National Audit Office

HM Treasury

Equity investment in privately financed projects

Appendix Four

FEBRUARY 2012

Appendix Four

Introduction

1 This appendix accompanies our report *Equity investment in privately financed projects*.[1] This appendix sets out the methodology behind our illustrative analysis of returns to primary investors following three equity sales set out in paragraphs 3.21 to 3.26 and Figures 13 and 14 of that report.

2 The illustrative analysis focuses on the difference between the returns sought by primary and secondary investors. It asks whether this difference can be explained by reference to the specific risks that primary investors bear but that secondary investors do not. We found that we could not fully explain the difference for each of the three projects we looked at.

3 In our illustrative analysis we followed a set of five principles:

- **Following a robust theoretical approach.** Public authorities have not traditionally analysed investors' returns by considering the risks investors bear. We have produced a new methodology based on our general experience of PFI projects and discussions with investors.
- **Use conservative assumptions.** The purpose of this analysis is to see if the entire return can be explained by considering the primary investors' risks. We used conservative assumptions to explain as much of the return as reasonable. Our analysis is more likely, therefore, to understate the portion of the return that we cannot explain by reference to the main risks, than it is to overstate it.
- **Triangulate wherever possible.** Owing to the limited amount of publicly available information, we have had to make a number of assumptions in our analysis. We have, wherever possible, triangulated both our assumptions and findings with the available evidence. We have also developed two different types of analysis (explained below) to explain the difference between the primary and secondary investors' returns, with similar results.

1 Comptroller and Auditor General, *Equity investment in privately financed projects*, Session 2010–12, HC 1792, National Audit Office, February 2012.

- **Use sensitivity analysis.** We have set out how our already conservative assumptions would need to be made even more conservative to explain the entire difference between primary and secondary investors' returns.
- **Consult and provide transparency.** We have shown our methodology and findings to investors and the Treasury during the study, to allow them to comment and refine our analysis. This methodology appendix aims to allow others to repeat our analysis and take it further if they want.

4 We developed two different ways of analysing the difference between primary and secondary investors' returns:

- **By considering the two principal risks that primary investors bear but which secondary investors do not.** The first of these risks is that primary investors need to recover the costs of their unsuccessful bids in the contracts that they win. The second is to cover investors' risks during the construction stage. Because most of the construction risk is passed to the construction contractor, investors' main construction risk is that this contractor defaults. If this happens, the primary investors may need to find another construction contractor, potentially causing them additional cost and a delay in receiving revenue payments. This method is not used by investors to price their equity, but we believe that it exposes a potential mismatch between risks and returns.
- **By considering investors' internal funding costs.** This method more closely resembles how investors actually price their equity. Some investors use different pools of funding to finance different phases of projects, such as the bidding, construction and operation phases. The investors have different rates of return that they charge to successful projects as each phase of the project draws on the relevant funding pool. This method builds up the total price of the equity by reference to investors' cumulative cost of funding the project.

Our principal methodology

Summary

5 In each of the three sales, there was a large difference between the original amount of equity and the sale proceeds (**Figure 1**). This difference can be attributed to:

- the premium charged by primary investors to cover risks not carried by secondary investors including construction and bidding risks;
- the fact that by the time of the sale in the secondary market some of the cash flows had already been distributed to investors;
- the fact that the sales were several years later than the initial investment; and
- changes in value of cash flows to investors in the remaining years of the project due to changes in forecast cash flows and changes in required rates of return in the secondary market.

Figure 1
Our estimates of the component parts of the investors' returns

	Queen Alexandra Hospital, Portsmouth (£m)	Bradford Schools, phase one (£m)		Derbyshire Mental Health (£m)	
Sale proceeds	**31.3**	**4.7**[1]	**5.6**[1]	**2.8**[1]	**3.3**[1]
Estimated changes in value of equity between financial close and sale, due to changes in post-sale forecast cash flows and the secondary market's rate of return	(10.5)	(1.3)	(2.2)	0.3	(0.2)
Time value of money	(7.0)	(0.9)	(0.9)	(0.6)	(0.6)
Present value of forecast presale distributions in the financial close model	–	0.6	0.6	0.2	0.2
Estimates of the primary investors' risks:					
• Construction contractor default	(2.3)	(0.1)	(0.1)	(0.1)	(0.1)
• Costs of failed bids	(0.9)	(0.5)	(0.5)	(0.9)	(0.9)
The primary investors' original investment	**(7.2)**	**(1.9)**	**(1.9)**	**(1.3)**	**(1.3)**
Unexplained residuals (rounded present values at financial close)	**3.4**	**0.6**	**0.6**	**0.3**	**0.3**

NOTES
1 Equity interests in these two projects were included in a portfolio that was sold. The seller provided information to the National Audit Office that allowed us to estimate ranges for sale proceeds relating to the two projects.
2 Numbers are rounded.

