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Social discounting: social opportunity cost, social time preference and risk*

Michael Spackman[1]

Current government practice in setting social discount rates reflects two main divides. One, fifty years old, is whether the marginal cost of public funds should be built into the discount rate or handled separately. The other, more recent, is whether or not the implications for discounting of the covariance of public service benefits with income, or with equity markets, are substantial. This paper discusses these latter, systematic risk issues. However it mainly addresses enduring misunderstandings on both sides of the debate about 'social opportunity cost' versus 'social time preference' discounting.

Keywords: cost benefit analysis, discounting, public investment, social opportunity cost, social time preference, systematic risk

JEL Classifications: D61, D81, D90

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Abbreviations

BCR	Benefit/cost ratio = the ratio of present value benefits to present value costs
CBA (BCA)	Cost benefit analysis (Benefit cost analysis in the US) – i.e. comparing dollars of public spending with dollars of consumption
CAPM	Capital asset pricing model
CCAPM	Consumption-based capital asset pricing model
CEA	[US] Council of Economic Advisers
NPV	Net present value
MCF	Marginal cost of public funds, defined here as a ratio (>1) for comparing public spending dollars with consumption dollars. Many other terms are also used to describe this quantity
OMB	[US] Office of Management and Budget
RFIR	Risk free interest rate
SDR	Social [time] discount rate
SOC	Social opportunity cost (as a percentage rate, or as an approach to social time discounting)
SPIF	Shadow price of investible funds
STP (SRTP)	Social time preference (as a percentage rate, or as an approach to social time discounting –) This is described as SRTP – social rate of time preference – by the CEA)

1. Introduction

Poor public spending or regulatory decisions arise overwhelmingly from perverse political priorities or perceptions, or errors in estimating costs or benefits, not from poor choices of social discount rate (SDR) or mishandling of the cost of public funding. Nonetheless the criteria for comparing public spending with consumption benefits, with each other and over time, deserve serious attention. These factors can be quantitatively very important and a sound conceptual framework is needed for reliable appraisal of many special situations.

Routine social discounting began in the 1960s, with the emergence of two main paradigms for deriving a social discount rate. One, still described as Social Opportunity Cost (SOC), was based on the rate of return that would be expected on funds left in the private sector, rather than raised by government borrowing or taxation. The other, still described as Social Time Preference (STP) was based on the estimated social preference for marginal consumption sooner rather than later. Both paradigms have subsequently evolved along different paths. This paper draws on important papers by leading advocates of the SOC paradigm, namely Harberger and Jenkins (2015) and Burgess and Zerbe (2011); henceforth H&J 2015 and B&Z 2011, and on an Issue Brief of the US Council of Economic Advisers (CEA, 2017), henceforth CEA 2017. The CEA Brief itself draws on B&Z 2011 in presenting, in a US context, a balanced picture of then current academic views. [2,3]

[2] The CEA paper was published on the White House website shortly before 20 February 2017, when much of that administration's material was transferred, some temporarily, to obamawhitehouse.archives.gov.

[3] B&Z 2011 (and subsequently Burgess, 2013) also assess an approach described as "marginal cost of funds", which is not discussed further here. Burgess and Zerbe have also had a revealing exchange with

This present paper is written from the perspective of a practitioner who has worked within SOC and STP regimes, has followed the literature over many decades and, with qualifications, favours the STP paradigm for most applications. Section 2 below outlines current national and international SDR regimes. Section 3 summarises the SOC and STP rationales, some common ground and their divergent evolution. Sections 4 and 5 discuss two, related areas where social discounting paradigms differ especially sharply, namely the marginal cost of public funds (MCF) and the appraisal of 'choices of technique'. Section 6 addresses risk. Section 7 summarises key points and reviews practical approaches. Appendices discuss systematic risk and several issues that are significant but would clutter the main text.

All annual percentage rates are expressed in real terms.

2. Current paradigm choices

Current regimes for public sector discounting are categorised here under five, slightly overlapping headings.

SOC regimes: Some countries, states and provinces, notably New Zealand and the federal governments of Australia and Canada, apply SOC discount rates, typically in high single figures.[4] The US federal government (OMB 1992, section 8b(1)) also specifies such a rate (7%, based on the return to business capital) for the comparison, in CBA, of consumption benefits with public spending.[5]

Conventional STP regimes: Most European-wide institutions and some European countries apply conventional STP discount rates, typically in low single figures. The US OMB has long specified such a rate for regulatory appraisal where the impact is on consumers rather than business investment.[6] The current rate of 3% follows from the assumption that "*the rate that the average saver uses to discount future consumption is a measure of the social rate of time preference [for which] the real rate of return on long-term government debt may provide a fair approximation*."

Cost of capital regimes: This covers regimes that either simply apply a risk free interest rate (RFIR), perhaps adding a significant premium for systematic covariance of project impacts with income, or adopt a **cost of capital paradigm** that includes an equity market risk

Canadian advocates of STP (e.g. Burgess and Zerbe, 2013; Moore et al, 2013a, 2013b, 2017), which is briefly discussed later below.

4 Although, with the very low real interest rates of recent years, SOC estimates may be as low as 6%, as in the 2016 figure for New Zealand (NZ Treasury 2016).

5 OMB (1992) also notes that, rather than discounting at 7%, "Using the *shadow price of capital* to value benefits and costs is the analytically preferred means of capturing the effects of government projects on resource allocation in the private sector. [But] … To use this method accurately, the analyst must be able to compute how the benefits and costs of a program or project affect the allocation of private consumption and investment. OMB concurrence is required if this method is used in place of the base case discount rate."

6 While for impacts on business the discount rate should be 7%. The rates are explained in OMB (2011, p10). The current guidance is simply that all regulatory impact assessment should use discount rates of 3% and 7% (OMB, 2017).

premium based on CAPM.[7] The OMB specifies for *'cost-effectiveness, lease purchase, and related analyses'* a rate equal to the government borrowing rate for an appropriate term (OMB 1992, section 8c). CEA 2017 refers to "the common practice of using Treasury rates as a proxy for the SRTP", but some countries, including Norway and the Netherlands use RFIRs as the risk free rate in the cost of capital paradigm. RFIRs are generally lower than conventional STP rates, but a systematic risk premium can lead to rates similar to or higher than those of most STP regimes.[8] France applies a conventional STP rate to which is added a systematic risk premium for covariance with income, using the consumption-based CAPM.

