Financial Accounts and Account Payable would either be transferred to the purchaser of the divestiture business or made redundant. Therefore, we have reduced HCA’s estimate of the loss of economies of scale across central services, group functions and quality assurances teams by 50%.</td></tr>
<tr><td>Group functions</td><td>The costs typically relate to functions relating to the group, or work conducted across insurers and suppliers rather than on an individual facility basis, and as such the workload for these staff is unlikely to decrease materially post divesture.</td></tr>
<tr><td>Quality Assurance Teams</td><td>Given that the roles would still need to be performed for the remaining HCA facilities and the group-level functions within their roles would be unchanged, HCA considers that the costs associated for the large majority of these teams would not be reduced following the proposed divestiture.</td></tr>
<tr><td>Group costs</td><td>These costs relate to the direct running of HCA’s headquarters and do not include services that are scalable at a hospital operation level.</td><td>We agreed that costs relating to the unrecoverable group costs could not be reduced further post divestiture.</td></tr>
<tr><td>HCA labs</td><td>HCA considers that even though the volume of tests overall may be reduced, it would still need to provide a similar level of service, therefore, would not be able to scale back its costs proportionately to the reduced volume. However, some cost reductions could be made.</td><td>We believe that HCA could make some cost reduction post divestiture (such as staff and other expenditure), albeit some other costs will be fixed (such as plant and machinery). We consider that approximately 50% of these costs could be reduced by scaling back the operation.</td></tr>
<tr><td>Sarah Cannon Research</td><td>Given the importance of SCRUK to HCA’s commitment to improving patient outcomes, it would not consider scaling back this operation.</td><td>We believe that HCA could scale back this operation if the volume of patients treated declined significantly post divestiture. HCA did not provide any evidence as to why it could not do so.</td></tr>
</table>

Source: HCA submission and CMA analysis.

24. As set out in Table 2, in some cases, we have included HCA's full estimate of its loss of economies of scale, while in other cases, we have reduced the estimate by between 50% and 100% (in the case of Sarah Cannon Research). We note that this assessment involves a number of assumptions over which there is some degree of uncertainty. As a result, we consider the results to be indicative rather than precise estimates of the likely loss of economies of scale. The table below summarises our assumptions in relation to the loss of economies of scale, which form our central estimate for the purposes of our NPV analysis.

Table 3: Loss of economies of scale

		£ million
	HCA	*CMA*
Recharged costs – estates	[✂]	[✂]
Recharged costs – central services	[✂]	[✂]
Recharged costs – group functions	[✂]	[✂]
Recharged costs – quality assurance teams	[✂]	[✂]
Group costs	[✂]	[✂]
Variable costs – HCA labs	[✂]	[✂]
Sarah Cannon Research Institute UK	[✂]	[✂]
Total	[✂]	**13.04**

Source: CMA analysis.

25. As a result, our best estimate of the likely loss of economies of scale due to divestiture of the Wellington hospital is £13.0 million.

26. In relation to AXA PPP's comments in paragraph 12, we agree that some overheads relating to the administration of the divested asset would be transferred to the buyer. However, there are other head office costs which cannot be disaggregated and therefore transferred on. We discuss these in Table 2 above.

Transaction and reorganisation costs

Parties' views

HCA

27. HCA provided an updated estimate of transaction costs during the remittal. HCA's estimate is that these costs would now be between a low of £[✂] (if it were to divest the Wellington Hospital to one buyer) and a high of £[✂] (if it were to divest the London Bridge and Princess Grace Hospitals to two separate buyers), comprising Merger & Acquisition (M&A) fees of between £[✂] and £[✂], legal fees of between £[✂] and £[✂] and due diligence fees and tax structuring advice fees of between £[✂] and £[✂]. HCA suggested that we should use the upper end of the range (ie £[✂]). In addition, HCA put forward the view that we should take into account the costs incurred by a

purchaser of the hospitals, which it estimated at between £[✄] and £[✄] (including debt arrangement fees and political adviser fees for the buyer), giving total transaction costs of between £[✄] and £[✄].[6]

Private medical insurers

28. AXA PPP told us that whereas scale economies, if they could not be regained, might impact on pricing on a forward-looking basis, and hence impact consumers, the transaction/reorganisation costs were one-off fixed and sunk costs that would not affect forward-looking pricing. They were merely a loss of producer surplus from a firm that had enjoyed – over a sustained period of time – returns significantly above the cost of capital (even excluding capital gains), and whose market position constituted an AEC. Therefore to accord significant weight to these in determining the outcome of the investigation was, in AXA PPP's view, misguided.[7]

29. Bupa told us that it had significant concerns that the divestiture costs included in the NPV analysis were overstated and, more importantly, that the economic effects that these costs had on prices were overstated. In Bupa's view, there was a significant risk that the CMA's current approach would simply reward and protect HCA's inefficiency at the cost of continued detriment to consumers.[8]

30. Bupa also noted that the £8 million of reorganisation costs were not submitted by HCA, but were assumed by the CMA. Bupa was concerned that these costs were unsupported by evidence that they were necessary or appropriate in size.