Source: National Audit Office analysis

6 After accounting for all of these factors, and adopting conservative assumptions that aim to attribute as much as possible to these factors, a significant portion of the capital appreciation remained unexplained (Figure 1). These unexplained residuals may indicate some inefficiency in the pricing of primary equity.

Selection of our sample of three projects

7 We chose three projects for our illustrative analysis. We wanted projects with a typical risk structure and publically available information about the sale of equity. Through interviews and a web-survey, we surveyed 34 projects that had contracts that generally met HM Treasury's standardisation of PFI contracts versions three and four. In five of these projects, a primary investor had sold at least part of its stake to secondary investors and the details of these sales were publically available. One of these had residual risk retained by the private sector and another had on-going construction risk, in each case making their secondary investor risk abnormal. We therefore selected the three remaining projects for our illustrative analysis (**Figure 2**).

Figure 2
The three equity sales analysed by the National Audit Office

	Queen Alexandra Hospital, Portsmouth	Bradford Schools, phase one	Derbyshire Mental Health
1 Capital cost[1]	£360 million	£95 million	£36 million
2 Service charges[2]	£560 million	£137 million	£41.6 million
3 Date of equity sale and proceeds	June 2010 sale of 50 per cent for £31.3 million	November 2010 sale of 25 per cent of Bradford (£4.7 million to £5.6 million) and 50 per cent of Derbyshire (£2.8 million to £3.3 million)[3]	
Short description	Combined three pre-existing hospitals at one site. Thirty-five year provision of estate services, portering, housekeeping, linen and laundry, catering, retail, and car parking.	By 2008, built three fully operational new schools. Twenty-five year provision of facilities management, cleaning, ground maintenance caretaking, and security.	Adult high and older persons' high dependency and dementia health units, a resource centre and a clinical services building.

NOTES

1 Row one shows construction and funding costs during the construction phase.

2 Row two shows the present value of the aggregate service charges over the life of the contract.

3 Equity interests in these two projects were included in a portfolio that was sold. The seller provided information to the National Audit Office that allowed us to estimate ranges for sale proceeds relating to the two projects.

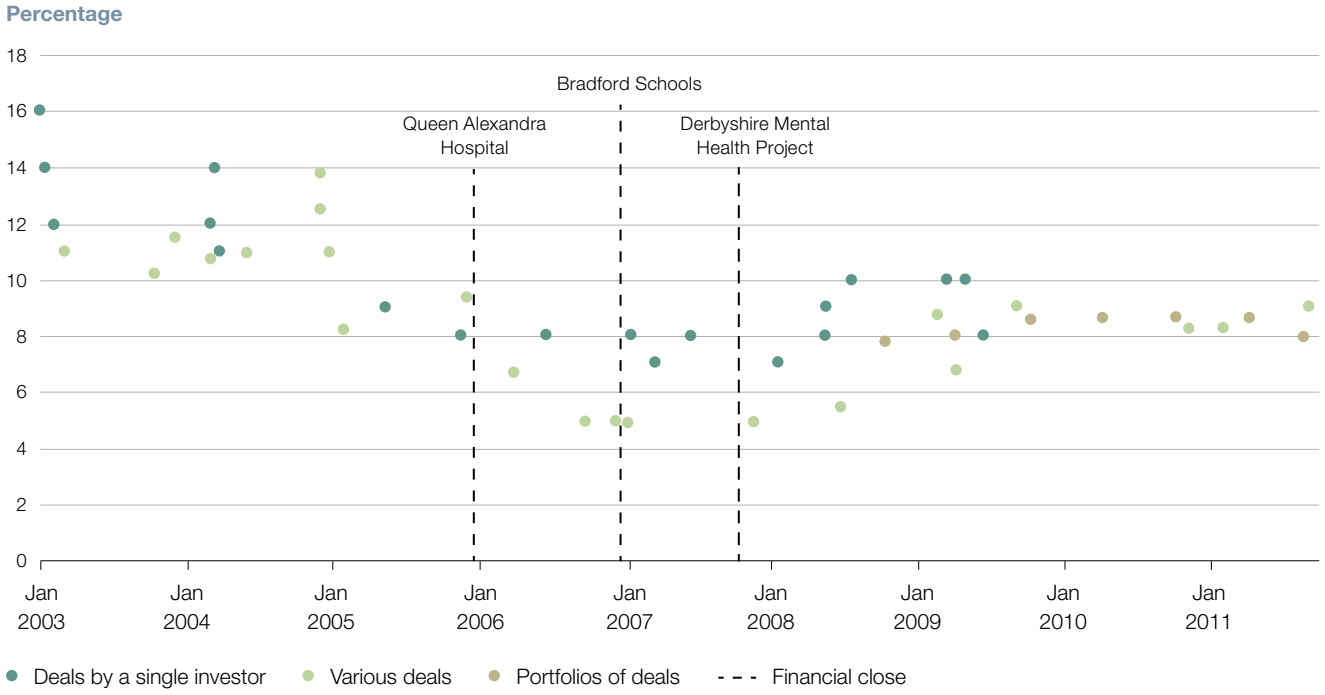
4 As the scope of this report is specifically limited to the role of PFI equity, it does not deal with all the issues that would be relevant to assessing the value for money of each project. For example, Portsmouth Hospitals NHS Trust encountered budgetary difficulties, which in March 2011 contributed to its decision to close 100 of the Queen Alexandra Hospital's 1,200 beds.

