

# HESG Policy Forum: Capital

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This paper is concerned with investment in physical capital—buildings and equipment for use in the NHS to deliver patient care. The areas of economic analysis of most direct relevance to this topic are project appraisal, cost benefit analysis and capital markets. The focus is on a few issues where economic analysis and research may be expected to contribute to policy on capital investment.

## Background

Since 1992 gross public sector investment (including PFI) in health has fallen from 0.4% of GDP to 0.2% in 2000 [1]. There is doubt as to whether this has been sufficient to even maintain the capital stock at the 1992 level. Over the same period current expenditure on the NHS rose from 5.3% of GDP to 6% and activity increased at roughly 2% per annum. A priori, there has been a significant fall in the capital to output ratio and the ratio of capital to other inputs employed to produce health care.

Current government policy is to change this trend and a major capital investment programme has been announced. Since 1997 over £7.5 billion<sup>1</sup> for new PFI hospital building schemes has been committed or approved. Over the same period, annual NHS capital spending has increased from £1.7bn (of which 3% PFI) in 1997 to £3.5bn (of which 22% PFI) in 2003 (current prices) [2]. The most frequently mentioned objectives of this new investment programme are to increase capacity, to reduce waiting times and to raise the standards of facilities for patient treatment. Improved health outcomes are expected for some investment projects.

There is a fundamental economic problem with the treatment of capital investment in the NHS. Treasury policy (but not practice) is to optimise employment of resources to produce health care. NICE seeks to implement this approach by examining the total resource costs of generating expected health outcomes from treatments. In practice, arbitrary constraints are placed on employment of capital and these constraints are inconsistent with attempts to secure cost effective delivery of services to meet NHS objectives.

## I. Project appraisal

### *The framework*

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<sup>1</sup> This is only the estimated capital value of PFI projects and is the cumulative value of approvals for the five years to 2002/03.

The demand for capital is a derived demand. For an existing activity (hospital services for a local population), investment decisions rarely involve simply replacing depreciating assets with identical assets. Technical change and changing demand means the product/service produced with new capital will differ from the services produced with the old. In the commercial world this leads to strategic investment where the firm invests to change the quality and type of product in order to maintain or improve market position and profitability as consumer demand changes. This is equally important for the NHS if it is to remain the supplier of universal health care. The traditional framework of analysis is focused on the net present value (NPV) of a project <sup>2</sup> For a public sector project such as an NHS hospital where the outputs/services are unpriced, expected market returns ( $R_i$ ) cannot be directly observed. The Treasury advocates imputing monetary values for the outputs produced using the methodology of cost benefit analysis (CBA)<sup>3</sup> [5]

### *Valuation of benefits*

In the draft version of the Treasury's new Green Book [5] the stress is on increasing the use of research evidence on social willingness to pay to value the benefits of services produced by public projects. In the context of the present NHS investment programme, the primary benefits to be valued are:

- 1) reduced waiting times;
- 2) improved amenities for patients and staff;
- 3) improved health outcomes.

The Treasury's preferred way of measuring health outcomes appears to be use of QALYs [5, Annex 3, p.21 ] but acknowledges that to date there is no agreement on the "willingness to pay" for a QALY. NICE has implicitly placed monetary values on a QALY<sup>4</sup> but this does not satisfy the criterion of a population based valuation. The recent call for tenders for a normative study of the value citizens place on QALYs [7] may mark the beginning of serious funding for research needed if there is to be movement away from use of cost-effectiveness analysis toward CBA.

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$$NPV = \sum \frac{[(R_i^1 - C_i^1) - (R_i^0 - C_i^0)]}{(1 - r)^i} - K$$

Where  $R_i^1$  = Revenue in year  $i$  (the product of price and quantity) if the investment takes place

$R_i^0$  = Revenue in year  $i$  if the investment does not take place.

$C_i^1$  = operating cost in year  $i$  if the investment takes place

$C_i^0$  = operating costs in year  $i$  if the investment does not take place

$K$  = the price of the capital goods.

$r$  = the cost of finance or discount rate

$n$  = the expected life of the project

The relationships can be reformulated to look at changes in the scale, timing etc. of capital programmes. See [3, 4] for standard treatments.

<sup>3</sup> Where cost-effectiveness rather than CBA is employed, the calculation of net present value of costs.

<sup>4</sup> Recent research [6] estimates the value at between £20,000-£30,000.

