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Discount Rates for Rail Safety Scheme Appraisals
Final Report for the Office of Rail Regulation

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Executive Summary

The theoretical problems of discounting health and safety impacts in public sector analysis are essentially resolved in the literature. Current UK government practice as set out principally in HSE guidance is essentially sound, although it might usefully be further polished.

There are circumstances where it is appropriate to apply cost-benefit analysis or cost-effectiveness analysis (from the public interest perspective as opposed to the enterprise perspective) to a privately financed activity. This may be because the activity has material public expenditure implications, or because of substantial external health and safety (or environmental) impacts.

In such cases the handling of private sector financing costs can sometimes be problematic. There is no problem when the financing costs are revealed in market prices, but the immediately available cost data may not include financing costs, in which case steps need to be taken to include them.

This inclusion of private financing costs in an analysis from a public interest perspective has no bearing at all on the discount rate, which remains the government social time preference discount rate. It may however require judgement about the rate of return that would be paid on the commercial financing of the assets in question and about the time profile of the payments. This profile provides a time stream of financing cost (in place of the capital expenditure itself), which can then be discounted at the government discount rate.

There is no current government guidance formally addressing this handling of private financing costs, although it is not necessarily needed, since the public sector discounting of cost streams that already include private financing costs is routine. There used also to be Treasury guidance, on the related but more complex issue of comparing private and public financing costs, that advocated the discounting of finacing costs. We understand that Defra are currently considering the issues in the same way and the procedure was recently applied, without controversy, to a proposed major water utility environmental investment.

1.   Introduction

This draft report is in response to a request from the Office of Rail Regulation for advice on the use of discount rates in rail safety scheme appraisals, where the appraisal is being carried out by a private sector body, but using public sector cost-benefit analysis (CBA) procedures. The Specification is attached at Appendix A.

Section 2 discusses the discounting of health and safety benefits, describing what is now a broad consensus across UK government and leading academics, with a summary of ways in which its presentation might be refined.

Section 3 discusses, in terms consistent with the Treasury Green Book, the use of cost-benefit analysis (from a public interest perspective) of activities undertaken by a privately financed enterprise.

Section 4 provides summary conclusions.

Appendix B covers some technical issues, especially with respect to risk, in slightly more detail.

2.   The Discounting of Health and Safety Impacts

2.1. The Literature and the Current Policy Assumption

Health and safety benefits in public sector analysis, whether they are valued in monetary terms in cost-benefit analysis or expressed in non-monetary units such as the QALY[1] in cost-effectiveness analysis, are in international practice often discounted (or sometimes explicitly not discounted). However the rate at which they are discounted is often a source of confusion.

Jones-Lee and Loomes (1995), who include a useful list of further references, set out the rationale underlying current UK government practice. Gravelle and Smith (2001) set out a comprehensive account of the implications of alternative assumptions. In an earlier paper the same authors (Smith and Gravelle, 2000) examined international practice and found that, in the 1980s and 1990s, health benefits measured in QALYs were almost invariably (and wrongly) discounted at the same rate as monetary costs and benefits.

The key assumption in UK central government practice is that the welfare impact or utility of a marginal change in the risk of premature death or injury (or a QALY) is independent of income. There is no robust empirical evidence on whether more welfare is lost if such an extra risk is imposed on the rich than on the poor, or vice versa, but it is prima facie a reasonable assumption. It is also an assumption that society and governments are likely in any case to prefer, for its self-evident equity.

The discount rate set by HM Treasury for analysis from a public interest as opposed to commercial perspective has since the 1980s been, as in many countries, a social time preference rate for marginal income. This rate is conventionally made up from two components. One component, often described as 'pure time preference', describes society's time preference for marginal *utility*, reflecting mainly the extent to which the current population cares about the marginal utility of future populations relative to its own. This is currently set by the Treasury as 1.5 per cent per year. The other, usually larger component, describes the extent to which the utility of marginal income declines over time, as real per capita incomes grow. This is currently set by the Treasury at 2 per cent per year, giving the overall discount rate of 3.5 percent.