Source: National Audit Office summary of project information

Identifying the premium in primary investors' returns over secondary investors' returns

8 Primary investors' rates of return at the point of financial close are typically 12 to 15 per cent. Secondary investors' rates of return at the point they buy the equity have ranged from 5 to 14 per cent. However, this range captures fluctuating trends over time as market perceptions changed (**Figure 3**). To estimate the premium demanded by primary investors over secondary investors, we wanted to compare the present value of the original equity injection with the present value of the forecast cash flows, discounted using the secondary market's rate of return at the point of financial close.

Figure 3
Secondary market rates of return



NOTE

1 An investor informed us about a purchase in December 2005 in which the rate of return was 12.1 per cent, which was considerably greater than rates of return linked to other sales in the same month. We did not include this rate of return in the above graph or in our analysis because it was an outlier and we had no knowledge of the project(s) included in the sale.

Source: National Audit Office analysis of publicly available information and data provided by investors

9 Unfortunately, there is no publicly available time series setting out the secondary market's rate of return, so we had to produce our own. We found some secondary market rates of return from publically available sources and from information provided by investors. We plotted the data in Figure 3 and used it to estimate secondary market rates of return at financial close.

10 The primary investors' forecast cash flows are set out in the financial models at the point of financial close (the financial close model). By applying our estimate of the secondary market's rate of return at financial close to the forecast cash flows, we were able to calculate their secondary market present value.

11 We estimated the primary investors' premium by comparing the present value of their equity injection (both in terms of share capital and shareholder loans) against our calculation of the secondary market present value. This premium represents our estimate of the amount charged for carrying the bidding and construction-related risks (**Figure 4**).

Figure 4

The estimated premium of primary investors' returns over secondary investors' returns

	Queen Alexandra Hospital, Portsmouth	Bradford Schools, phase one	Derbyshire Mental Health
Date of financial close	15 December 2005	18 December 2006	9 October 2007
Primary investors' rate of return (blended equity return in financial close model) (%)	15.0	14.0	14.0
The NAO's estimate of the secondary market's rate of return at financial close (Figure 3) (%)	9.5	8.0	7.5
The NAO's estimate of the amount the secondary market would pay for the cash flows in the financial close model (assuming the cash flows only had secondary market type risks) (£m)	13.8	3.2	2.6
Primary investors' equity (valued on basis of cash injection) (£m)	(7.2)	(1.9)	(1.3)
The NAO's estimate of the primary investors' premium (present value at time of financial close) (£m)	**6.6**	**1.2**	**1.4**

NOTE

1 Numbers are rounded.

Source: National Audit Office analysis of financial models using secondary market rates of return from Figure 3

Reconciling the difference between the primary and secondary investors' returns to the sale proceeds

12 To give context to our analysis, we reconciled the primary investors' returns in the financial close model with the amount they later received from selling their investments. This required the sale proceeds to be broken down into three component parts:

- **Changes in the valuation of the project's future cash flow since financial close** including changes in cash flows, movements in the secondary market, and the elapse of time between financial close and the sale (paragraphs 13 to 18).
- **The original investment** by the primary investors (Figure 4).
- **The premium in the primary investors' return over the estimated secondary market return** at the point of financial close (Figure 4).