While some of the investment in diagnostic and other equipment may be expected to improve health outcomes, the major expenditure on replacing hospitals and primary care facilities is unlikely to have a significant direct impact on health outcomes. If this investment is to be justified in CBA terms, it is necessary to identify the value of the other expected benefits, reduced waiting times and higher amenities<sup>5</sup>. The view that individuals have preferences over standards of accommodation (room size, privacy, environment) is common place for economists who study the demand for housing. Techniques for estimating hedonic prices have long been used to estimate market values for the various characteristics of houses bundled into a single market exchange. It is also common place that over time the relative valuation of characteristics can change as real incomes increase. In the absence of market prices for hospital services, stated preference techniques would be required or imputed values from other sectors.<sup>6</sup>

Judging by the frequency with which DH documents on the investment strategy stress the reduction in waiting times, the Department expects this to be the major benefit of new investment. The issue is how to value reduced waiting times. If the outcome valued is simply the change in health states (QALYs) generated by bringing treatment forward 6-8 months, the measured benefit would be small [9]. Whether a small change in QALYs times the monetary value of a QALY times the number of patients with reduced waits is a small number is a question for research. The alternative approach is to treat reduced waiting time as an outcome valued in its own right. The demand for health care is a demand for a bundle of characteristics of which waiting time, amenities and health outcomes are three. Indirect evidence from the market for private health care would support this approach. Health outcomes from treatment are unlikely to be different if a patient (who can afford it) chooses private or NHS treatment but the waiting time is significantly lower and the amenities higher in the private sector. This is what they pay for.<sup>7</sup>

## II Interdependent projects

The Treasury advocates use of a CBA framework for investment but it is questionable whether this methodology is consistent with the fragmentation of investment programmes being introduced into the NHS (Annex 1).

Two key issues arise from the economics literature. First, large capital projects for the NHS will be interdependent. A decision to approve a new DTC in the market area of an existing Trust will affect the distribution and the valuation of benefits and costs between the two projects. Second, current practice is to set different capital budget constraints depending on the source of finance. At present there is no capital budget

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<sup>5</sup> For an indication of the range of amenity improvements planned for services see [8]. Given past NHS policy, the most notable “amenity” improvement is to be the rationalisation of bed spaces to achieve a “ratio of 50% or greater of single beds to multi-bed bay ward accommodation.”

<sup>6</sup> Imputed values for the standards of space and amenity of the physical infrastructure within which citizens of the 21<sup>st</sup> century consume services can be estimated from investment in maintaining and upgrading buildings in other sectors more responsive than the NHS to consumer demand. Obvious examples include hotels, office blocks, solicitors offices, airports and private sector hospitals.

<sup>7</sup> In the past there has been some work by economists on valuation of waiting times (see [10] for a review) but no evidence that such work has been considered of relevance to the NHS investment programme.

constraint for projects funded by a PFI company. Presumably this extends to projects funded by LIFT and by definition applies to privately funded DTCs. In contrast, projects funded by public sector capital face a tight capital expenditure constraint.

When projects are interdependent, selection of the projects that maximise net social benefit depends on the capital budget constraint. Given a set of interdependent projects ranked by net benefit, if some projects are subject to a capital budget constraint but others are not, there is no reason to believe the projects selected will be those that are expected to maximise net social benefit.<sup>8 9</sup>

The demand for capital is a derived demand. Expenditure on capital goods and services should be derived from the demand for health care services. In the NHS the relevant budget constraint is the annual revenue budget constraint of purchasers<sup>10</sup>. All projects, whether financed by private or public sector funds are subject to this budget constraint (officially referred to as “affordability”). Imposing an additional budget constraint on one input, capital, for some projects and not for others, leads to inefficient investment decisions.

The inefficiency of setting both a capital budget constraint and a separate revenue budget constraint goes beyond the problem of ranking capital projects. For example, if the objective is reduced waiting times, in one locality the binding constraint may be physical assets (beds), and in another labour. Super imposing a capital spending constraint on top of a revenue budget constraint makes it impossible to optimise deployment of public resources over the two localities.

### **III Capital markets**

At first glance it would appear that the area where economic theory and research has had most impact on investment in public services is in the analysis of the cost of capital and the discount rate. In the new draft Green Book the Treasury has announced a major change in the discount rate to be used in appraisal of investment projects and in setting capital charges for public bodies such as NHS Trusts. The discount rate will be reduced from 6% to 3.5% [5 p.51]<sup>11</sup>. For the last twenty years policy decisions on the choice of discount rate have drawn heavily on the economics literature.