31. Bupa said that it was perverse in the modelling that including these one-off costs to HCA apparently reduced the benefit to consumers from the divestiture, even though they contributed substantially to 'condemning' consumers to a continued AEC in future.

Our assessment

32. In response to AXA PPP's points in paragraph 28, we considered that transaction costs are one-off costs that are only incurred as a result of the divestiture. Our view is that, although we would not expect them to have an impact on prices in the future, they should be netted off against the benefits of

[6] HCA response to the Remittal PDR, p56, paragraph 7.47.
[7] AXA PPP response to the Remittal PDR, p10, factor 8.
[8] Bupa response to the Remittal PDR, pp35 & 36, paragraphs 3.71–3.82.

divestiture. HCA and the potential buyer would not incur those costs if it were not for the divestiture. Therefore, we considered that the right treatment of those costs is to include them in the NPV calculation. This is consistent with the position set out in our published guidance.[9]

33. In response to Bupa's points, we analysed the costs presented by HCA and reduced, wherever reasonable, the quantum of those costs to a level where we considered the costs to be realistic. We left out of our calculation costs that we did not consider to be reasonable, such as political adviser costs and debt arrangement costs.

34. We considered HCA's arguments concerning the transaction and reorganisation costs caused by divestiture which should be included in the NPV analysis.

35. Consistent with the approach that we have adopted in estimating the loss of economies of scale, we have assumed that HCA would choose the least costly divestiture, ie that of the Wellington hospital. Therefore, in relation to most of the transaction costs, we have taken the lower end of the range given by HCA. We reviewed the transaction cost figures submitted by HCA and made the following adjustments:

(a) We took the lower point of HCA's estimates for M&A fees of £[✄], equating to approximately [✄]% of the property value and consistent with our understanding of average fees charged by financial advisers for transactions of this nature.

(b) For legal fees, we took the middle points of HCA's ranges, of [✄] for HCA and £[✄] for the buyer. We deviated from our approach of using the lower bound estimate as we considered that these may understate the actual legal costs that HCA was likely to incur on the sale of a hospital of the size of the Wellington.

(c) For due diligence fees, we took the lower bound of HCA's range to cover both the buyer and HCA.

(d) We did not include the political adviser fees as we did not consider that either vendor or purchaser would need to incur such costs.

(e) We also did not include the debt arrangement fees from the buyer's estimate as we consider that the buyer might pay for the property from existing cash reserves.

[9] *CC3*, paragraph 352.

36. These adjustments (detailed in Table 4 below) give us an estimate of approximately £9.4 million of fees to be incurred by the buyer and the seller (HCA) combined, in the event of HCA divesting the least costly, least intrusive package (ie the Wellington hospital).

Table 4: Transaction costs of a divestiture remedy*

£ million

	Low	*High*	*CMA estimate*
To HCA			
M&A/Corporate Finance	[✂]	[✂]	[✂]
Financial, Tax, IT and Pension DD	[✂]	[✂]	[✂]
Clinical/Commercial/Quality/Governance DD	[✂]	[✂]	[✂]
Tax Structuring	[✂]	[✂]	[✂]
Property Valuations	[✂]	[✂]	[✂]
Political Adviser	[✂]	[✂]	[✂]
Legal Fees	[✂]	[✂]	[✂]
Total	[✂]	[✂]	[✂]
	[✂]	[✂]	[✂]
To acquirer	[✂]	[✂]	[✂]
M&A/Corporate Finance	[✂]	[✂]	[✂]
Debt arrangement fees	[✂]	[✂]	[✂]
Financial, Tax, IT and Pension DD	[✂]	[✂]	[✂]
Clinical/Commercial/Quality/Governance DD	[✂]	[✂]	[✂]
Tax Structuring	[✂]	[✂]	[✂]
Property Valuations	[✂]	[✂]	[✂]
Political Adviser	[✂]	[✂]	[✂]
Legal Fees	[✂]	[✂]	[✂]
Total	[✂]	[✂]	**4.60**

Source: CMA analysis.
*Assuming HCA divests the Wellington Hospital.

37. In addition to the transaction costs discussed above, we thought that redundancy (and reorganisation) costs would also be incurred as a direct result of our divestiture remedy and the need to reduce the central business functions to reflect the smaller size of the business. In response to Bupa's response to the Remittal PDR,[10] we note that this figure is approximate and was based on the submissions of another party in the original investigation. However, this estimate does not have a material impact on the overall NPV figures as it is a one-off cost. HCA submitted that our estimate would be at the low end of the spectrum. In the Remittal PDR we assumed that £8 million would be spent on reorganisation costs.

Other aspects of our approach to estimating the NPV of divestiture

38. In addition to the submissions set out above and in Section 12, the parties also raised a number of more detailed points regarding our approach to estimating the NPV of divestiture. We summarise these, by topic, below and assess them in paragraphs 46 to 53.

[10] Bupa response to the Remittal PDR, paragraph 3.72.