Changes in the valuation of the project's future cash flow since financial close

Identifying sale proceeds

13 Investors in the Queen Alexandra Hospital published the sales proceeds as £31.3 million for 50 per cent of the equity. The other two projects (Bradford Schools and the Derbyshire Mental Health project), were part of a sold portfolio of equity in six projects. The published price for the portfolio was £22 million, with no disaggregation. The seller provided information to the NAO that allowed us to estimate ranges for sale proceeds relating to the two projects (**Figure 5**).

Figure 5

Estimated changes in the value of equity between financial close and the sale due to changes in cash flow and movements in the secondary market

	Queen Alexandra Hospital, Portsmouth (£m)	Bradford Schools, phase one (£m)	(£m)	Derbyshire Mental Health (£m)	(£m)
Sale proceeds	**31.3**	**4.7**[1]	**5.6**[1]	**2.8**[1]	**3.3**[1]
The NAO's estimate of the value of the equity at the point of sale using information only available at financial close	(20.8)	(3.4)	(3.4)	(3.1)	(3.1)
The NAO's estimate of the change in the value of equity between financial close and sale, owing to changes in forecast post-sale cash flows and the secondary market's rate of return	**10.5**	**1.3**	**2.2**	**(0.3)**	**0.2**

NOTE

1 Equity interests in these two projects were included in a portfolio that was sold. The seller provided information to the NAO that allowed us to estimate ranges for sale proceeds relating to the two projects.

Source: National Audit Office analysis

Estimating changes in the valuation of the equity at the time of the sale

14 Recognising that the forecast cash flows were likely to have changed between financial close and the point of sale, we asked investors and the client authorities to provide updated financial models. Only those engaged in the Derbyshire Mental Health project provided us with an updated model. This allowed us to estimate the secondary investors' rate of return, which was in line with the market rates set out in Figure 3.

15 To estimate changes in the valuation of equity at the time of the sale, we compared the sale proceeds achieved against what would have been predicted using information available at the point of financial close (Figure 5). We used the financial close model to identify the forecast cash flows for the period after the sale. We discounted these cash flows back to the point of sale using the secondary market rate at the point of financial close. This gave us our estimate of the value of the equity at the point of sale, had it been calculated using only information available at financial close. The difference between the sale proceeds and our calculation using financial close information represents a combination of:

- changes in the forecast cash flow; and
- changes in the secondary market's rate of return.

Estimating increases in the value of equity between financial close and the sale that are solely due to the passage of time

16 Our estimates in Figure 5 are values of the equity at the point of sale. The present value of equity at the point of sale also increased due to the passage of time reducing the period remaining to all future payments. We took the cash flows forecast in the financial close model for the period after the sale. Using the secondary market rate of return at the point of financial close, we discounted the cash flows back to the date of the sale (paragraph 15) and then discounted them back to the point of financial close. The difference between these two present values was our estimate of the increase in value due to the passage of time (**Figure 6** overleaf).

17 Against this increase, we had to offset any dividends and shareholder loan interest payments that were forecast in the financial close model to be paid to investors between financial close and the sale. We discounted these payments using the secondary market's rate of return at financial close (Figure 6).

18 Theoretically, the time-related increase in the value of equity and the received payments represent primary investors' profits relating to the operational risks.

Reconciliation of sale proceeds to the secondary market valuation of equity at financial close

19 Figures 5 and 6 allow us to reconcile our estimates of the sale proceeds to our valuation of the amount the secondary market would pay for the cash flows in the original financial model (Figure 4). We set out this reconciliation in **Figure 7** overleaf.