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<sup>8</sup> See Sassone and Schaffer [ 11 ] pp 25-29 for a relevant example of this problem.

<sup>9</sup> In the past it has been argued that project interdependence would be dealt with by Regional Offices (and now Strategic health Authorities). They would use planning and administrative powers to seek consistency of investment plans by NHS agents in the area. There is no evidence on the criteria used or how they affect ranking of projects. The problem of how to deal with interdependence will be complicated by the proposal to have a different and separate regulator to oversee investment expenditure of Foundation Trusts that choose to access private capital markets (see below). If both capital budget constraints and regulatory regimes are to differ as between health care providers, it is even less likely that simple economic criteria on the ranking and selection of projects will be relevant to investment decisions.

<sup>10</sup> This budget constraint includes all current expenditure plus capital charges for capital assets employed in providing services.

<sup>11</sup> Among other impacts, the reduction in the discount rate should have important implications for the relative attractiveness (to the Treasury) of PFI projects.

Aside from analysis of the discount rate, there is little evidence of policy interest in the contribution economic analysis of capital markets can make to improving investment decisions. The historic decline in capital to output ratios and the inefficiency of differential capital budget constraints can both be traced to the policy of setting an aggregate capital expenditure constraint that is usually explained in terms of adverse impacts of public sector borrowing on capital markets. The dominance of PFI in financing major NHS projects is a consequence of this policy. The economics literature reveals neither theoretical nor empirical support of the view that financing a project by private sector borrowing is superior to financing by public sector borrowing [12].<sup>12</sup>

The Department of health is in the process of introducing a new policy that will give Foundation Trusts access to capital markets. From what little information is publicly available on the policy [16 ], a few key issues stand out. Foundation Trusts, when borrowing from capital markets (banks, venture capital companies etc.) will not be able to use core NHS assets as security. The expected income stream from purchasers (PCTs and others) will be the security and these income streams are likely to become increasingly uncertain.<sup>13</sup> In addition, while PFI investors are protected from financial insolvency of a Trust, lenders to a Foundation Trust are to receive no protection. These factors combined make it likely capital markets will price these loans as relatively risky in comparison to other sources of NHS capital. However, we may find that Foundation Trusts borrow, even at relatively high costs of capital if it enables them to take a strategic position to exploit future demand. In effect they will be buying an option on future development of a service.

If current information is correct, the introduction of Foundation Trusts will exacerbate the economic problems of differential capital budget constraints. While Foundation borrowing from the private sector is not guaranteed by the Treasury, it will be deducted from the public sector capital budget available for all Trusts.<sup>14</sup> In effect Foundation Trusts will have first call on allowable public sector capital expenditure thus increasing the degree of capital rationing for those Trusts that do use public capital.

#### **IV The future**

Research by health economists reflects the availability of funding and a policy interest in using the research. At a rough guess, three-quarters of HESG members are

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<sup>12</sup> The official position is that PFI delivers better “value for money” than public sector procurement. It would be surprising if in some cases a PFI company did not come up with better project design than the public sector alternative. A recent survey of the Institute of Healthcare Management found that of those directly involved in PFI projects, 20% considered the PFI deal delivered value for money. The Audit commission in its published reports find some PFI projects are value for money and others not. What is implausible is that 98% of PFI proposals for major NHS projects are superior to the public sector alternative. This is *prima facie* evidence of a binding public sector capital constraint. There is no shortage of economists interested in doing research on the PFI approach to investment in the NHS [13,14,15] but in a data free environment this has not been possible.

<sup>13</sup> The period over which Foundation Trusts are to be introduced will coincide with introduction of fixed price tariffs for Trust activity [17 ] and patient choice.

<sup>14</sup> It is difficult to find economic logic in a situation where PFI borrowing from the private sector is guaranteed but does not score against public sector borrowing while Foundation borrowing from the private sector is not guaranteed is counted as part of public sector borrowing.

involved in economic evaluation of pharmaceuticals and technology assessment. There is a market demand for this research from both the private sector and the public sector. These researchers have access to the data needed to produce research that may be of policy interest.