Growth of the central London market

39. AXA PPP told us that the private healthcare market in central London was growing and this scaled up the revenues to which the price benefit should be applied.[11]

40. Similarly, Bupa told us that we should grow revenue year-on-year going forward for the NPV analysis, not just focus on 2015 revenues.[12]

41. In relation to past growth, HCA argued that its revenues have been driven by output expansion (by continuing to attract more patients and attracting patients for more complex procedures, including by opening new facilities and offering innovative services) rather than by price increases. HCA also said that, as our assessment of potential benefits from a divestment is based on an assessment of HCA's excess profitability, it is unrealistic to apply a growth rate to HCA's revenues going forward, but not to consider likely changes to its cost base associated with providing services to those patients.[13]

Scope of price impact

42. AXA PPP submitted that the CMA appeared to have applied the price benefit of the remedy only to the (pre-divestiture) HCA assets, as opposed to the market as a whole. Since HCA's share of the central London market was a little below 50%, in AXA PPP's view the CMA had applied the price benefit to less than half the market.[14]

43. Bupa submitted that there appeared to be discrepancies in the revenue figures used in the CMA's analysis, with price benefits only being applied to £[✂] million of revenues (relating to UK patients in central London). Bupa noted that other sources indicated that total revenues from UK patients were around £[✂] million and that over [✂]% of HCA's total revenues were earned in central London. It suggested that that CMA's approach of applying the price benefits to only [✂]% of HCA's revenues may result in an understatement of the benefits of divestiture. [15]

[11] AXA PPP response to the Remittal PDR, section 3.
[12] Bupa response to the Remittal PDR, pp26–41, paragraphs 3.17–3.110.
[13] HCA response to the Remittal PDR, Annex 2, paragraphs 37 & 38.
[14] AXA PPP response to the Remittal PDR, section 3.
[15] Bupa response to the Remittal Supplemental PDR, p39, paragraphs A35–A38.

Timing of price benefits

44. Bupa submitted that it was unnecessarily conservative to assume that no price benefits would accrue to insured patients for 18 months after divestiture and that the CMA could simply mandate that HCA and insurers came to terms more quickly. Bupa told us that this would add approximately £[✄] million to the expected value of divestiture in each year.[16] Bupa told us that a range of benefits that would flow from the divestitures was not taken into account in our analysis – ie price effects across the market, reduced deadweight loss for consumers, quality & innovation benefits and benefits to international patients (cheaper tariffs).[17]

45. HCA said that the CMA did not take into account the impact of further litigation on the date at which divestiture would occur. A conservative estimate would be that a divestiture would be delayed by at least 12 months, commensurately shortening the period over which any benefits would be realised before expected entry.[18]

Our assessment

46. First, we considered the various submissions regarding the treatment of market growth going forward. We agree with Bupa and AXA that the central London private healthcare market is likely to continue to grow and that we should reflect this in our NPV analysis. The latest LaingBuisson report states that as a whole, the sector has grown by around 8% per year (in current terms) since 2006. LaingBuisson highlights that this revenue growth has resulted, at least in part, from an increase in the acuity of treatments offered by private hospitals in central London, with the volume of patients treated remaining broadly static over the period.[19] As our NPV analysis is in real terms, we consider that it should seek to reflect expected growth in revenues resulting from either an increase in the volume of patients treated or an increase in the acuity of services provided but should exclude revenue growth that was the result of inflation. We are not aware of any reliable long-term forecasts of growth for the private healthcare market and note that this would be influenced by a broad range of factors. However, we consider that real growth might be expected to be lower in the future than in the past as private hospitals have, in recent years, sought to 'catch up' with the NHS in terms of the range and acuity of services provided. In this context, we noted that AXA PPP suggested a market growth rate of 2%.We reasoned that, even

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[16] Bupa response to the Remittal Supplemental PDR, p38, paragraphs A27–A30.
[17] Bupa response to the Remittal Supplemental PDR, pp26-41 paragraphs 3.17–3.110.
[18] HCA response to the Remittal PDR, p9, paragraphs 2.12 & 2.13.
[19] LaingBuisson's Healthcare Market Review, published 8 March 2016, p xvii.

accounting for inflation of around 3%, past growth had significantly exceeded the 2% forecast level suggested by AXA PPP. As a result, we have included an assumed a constant growth rate of 3.5% a year (in real volume terms) over the next 20 years, which is approximately halfway between the historical rate of growth (of approximately 5% in real terms) and the rate forecast by AXA PPP.

47. We did not agree with HCA's submission that it was unrealistic to apply a growth rate to HCA's revenues going forward, but not to consider likely changes to its cost base associated with providing services to those patients. Our assumption regarding market growth takes into account the fact that as either the number of patients or the complexity of services offered increases, there will be a proportionate increase in customer detriment. We recognise that, in reality, growth in the market may lead to an increase in customer detriment that was either more or less than proportionate to the overall real growth. However, we did not have any basis for making such an assumption. We concluded that making further assumptions regarding changes in HCA's cost base would result in unnecessary complexity and spurious accuracy in the NPV estimates.