2.2. HSE Guidance

The most comprehensive UK government guidance on the discounting of health and safety benefits is that of the HSE, whose current guidance (HSE, 2007.1) notes that "the Treasury recommended discount rate for both costs and benefits is 3.5%. However, it is considered that individuals place an increased value on health and safety benefits as their living standards increase. This leads, currently, to an effective discount rate for health and safety benefits of 1.5%." The guidance explains this latter figure more fully in a footnote as follows:

> *"It is considered that the value of preventing a fatality has a constant utility value over time and it is therefore uprated in real terms each year by real*

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[1]   Quality Adjusted Life-Year.

> *GDP per capita growth (i.e. currently, by about 2% per year, since at the moment the real per capita GDP growth is forecast at around 2% per annum). This uprating, coupled with a 3.5% discount rate, gives an 'effective' discount rate for health and safety benefits of 1.5% (lower effective discount rates apply to health and safety benefits accruing more than 30 years into the future). It needs to be noted that the real per capita GDP growth forecast could change over time."*

In its current practical impact the HSE guidance is satisfactory and consistent with the appropriate literature, although there are ways in which it might be further refined.

It could be explained directly that health and safety impacts, measured in non-monetary units or valued at *today's* monetary value, are assumed to have a constant marginal utility impact over time; and that they may simply be discounted at the "pure time preference rate" for marginal utility. This might make it clearer what assumptions are being made and would omit two variables (the per capita growth rate and the elasticity of marginal utility) that are irrelevant to the pure time preference rate. This might possibly avoid confusion if and when the UK government discount rate is revised on the basis of an elasticity of marginal utility different from the current low value of 1.

It would also be helpful to update the long standing presentation by the Department for Transport of its figure for valuing prevented fatalities (VPF) (currently as in Department for Transport, 2007). This adopts a format that no longer reflects the way in which the figure is derived. It is presented in the form of "human costs" plus "lost gross output" (plus medical and ambulance costs), whereas the VPF is actually derived from the "willingness-to-pay (WTP), by those at risk, to avoid a fatality" plus "lost net output".[2] A correct format is set out in HM Treasury (2005, paragraphs C2 and C3),

It could also be helpful to note and dismiss the fallacy that discounting a benefit at a lower rate than conventional costs implies indefinite postponement. Described as the Keeler-Cretin paradox since it first appeared in the literature in 1983, this is surprisingly widely cited, but as Gravelle and Smith (2001) say bluntly at the end of an extended discussion, "it is simply incorrect to use the same discount rate for health and cost effects if the value of health is growing".

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[2]   Strictly speaking, the only component of the VPF to which the pure time preference discount rate should be applied is the WTP component. However the net output and ambulance/medical cost components are so small relative to the WTP component that little would be gained, and much lost in greater complexity, by discounting the different components of the VPF at different rates. In any case, besides being relatively small, these elements have components that also increase in real unit value over time.

3.   The Application of Cost-Benefit Analysis to Privately Financed Activities

3.1. The Public Interest Perspective and the Commercial Perspective

Public sector appraisal is normally concerned with the public interest. This requires a time discount rate that reflects social time preference (STP) rather than a market cost of capital.[3] It requires the inclusion of all social impacts and may include non-market valuations of impacts on for example the environment or leisure time or changes in health and safety risks. It also includes private sector costs, usually with no need for any specific identification of the private cost of capital, because the private sector costs are expressed as output prices including financing costs.

Private sector appraisal is concerned with the interests of the firm. This normally requires a time discount rate equal to (or sometimes for pragmatic reasons higher than) the relevant market cost of capital. The discounted cash flow analysis is also concerned with the costs and revenues faced by the firm. Where there are significant external impacts on society, the presentation of the commercial appraisal within the enterprise may well include a discussion of, for example, the reputational implications for the enterprise, and even (outside the commercial appraisal's present value or internal rate of return calculations) some monetary valuation of health and safety or environmental impacts.