Dual, or multiple approaches: Sometimes different regimes are specified for 'choice of technique' analysis and cost benefit analysis (CBA/BCA) and perhaps for specific kinds of regulation, all of which are illustrated above for the US. The Australian Victoria State guidance (Department of Treasury and Finance, 2013) adopts a simpler dual approach.

Pragmatic regimes: Some bodies face institutional constraints on promoting a formal analytical framework. The World Bank, for example, has for many years specified a real rate of 10% or higher for project appraisal.[9]

This overview illustrates how "SOC vs STP" and the approach to systematic risk are both important divides. Systematic risk is technically more complex and also more subject to alternative, subjective views on human perceptions and preferences around different characteristics of risk. It is however addressed only lightly and descriptively in this paper, as it is peripheral to longer standing, core issues in the SOC/STP debate.

Recent decades have seen a trend towards the use of lower social discount rates.[10] This will have been due in part, as noted by CEA 2017, to the long term decline in real interest rates, and perhaps lower growth prospects, which can affect both STP and SOC regimes. Also, from the 1980s the STP paradigm gained more traction for several possible reasons. Social discounting extended increasingly beyond CBA of capital projects to wider areas, often to 'choice of technique' analysis where, as explained below, the SOC framing can be less intuitively powerful. Public agencies became increasingly engaged with direct private financing for public services, which some finance ministries may see as being overly encouraged by a 'high' social discount rate. And fields emerged entailing very long term policy analysis, such as climate change and nuclear decommissioning, for which STP is generally preferred.

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7 The 'cost of capital paradigm' has features in common with the SOC paradigm, but estimates a direct cost of public funding, not an opportunity cost. It is mentioned in Section 6 below and the issues are discussed in Appendix B, Section B1.

8 Norwegian practice is described in Norwegian Expert Group (2014). A group commissioned by the Netherlands Government (Werkgroep discontovoet 2015), recommends an RFIR as a proxy for STP, then similarly increased by a risk premium.

9 Although in backroom analytical work the Word Bank may adopt STP rates (e.g. Lopez 2008), and account may be taken of locally established rates.

10 This trend is well summarised by a leading advocate of the SOC approach in Harrison (2010) (p 12).

3. Rationales, common ground and separate evolutions

Basic rationales

The SOC approach starts from the premise that the annual percentage rate of return to public investment should be no less than the rate of return from the funds being left in the private sector. The social discount rate is therefore derived from market data, usually as a weighted average cost of capital. The STP approach, in contrast, starts from the premise that the weight given by government to future marginal income should be based partly on how much the current population cares about future populations' marginal welfare and more substantially on how much the welfare gain from marginal income will decline with future income growth. In contrast to an SOC discount rate, an STP discount rate does not incorporate any marginal cost of public funds (MCF), which therefore needs to be handled, where necessary, by other means.

B&Z 2011 (p3) justify the SOC approach as follows:

> *"The SOC approach is justified by the straightforward principles of applied welfare economics – demand price measures marginal benefit, competitive supply price measures marginal cost, and adding up (i.e. dollars of benefits and costs are valued independently of to whom they accrue) (Harberger, 1971). The basic exercise is the extraction of resources from the economy, which displaces investment and stimulates saving and in an open economy attracts additional foreign funding.*
> *"The discount rate should be consistent with choosing a project that is more productive over another that is less productive. The rate then must cover the productivity that is forgone as a consequence of displaced investment and the [social costs of] newly induced savings and … incremental foreign funding. Any lower rate than the weighted average represented by the SOC will fail this test. … Any higher rate will forego desirable projects."*

Much of this justification is sound, but it skips over serious problems, discussed later below, with handling both time preference and the MCF by a discount rate alone, rather than by a discount rate for time preference and shadow price for public funding relative to consumption.

However both B&Z 2011 and H&J 2015 note how, if an MCF is included in the STP approach, the STP and SOC approaches can for many CBAs give a similar division of projects into those with positive and negative NPVs.

H&J 2015 (p 9) make this point as follows, where SPIF is the Shadow Price of Investible Funds, applied to public investment dollars to make them commensurable with consumption dollars:

> *"We … consider as close allies those who [like H&J] opt for a weighted average [SOC] discount rate of ω with a SPIF of one, and those who opt for a [STP] discount rate of r with a SPIF of ω/r. The real enemies of sound economics are those who press for the use of low discount rates like r, without due recognition of the costs entailed when forgone investments would have had rates of marginal productivity much higher than r."*

As H&J rightly imply, users of STP discount rates too often forget that public spending dollars carry more weight than consumption dollars. This is serious although, as discussed in Sections 4 and 5 below, it is not always important.

Some common ground …

SOC and STP advocates normally work in real as opposed to nominal values. And most regimes apply the same discount rate to nearly all cases.

Both approaches generally hold back from assuming systematic changes in future growth rates or other economic variables.[11]

Harberger (2007) introduced into the SOC paradigm the concept of the marginal dollar of taxation as "*a necessary supplement … [to] … the conventional [SOC] assumption of capital market sourcing"*. This distinguishes between projects that are self-financing, say by user charges, and those that are not. It assumes that, with no cost recovery, a project would accumulate debt, with tax raised to recover the financing of this debt over the project lifetime. This tax raising would incur an MCF, in the sense used in this paper and described in Harberger (2007) as the 'shadow price of public funds'.

Thus the SOC world has been slow to recognise public revenue as a form of 'negative public spending', but some users of STP discounting still treat cash flows between consumers and the public sector as pure transfers. Both cases undervalue public spending and/ or revenue relative to consumption.

Marginal social costs of taxation (and hence of public funding) are now often derived by estimation of the 'triangles' of lost consumer and producer surplus. This approach generally values social cost of a marginal $1 of taxation as around $1.2 to $1.3 of consumption. SOC advocates would argue that the MCF is normally higher than this, but so too would many STP advocates, notably Feldstein (1997) and Barrios et al (2013). [12,13]

Another field in which many practitioners of both paradigms might today agree is the basic mechanics of public finance. Public spending in developed economies is generally funded mainly via some form of consolidated fund, funded in turn mainly by taxes and borrowing. Distribution at the margin between tax and borrowing is generally handled as an issue of macroeconomic management, which can be assumed in microeconomic analysis to be competent, so that the social costs of marginal dollars of taxation and of borrowing are for practical purposes the same.