48. Next, we considered AXA PPP's submission on the scope of any price benefit. We do not consider that we should assume that any price benefit would apply to the whole market. As set out in Section 12, we have not been able to model the price-setting process in a way that allows us to make predictions regarding how much prices might be expected to change in response to additional competition. We have made a simplifying assumption that, following divestiture, we expect that HCA's price will fall towards the competitive level, but we do not have any basis to assume that the prices of HCA's competitors will also decrease following divestiture.

49. Finally, we considered AXA PPP's submission that a reduction in prices would increase growth over and above the exogenous trend in the market. We agree that this could be the case. We note that the size of this effect will depend on the extent to which a divestiture is successful in lowering prices and the price elasticity of demand, which, for insured patients, depends on the extent to which lower prices are passed on to final customers and on the extent to which this increases demand for PMI. We have not sought to quantify these effects since we consider that it would be difficult to do so reliably. However, we recognise that our NPV estimates may (slightly) understate the net benefits of a divestiture remedy to the extent that this effect is not already included within the 3.5% market growth assumption.

50. Similarly, we note Bupa's submission on the quality impacts of divestiture and we agree that other potential benefits will flow from the divestiture. The NPV

estimate of divestiture does not account for any quality and/or innovation benefits that would result from the dynamic process of rivalry between competing hospital operators. We have considered the impact of such benefits in our qualitative assessment in Section 12.

51. We have considered the parties' submissions regarding the inclusion / exclusion of outpatient revenues in Section 12. We noted Bupa's submission (paragraph 43) regarding the revenues to which we applied the estimated price benefits. While we recognise that there are some discrepancies in the disaggregated revenue figures provided by HCA in response to CMA data requests, these predominantly related to revenues earned from overseas patients (which are excluded from our analysis) rather than UK patients. Once 'irrelevant' revenues (ie those earned outside central London, from overseas patients and those earned from non-hospital activities) are excluded, the difference in the revenue figures provided by HCA for self-pay and insured patients in central London is approximately £[✄] million in the context of total relevant revenues of around £[✄] million, ie around 1%. We did not consider this difference to be material and have not, therefore, made any further adjustments.[20]

52. In response to HCA's submission regarding litigation, we noted that we did not consider it appropriate to take into account the impact of litigation on the time frames when considering the costs and benefits of imposing a remedy.

53. Finally, we considered Bupa's point regarding the timing of insured price benefits. However, as set out in the Final Report,[21] we considered that it would be necessary to require the insurers to roll over their existing contract terms with the divested hospitals for a period of 18 months from the date of divestiture, while permitting a shorter period by mutual agreement. In choosing this 18-month period, we sought to balance the need to prevent disruption to patients and to enable HCA to receive an appropriate market value from the sale by obviating the risk of losing insurer recognition, against the desire to ensure that competitive constraints were increased as soon as possible to remedy the AEC. Therefore, we have not changed this assumption.

[20] We noted that the £[✄] million revenue figure referred to by Bupa includes around £[✄] million of primary care revenues and a further £[✄] million of non-central London revenues, such that around £[✄] million relates to private hospital revenues earned from UK patients in central London.
[21] Final Report, paragraph 11.181.

NPV analysis

54. This section sets out the assumptions that we have used in carrying out our NPV analysis, as well as the results of that analysis.

Assumptions used in NPV analysis

55. Our NPV analysis brings together the costs and benefits of the proposed divestiture remedy. We have made a number of assumptions in estimating the NPV of our divestiture remedy including:

(a) In the 2014 Final Report we used a WACC of 10.0% as our benchmark for assessing the extent of HCA's excess profits. This was towards the upper end of our range of WACC estimates. As set out in Appendix I, the midpoint of our WACC range is 9.0%. During this remittal, we have considered a range of values in our analysis of between 9.0% (the mid-point) and 10.0% (towards the upper end of the range). We consider that this, slightly conservative approach, is appropriate in light of the uncertainties over the appropriate WACC value, and the intrusive nature of the remedy under consideration. Therefore, for the purposes of our NPV analysis, the range of potential benefits considered is 3.0% to 7.5%.[22]

(a) The one-off costs of divestiture are approximately £17.4 million for HCA. We reasoned that the transaction costs (£9.4 million) would be incurred in the first year (this figure has increased from the previous £8.0 million in the Remittal PDR NPV analysis), while the reorganisation costs (£8.0 million) would be incurred equally across the first two years following divestiture (50% in year 1 and 50% in year 2).

(b) The loss of economies of scale is zero in our low economies of scale case for all years, £13.0 million per year in our central estimate scenarios and £[✄] per year in our high economies of scale case.

(c) The price benefit of divestiture, for our central estimate Scenario 1, is assumed to reduce to 25% (ie 75% reduction from pre-new entry level) following new entry. The central estimate Scenario 2 assumes a 100% and the central estimate Scenario 3 assumes a 50% reduction, respectively, in the year of entry which stays at that level for the remainder of the 20-year period.

[22] See Appendix I for more details.

(d) We assume that new entry which reduces the price benefit of divestiture could occur in either year 5, year 7, year 10 after divestiture (ie 7, 9 or 12 years from now) or does not occur at all by year 20.