However sometimes, because of the importance of the public spending implications or the health and safety or environmental externalities, an enterprise may decide, or a regulator or its parent Department may insist, that the potential project should be appraised not only from a commercial perspective but also from a public interest perspective.[4]

In such a case, as in a conventional public sector appraisal, the operating expenditures[5] will be discounted at the government's STP discount rate and the health and safety or environmental benefits, if they are valued, discounted as described in section 2 above. The capital expenditure data however will normally exclude financing costs. If they are handled simply as a cash expenditure, as in the appraisal of publicly financed capital, exclusion of the private financing costs will lead to an understatement of the social costs.

The only Department to have take a firm interest in such financing cost issues in recent years (since the Treasury interest in the early days of major public / private financing comparisons in the 1980s) is Defra. The EC Water Framework Directive may present cases in which alternative means are available to achieve the Directive's standards, that might impose

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[3]   As outlined in Appendix B, there is a strand of literature extending over forty years that does not accept this.

[4]   In the case of an English water utility the costs would normally fall entirely on consumers, with no public spending implications, whereas in the case of Network Rail the costs will typically fall ultimately to public spending rather than to higher fare revenues. We note for example that any increase in Network Rail's costs might normally result in higher track access charges after the next regulatory review. This increase will then be passed through to DfT, as a result of the clause 18.1/Schedule 9 franchise contract provisions. And even if TOCs bear additional costs that they cannot pass on to DfT in the short term, these costs will be reflected in higher subsidies/lower premia in future franchise bids.

[5]   Subject to the usual Treasury Green Book conventions, such as the need to reflect social opportunity costs, which are usually but not always near enough the same as market prices.

alternative requirements for capital investment of different kinds by different types of private sector bodies. The Department has therefore commissioned research and a peer review of that research and it is currently considering its position before consulting the Treasury. The work in question has so far been consistent with the principle described above of setting out the privately financed capital not as a cash expenditure but as a flow of depreciation and return on capital charges over time and discounting this cash flow at the social time preference rate.

Informal discussion with Treasury Green Book guardians suggests that, for any analysis from a public interest perspective, they are content with this principle, which is consistent with past Treasury guidance as explained below.

3.2. Handling of the Private Cost of Capital in Cost-Benefit Analysis

3.2.1.   Background

The Treasury Green Book has traditionally been concerned with the appraisal and evaluation of publicly financed activities.[6] However it has always recognised that financing costs sometimes need to be explicitly considered in comparisons of private with public financing, although historically the issue has been the costing of public financing costs (for comparison with private sector costs) rather than private financing costs, as the latter are virtually always included in the private sector leasing or service charge.

The very first edition of the Green Book (HM Treasury, 1973) recognised as "one common exception" to use of the standard discount rate, "the choice of methods of financing investment [as in buy versus lease] once the actual decision to invest has been taken", advising that in this case the alternative cash flows should be discounted at the government borrowing rate.[7]

However when such financing choices became more frequent the Treasury issued guidance in 1982 setting out a fuller methodology in which, as described above, financing costs were spread over time and discounted at the STP discount rate. In a regime where, unlike today, the government's discount rate and its own cost of capital were markedly different, the necessary procedures proved administratively too difficult for run-of-the-mill financing comparisons. The guidance was therefore relaxed (Treasury, 1984) to allow the approximation in most cases of simply discounting the direct public cash flows for both

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[6]   Specific guidance on Regulatory Impact Assessment is provided by the Better Regulation Executive (BRE), but that guidance is cleared by the Treasury and is Green Book compliant. It does not add to the Green Book guidance on private financing.

[7]   This procedure, which is a simplification as it implies that social time preference is equal to the government borrowing rate, was later recommended by no less than Robert Lind (1990, p S-23), joint author of the famous Arrow and Lind (1970) that opened the first major exchange between welfare economists and financial economists on the social cost of public financing, and author of the most quoted, if now rather outdated, summary of public sector discount rate literature (Lind, 1982).

options at the STP rate.[8] Recommendation of the full methodology was however retained for exceptional cases in subsequent issues of the Treasury Green Book up to 1997.[9]

With the lower discount rate introduced in 2003 the issues are simpler, as the government discount rate is now close to the tax-adjusted government borrowing rate. In this case it is always adequate to compare public and private financing simply by discounting the cash costs in both cases to the public sector at the real STP discount rate of 3.5 per cent.