Related to this is the distinction between capital and current public spending. The distinction is central to public expenditure planning and management. But this is separate from the question of whether the social cost of funding $1m of public capital spending (or overspending) differs from that of funding $1m of public current spending (or overspending). In the STP literature there is today usually no difference.[14] In the SOC

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11 STP regimes often assume declining social discount rates over the very long term, but this reflects uncertainty, not assumptions about expected trends in future growth or other variables.

12 This is not to dismiss the value of work on lost consumer and producer surplus, of which the impressive book by Dahlby et al (2008) is a widely cited example. Its analysis is relevant to applications such as the comparison of fiscal regimes across federated states.

13 Feldstein uses the term 'deadweight cost of tax changes' (i.e. MCF - 1).

14 Early CBA literature focused on the comparison of public capital spending with later consumption benefits, with little attention to public operating costs. This may have led to some impression within economics, now fading, that dollars of capital and current public spending are funded in different ways. Sometimes

literature the issue is less explicit, but appears to be seen in a similar way. A thoughtful paper cited with approval by B&Z 2011 (Sjaastad and Wisecarver, 1977) implies (p 516) that public capital and public current spending have the same opportunity cost: *"there can be no doubt that current public expenditure must be charged not only with current consumption forgone, but also with unrealized potential future consumption due to displacement of current investment in other sectors."*

B&Z 2011 comment on the survey by Weitzman (2001) of professional economist opinion of the appropriate social discount rate for long term benefits, the responses to which lay predominantly in low single figures.[15] B&Z 2011 (pp 11-12) cast doubt on the validity of this work as a basis for public policy, but many STP advocates would share these doubts. [16]

It is widely accepted across both discounting paradigms that discounted present values of costs and benefits, while often central to the analysis, are rarely the last word. There will generally be other significant factors to feed into decision making.

… but two separate literatures

In the early literature the focus of both paradigms was on the displacement by government of private investment that would have earned a rate of return higher than the STP rate. B&Z 2011 cite Marglin (1963), as a leading early proponent of STP discounting, who developed the principle of combining an STP social discount rate with a shadow price (>1) for public investment.

B&Z 2011 note that, today as in the 1950s and 1960s, *"While the SOC is conceptually straightforward, it is empirically challenging to arrive at a reliable estimate; not only must rates of return on alternative sources of funds be estimated, so must the proportions of funding drawn from each source"*. Thus the focus of SOC literature is on the opportunity cost of public fundraising and this analysis has developed substantially. [17,18]

In recent decades STP literature and practical application has largely separated from work on the cost of public funding, which is sometimes ignored and sometimes handled in a different, pragmatic way as outlined later below. Thus the focus of STP literature is now on

today a government may, to discipline its borrowing, tie its borrowing to its capital spending. But it would still be seeking similar social costs for marginal taxation and marginal borrowing.

15 Harrison (2010, p11) records that Weitzman's responses from 2160 PhD economists had a sample mean at around 4% per year, a standard deviation of around 3%, a median of 3% and a mode of 2%, with a range of -3% to 27%.

16 Whether Weitzman (2001) had much practical impact seems doubtful, although his earlier (1998) paper, on the case for rates that decline over the long term, had been influential. A more rigorous and wider ranging exercise (Drupp et al, 2018) did however later produce broadly similar results to those of Weitzman (2001), with support for a real social discount rate of 2% for costs or benefits 100 years or more into the future.

17 Harrison (2010) provides an outstandingly thorough, Australian exposition and analysis of the issues. H&J 2015 provide a higher level, but full and clear exposition of then current SOC thinking.

18 An approach sometimes promoted for social discounting is that the rate of return to a public investment should be at least the rate required for a privately financed investment of similar risk in a competitive market. This implies case-specific discount rates depending upon the project's level of (systematic) risk. However the main differences between the SOC and STP paradigms apply equally to this "private sector analogue" approach.

the specification and quantification of STP and the cost of systematic risk. Overlap with the SOC literature is minimal.

4. The marginal cost of public funds (MCF)

Raising $1 of taxation, or government debt, costs more than the loss of $1 of consumption. SOC discount rates embed such a cost.[19] STP rates reflect time preference only.

The MCF in the SOC paradigm

In the SOC paradigm the opportunity cost of public spending is derived as the rate of return that would be yielded by dollars left in the private sector. In the 1960s and 1970s this was often seen as the rate of return to business investment. However, as CEA 2017 records (drawing on B&Z 2011), Harberger and others developed from the 1970s a 'blended approach', having regard to not only pre-tax marginal returns to capital but also post-tax marginal returns to savers and the marginal cost of foreign financing. Public revenue may be handled differently, as was noted in Section 3.

CEA 2017 summarises, drawing in part on H&J 2015, many problems facing such analysis, all of which are so far as possible addressed by leading SOC practitioners and not rehearsed here.

However valuing the marginal cost of public funds as a rate of return, rather than an absolute cost, presents problems. Financial percentage rates of return are so commonplace in the comparison of financial products that they often seem like ordinary prices. But social discounting at say 7% does not imply any single MCF. The implied MCF (the consumption dollar equivalent of a dollar of public funding) clearly depends on the time profiles of the consumption flow lost by diverting the money from the private sector and of the public project cash (or consumption equivalent) flows. For many CBAs these two profiles may be similar, but for very long term CBAs they will not be.

It is in any case impossible for the opportunity cost of diverting resources from the private sector to accumulate indefinitely at a compound rate higher than the national economic growth rate.[20]

The MCF is the present value, at the STP rate, of the lost consumption arising from $1 of public fundraising. This is finite so long as the STP rate exceeds the projected long term economic growth rate. In a developed economy this will almost always be the case.[21]

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[19] As noted above, this cost is often presented as if it is confined to funding public capital spending, but MCF refers here to all tax or public debt funding.

[20] In the quotation from H&J 2015 in Section 3 above, the first sentence assumes that the opportunity cost of $1 of public spending can be approximated by the value of a plausible, 'simple interest', constant flow of $\$\omega$ of consumption per annum, the present value of such a flow, discounted at r, being ω/r.

[21] If, most improbably, STP were less than the growth rate, there would be a case for taking the growth rate as the social discount rate (Spackman, 2004, pp511-2).

The MCF in the STP paradigm

In the STP paradigm the MCF is the ratio by which public spending dollars need to be multiplied to make them commensurable with consumption dollars.