For 2000/01 total NHS expenditure on pharmaceuticals and medical devices was £6.6 bn [18]. Total capital employed by the DH in 2000/01 was £32.1 bn and capital consumption was £1.6 bn. For 2002/03 expenditure on new capital projects is expected to be £ 3.5bn. In contrast to the active involvement of health economists in evaluation of pharmaceuticals, a search of Medline and Econ lit revealed few relevant contributions to project appraisal. The discrepancy in research activity can not be put down to the insignificance of the scale of the resources committed to the NHS. In considering reasons for this difference in research output several key issues emerge.

First, health economists are not asked to produce an answer to the question of what is the socially efficient level of expenditure on pharmaceuticals. Instead, they have been asked to develop methodologies and research techniques that enable them to examine the cost-effectiveness of a particular intervention (Beta interferon, laparoscopic surgery). If the DH wants to encourage research that can be applied to capital programmes, the same applies. The research questions must be tractable. Economists will not be able to answer the questions of what should be aggregate expenditure on hospitals or where they should be located. Condition and disease focused research that draws out capital input requirements for efficient service delivery could help to build up a knowledge base to be accessed by those who must make investment decisions. In future centres for the treatment of diabetes may be stand alone or in hospitals. If some services are to move from acute units to primary care centres, analysis of investment decisions will require condition specific research evidence on input mix. The same applies if elective surgery is to be separated from medical and A&E services.<sup>15</sup>

Second, research on NHS capital investment depends on the availability of data. If policy on confidentiality prevents researchers obtaining access to relevant data, the research will not take place. Current policy is to proliferate the sources of finance for NHS investment and each source brings its own conditions of secrecy. Empirical research cannot take place in a data free environment.

Third, greater use could be made of existing economic theory and research on investment. The most important is to take seriously the proposition that the demand for capital should be treated as a derived demand. Government sets the standards and scale of health care provision in the NHS (“demand”)<sup>16</sup> and determines the budget

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<sup>15</sup> There are significant time lags in generating research methods and evidence that may eventually be policy relevant. Over fifteen years ago the DH decided that research was needed on outcome measures and started to fund major research on this topic. There is still controversy over and continual development of this work but the research evidence is now beginning to be (selectively) applied by policy makers. If the DH believes an economic input into analysis of employment of capital in the NHS may be of some value and wants to increase research activity, research needs to be commissioned now but the research activity this stimulates may only yield useful results over the next decade, not tomorrow.

<sup>16</sup> When government valuation of outputs differs from population demand, government valuations can be used in investment appraisal. Unless government is remarkably attuned to the preferences of the

constraint for service delivery. That is the budget constraint that should determine the mix of capital and other inputs employed. The investment programme should be a consequence of those local decisions, reflecting the marginal efficiency of different inputs in meeting service objectives. Dropping the superimposed capital budget constraint would make it more likely that individuals responsible for planning NHS services could make use of economic research on efficient input-mix and translate that research into investment programmes.<sup>17</sup>

If the Treasury believes that it is efficient to impose differential capital budget constraints on providers, in addition to a revenue budget constraint, than it should insist on consistency (a requirement stressed in the Green Book). NICE, when evaluating an intervention such as laparoscopic surgery, should use a set of shadow prices for capital costs depending on whether the procedure was to be delivered in a Trust using public capital, PFI or a Foundation Trust with access to other capital. We replace postcode rationing with capital access rationing.

Finally, the brief for preparation of papers in this Policy Forum listed key issues to be addressed. Among other things we were asked to examine where “health economics had failed in grasping or solving particular issues”. It is for discussion whether the paucity of work by health economists on investment decisions should be considered a “failure” of the profession. Given secrecy, lack of data and lack of interest in commissioning research, it is not obvious what further contribution health economists could have been expected to make to this area of policy. Can we improve on this state of affairs?

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### **References**

1. Clark, T., Elshly, M. and Lowe, S (2002) Trends in British public investment, *Fiscal Studies*, v.23 no3.
2. Department of Health, *Departmental Report*, 1998/99 and 2002/03. [www.doh.gov.uk](http://www.doh.gov.uk)
3. Brealey, R.A. and Myers, S.C. (2003) *Principles of Corporate Finance*. McGraw-Hill; New York.
4. Brent, R.J. (1996) *Applied Cost-Benefit Analysis*. Edward Elgar; Cheltenham.
5. H.M. Treasury (2002) *Appraisal and Evaluation in Central Government: Treasury guidance*. (The Green Book) Draft under consultation. [www.hm-treasury.gov.uk](http://www.hm-treasury.gov.uk).
6. Devlin, N and Parkin D (2002) Does NICE have a cost-effectiveness threshold and what other factors influence their decisions? A discrete choice analysis. Paper presented to HESG, Brunel University 3-5 July 2002.