However the Treasury Green Book has never explicitly addressed the situation in which the immediately available *private* sector costs exclude the private financing costs. It can be argued that it does not need to, since the inclusion of the financing costs of privately financed activities in cost-benefit and regulatory impact analysis is commonplace, as they are an element in market prices; but confusion can arise in practice where financing costs are not included in the immediately available private sector cost data.

Discounting is such a familiar procedure that the relationship between discounting and the cost of capital is easily overlooked. These two quantities are typically identical in private sector applications but typically different in public sector applications. The relationships are considered barely ever in the academic literature and very rarely in government guidance.[10]

Discounting at the cost of capital is a rational way of comparing expenditures and revenues over time from the private enterprise's perspective. Discounting at the social time preference rate is a rational way of comparing public expenditures (or expenditure savings) over time from the public interest perspective.

It is widely accepted that the risk-free market cost of capital to the government understates the social time preference value to society of postponing monetary costs or bringing monetary benefits forward. This implies that there are social costs beyond the market cost of increasing public debt. The STP rate, being higher than the risk-free market rate, subsumes the market cost of capital: the government's market cost of capital is not an additional cost.

However the risk premium in private financing costs is a social cost, which is normally reflected in market prices, but should not be overlooked in a public interest analysis just because the immediately available cost data do not include it. The most realistic way to do this, as noted above, is to express the capital cost not as a cash expenditure but as a flow of depreciation and return on capital charges over time, and then discount this cash flow at the social time preference rate.

As an aside it might be noted that nowadays, in CBA, no distinction is normally made between spending on capital assets and spending on operating costs. Much of the literature of

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[8] This gave some bias against public financing as it implied that the government borrowing rate (after addition of a small tax adjustment) was equal to the STP rate of 5 per cent or subsequently 6 percent..

[9] See HM Treasury (1997) Annex D, paragraph 32. At that time the absence of corporate taxation in public financing costs was handled by ignoring such tax in private finance costs. In today's circumstances it is simpler to handle this by adding a corporate tax adjustment to the public cost of capital, giving, conveniently, a figure broadly equal to the currently specified social time preference rate of 3.5 percent.

[10] Indeed the only instance appears to be in pre-2003 Treasury guidance. The 2003 Green Book and its associated documents assume wrongly that the STP rate is equal to the cost of capital.

the 1950s and 1960s did make such a distinction, with fruitless attempts to derive a shadow price for capital relative to current spending. However it is now normally accepted that the social cost of, say, professional, skilled, or unskilled labour, or for that matter cement, is the same whether the activity is classified as capital or current. [11] The special circumstance addressed in this present study is that, with *private financing*, the capital asset may appear on the company's balance sheet, financed by debt and/ or equity, the financing costs of which are a social cost. Ignoring the private financing cost will understate the costs of the policy, programme or project being considered.

3.2.2.   Practical Application

3.2.2.1.   When is a public interest analysis required?

It would be inconsistent to privatise an enterprise, in order to expose its management to market disciplines, and then to require it to base its investment decisions wholly on cost-benefit analysis, reflecting a social and not a commercial perspective. However there are cases where CBA is appropriate at least as a complement to commercial appraisal, because of the magnitude of the external impact, or of the implications for public funding, or both.

A conceptually simple case, that involves no problems of adjusting for private financing costs, is that of pharmaceuticals which may be procured by the NHS. The National Institute for Clinical Excellence, under guidance from the Department of Health, requires the government discount rate of 3.5 per cent (and 1.5 per cent for health benefits) to be used by producers in appraising pharmaceutical costs and benefits. The question of financing costs does not arise as the costs in this application are always private sector output prices, in which financing costs are already included.

The only recent application of the principles described in section 3.2.1 appears to have been to a CBA commissioned by a water utility of a major investment for environmental benefits. The CBA was required by Defra, but it was clear to all parties that it was needed. The procedure described above was applied (in parallel with a calculation ignoring financing costs), using the utility's WACC as the cost of capital. All the parties concerned – OFWAT, the Environment Agency, Defra and the utility – were content with this. The assumed distribution over time of the financing costs was based on linear depreciation.