It is widely accepted that this ratio is more than 1, but even this is not uncontentious. Jacobs (2018) presents an analysis on the basis of which the Dutch government recently decided to set MCF=1 in social cost-benefit analyses for public projects in the Netherlands, though the analytical framing, including redistributional benefits, is debateable. Moore et al (2013b) argue that the MCF is in practice very small: *"… as a first approximation, the main effect of engaging in a government project will be to reduce private consumption, not investment, making shadow pricing largely unnecessary".*[22] But government fundraising, wherever it falls, affects the economy in many ways, via commercial location decisions, remuneration structures, tax avoidance activities, and much else, well beyond the effects conventionally assumed in the SOC paradigm.[23]

It is also occasionally suggested by practitioners that public agency budget constraints may arise from enduring political short termism, rather than the social cost of marginal taxation. But for policy appraisal the reasons for the budget constraint are unimportant. The financial constraints faced by public agencies are in practice real and impose threshold benefit/ cost ratios (consumption benefits divided by public spending), which are generally more than one.

Although literature on the MCF has in recent decades moved away from that on STP discounting it has still developed, along several parallel strands, as discussed by Barrios et al (2013). One approach, noted in Section 3 above, is by estimation of the 'triangles' of lost consumer and producer surplus when a tax is applied, giving low MCF values in the region of 1.2 to 1.3. Feldstein (1997), appealing for more work on the issue, derived a rough and ready, much larger estimate of more than 2, based on experience of the US tax reductions under President Reagan. Barrios et al themselves used a computable general equilibrium model, giving figures not inconsistent with Feldstein.[24]

With an STP discount rate, overlooking the MCF means that NPVs are misleading in cost benefit analysis, because they add together dollars of public and private spending as if they were equivalent. That this can happen is serious. However the MCF can be handled in cost benefit analysis with an STP discount rate by ranking CBAs in terms of benefit/cost ratios (BCRs).[25] Threshold BCRs revealed by the boundary between proposals accepted and rejected, within constrained budgets set by high level political processes, are indicators of the MCF. These thresholds are an imprecise measure, not least as there are always non-

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22 Creedy and Passi (2017), from a New Zealand perspective, also suggest that taxes on consumption impose no significant further social cost.

23 It is also sometimes suggested that these effects can be ignored in CBA as *de minimis* at the margin. But it might be expected that such adverse impacts per marginal dollar exceed those of the average dollar.

24 This is for taxes on labour. Barrios et al estimate much lower figures for environmental taxes. However labour taxes are applied in practice. It seems fair to assume that other taxes present difficulties that bring their marginal social costs to a similar level, for those taxes would otherwise be increased.

25 As illustrated by Department for Transport (2014). The alternative of specifying a value for the MCF is superficially attractive. But it seems doubtful that an analytically defensible and acceptable figure for such a complex and politically sensitive concept will often be feasible.

monetised factors that are excluded. But limited evidence suggests that MCFs indicated in this way are not inconsistent with the figures of Feldstein (1997) and Barrios et al (2013).

In 'choice of technique' analysis, as noted Moore et al (2013b) and set out more fully in Section 5 below, the MCF is unimportant.

5. 'Choice of technique' analysis and the Feldstein simplification

It is at least widely accepted that $1 of public funding costs the economy the loss of more than $1 of consumption. SOC discounting regimes handle this by applying a discount rate higher than the social discount rate. In STP regimes it may be overlooked, but in cost benefit analysis it ought to be handled either by ascribing a shadow price to public spending relative consumption, or, as noted above, by ranking CBAs in terms of their BCRs.

'Choice of technique' analysis, in sharp contrast to CBA, compares alternative time streams of public spending for a given output. The problem of $1 of public funding costing more than $1 of consumption therefore does not arise, and options can be compared on the basis of the NPVs at an STP discount rate. This is described here for convenience as 'the Feldstein simplification', following Feldstein (1970).

The debates that these issues still generate, in the literature and in practical application, illustrate the problems of conceptual framing and practical implementation that beset social discounting. The framing of the MCF leads some discounting authorities to see the Feldstein simplification as obviously right and others to see it as obviously wrong.

The issue first emerged in academia in the late 1960s. It is recorded as a small item in the highly regarded and wide ranging work by Arrow and Kurtz (1970, page xxv). However Feldstein (1970) is wholly focused on the choice of technique issue and, while analytically rigorous, presented from an applied perspective. Being short and specialised in scope it appeared only as one of several "Notes and Memoranda" at the back of a British Journal and perhaps for this reason passed largely unnoticed by the wider academic world.

In Feldstein's words: *"in an important special class of expenditure decisions the problem of evaluating the social opportunity cost of funds transferred from the private sector can be ignored; in these cases only the social time preference rate is relevant"*. This class of decisions is described as *"the choice among alternative techniques of producing a given output when project expenditures are equal or proportional to the social costs of the resources used. The most obvious examples include the degree of capital intensity, the planned durability of equipment, the timing of replacements and maintenance, the choice of fuels and materials, and other specific aspects of the choice of technique."*

Such examples are not uncommon. In at least some developed economies 'choice of technique' analysis may be more common than CBA. The fields of public policy, such as transport and environmental spending, where consumption-equivalent valuation of the main benefits is routinely feasible, are still fairly limited, and even within those fields 'choice of technique' options still to be compared.

An illustration of the Feldstein simplification

Suppose that the opportunity cost of $1 of public spending were a stream of forgone consumption with an internal rate of return of 8%. And suppose that the present value of this return on $1 of public spending, discounted at an STP rate *r*, is $[MCF].

At a base date t_0, the net present value of a public expenditure cost of $*C* in t_1, followed by a public expenditure cost saving of $*B* in t_2, would be [MCF]$\{B/(1+r)^{t2-t0} - C/(1+r)^{t1-t0}\}$.

The value of the MCF may be unknown. But it can be assumed for most practical purposes that it is constant over time. It therefore does not affect the ranking of alternative options of this kind, whatever the values and time distributions of *B* and *C*.

The simplification assumes no constraints on what alternative uses could or would be made of marginal public funds, except that, in general, what is assumed for year t_1 can also be assumed for year t_2.

The main point is repeated, less clearly and more narrowly, in Bradford (1975). Three and a half decades later this prompted a response from B&Z 2011, who explain that: *"Bradford (1975) argued that for projects whose costs displace investment in the same proportion as the benefits induce investment, the appropriate discount rate is the STP rate with no need to shadow price benefits or costs. However, his result depends upon two critical assumptions."*

One of these two critical assumptions ascribed to Bradford is that "*investments in the private sector are not feasible options for the government, because otherwise scarce resources should be invested in such projects rather than in any project that can pass muster only at the STP rate".* But this is not an assumption in Feldstein's argument.