(e) We apply the price reduction to year-end 2015 HCA revenues for UK patients only (both insured and self-pay) across inpatient, outpatient and day-case treatments.

(f) We assume market growth of 3.5% a year post 2015.[23]

(g) We assume that self-pay benefits will occur immediately after divestiture, whereas insured benefit will lag by 18 months.

(h) All NPV figures are calculated over a 20-year period.

(i) We have used a discount rate of 3.5%, in line with the HM Treasury Green Book[24] approach.

56. Given the uncertainties surrounding the assumptions underlying our NPV analysis, we ran three scenarios and one sensitivity on the potential loss of economies of scale and price reduction in our NPV analysis. Specifically we considered the following:

(a) Central estimate: the loss of economies of scale is constant every year at £13.0 million for the next 20 years;

(i) Scenario 1: we assume that after new entry takes place, competitive pressure on HCA would result in its prices falling by 75% of the difference between its current price level and the level at which it would make normal profits.

(ii) Scenario 2: we assume that after new entry takes place, competitive pressure on HCA would result in its prices falling to the level at which it would make normal profits.

(iii) Scenario 3: we assume that after new entry takes place, competitive pressure on HCA would result in its prices falling by 50% of the difference between its current price level and the level at which it would make normal profits.

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[23] The growth applies to self-pay and insured patients, although we do not recognise the price benefits to insured patients in the first 18 months post divestiture. We note that HCA revenues will continue to grow from their 2015 level during these 18 months.

[24] The Green Book – HM Treasury guidance for public sector bodies on how to appraise programmes or projects.

(b) Low economies of scale case: there is no loss of economies of scale and once new entry takes place competitive pressure on HCA would result in its prices falling by 75% of the difference between its current price level and the level at which it would make normal profits.

(c) High economies of scale case: the loss of economies of scale is constant every year at £[✄] for the next 20 years and once new entry takes place competitive pressure on HCA would result in its prices falling by 75% of the difference between its current price level and the level at which it would make normal profits. We note that using HCA's upper bound estimate of £[✄] (for the divestiture of London Bridge and Princess Grace Hospitals) would yield a much lower NPV.

57. In our view, these three factors (treatment of economies of scale, price impact of divestiture and assumed year of entry) are the key determinants of the calculated NPV of divestiture, but are also the factors with the greatest uncertainty. The NPV tables therefore indicate the range of NPVs of the divestiture option that can be calculated under plausible assumptions.

58. In addition, as we set out in our Final Report, we consider that the hospital performance (or quality) information remedy imposed after the original investigation is expected to reduce prices, irrespective of whether there is a divestment. While it is not possible to estimate the precise impact of such remedies with any certainty, we took the view at the time of the Final Report that it was reasonable to assume a reduction in prices up to 1%. While we have not made any adjustment for the effect of such remedies in our revised NPV analysis, given the uncertainty about the precise impact of such remedies, we note that the exclusion of this effect means that our estimates of net benefit resulting from a divestiture remedy are likely to be overstated. Taking this factor into account, in the tables below we show the price benefit of a divestment in the range of 2.0% to 7.5% to account for the information remedy of up to 1% reduction.

Results of revised NPV analysis

59. The tables below show our estimates of the likely impact on revenues of the divestiture of HCA's hospital under our central estimate Scenarios 1, 2 and 3, low economies of scale case and high economies of scale case.

60. The tables show the NPV of divestiture under various assumptions. Each column shows the date at which entry becomes effective in constraining HCA's prices. For example, if entry takes place in year 5 and HCA's economic profits are currently 4% above the competitive level, the expected NPV of divestiture under our central estimate Scenario 1 is –£[✄]million.

61. Our central estimate Scenario 1 (which assumes that entry removes 75% of HCA’s profits in excess of its cost of capital), gives a range of NPV estimates of between –£[✂]million and £[✂]million. Under this central estimate Scenario 1, there are both various scenarios based on plausible assumptions in which divestiture will result in a net benefit, and various scenarios based on plausible assumptions in which divestiture will result in a net cost (that is, negative NPV). For example, if entry were to happen within seven years of divestiture taking place (ie within nine years from the date of this report), HCA’s prices would need to exceed the competitive level by just under [✂]% for divestiture to result in a net benefit.

Table 5: Central estimate Scenario 1 (entry removes 75% of price benefit)

		Year of entry / year when entry reduces the price impact of divestiture			
	£m	*5*	*7*	*10*	*20*
	2.0%	([✂])	([✂])	([✂])	[✂]
	2.5%	([✂])	([✂])	([✂])	[✂]
Extent to which HCA’s prices exceed the competitive level	3.0%	([✂])	([✂])	([✂])	[✂]
	3.5%	([✂])	([✂])	[✂]	[✂]
	4.0%	([✂])	([✂])	[✂]	[✂]
	4.5%	([✂])	[✂]	[✂]	[✂]
	5.0%	([✂])	[✂]	[✂]	[✂]
	5.5%	[✂]	[✂]	[✂]	[✂]
	6.0%	[✂]	[✂]	[✂]	[✂]
	6.5%	[✂]	[✂]	[✂]	[✂]
	7.0%	[✂]	[✂]	[✂]	[✂]
	7.5%	[✂]	[✂]	[✂]	[✂]

Source: CMA analysis.
Note: The table shows the NPV associated with each level of excess prices and each potential entry point. These figures take into account a £13 million loss of economies of scale in each year.