The HSE position on major projects is that cost-benefit analysis, while one approach to consider, is only one of many considerations and therefore has not so far merited any special concerns about private sector costs of capital. Indeed while HSE's guidance to duty holders on the application of ALARP does recommended cost-benefit analysis the guidance is non-prescriptive and it is not known how widely it is applied. This may be justified insofar as many of the risks concerned are very low probability very high impact hazards, where professional judgment tends properly to dominate over formal cost-benefit analysis.

Network Rail is a special case among regulated industries, in part because its investment is for the most part heavily subsidised by government, directly or via subsidies to train

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[11]   The past debate about shadow pricing capital has to some degree been replaced by the much better founded issue of what in Whitehall terminology is called the "social opportunity cost of exchequer funds" (SOCEF) – that is a shadow price for public spending relative to consumption expenditure. This however is outside the scope of this study.

operators and track access charges. Also, in transport, external impacts in terms such as time savings are often considerable and can often be valued. Thus virtually all of Network Rail investment is subject to cost-benefit analysis, by DfT or by the industry.

This poses the question of how DfT and Network Rail handle the financing cost of any debt financing of this spending (whether debt financed by an addition to the regulatory asset base, or by a choice to spend on investment instead of reducing debt). This appears to be overlooked in Network Rail's current procedures. We understand however, subject to further confirmation when the Department comments on this Report, that in DfT debt financed (i.e. "RAB funded") Network Rail investment spending is now costed in their CBA as a flow of capital repayments and returns on capital, to be discounted at the STP discount rate, consistently with the principles discussed in section 3.2.1.

3.2.2.2.   The estimation of private financing costs

Estimating private financing costs, when this needed for a CBA, is in practice a matter for informed judgement about what the financing consequences of the particular investment would be. Two judgements are needed, one about the relevant cost of capital, the other about how the payment of this return would be distributed over time.

A simple assumption for most regulated industries may be that the investment would be an addition to the enterprise's regulatory asset base and that financing cost is given by the WACC, with repayment spread over the relevant asset lifetime; or sometimes a case might be made for a project specific cost of capital.

Network Rail, being debt financed, poses the question of whether the relevant cost of capital is the marginal interest cost or the allowed return on the regulatory asset base.

However none of these issues appears to be especially challenging, insofar as they draw on principles that will already have been carefully considered and largely resolved in the course of establishing a regulatory asset base and an associated rate of return for the industry as a whole.

As a stylised numerical example, suppose that:

§   the (gross of tax) cost of capital for the asset is 6.5 per cent or, as an alternative assumption, 4.5 per cent in real terms;

§   the social time preference rate, also in real terms, is 3.5 percent;

§   the capital is repaid in two equal instalments after 10 years and 20 years, each time with accumulated interest.

If the initial capital investment is 100 in year 0, the present value including financing costs can then be derived as in Table 3.1.

Table 3.1
Illustrative calculation of the social cost of private financing costs

	Year	0	10	20
Capital spending		100		
Capital repayment			50	50
Cumulative interest payment @ 6.5% (or 4.5%)			88 (or 55)	44 (or 28)
Total payment of capital + interest			138 (or 105)	94 (or 78)
Discount factor @ 3.5%			0.709	0.503
Present value			98 (or 74)	47 (or 39)
Total present value		145 (or 113)		

Thus in this example the financing cost adds 45 per cent to the cost of the investment with a private cost of capital of 6.5 per cent, and adds 13 per cent with a private cost of capital of 4.5 per cent.

4.   Conclusion

4.1. Discounting of Health and Safety Impacts

The discounting of health and safety impacts in public sector analysis remains a source of fairly widespread confusion in international practice. However it is essentially resolved in the literature, and current UK government practice, as set out principally in HSE guidance, is essentially sound. There are however a few respects in which it might usefully be further polished.

4.2. Application of Cost-Benefit Analysis to Privately Financed Activities

Discussion and quantification of health and safety or environmental impacts may often be included in the presentation of a commercial appraisal. However they will not be included in the main discounted cash flow analysis (and discounting them at a commercial discount rate would in any case understate their social value). There are therefore circumstances where it is appropriate to apply cost-benefit analysis or cost-effectiveness analysis (from the public interest perspective as opposed to the enterprise perspective) to privately financed activities. Such circumstances may arise because of importance of the public expenditure implications, or of the external health and safety or environmental impacts.