Within the SOC framing it can seem intuitively obvious that, given the opportunity to invest in the private sector to earn a return of 8%, it would be inefficient to invest in a public sector project to earn a return of only 4%. But this powerful intuition itself embodies the crucial assumption that, as in cost benefit analysis, <u>costs are measured in public spending dollars and the benefits in consumption dollars</u>. If the costs and benefits are both public spending (or are both consumption) the private sector rate of return is irrelevant.

The second critical assumption ascribed by B&Z 2011 to Bradford is that *"private sector … saving is not governed by optimizing behavior but rather by a simple rule of thumb whereby a constant proportion of (disposable) income is saved independent of the rate of return;".* Bradford states this in his Introduction, but it is not material to the Feldstein simplification. The simplification assumes what Arrow and Kurtz describe as 'balanced growth'. But this is normal in the derivation of operational social discount rates: it would be most unusual to incorporate assumptions about changes over the next several decades in variables such as growth rates, interest rates, or savings rates.

Feldstein covers the impact of public expenditure on private saving and private investment by the variables *S* ('the shadow price of one dollar of forgone private investment') and *p* ('the proportion of public spending that would otherwise be invested [by the private sector]'), explaining that *"The factors which determine S and p – the social return on private investment, the incidence of taxes, the social time preference rate – are likely to remain constant or change only slowly. The resulting small changes in S and p would be of only second-order importance."*

B&Z 2011 also suggest that *"Even if private sector investments are off limits for the government, whenever there is public debt outstanding debt reduction is always an option and the rate of return on debt reduction is the SOC rate."* But the STP and SOC paradigms have here drifted apart. In the STP paradigm the social benefit of $1 of public debt reduction is not well described by a percentage rate of return. It is equal to $[MCF] of consumption.

6. Risk

Public sector appraisals face many categories of risk. Some, notably the following, should not raise contentious differences between alternative approaches to social discounting:

a) *Non-project-specific risks, such as global catastrophe.* These are implicitly included in private sector and hence SOC rates and to some extent in 'risk free' bond or bill rates. With an STP rate they need to be explicitly addressed, perhaps by inclusion of a small element for this in the discount rate.

b) *Project-specific or institution-specific risks of optimism in estimates of costs, technical performance, or demand.* Such risks will be reflected only weakly at best in an SOC social discount rate or in an STP rate. They need to be addressed in other ways.

But one aspect of risk on which economists and economic traditions can start from different premises is the cost of variability risk, especially 'systematic' risk that has a significant covariance with the equity market or with income.

STP discount rates in early academic literature included little or no premium for systematic risk, the effect being seen as very small. SOC discount rates, to the extent that they include returns to equity-financed investment, include an equity market risk premium. But the issue arises more starkly with the 'cost of capital' paradigm mentioned in Section 2 and promoted by financial economists, arguing that the social cost of public financing should be estimated as the sum of a risk free rate and a usually significant premium for systematic risk.

There are here two issues.

a) Should an STP discount rate include an adjustment for the covariance of public sector costs or benefits with *income*, and if so how?

b) Should any social discount rate be adjusted for the equity risk premium that private financing would require for a similar privately financed project?

These questions, which have appeared in the literature for many decades, are addressed in Appendix B, which suggests that the answer to (a) is "yes", but that this effect is very small, and that the answer to (b) is generally "no". But these issues are complex and raise behavioural questions on which respected authorities differ.

7. Concluding summary

The status quo

The SOC and STP paradigms for social time discounting now diverge widely. Debate within finance ministries and in the literature about the fundamental methodology of social

discounting (in contrast to the continuing development of the separate paradigms) has advanced little in the past forty years. Some mutually inconsistent positions are entrenched. Within each paradigm there are issues on which there may never be a wide consensus. However, on both sides of the debate, important analytical and practical questions are routinely overlooked or prematurely dismissed.

Analytical basics

Points (1) to (3) below are mostly institutional. In practice they are usually tacitly assumed (or rejected).

1. The distinction between capital and current public spending is important, and public spending agencies generally have separate capital and current budgets. But in a developed economy the balance between government borrowing and taxation is generally designed to broadly equalise the marginal social costs of extra taxation and extra borrowing. The social opportunity cost of $1 of public funding does not depend on the dollar's subsequent public expenditure accounting classification.
2. This marginal cost of public funds (MCF) is a stream of lost consumption, distributed over future years, arising from a marginal dollar of taxation or borrowing. It can be quantified as a percentage rate of return, or more precisely as a present value (discounted at the STP rate). The stream of lost consumption may continue to grow in perpetuity, but it cannot grow indefinitely at an exponential rate higher than the growth rate of the national economy. It follows that, provided the STP rate exceeds the expected long term growth rate (as will almost always be the case), the present value of the MCF is finite.
3. Valuing the MCF robustly enough for use in policy and project appraisal may often not be feasible. It can however generally be taken as a working assumption, as noted by Feldstein (1970), that the MCF will be broadly constant over time.

Points (4) to (6) are practical implications.

4. It follows from (3) that in 'choice of technique' analysis, where public spending is being appraised against future public expenditure savings (or consumption increases against consumption losses), the STP rate is appropriate for time discounting and the ranking of alternatives, with no adjustment for the MCF, since the MCF applies equally to all costs and benefits.
5. STP is also appropriate for time preference in cost benefit analysis (CBA/BCA), where public spending is being appraised against benefits valued in terms of consumption. However public spending dollars carry more weight than consumption dollars, so it is misleading to add them together to obtain an NPV. One mechanism for incorporating the MCF in CBA/BCA is to rank options by their benefit/cost ratios, with spending from the constrained budget as the denominator.[26]

[26] The BCR thresholds that emerge from this give some indication of the MCF implicit in the political setting of high level aggregate budgets, but many, fluctuating factors influence both specific project decisions and high level budget allocations.

6. The SOC alternative of applying a higher discount rate and calculating NPVs probably compares many CBA options adequately, but not 'choice of technique' options, nor very long term CBA options.

Points (7) and (8) address the 'cost of capital paradigm' and the relevance to social discounting of covariance of benefits and income.