Figure 6

Estimated increase in the value of the equity due to the passage of time

	Queen Alexandra Hospital, Portsmouth (£m)	Bradford Schools, phase one (£m)	(£m)	Derbyshire Mental Health (£m)	(£m)
The NAO's estimate of the change in the value of post-sale cash flows due to the passage of time between financial close and the sale[1]	**7.0**	**0.9**	**0.9**	**0.6**	**0.6**
The NAO's estimate of the present value of forecast presale distributions in the financial close model[1]	**–**	**(0.6)**	**(0.6)**	**(0.2)**	**(0.2)**

NOTES

1 Using secondary market rates of return at financial close given in Figure 4.

2 Numbers are rounded.

Source: National Audit Office analysis

Figure 7

Reconciliation of sale price to the secondary market valuation of equity at financial close

	Queen Alexandra Hospital, Portsmouth (£m)	Bradford Schools, phase one (£m)	(£m)	Derbyshire Mental Health (£m)	(£m)
Sale proceeds (Figure 5)	31.3	4.7[1]	5.6[1]	2.8[1]	3.3[1]
The NAO's estimate of the changes in the value of equity between financial close and sale, owing to changes in post-sale forecast cash flows and the secondary market's rate of return (Figure 5)	(10.5)	(1.3)	(2.2)	0.3	(0.2)
The NAO's estimate of the change in the value of post-sale cash flows due to the passage of time between financial close and the sale (Figure 6)	(7.0)	(0.9)	(0.9)	(0.6)	(0.6)
The NAO's estimate of the present value of forecast presale distributions in the financial close model (Figure 6)	–	0.6	0.6	0.2	0.2
The NAO's estimate of the amount the secondary market would pay for the cash flows in the original financial model (assuming the cash flows only had secondary market type risks) (reconciles with Figure 4)	**13.8**	**3.2**	**3.2**	**2.6**	**2.6**

NOTES

1 Equity interests in these two projects were included in a portfolio that was sold. The seller provided information to the NAO that allowed us to estimate ranges for sale proceeds relating to the two projects.

2 Numbers are rounded.

Source: National Audit Office analysis

Evaluating the premium for bidding and construction related risks

20 Primary investors bear two principal risks that secondary investors do not carry. These are:

- risks during the construction phase; and
- costs for unsuccessful bids.

Construction contractor credit risk

21 Contractual arrangements between the construction contractor and the special purpose vehicle tend to protect PFI investors from construction risks, providing the construction contractor remains solvent. Therefore, the key risk to which investors are exposed during the construction phase is the contractor's insolvency. The shape of this risk is binary: either the contractor defaults or it does not.

22 To calculate the value of the construction contractor credit risk, we estimated the probability of a default and multiplied it by an estimate of the impact of a default (**Figure 8** overleaf). The construction risk would be carried by all shareholders. To capture this fact, we proportioned the value of the risk on the basis of the seller's shareholding in the project.

23 To calculate the probability of default we:

- assessed the construction contractor's credit default risk by using Standard & Poor's generic investment grade ratings. We assumed that the project (its special purpose vehicle) had a minimum investment grade rating at financial close of BBB-. This is Standard & Poor's minimum investment grade rating. To be conservative in our analysis, we assumed that the construction contractor had a lower-than-minimum investment grade rating of BB+. Standard & Poor's mean one-year global corporate default rates for BB+ rated entities is 0.68 per cent;[2] and
- applied this rating to the length of the construction phase to calculate a probability of default. Ratings of contractors can, however, change over the construction phase of a project. To capture such potential changes, and to increase the conservative nature of our analysis, we doubled the probability of default.

2 Mean measured over period 1981–2008, Table 1, Standard & Poor's, Global Credit Portal, Ratings Direct, *General Criteria: Understanding Standard & Poor's Rating Definitions*, June 2009.

Figure 8
Construction contractor credit risk

	Queen Alexandra Hospital, Portsmouth	Bradford Schools, phase one	Derbyshire Mental Health
Impact			
Construction cost	£260m	£80m	£29m
Estimated impact of default	£78m	£23m	£7.7m
Probability			
Estimated probability of default over construction period	6.0%	2.26%	2.13%
Value (impact x probability)			
Estimated value of construction risk	£4.7m	£520,000	£164,000
Portion of equity being sold	50%	25%	50%
Portion borne by seller	**£2.3m**	**£130,000**	**£82,000**
Comparing our estimated impact as a proportion of construction cost with Moody's estimates			
Estimated value of construction risk as a proportion of construction cost (%)	30	29	26
Moody's estimated impact of default for a similar building as a proportion of construction cost (%)	27.5	20.4	20.4

NOTE
1 Numbers are rounded.

Source: National Audit Office analysis

24 For any project, the impact will change depending upon the extent of construction. The impact increases over the first few months of construction, peaks and plateaus before falling during the latter stages of the phase. To calculate the impact of insolvency during the construction phase we assumed a uniform impact over the entire construction period. The size of impact that we adopted was a 15 per cent increase in construction costs and the complete loss of revenue in the first full operational year.