Network Rail is a special case, in that virtually all of its investment spending is subject not only to financial analysis but also to cost-benefit analysis by either DfT or the industry.

For the most part such public interest analysis can follow normal, well documented procedures. However private sector financing costs can be problematic. There is currently no problem when the financing costs are revealed in market prices. These prices can be used directly in a cost-benefit analysis, and discounted at the government discount rate. However sometimes the available cost data do not include financing costs, which need then to be explicitly included.

This need to estimate the private financing costs has no bearing at all on the appropriate discount rate. For cost-benefit analysis this is always the government discount rate as defined in the Treasury Green Book.

Estimation of private financing costs needs judgement about the rate of return that would be paid on the commercial financing of the assets in question, and about the time profile of the payments. This provides an estimated time stream of capital charges (in place of the capital expenditure itself), which can then be discounted at the government discount rate.

No current government guidance formally addresses the handling of such financing costs, although such guidance is not necessarily needed, since the public sector discounting of procurement costs or savings that already include private financing costs is routine.

There used to be Treasury guidance on the related but more complex issue of comparing private and public financing costs, in the days before the government discount rate was close to the government's own financing rate of return. That guidance recommended the principle just described of replacing the cash expenditure on the asset by the subsequent stream of

capital repayment and return on capital charges. Defra have recently commissioned research on the issue in the environmental context. This is still being considered by that Department, but indications are that they are considering the issues in the same way. Informal indications from the Treasury are, again, that for analysis from a public interest perspective, the public sector discount rate should be used invariably for comparisons over time. The procedure just described was recently applied, without controversy, in parallel with an analysis which ignored financing costs, to a recent proposed major water utility investment for environmental benefits.

Any procedure that discounted health and safety or environmental benefits at a commercial discount rate would understate their social value. At the same time any procedure that ignores private financing costs will understate the costs that will in due course fall on consumers and/or taxpayers.

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Appendix A.   Specification

Provision of Consultancy Services To The Office Of Rail Regulation (ORR) For Discount Rates For Rail Safety Scheme Appraisals.

Tender Objective

1   The aim of this tender is to appoint a supplier to provide advice on the appropriate discount rate that should be used in rail safety scheme appraisals.

Background

2   ORR assumed responsibility for health and safety regulation of Britain's railways on 1 April 2006. One of the primary concerns under the Health and Safety at Work Act 1974 is for duty holders to control the risks to health and safety "so far as is reasonably practicable" (SFAIRP). Therefore, if an employer wants to defend a charge of failing to ensure health and safety, it is for them – and not ORR – to show that better means to ensure health and safety were not available, or that it was not reasonably practicable to do more than was done.

3   The courts have decided that a control measure is not reasonably practicable when the costs incurred in introducing the measure (be they costs in time, money or inconvenience (amongst others)) are 'grossly disproportionate' to the health and safety benefits of controlling the risk.

4   This concept arises from the judgment in Edwards v. National Coal Board (1949). In this case the Court of Appeal held that:

"... in every case, it is the risk that has to be weighed against the measures necessary to eliminate the risk. The greater the risk, no doubt, the less will be the weight to be given to the factor of cost."

5   Lord Justice Asquith said that:

" 'Reasonably practicable' is a narrower term than 'physically possible' and implies that a computation must be made by the owner in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other, and that, if it be shown that there is a gross disproportion between them – the risk being insignificant in relation to the sacrifice – the defendants discharge the onus on them."

6   Although this case predates HSWA , the test it defines (what is 'reasonably practicable') continues to be followed.

7   One of the ways that duty holders can inform their judgement on what is reasonably practical is to undertake a cost benefit appraisal. This compares the costs of a measure against the health and safety benefits of introducing the measure.