7. It is sometimes claimed that the equity risk premiums observed with private financing apply also to the social cost of public financing of a similar activity. But from a welfare economics perspective this looks implausible in the absence of persuasive empirical evidence. The freedom of equity markets that makes them crucial to a market economy brings with it, from their large and very visible fluctuations, a cost of risk that appears to be largely absent with public financing.

8. Nonetheless public service costs and benefits are often correlated with income and this implies some systematic risk premium. This is quantitatively trivial if risk aversion in this context is estimated from a conventional utility function, but more substantial if it is derived from an equity risk premium.

Pros and cons of the STP and SOC paradigms

The STP paradigm has the advantage of separately handling social time preference (STP) and the marginal cost of public funds (MCF). In particular STP discounting is correct for 'choice of technique' analysis. But it has the disadvantage of requiring, for cost benefit analysis (CBA), explicit recognition of the MCF. This can be handled by the use of benefit/cost ratios, with constrained funding in the denominator. However SOC advocates are correct in claiming that STP practitioners often wrongly overlook the MCF.

The SOC paradigm has the strong advantage that (for CBA) it is simpler to apply than an STP regime. It is also much easier to present persuasively.

However, even if the marginal cost of public funds as an annual percentage rate is accurately estimated, its use as a social discount rate for cost benefit analysis is only an approximation, because the implied MCF depends on the time distribution of the public project costs and benefits. An SOC discount rate may therefore be satisfactory for many CBAs, but not if there are large costs or benefits more than a few decades into the future. It is not suitable for 'choice of technique' analysis, comparing public spending with other public spending. It will for example overstate the case for private financing of public services.[27]

Operational conclusions

Government offices responsible for public discount rate regimes face conflicting academic mindsets. They also need to define and maintain a regime that takes account of both time preference and the MCF, and is simple enough to be applied reliably across government.

As an approach to handling these issues in a context of exceptional political constraints, the US Office of Management Budget stands out, as a thoughtful and structurally sophisticated,

[27] Unless it is believed that equity risk premiums apply to public financing, as discussed in Appendix B.

if sometimes also brutally pragmatic example.[28] Government borrowing rates, which are far from perfect, but politically fairly uncontroversial as a rough estimate for social time preference, have been specified for choice of technique analysis. An STP rate of 3% has been specified for regulatory appraisal of impacts on consumption. For CBA, where public spending is being compared with consumption benefits, 7% has been specified, presented in SOC terms. But if an agency wishes and has the capacity to apply a more sophisticated methodology, such as using a government borrowing rate as a discount rate and an extra weighting for public spending relative to consumption, it may do so with OMB approval.

An academically more rigorous set of conventions could be developed. But it is very challenging for governments to engage effectively with these issues, partly because many economists and others see as simple, or even "obvious", issues which are deceptively tricky and often technically contentious, and which also trespass into politics.

For a developed economy with a strong central finance ministry the best compromise between analytical rigour and practicality might often be an STP discount rate regime, with provisions to ensure that, in CBA/BCA, public spending and consumption dollars are not added together.

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[28] Circular A-94 (OMB, 1992) appears to have survived, largely unscathed, the January 2017 change of US Administration. That it is still operational after more than 25 years reflects in part the institutional difficulty of changing guidance in this field, but also its quality.

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Appendix A. The estimation of social time preference

A.1. Social time preference and market rates

H&J 2015 dismiss the conventional derivation of STP, taking it as self-evident that the sound basis for its estimation is financial market data. But such data do not provide a convincing measure of the extent to which a current population would (or should) wish to weight the marginal income of future populations.

Market rates can be strongly influenced by short to medium term government policy changes unrelated to social time preference for consumption, and by foreign demand for a nation's debt. CEA 2017 notes many other reasons for market rates being a poor indicator of STP. Individuals routinely save and borrow at widely varying rates. Mortality may influence market rates more than intergenerational preferences. Public project time horizons can be much longer than those of Treasury bonds.

There is also the fundamental issue, widely overlooked, that the holding, or failure to hold financial assets has value beyond the expected financial returns or financial costs. Lower stocks of financial assets reduce security and flexibility, for an individual or for a nation. Thus risk-free borrowing rates may be at best downwardly biased estimates, or lower limits, for STP. This is supported by the empirical evidence of STP rates exceeding risk-free market rates.

A.2. The conventional estimation of social time preference

The estimation of STP from first principles conventionally considers two main components, namely the extent to which:

- the present population is (or perhaps should be) concerned about future populations' marginal utility;
- future populations' marginal utility of consumption or income declines as per capita income increases over time.

These two components, discussed in turn below, appear in the Ramsey equation as $STP = \delta + \eta g$, where δ is time preference for utility, g is the growth rate of per capita income and η is the elasticity of marginal utility. As a star in the early development of growth theory, the name of Frank Ramsey, who died in 1930 aged 26, deserves the fame brought by this use of the equation. However it is sometimes (as in CEA 2017) suggested that using the equation implies some particular growth model, with perhaps many associated restrictive assumptions. But the STP paradigm has a more pragmatic basis. The equation is a useful hook on which to hang an intuitively satisfactory way of constructing social time preference. But its use in this way implies no restrictive assumptions beyond constant values for δ, η and g, except in certain cases where the equation may be further developed.

A.3. Social time preference for utility, δ

The element δ is generally seen as the sum of small elements for risk and perhaps a pure time preference rate for future marginal utility.

On risk, Martin Rees, the UK Astronomer Royal, has written that *"I think the odds are no better than fifty-fifty that our present civilisation on Earth will survive to the end of the present century"* (Rees, 2003). This assessment, seen by many as too gloomy, would imply a contribution to the SDR of 0.8% per year. Practitioners might also consider two further risks.

- Potential impacts that are unlikely to have been otherwise considered during even a well conducted appraisal – for example the premature, political termination of German nuclear power generation following the Fukushima tsunami of 2011.
- Income covariant risk. This is discussed quantitatively in Appendix B, noting that, while presentationally significant, its effect may generally be very small.

These three factors combined may suggest a premium in δ for risk of 0.5% to 1%.

As for pure time preference CEA 2017 records that "Expert disagreement … is especially fierce". Many academic authorities see no ethical case for giving less weight to expected future marginal utility. Economists in government tend to see the issue more in terms of the likely informed preferences of the population they are serving. This is generally taken to imply a slow decline over time as increasingly distant future populations command less empathy, but the empirical data are thin.[29]

Confusion can arise between general concern for others' marginal utility, where human preferences favour those with whom people empathise more closely, and the 'rule of rescue', where everything possible may be done to rescue anyone in immediate peril. The survival of civilisation may have characteristics of the latter.