62. The table below shows our central estimate Scenario 2. In this case, we assumed that new entry would reduce HCA’s prices to the level where it made returns in line with its cost of capital. In this case, the NPV of divestiture would be negative if entry were to take place within five years of divestiture (ie seven years from the date of this report) regardless of the extent to which HCA’s prices currently exceed the level at which it would make normal returns. If HCA’s economic profits were currently 4% above the competitive level, with divestiture reducing these to the level where HCA made returns in line with its cost of capital and entry happened in year 10 (following divestiture), the expected NPV of divestiture under our sensitivity case is £–[✂]million.

Table 6: Central estimate Scenario 2 (entry removes 100% of price benefit)

		Year of entry / year when entry reduces the price impact of divestiture			
	£m	*5*	*7*	*10*	*20*
Extent to which HCA's prices exceed the competitive level	2.0%	([✂])	([✂])	([✂])	([✂])
	2.5%	([✂])	([✂])	([✂])	[✂]
	3.0%	([✂])	([✂])	([✂])	[✂]
	3.5%	([✂])	([✂])	([✂])	[✂]
	4.0%	([✂])	([✂])	([✂])	[✂]
	4.5%	([✂])	([✂])	([✂])	[✂]
	5.0%	([✂])	([✂])	[✂]	[✂]
	5.5%	([✂])	([✂])	[✂]	[✂]
	6.0%	([✂])	([✂])	[✂]	[✂]
	6.5%	([✂])	([✂])	[✂]	[✂]
	7.0%	([✂])	([✂])	[✂]	[✂]
	7.5%	([✂])	[✂]	[✂]	[✂]

Source: CMA analysis.

63. The table below shows our central estimate Scenario 3. In this case, we assumed that new entry would remove 50% of HCA's profits in excess of its cost of capital. In this case, the NPV of divestiture would be negative if entry were to take place within seven years of divestiture and the extent to which HCA's prices currently exceed the level at which it would make normal returns is at the lower end of our range (ie 3%).

Table 7: Central estimate Scenario 3 (entry removes 50% of price benefit)

		Year of entry / year when entry reduces the price impact of divestiture			
	£m	*5*	*7*	*10*	*20*
Extent to which HCA's prices exceed the competitive level	2.0%	([✂])	([✂])	([✂])	[✂]
	2.5%	([✂])	([✂])	([✂])	[✂]
	3.0%	([✂])	([✂])	[✂]	[✂]
	3.5%	[✂]	[✂]	[✂]	[✂]
	4.0%	[✂]	[✂]	[✂]	[✂]
	4.5%	[✂]	[✂]	[✂]	[✂]
	5.0%	[✂]	[✂]	[✂]	[✂]
	5.5%	[✂]	[✂]	[✂]	[✂]
	6.0%	[✂]	[✂]	[✂]	[✂]
	6.5%	[✂]	[✂]	[✂]	[✂]
	7.0%	[✂]	[✂]	[✂]	[✂]
	7.5%	[✂]	[✂]	[✂]	[✂]

Source: CMA analysis.

64. Furthermore, if the extent to which HCA's prices exceed the level at which it would make normal returns is at the bottom end of our range (3%) and the information remedy results in a fall in prices of 1%, the NPV of divestiture is net negative or very small positive in all three central estimate scenarios, regardless of whether there is new entry within the 20 years following divestiture.

65. In the high economies of scale case (table below), we modelled economies of scale loss of £[✂] per year (which are based on HCA divesting the Wellington

Hospital) and assumed that entry would reduce the benefit of divestiture by 75% from pre-new entry levels.

66. With this level of economies of scale loss, for divestiture to yield a positive NPV, we need to believe that prices are currently at least 3.5% above the competitive level and that no new entry will occur in the 20 years following divestiture. However, even then the benefits of divestiture are £[✂] million over 20 years.

Table 8: High economies of scale case (entry removes 75% of price benefit)

		Year of entry / year when entry reduces the price impact of divestiture			
	£m	*5*	*7*	*10*	*20*
Extent to which HCA's prices exceed the competitive level	2.0%	([✂])	([✂])	([✂])	([✂])
	2.5%	([✂])	([✂])	([✂])	([✂])
	3.0%	([✂])	([✂])	([✂])	([✂])
	3.5%	([✂])	([✂])	([✂])	[✂]
	4.0%	([✂])	([✂])	([✂])	[✂]
	4.5%	([✂])	([✂])	([✂])	[✂]
	5.0%	([✂])	([✂])	([✂])	[✂]
	5.5%	([✂])	([✂])	[✂]	[✂]
	6.0%	([✂])	([✂])	[✂]	[✂]
	6.5%	([✂])	([✂])	[✂]	[✂]
	7.0%	([✂])	[✂]	[✂]	[✂]
	7.5%	([✂])	[✂]	[✂]	[✂]

Source: CMA analysis.