25 Our estimate of the impact is more conservative (larger) than similar estimates produced by Moody's.[3] We assumed that, under Moody's project type classifications, the Bradford Schools and Derbyshire Mental Health Projects could be described as 'standard building'. Moody's project mean loss with contractor default for these types of project is 20.4 per cent of construction cost. We assumed that the larger Queen Alexandra Hospital project would be classed as a 'medium complex building'. For this type of project, Moody's project mean loss with contractor default is 27.5 per cent of capital cost, again less than our impact allowance for the project (Figure 8).

26 The total size of our impact allowances ranged from £7.7 million to £78 million (Figure 8). For all three projects, the size of our impacts exceeded the equity injections by factors in the range two to three. This reflects the conservative assumption that, in the event of construction contractor default, equity investors would be prepared to inject more money into their projects, to protect their reputations.

Recouping unrecovered bid costs

27 Primary investors told us that their returns from PFI projects need to compensate them for costs associated with unsuccessful bids. Our investigation revealed that bid costs tend to be shared between parties in a bidding consortium on a basis of each member's proposed future shareholding in the project.

28 Primary investors say they typically expect to win one bid in three. We do not, however, know how much losing bids cost investors, although one non-trade investor informed us that it wrote off between £1.0 million to £1.5 million a year on losing bids.

29 In 2002, PricewaterhouseCoopers published a report commissioned by the Office of Government Commerce into rates of return bid on PFI projects.[4] The base case for project returns included an allowance of £1.5 million in each successful bid for costs of unsuccessful bids. We used this estimate of £1.5 million and adjusted it for inflation for the period between October 2002 and the date of financial close for the particular project.[5] We then apportioned the estimate based on the proportion of equity sold, to provide an allowance for recouping lost bid costs.

3 Moody's Global Project Finance, *Construction Risk in Privately-Financed Public Infrastructure (PFI/PPP/P3) Projects*, December 2007.
4 PricewaterhouseCoopers, *Study into Rates of Return bid on PFI Projects*, October 2002.
5 The inflation index that we used was the Office for National Statistics' data series K5C4 'LMSB SA Average Weekly Earnings – Total pay Finance and business services'.

Residual difference

30 We deducted our estimates of the construction contractor credit risk and our allowance for recouping unrecovered bid costs from our estimate of the primary investors' premium (Figure 4). For all three projects there remained a residual difference that we could not explain (**Figure 9**). This possible pricing inefficiency is equivalent to an increase of 1.5 to 2.2 per cent in the service charges, or annual payments to the investors from these three projects totalling up to £1.15 million in 2011 prices.

Sensitivity analysis of our evaluation of the premium for bidding and construction-related risks

31 We conducted sensitivity analysis on our results to test the reasonableness of three key assumptions:

- The secondary market's rate of return at financial close for operational PFI projects to account for the residual.
- The additional construction costs incurred in the event of construction contractor default to account for the residual.
- The additional bid costs investors would need to be seeking to recoup to account for the residual.

Figure 9
Residual differences that we cannot explain

	Queen Alexandra Hospital, Portsmouth (£m)	Bradford Schools, phase one (£m)	Derbyshire Mental Health (£m)
The NAO's estimate of the primary investors' premium using the cash flows in the original financial model (present value at time of financial close) (Figure 4)	6.6	1.2	1.4
Construction contractor credit risk (Figure 8)	(2.3)	(0.1)	(0.1)
Allowance for recouping lost bid costs (paragraph 29)	(0.9)	(0.5)	(0.9)
Residual difference	**3.4**	**0.6**	**0.3**

NOTE
1 Numbers are rounded.

Source: National Audit Office analysis

The secondary market's rate of return at financial close

32 Our estimate of the premium primary investors' charge over the secondary market would be reduced if our estimate of the secondary market's rate of return at financial close increases.

33 At the time of financial close for the three projects, the upper bound of the rates of return accepted by the secondary market ranged from 7.5 to 9.5 per cent. For each project, we increased these rates of return to levels that eliminated the unexplained residuals. The increased rates ranged from 8.5 to 11.4 per cent (**Figure 10**).

Increase in construction cost if the construction contractor defaulted

34 The second assumption that we tested was the size of the impact on the cost of construction if the construction contractor defaulted. In our analysis, we allowed a 15 per cent increase in construction costs if the construction contractor were to default at any time during the construction phase. For all three projects, we increased the impact to the point that eliminated the unexplained residual. The increases ranged from 59 to 153 per cent of the forecast construction cost (**Figure 11** overleaf).