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population, relative valuations of outputs will differ from the population valuations favoured recommended by the Treasury.

<sup>17</sup> The Chancellor’s “golden rule”, that public sector borrowing should, over the economic cycle, only be undertaken to finance investment, is well based in economics. It is also consistent with a derived demand, bottom up, approach to estimates of the efficient scale of capital investment in the NHS.

7. NCCRM (2002) Invitation to tender: 'What is the value of a QALY?'  
[www.publichealth.bham.ac.uk/nccrm/](http://www.publichealth.bham.ac.uk/nccrm/)
8. NHS Estates (2002) *Quarterly briefing*. V.11 no.3.
9. Edwards, R. (1997) NHS Waiting Lists: Towards the Elusive Solution, Office of Health Economics. London.
10. Cullis, J.G., Jones, P.R. and Propper, C. (2000) Waiting Lists and Medical Treatment: Analysis and Policies, pp.1221-1231 "Waiting: empirical matters" In Culyer and Newhouse (eds.) *Handbook of Health Economics*. Elsevier. Amsterdam
11. Sassone, P.G and Schaffr, W.A. (1978) *Cost-Benefit Analysis: a handbook*. Academic press; London.
12. Flemming, J and Mayer, C. (1997) The Assessment: public-sector investment, *Oxford Review of Economic Policy* v.13 no.4
13. Boyle S and Harrison A. (2000) PFI in health: the story so far. In *A Healthy Partnership: The Future of Public Private Partnerships in the Health Service*, Kelly G and Robinson P (eds). Institute for Public Policy Research: London.
14. Sussex J (2001) *The Economics of the Private Finance Initiative in the NHS*. Office of Health Economics: London.
15. Mayston D. (get full reference)
16. Timmins, T (2002) Greater freedoms and right to borrow could give NHS a clean bill of health: FT Briefing, Financial Times 20 October.
17. Department of Health (2002) *Reforming NHS Financial Flows: Introducing payment by results*. [www.doh.gov.uk](http://www.doh.gov.uk)
18. Health Select Committee (2001) Memorandum by the Department of Health (15 October 2001).
19. Department of Health (2000) Departmental Investment Strategy. [www.doh.gov.uk](http://www.doh.gov.uk)
20. Department of Health (2001) The NHS Plan: Investment and reform for NHS hospitals. [www.doh.gov.uk](http://www.doh.gov.uk).



## **Annex 1: THE NHS CAPITAL PROGRAMME: source of finance and body responsible for granting approval \***

### **I Trusts**

*publicly funded:*

Less than £1m (adjusted for Trust turnover) to be approved by the RO of the Executive.

Between £1m and £10m, to be approved by the RO of the Executive and maybe Executive headquarters

Between £10m and £25m to be approved by NHS Executive headquarters\*

*PFI:*

Less than £1m (adjusted for Trust turnover) to be approved by the RO of the Executive

Between £1m and £4m, approval by RO and Executive headquarters

Between £4m and £10m Executive headquarters and maybe the Treasury

Between £10m and £49m, Executive headquarters and definitely the Treasury

Over £50m, DH ministers and the Treasury.

### **II Somewhere between Trusts and Primary care (but interdependent when undertaking project appraisal)**

Variations on PFI including PUK (Partnerships UK) and NHS LIFT (Local Improvement Finance Trust)

- Diagnostic and Treatment centres
- CT and MRI scanners

(no information at present on who approves)

### **III Primary care**

Surgeries (governed by Red Book reimbursement rules)

- Traditional surgeries, privately financed by GPs

Surgeries (governed by rules associated with the new PMS contract; what are these rules?)

- PFI and NHS LIFT in future to be developers of surgeries rented/leased to GP practices

Resource centres / one stop health centres / primary care centres to be financed by PFI and perhaps NHS LIFT

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Sources: Department of health 2000b and 2001b

\* Some of these arrangements may have been changed or are being changed with the transfer this year of responsibilities from RO to Strategic Health Authorities.

\*\*There is a further category for public projects greater than £25m but it is not important as virtually all these projects are funded by PFI.