A.4. The decline in marginal utility of consumption as per capita income increases, η

The term $cu''(c)/u'(c)$, where c is consumption and $u(c)$ is utility, defines (normally with the sign reversed to make it positive) the *elasticity of marginal utility of consumption*. It is in this sense that it is normally used, here denoted by η, in deriving an STP discount rate.

However the term is best known in textbooks as the Arrow-Pratt measure (or index, or coefficient) of *relative risk-aversion*. It is also presented as an index of *inequality aversion* and as the inverse of the *elasticity of intertemporal substitution*.

These different concepts all have uses, but the relevance of each depends on the context.[30] Human preferences seem too complex to justify supposing that a value derived for one concept provides a useful estimate for another. The literature often presents the term in the STP context as a measure of risk aversion or of inequality aversion, implying some value

[29] For many years studies of how much people said they cared about future utility impacts implied implausibly high pure time preference rates of several percentage points (e.g. Cropper et al, 1994). Frederick (2006) replicated these results and identified methodological flaws that explained them. A more reliable study was too imprecise to provide a robust figure, though it would not have been inconsistent with zero.

[30] Atkinson et al (2009) usefully discusses the first three of these uses.

judgement. But practitioners appear mostly to see it as no more than a value-free estimate of the elasticity of marginal utility.

Many methods have been used to estimate η. Some of the more plausible ones are well presented in Groom and Maddison (2018). Estimates have generally converged over recent decades to between 1 and 2.

Appendix B. Systematic risk

B.1. Systematic risk and financial economics

The transformation of financial economics in the 1960s included emergence of the Capital Asset Pricing Model (CAPM), which quantifies the return required on an investment as the sum of a risk-free rate and a premium arising from the covariance of an asset's yield with the general equity market risk. CAPM is now widely used in analysis of the financing costs of activities that are at least partly equity financed. The late 1970s subsequently saw developed of the Consumption CAPM (CCAPM), addressing the covariance of an asset's yield with the investor's income or consumption. [31]

Finance textbooks teach that the cost of (variability) risk of an activity is revealed by private sector financial markets, as in CAPM. Some economists believe that this same cost applies to publicly financed activity where there is no equity financing.

An example cited by CEA 2017 is Lucas (2014). Lucas makes many fair observations, noting for example that the focus of Arrow and Lind (1970) was largely on diversifiable risk. But the paper misses the main reasons for doubting the relevance of equity risk premiums to most applications of public sector time discounting.

Fluctuations in equity markets, driven by economic changes and amplified by market sentiment, are large.[32] They are also fluctuations of which the active equity investor will be aware. It seems therefore unsurprising that investors' loss aversion takes equity market yields several percentage points above the risk-free rate, to much more ("the equity premium puzzle") than the increase implied by deriving the welfare loss from a plausible utility function. The freedom of equity markets is crucial to a capitalist economy, but the resulting wide fluctuations bring some cost. [33]

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[31] CAPM is usually expressed by the formula: $E(R_i) = R_f + \beta_i\{E(R_m) - R_f\}$, where $E(R_i)$ is the expected rate of return on capital asset i; R_f is the risk-free interest rate; and $E(R_m)$ is the expected average market rate of return, so the term in curly brackets is the "market risk premium". β_i (beta) is a factor equal to $\text{cov}(R_i, R_m)/\text{var}(R_m)$, relating the variability of the asset's returns to that of the market. R_i may be defined in terms of the cost of equity finance alone or in terms of project risk: the latter, given debt as well as equity in the project financing, will have a lower beta. CCAPM is generally applied in a similar way, with beta reflecting the covariance of the asset yield with the investor's (or national per capita) income.

[32] The Dow Jones fell by 73% over 16 years from January 1966 to September 1982 and fell 50% over 17 months from September 2007 to February 2009. The UK FTSE 100 index fell by nearly 50% in 1999-2000 and by over 40% in 2007-2009. It was also, in real terms, significantly lower in early 2017 than it was thirty years earlier.

[33] It is sometimes suggested, as a proposed *reductio ad absurdum*, that if public financing avoids the equity risk premium the government should be financing most or all of the economy. But experience shows that, in many areas, public financing seriously restrains socially productive entrepreneurial initiative.

There appears to be no explanation of how an equity risk premium could arise in a typical publicly financed project, such as an untolled road. The costs and benefits of such a project, after the initial investment, have a minimal effect on taxpayers. There is systematic variation in the benefits to users, but no evident reason why the welfare impact should be more or less than that estimated from a conventional utility function.

A more sophisticated approach (Gollier, 2013) accepts that, with public financing, the CCAPM (deriving a risk premium from covariance of benefits with national per capita income), is more relevant than CAPM (deriving a premium from the cost of private finance for a similar activity). However the CCAPM conventionally follows CAPM in drawing on the equity risk premium to quantify the cost of a given level of covariant risk.

Nonetheless, as noted in Section 2, systematic risk premiums based on financial market data are used by several governments in setting social discount rates.

B.2. Systematic risk and welfare economics

The social benefits (and costs) of public interventions are often correlated with income. The value of a given change in fatality risk, or an environmental impact, may increase as higher incomes increase people's willingness to pay for such benefits. Use of transport infrastructure may be strongly correlated with GDP.

However, while correlations between public service impacts and income can be strong, the *covariances* are normally very small. Arrow and Lind (1970) dismissed the issue rather casually, with the observation that *"It is sometimes argued that the returns from public investments are highly correlated with other components of national income through the business cycle. However, if we assume that stabilization policies are successful, then this difficulty does not arise."* However these covariances are not only low but, in contrast to changes in equity yields, they are generally not consciously perceived as gains and losses. So there is good reason to value these variations by reference to a conventional, concave utility function against wealth or income. The discount rate premium in this case, for costs or benefits that vary proportionately with per capita income, is given by $\eta\sigma^2$, where σ is the proportional standard deviation of the income growth rate and η is as defined in Section A.4 above.

Gollier (2013, Table 3.2) presents values of σ for five developed countries for 1969-2010, ranging from 1.74% (US) to 2.21% (Japan). These figures, together with a range of values for η of 1 to 2, imply a discount rate adjustment for such costs or benefits of no more than about 0.05% to 0.1%. Some impacts vary more than proportionally with income, but even if their percentage fluctuations were more than twice that of income this would still imply a discount rate premium of no more than about 0.1% to 0.2%.