Figure 10
Sensitivity to the secondary market's rate of return at financial close

	Queen Alexandra Hospital, Portsmouth	Bradford Schools	Derbyshire Mental Health
Financial close	15 December 2005	18 December 2006	9 October 2007
The NAO's estimate of the secondary market's rate of return at financial close (%)	9.5	8.0	7.5
The secondary market's rate of return that would eliminate the unexplained residual (%)	11.4[1]	10.3	8.5

NOTE

1 The secondary market's rate of return that would eliminate the unexplained residual for Queen Alexandra Hospital is below a privately reported 12.1 per cent rate of return for a secondary market purchase in December 2005. We treated this purchase as an outlier because the rate of return was considerably above rates of return in two other similarly dated transactions and we had insufficient information about the project(s) sold to ensure that it/they did not contain non-standard operational risks (Note 1, Figure 3).

Source: National Audit Office sensitivity analysis

Increase in allowance for recovering the costs of unsuccessful bids

35 The third assumption that we tested was the allowance for recovering the costs of unsuccessful bids. In our analysis, we had assumed an allowance of £1.5 million, in 2002 prices, per successful bid (paragraphs 28-29). This is split between the shareholders. To eliminate the unexplained residual values, the allowance would need to be increased to between £2.5 million and £8.6 million (**Figure 12**).

Figure 11
Sensitivity to an increase in the cost of construction if the construction contractor defaulted

	Queen Alexandra Hospital, Portsmouth (%)	Bradford Schools (%)	Derbyshire Mental Health (%)
Increase in the cost of construction needed to eliminate the unexplained residual	59	153	121

NOTE
1 See paragraph 24 for explanation of how these percentages are applied.

Source: National Audit Office sensitivity analysis

Figure 12
Sensitivity to an increase in the allowance to recover costs for unsuccessful bids

	Queen Alexandra Hospital, Portsmouth	Bradford Schools	Derbyshire Mental Health
Date of financial close	15 December 2005	18 December 2006	9 October 2007
The NAO's allowance to recover costs of unsuccessful bids (per bid basis) (£m)	1.7	1.9	1.9
Increased allowance that eliminates residual value (£m)	8.6	4.4	2.5

NOTE
1 Priced at the date of financial close. This is the allowance for all shareholders and not just the seller.

Source: National Audit Office sensitivity analysis

Our alternative methodology

Evaluating the cost of funding the bid and construction phases

36 Primary investors told us that their rates of return were driven by the cost of funding the bid and construction phases. They stated that, during both phases, funding costs were higher than the rates of return accepted for operational cash flows. We developed another model of the investors' returns by considering their internal funding costs. We used this model to triangulate the results above and provide further assurance that the residual amounts could not be explained.

37 In this method, we assumed that the investor runs three separate funding pools over the life of a project:

- **A bid fund.** If the bid is successful, the bid fund sells its interest to a construction fund.
- **A construction fund.** The construction fund retains the investor's interest in the project during the construction phase before selling it on to an operational fund.
- **An operational fund.** The operational fund funds the project post-construction.

38 We produced an estimate of how much the primary investors' construction fund would sell the equity to their operational fund. We compared this estimate to an estimate of the secondary market's valuation of the operational cash flows. Again, we were left with unexplained residuals across all three projects.

Funding the bid phase

39 From the financial close model, we obtained the bid costs that the investors recovered at the start of the each of the projects. We created a spend profile for the period between the invitation to tender and financial close. We assumed that:

- nearly 10 per cent of bid costs were incurred in the first third of the procurement;
- nearly 30 per cent of bid costs were incurred in the second third of the procurement; and
- the remaining 60 per cent was spent in the last period.

40 One investor told us that it charges 25 per cent interest per year on funds used to bid for projects. We adopted this rate of interest in our analysis and assumed that the charged interest was not recovered from reimbursed bid costs, but rather paid by the construction fund. Using the spend profile and the rate of interest, we estimated how much the construction fund would pay the bid fund for the investor's interest in the project. We deducted the reimbursed bid costs from this figure, to leave the amount the construction fund paid from its cash reserves for the project equity.