67. In the low economies of scale case (table below), we modelled economies of scale loss of £0.0 million per year and assumed that entry would reduce the benefit of divestiture by 75% from pre-new entry levels. We note that the NPV is positive across all scenarios and across all price reduction levels.

Table 9: Low economies of scale case (entry removes 75% of price benefit)

		Year of entry / year when entry reduces the price impact of divestiture			
	£m	*5*	*7*	*10*	*20*
Extent to which HCA's prices exceed the competitive level	2.0%	[✂]	[✂]	[✂]	[✂]
	2.5%	[✂]	[✂]	[✂]	[✂]
	3.0%	[✂]	[✂]	[✂]	[✂]
	3.5%	[✂]	[✂]	[✂]	[✂]
	4.0%	[✂]	[✂]	[✂]	[✂]
	4.5%	[✂]	[✂]	[✂]	[✂]
	5.0%	[✂]	[✂]	[✂]	[✂]
	5.5%	[✂]	[✂]	[✂]	[✂]
	6.0%	[✂]	[✂]	[✂]	[✂]
	6.5%	[✂]	[✂]	[✂]	[✂]
	7.0%	[✂]	[✂]	[✂]	[✂]
	7.5%	[✂]	[✂]	[✂]	[✂]

Source: CMA analysis.

Glossary

Act	The Enterprise Act 2002.
Admission	A patient will be admitted to hospital where their treatment requires admission to a hospital bed. This is a clinical decision and a patient admitted may be admitted either as a **day-case patient** or as an **inpatient**.
AEC	Adverse effect on competition as set out in section 134(2) of the **Act**.
Aviva	Aviva Health UK Limited, a principal subsidiary of Aviva plc, provider of insurance, savings and investment products.
AXA PPP	AXA PPP healthcare, a subsidiary of The AXA Group and provider of **PMI**.
BMI	BMI Healthcare Limited and any company in the group as appropriate, part of **GHG**, a **private hospital group** in the UK.
Bupa	The British United Provident Association Limited, a provider of **PMI** and a **hospital operator**.
Catchment area	Geographical area from which a hospital draws its patients.
CC	Competition Commission.
CC3	*Guidelines for market investigations: Their role, procedures, assessment and remedies* (April 2013).
CCSD	The Clinical Coding & Schedule Development. A group consisting of representatives from five **PMI**s: **Aviva**, **AXA PPP**, **Bupa**, **PruHealth** and **Simplyhealth**, which establishes and maintains a common standard of procedure codes and narratives within the independent healthcare sector.
Central London	The NUTS2 region of Inner London, which roughly coincides with the areas within the North and South Circular Roads. Inner London consists of Camden, City of London, Hackney, Hammersmith and Fulham, Haringey, Islington, Kensington and Chelsea, Lambeth, Lewisham, Newham, Southwark, Tower Hamlets, Wandsworth, and Westminster.

Clinician	A health professional such as a GP, consultant, other physician or nurse involved in the care of patients.
CMA	Competition and Markets Authority.
Consultant	A registered medical practitioner who holds or has held or is qualified to hold an appointment as a consultant in the **NHS** in a speciality other than general practice or whose name is on the register of specialists kept by the **GMC**. A consultant may work exclusively for the **NHS** or in private practice or a combination of the two. Except where the context otherwise provides, consultant refers to a consultant in private practice whether or not they also work in the **NHS**.
Corporate PMI	**PMI** provided by an employer to its employees and in some cases dependants of the employee.
Cost of capital	The return that investors in a project expect to receive over the period of that investment. It is an opportunity cost and can be seen as the yield on capital employed in the next best alternative use.
Day-case patient	A patient admitted during the course of a day with the intention of receiving care without requiring the use of a hospital bed overnight. If the patient's treatment then results in an unexpected overnight stay they will be admitted as an **inpatient**.
GMC	General Medical Council, the independent regulator for doctors in the UK.
GP	General Practitioner, a doctor who works in a local surgery or health centre, providing medical advice and treatment to patients registered on their list.
GP referral	A referral from a **GP** for specialist treatment.
Greater London	The combined area of **central London** and **outer London**, synonymous with **London**.
HCA	HCA International Limited and any company in the group as appropriate, a **private hospital operator**.