8   As part of the transfer of responsibility for railway safety, ORR inherited a number of documents on cost benefit appraisal for railway safety schemes originally produced by

HSE/C[12]. They are intended to guide railway inspectors in applying and testing the application of the SFAIRP principle. Duty holders would be expected to apply the statutory test for themselves, as appropriate when discharging their responsibilities.

9   The guidance originally produced by HSE/C provides two slightly different recommendations for discount rates:

§   'HSE principles for Cost Benefit Analysis (CBA) in support of ALARP decisions' states that

"The Treasury recommended discount rate for both costs and benefits is 3.5%. However, it is considered that individuals place an increased value on health and safety benefits as their living standards increase. This leads, currently, to an effective discount rate for health and safety benefits of 1.5%[13]" whereas

§   'HMRI Specific Cost Benefit Analysis (CBA) Checklist' recommends a discount rate of "no less than 3.5%" to future costs and cost savings and a discount rate of no greater than 1.5% of future health and safety benefits".

10   We are now reviewing these documents with a view to publishing revised guidance in the coming months.

Purpose

11   The aim of this study is to provide advice on the appropriate discount rate that should be used in cost benefit appraisal of safety schemes. A critical element of this consideration is that costs of safety schemes would accrue to private sector duty holders, whether they are Network Rail or train operating companies, and health and safety benefits accrue both to the organisation and to society. A further consideration is that Network Rail receives a large element of its funding from the public sector.

12   The advice should cover the following issues:

§   what would be the appropriate discount rates for duty holders to discount their costs (and the costs of others?);

§   what would be the appropriate discount rate for health and safety benefits;

§   advice on how future health and safety benefits should be changed over time to reflect changes in real income;

13   To answer these questions the study should examine:

§   the rationale for using different discount rates for central government, government owned or funded commercial entities (e.g. Royal Mail), and commercial entities; and

§   examine practice with respect to other regulators, particularly where private sector companies have to appraise schemes with societal impacts, for example schemes with environmental benefits in the water sector.

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[12]   http://www.rail-reg.gov.uk/server/show/nav.1118

[13]   presumably on the assumption that real incomes grow at 2% a year on average

§   If the advice is use Network Rail's Weighted Average Cost of Capital (WACC) to discount costs and/or benefits, we would like advice on whether it is appropriate to use the current WACC for appraising impacts that may take place some time in the future.

Outputs

14   The output of the study is expected to be short thought-piece, three weeks after appointment, identifying the key issues and providing advice on the issues identified above. The thought-piece may be published on ORR's website.

Appendix B.   Technical Aspects of the Cost of Capital and Discounting

This Appendix slightly expands, especially with respect to risk, some of the technical issues covered in this report.

B.1. The Cost of Capital and Time Preference

In the private sector, appraisal is concerned with the interests of the firm. Thus the normal procedure (or at least that recommended in business schools) is to discount future costs and revenues at a rate equal to the cost of capital for that activity. Indeed the terms cost of capital and discount rate are often used interchangeably.

In the public sector, appraisal is usually concerned with the public interest. This normally requires a time discount rate that reflects the extent to which the society as a whole prefers marginal income sooner rather than later. In the UK this social time preference rate has for many years been set by the Treasury, currently at 3.5 per cent in real terms.

The government also has its own cost of capital, as observed in the gilts market. It would not be in the public interest to adopt a social time preference (STP) rate that was lower than this cost of capital. However in practice the UK STP rate, derived mainly from other data, has always been higher than the government's borrowing rate. In this case the cost of capital is subsumed in the STP discount rate.

B.2. Categorisation of Risks

To most Ministers and policy officials, risk in project appraisal is about the chance that the projected costs or benefits are optimistically biased.[14] Discussion of "risk transfer" from a government client to the contractor is usually in the context of optimism bias.

In the economics literature, in contrast, risk describes variability around the expected outturn. The main concern in the literature is with the effects of covariance between projected costs or benefits and other risks. However different approaches are adopted in the welfare economics literature and the financial literature.

The welfare economics literature takes a first principles approach to the cost of covariance of costs or benefits with income.[15] However the effects of such covariance on taxpayers or beneficiaries are rarely considered to be material in developed economies.