Funding the construction phase

41 At the start of the construction phase, we assumed that the construction fund would fund the seller's portion of:

- the payment to the bid fund, less reimbursed bid costs;
- the pure equity injection; and
- the amount of the shareholder loan placed on short term deposit. We assumed that 20 per cent of the loan would be placed on short term deposit earning, in the pre financial crisis period before 2008-09, 4 per cent interest per year.

42 From information provided by investors, we allowed a 2 per cent premium over the upper bound of the secondary market's rate of return for funding the construction phase. Over the construction phase, we compounded interest at this rate, after deducting interest earned on the portion of the shareholder loan that we assumed was on deposit.

43 We also assumed that at the end of the construction phase, the construction fund injected the remaining 80 per cent of the shareholder loan. This amount together with accrued net interest and principal over the construction phase represents our estimate of the price paid by the operational fund for the project (**Figure 13**).

Secondary markets' valuation of the operational cash flows

44 We estimated the secondary markets' valuation of the operational cash flows using the financial close model and the secondary market's rate of return at the point of financial close. This is very similar to the method set out in paragraph 10 above. However, instead of estimating the valuation at the point of financial close, it gives an estimate of the secondary market's valuation at the end of the construction stage.

Unexplained residual

45 We deducted our estimate of the amount paid by the primary investors' operational fund from our estimate of the secondary market's valuation of the operational cash flows. We were left with residual values that again we cannot explain (**Figure 14** on page 20). These residual amounts are present values at the date when construction was completed.

Figure 13

Estimate of the amount paid by the primary investors' operational fund for the project

	Queen Alexandra Hospital, Portsmouth	Bradford Schools, phase one	Derbyshire Mental Health
Interest and principal on bid funding (£m)	11.8	8.0	4.0
Reimbursement of bid costs (£m)	(9.3)	(6.3)	(3.2)
Payment by construction fund (£m)	2.5	1.7	0.9
Payment of share capital, placing 20 per cent of the shareholder loan on deposit and compounded interest through to completion of construction (£m)	8.5	2.5	0.9
The 80 per cent of shareholder loan not held on deposit (£m)	19.4	7.5	2.6
Primary investors' valuation of equity at the operational stage (£m)	30.4	11.7	4.4
Amount paid by sellers' operational fund (£m)	**15.2**	**2.9**	**2.2**
Portion of equity being sold (%)	50	25	50

NOTE

1 Numbers are rounded NAO estimates.

Source: National Audit Office analysis

46 To compare these residual values with those set out in Figure 9, we discounted them back to financial close. Acting conservatively, we used our estimate of the rate of return demanded by the construction fund as the discount rate. Under this alternative approach we found residual differences of between £0.6 million to £3.4 million (Figure 14). These results closely matched the residual differences calculated using our first approach.

Sensitivity analysis

47 The key assumptions above are the interest rates charged by the bid and construction funds. We increased:

- **the cost of funding the construction phase.** We increased from 2 per cent (paragraph 42) to 3 per cent the premium over the upper bound of the secondary market's rate of return for distributions from operational projects; and
- **the interest charged on financing bids.** We increased the interest charged on financing bids to a level that eliminated the unexplained residual.

Figure 14

Residual amounts after comparing the primary investors' internal cost of funding with the secondary markets' valuation of the operational cash flows

	Queen Alexandra Hospital, Portsmouth (£m)	Bradford Schools, phase one (£m)	Derbyshire Mental Health (£m)
Secondary markets' valuation of the operational cash flows at completion of construction	20.8	3.6	3.0
Estimate of payment by primary investors' operational fund to the construction fund (Figure 13)	(15.2)	(2.9)	(2.2)
Residual difference (present value at completion of construction)	5.5	0.7	0.8
Residual difference (present value at financial close)	**3.4**	**0.6**	**0.7**
Residual difference calculated using the NAO's first approach (Figure 9)	*3.4*	*0.6*	*0.3*

NOTE

1 Numbers are rounded NAO estimates.

Source: National Audit Office analysis

48 Taking both these effects together, to eliminate the unexplained residual we had to increase the interest rates charged by the bid fund from 25 per cent to between 52 to 75 per cent per year (**Figure 15**).

Figure 15
Sensitivity analysis on the rates charged on the bid funding pools

	Queen Alexandra Hospital, Portsmouth (%)	Bradford Schools (%)	Derbyshire Mental Health (%)
Rate of interest charged on funds used to bid for projects that eliminates the unexplained residual	75	52	57

Source: National Audit Office sensitivity analysis

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