Sometimes costs or benefits, especially in overseas development projects, are significantly correlated with the income of those affected, but not necessarily with income growth rates over time. For example a scheme may improve crop yields more in years of drought than years of plenty. But such case-specific impacts are conventionally handled outside the discount rate.

Appendix C. The very long term and climate change

There is a compelling case for applying a declining social discount rate over the very long term, mainly because of uncertainty about the rate. If the present values of a dollar are calculated for ever-more-distant future years, the effective discount rate falls ever closer to the lower end of the plausible range of rates. (For example the present value of $1k, discounted over 100 years at 2% or 5%, is $138 or $8. If these were equally likely their average value of $73 would imply an effective discount rate of 2.6% – much closer to 2% than 5%.)[34,35]

Very long term climate change analyses rarely if ever explicitly incorporate any MCF. However these analyses are mostly 'choice of technique' analyses of alternative ways of obtaining given levels of climate mitigation or adaptation, or of alternative long term streams of consumption.

The most significant impact of the discount rate on climate change analysis may be its effect on estimates of the 'cost of carbon', when this is derived from future *damage costs* (as in the US), rather than (as in the UK) the *abatement costs* of achieving a chosen level of decarbonisation.

Climate change may be a modest exception with respect to systematic risk (Kolstad et al, 2014; Dietz et al, 2015). Dietz et al derive for projected, very long term variances in income and climate change impacts a relatively high risk premium of about 0.6%.

Appendix C. Pricing versus appraisal

The cost of capital paradigm is appropriate for *pricing the output* of a government enterprise in a competitive market. It is also appropriate, and sometimes applied, to the regulation of private sector monopolies such as energy grids.

The comparison of pricing and appraisal regimes illustrates the difficulty of maintaining analytical consistency in some political contexts. In the UK from the mid 1960s to the 1980s there were many public enterprises with specified appraisal discount rates and pricing regimes. The *appraisal* rate was for many years in high single figures. But the *pricing* regime rates of return were in real terms in low single figures, or negative. Thus choice of technique decisions, such as engineering design, gave too little weight to future cost savings, while prices were often set at inefficiently low levels, so encouraging excessive demands for investment.

[34] An account of some of the complex history of academic debate on the long term is set out in Gollier and Hammitt (2014). That paper also sets out a cost of capital approach to the social discount rate, with however numerical conclusions very similar to those of a conventional STP derivation.

[35] Netherlands guidance however maintains a constant discount rate over time, partly because interest rates, on which their SDR partly depends, are today exceptionally low and partly because "the same factor that causes the risk-free interest rate to fall could also explain an increase in the [market] risk premium", on which their SDR also depends (van Ewijk and Tang 2003, Werkgroep discontovoet 2015).

Appendix D. Social discounting of project-specific private financing

Private financing costs in social CBA are normally subsumed in the market price of privately supplied goods and services. In public sector appraisal they do however need to be explicitly addressed in two cases:

- where a proposed new regulation would require significant investment by private sector companies;
- where a comparison is being made between public and private financing of a public service.

The analysis of such cases is helped by the recognition of time preference and the MCF as separate concepts.

In the first case the private financing costs over the accounting life of the project can be broadly estimated and discounted at an STP rate. If the private WACC (weighted cost of capital) exceeds the STP rate, this will give a social cost greater than the asset capital cost.[36]

The second case involves three percentage rates: a public cost of capital, a private cost of capital and a social time preference rate. It is unlikely that any government could in practice maintain a regime incorporating all three rates, except perhaps for very special cases such as 'mega-projects'.

One simpler approach is to discount the real cash costs of both the private financing option (i.e. the costs incurred by the public sector or consumers) and the public finance alternative at a government borrowing rate. This would follow recent US OMB guidance. It was also advocated by UK Treasury accountants in the early 1970s, when the general discounting regime was SOC. Use of a government borrowing rate in this way will bias the comparison slightly against private financing.

Another simple approach is to discount the real terms cash costs at an STP rate. This rate will typically be higher than the government borrowing rate, so biasing the comparison slightly in favour of private financing.

A more rigorous approach, taking account of all three rates, would apply the logic described for regulatory analysis to both public and private financing costs, public debt financing costs being distributed over time in the same way as that assumed for the private financing costs.

Appendix E. Discounting of health

Some costs and benefits may be quantified directly in units that may be closer to of marginal utility than consumption. A prominent example is the Quality Adjusted Life Year (QALY). The monetary value of the QALY will increase over time, and monetising the units before discounting would be one way to handle this. But monetising the QALY is not straightforward and an alternative is to discount QALYs at an appropriately lower rate than that for consumption and public spending.

[36] This technique is now used by UK regulators (Joint Regulators Group, 2012).

With a lower rate for benefits than for costs the arithmetic can seem to imply that a project should always be postponed. It has long been noted that, if the earlier option has a higher BCR than other options for spending at that time, it should still take priority (Parsonage and Neuberger ,1992). However the paradox, named after Keeler and Cretin (1983), still holds some sway as one argument against discounting financial costs and QALYs at different rates.[37]

Health economics has also generated other arguments for discounting health costs and/or benefits at rates different from those applied to public spending programmes generally. This appears to be partly because the QALY is unusual in being a very widely applied, but often non-monetised measure of benefit, and partly because health regulators comparing medical treatments tend to be outside mainstream government ministries, so generating their own perceptions of discounting. One still inconclusive debate is portrayed in Claxton et al (2011). One side is well set out in Paulden and Claxton (2012)which concludes that time preference for public spending on health should be the government borrowing rate and that the rate for QALYs should be adjusted down from this by the rate at which the $/QALY threshold, imposed by the budget constraint, is projected to increase over time.[38]

It is however hard to see why the discounting convention for public spending on health should differ from that applied to other national public spending programmes, or why the discounting of QALYs should differ from that rate minus the rate at which the real money value of the QALY is projected to increase over time.

Health is however unusual in one special case, where an individual's exposure to a health risk may have a long delayed effect on the individual's health. There is here a case for applying an *individual* time preference rate for health to the duration between the exposure and the health impact.

[37] The point of course arises with any benefits, such as environmental improvements, that increase in real unit value over time.

[38] The rate at which the $/QALY threshold increases over time can be expected in the long term to be very close to that at which the monetary value of the QALY increases. But it is likely to be affected by large, extended fluctuations from changes in, for example, macroeconomic pressures and political shifts in budgetary priorities across programmes.