The financial economics literature is concerned primarily with the cost of risk to a firm in financing capital investment.[16] The model most often used in such analysis (the capital asset

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[14]   Most institutions are of course averse to any risk that may bring them embarrassment or worse. In the context of regulation this includes risks of any adverse impacts, financial or otherwise.

[15]   As set out in for example Layard and Walters (1978, pp 364-5). The current Green Book, in contrast to its predecessors, presents the cost of variability risk mainly in terms only of a random risk. It also notes that "when risk is correlated systematically with income or GDP [it] cannot be diluted by spreading across the economy", but does not explain how to quantify this effect (HM Treasury, 2003, Annex 4, paragraphs 36-38).

[16]   See for example any financial economics textbook, Brealey and Myers (1981-2003) being one of the most popular.

pricing model, CAPM) takes the cost of capital as the sum of the risk free market rate and a risk premium. This premium is equal to a market (usually equity market) average multiplied a factor, beta, which depends upon the covariance of the particular equity value with the market.

The financial literature regards risk that is uncorrelated with the market as costless, on the grounds that it can be diversified by spreading risk across diverse assets. Similarly the welfare economics literature regards variability risk in public projects that is not correlated with income as costless, so long as it is very small for any individual.

B.3. The Equity Risk Premium

The different approaches to risk of the welfare economics and financial and welfare economics literatures reflect their different histories and different applications and there is no necessary contradiction between them. However since the origins of modern financial economics in the 1960s there has been a divide between those who conclude (on the basis of much evidence) that the CAPM risk premia, based on correlation of the value of specific equities with general equity market fluctuations, are specific to equity financing, and those who believe that, because financial markets are so efficient, the equity risk premium must reveal a fundamental social cost of the activity in question, however it is financed.

In public policy, this latter, efficient markets assertion carries serious weight in a very few developed economies (New Zealand, Australia and Canada) (Spackman, 2006). It seems to carry no weight in the US. Within Europe outside the UK the efficient markets assertion seems never to arise even in the literature. In the UK it was debated in the Treasury in the late 1980s but rejected and the issue appears now to be quiet, although it has a significant UK literature.[17]

This note, as does HM Treasury, accepts that equity risk premia are not materially relevant to the social costs of public financing. If the efficient market assertion were accepted it would not affect the costing of private financing. It would however imply that the same risk premia should be applied to public financing.

B.4. Taxation and the Numeraire

B.4.1.   Indirect taxation

The current Treasury Green Book, like its predecessors, recommends that government appraisal and evaluation should be carried out in market prices (HM Treasury, 2003.1, paragraph 5.11). This is because market prices is the numeraire most familiar to officials and Ministers and also because willingness-to-pay valuations of non-marketed impacts in cost-benefit analysis are perforce in market prices.

The most important issue in practice is that of consistency. Costs and benefits should be in the same numeraire. And in comparing alternative sources of supply care needs to be taken

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[17]   A listing of the usual arguments may be found in Currie (2000), with a response by Spackman (2001).

to ensure that administrative convention (for example with respect to when VAT is or is not paid) does not lead to any distortion.

It may sometimes be more convenient to work in prices excluding VAT on final outputs. The usual convention is such cases used to use "factor costs", but in recent years, in a move towards more international standardisation, "basic prices" has largely succeeded "factor cost" as a standard measure of output. Basic prices exclude taxes on *products*. Factor costs also exclude taxes on *production*, such as excise duties paid by a supplier on fuel used by its vehicles. Willingness-to-pay valuations are nearly always derived at market prices. Thus if they are to be compared with basic prices they need to be adjusted downwards by a factor for average VAT on final output prices.

A special case of indirect tax is taxes imposed to recover the cost of an externality, such as a carbon tax. These may often best be included as proxies for monetary values of the relevant externality.

B.4.2.   Corporate direct taxation

Private sector firms pay corporation tax, whereas no such tax is paid on publicly financed investment. Thus, in comparing public and private financing costs, either corporation tax should be omitted or an equivalent adjustment added to the public financing costs before if they are to be compared with private financing. The latter is more conventional. The figure of 3.5 per cent serves well enough as a "corporation tax inclusive" public sector cost of capital.

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