Healthcare provider	A person that provides preventive, curative, promotional, or rehabilitative healthcare services including a hospital, clinic, **GP**, **consultant** or other medical professional.
Healthcode	A provider of online practice management software and services to the private healthcare market. Healthcode processes medical bills for private hospitals and **PPU**s, acting as an intermediary between private hospitals and **PMI**s.
Hospital services	All services provided by a **private hospital** including **inpatient**, **day-case** and **outpatient** services. Where it is necessary in this report to distinguish between different types of hospital services this is made clear in the text.
Hospital Group	A **private hospital operator** that operates more than one hospital.
HPA	Healthcare Purchasing Alliance, a joint venture between **Aviva** and **VitalityHealth** to procure healthcare services from **private healthcare providers** for both PMIs.
ICU	Intensive care unit.
Inpatient	A patient admitted to hospital with the expectation that they will remain in hospital for at least one night.
Insured patient	A patient who will use **PMI** to pay (in whole or in part/the majority) for their medical care.
Insurer network	A list of private hospitals which are on a **PMI**'s approved list. Some **PMI**s create narrower networks for different types of policies.
LOC	The London Oncology Centre is a specialist cancer treatment centre set up by consultants in 2005.
LOCI	A measure of weighted-average market share used by the **CC** to measure local concentration. Based on the 'Logit Competition Index', a measure of competition that has been used to analyse healthcare markets.
London	The combined area of **central London** and **outer London**, synonymous with **Greater London**

LRC	The London Radiotherapy Centre at Guy's and St Thomas' is run by HCA International Limited.
Medical treatment	Except where the context otherwise provides, medical treatment includes medical, surgical and/or diagnostic/ pathology treatments.
NHSs	National Health Services in England, Scotland and Wales and the Health and Social Care Services in Northern Ireland.
NHS Trust	A public benefit healthcare organisation created by Act of Parliament to treat **NHS** patients.
NPV	Net present value.
NRV	Net realisable value. The amount that can be obtained by selling an asset net of selling expenses.
Nuffield	Nuffield Health and any company in the group as appropriate, a **private hospital operator**.
OFT	Office of Fair Trading.
ONS	Office for National Statistics.
OPCS coding ICD-10	An international standard for diagnostic coding.
Open referral	A referral from a clinician that does not name the **consultant** and/or **private healthcare facility** to whom/which the **patient** is being referred.
Outer London	The NUTS2 region of Outer London, roughly the area between the North and South Circular Roads and the M25 ring road. **Outer London** consists of Barking and Dagenham, Barnet, Bexley, Brent, Bromley, Croydon, Ealing, Enfield, Greenwich, Harrow, Havering, Hillingdon, Hounslow, Kingston upon Thames, Merton, Redbridge, Richmond upon Thames, Sutton, and Waltham Forest.
Outpatient	A patient treated in a hospital, consulting room or clinic, who is not admitted.
PCA	Price-concentration analysis.

PHIN	Private Healthcare Information Network, a body whose membership is made up of **private hospital operator**s.
PMI/insurer	As the context provides, either a private medical insurer or private medical insurance. Private medical insurance is an insurance product under which an insurer agrees to cover the costs, in whole or in part, of acute medical care. Insurer in this report refers to a PMI.
PPU	Private patient unit, a facility within the **NHS** providing medical care to private patients. Such units may be separate units dedicated to private patients or be facilities within the main **NHS** site which are made available to private patients either on a dedicated or non-dedicated basis.
Privately-funded healthcare services/ private healthcare	Services provided to patients via **private facilities/clinics** including **PPU**s through the services of consultants, medical and clinical professionals who work within such facilities.
Private healthcare facilities	Any facility providing **medical treatments** on an **inpatient**, **day-case** and/or **outpatient** basis which charges fees for its services including a **PPU**.
Private healthcare provider	A **healthcare provider** that charges fees for its services.
Private hospital	A facility which provides **inpatient hospital services** that charges fees for its services including a **PPU**. Except where the context provides otherwise, in this report hospital refers to a **private hospital**.
Private hospital operator	A person that operates a **private hospital** including where relevant the **NHSs** in relation to **PPU**s.
Private patient	A patient who is charged for medical services either as a **self-pay patient** or as an **insured patient**.
Provisional decision on remedies	The provisional decision on remedies published on 16 January 2014.
Provisional findings	The provisional findings of 28 August 2013.

PruHealth	Prudential Health Services Limited, Prudential Health Insurance Limited and any company in the group as appropriate, now known as **VitalityHealth**, providers of **PMI**.
Ramsay	Ramsay Health Care UK Operations Limited and any company in the group as appropriate, a **private hospital operator**.
Relevant customer benefit	A benefit as defined by section 134(8) of the **Act**.
Remedies Notice	The notice of possible remedies published on the same date as publication of this Provisional Findings Report.
Self-pay patient	A patient who pays for their medical care themselves.
SLT	Service-line tender. A process through which specific services, which PMIs have identified could be carved out of the main insurer/hospital contract, are procured separately, often via a competitive tender. Policyholders are then required only to use providers that are part of the new service-line network.
Simplyhealth	Simplyhealth and any company in the group as appropriate, a **PMI** provider.
Specialties	The **GMC** divides areas of medical care into 65 specialties.
Spire	Spire Healthcare Limited and any company in the group as appropriate, a **private hospital operator**.
TLC	The London Clinic, a **private hospital operator**.
ToH	Theory of harm.
VitalityHealth	Vitality Health Limited, Vitality Health Insurance Limited, and any company in the group as appropriate, formerly known as **PruHealth**, a **PMI** provider.
WCC	Westminster County Council, the local authority responsible for planning applications in central London.