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Working Paper: 01/2021

# Commercial Financing, Social Discounting and the Cost of Public Funding: An Ongoing Saga

7th September 2021

**Author:** Michael Spackman

**Contact:** Michael Spackman
Department of Geography and Environment
London School of Economics and Political Science
m.j.spackman@lse.ac.uk

# Abstract

Fundamental differences of view between economists on social discounting and the cost of public funds have persisted for many decades. This paper explores the assumptions and beliefs that underpin four controversies. Most deeply entrenched in practice is that between advocates of social opportunity cost (SOC) and social time preference (STP) discounting. Also long standing is the claim by many financial economists that the financing costs of commercial enterprises should be applied to tax funding. More recently some economists who accept STP discounting claim that the high systematic risk premiums required by commercial equity investors apply also to systematic risk in public service outputs. Finally, handling the cost of public funding in STP regimes varies very widely.


# 1. Introduction

## 1.1 Historical background

During the 1960s many governments introduced "discounted cash flow", following its adoption in major industries. Meanwhile Arnold Harberger and Kenneth Arrow were leaders in developing analytical approaches to social discounting with public funding. Both focused on cost benefit analysis (CBA) – that is the comparison of public spending with consumption-equivalent benefits.

The Harberger approach frames public funding as if governments were a commercial enterprises generating revenue equal to the monetary value of the public service benefits (Harberger, 1969). The cost of public funding is derived as a weighted average cost of capital, financed by taxation that displaces private consumption and investment and by borrowing that is ultimately redeemed by taxation. This is today's social opportunity cost (SOC) approach to social discounting.

The Arrow approach frames the social discount rate as a social time preference (STP) rate for marginal consumption and the cost of taxation as a stream of lost consumption (Arrow, 1966; Feldstein, 1964a, 1964b; Layard, 1972, 27-51). The present value of this cost stream gives a shadow price (≥1) to public spending relative to consumption. The approach in principle converts all monetisable quantities to consumption dollars and discounts these at the STP rate. This is today's social time preference (STP) approach.

The early literature set out how, if STP is much lower than an SOC rate, the SOC approach, while simpler, has important analytical limitations (Feldstein, 1973). However in the 1960s and 1970s versions of the SOC approach were widely adopted by governments.

By the 1980s the STP framing was gaining support, but now faced criticism from a new source. Many financial economists have argued since then that public spending should be appraised as if it were financed from a competitive financial market, using a cost of equity and debt as the social discount rate (Brealey, 1997; Lucas, 2014). This is described here as "the financial economists' approach".

Arrow and Lind (1970) had addressed the relevance of commercial financing risk premiums to public appraisal criteria. The paper presumed (as was then usual outside financial

economics) that the equity premium over the risk free rate was due mainly to non-systematic (random, idiosyncratic) risk and showed that this was not a material cost with tax funding. However the 1960s revolution in financial economics led to the current consensus that the equity premium is attributable mainly to systematic (aggregate, non-diversifiable) risk. Arrow and Lind did however record that "*It is sometimes argued that the returns from public investments are highly correlated with other components of national income*..." and noted that, applying neoclassical analysis, this cost is generally very small.

Many years later Mehra and Prescott (1985) identified the "equity premium puzzle" that the equity market premium is several times higher than a neoclassical estimate. The relevance of this high premium to the social cost of taxation and/or the value of public service benefits remains contentious.

The 1990s saw the emergence of climate change as a global concern, generating academic and practical interest in social discounting over the very long term. In this case popular intuition favours a discount rate in low single figures, which may have helped to establish STP discounting as the usual, though not uncontested convention in that field, worldwide (Hänsel et al, 2020; Burgess, 2018).

The 21st century has seen an offshoot of the financial economists' approach with claims, typically by economists expert in both financial economics and CBA, that high premiums should be added to STP discount rates for systematic risk in public service benefits (Gollier, 2021). This is described here as "the financial economists' STP approach".

## 1.2 Current practice

In developed economies the SOC approach is applied for general use in Federal Canada, in Federal and State governments in Australia, and in New Zealand.

The European Commission and several European countries adopt STP rates, often with a shadow price for public spending.

The US Federal government adopts a hybrid regime, applying an SOC rate to cost benefit analysis (CBA), and an STP rate for comparison of consumption streams and a proxy STP rate for cost effectiveness analysis (CEA).[1]

The UK adopts an STP rate and handles the cost of public funding in CBA by value-for-money (VFM) ratios rather than an explicit shadow price.

France adopts "the financial economists' STP approach", adding a commercial debt and equity financing premium to an STP rate.

Some countries add a commercial debt an equity financing premium to a risk-free market rate, which is conceptually very similar to the financial economists' approach. With today's risk-free rates this can lead to discount rates similar to STP rates.

[1] CBA here describes comparisons of public spending with consumption. CEA describes comparisons of public spending with public expenditure savings.

### 1.3 Continuing differences of view

Understanding of social discounting has since the 1970s seen important advances, but few signs of convergence on questions such as the following.

- Some public policy economists see the SOC approach is analytically optimal. Others see it as acceptable for many CBAs but not well-suited to other applications.[2]
- Many financial economists believe that the rate of return revealed by equity and debt financing of an activity in competitive financial markets applies to public funding of similar activities. This is widely rejected by government administrations.
- Some economists accept STP discounting but believe that the high premiums required by investors in equity are relevant also to the cost of systematic risk (correlated with consumption) publicly funded outputs. Other economists reject this.
- Economists applying STP discounting regimes appear often to be unaware of the need in CBA for a shadow price of public spending. Where a shadow price is specified it is usually in the range of 1.0 - 1.3, which may be far too low for most countries.
- With STP discounting the best practicable way of handling this cost of public funding in ranking CBA options is probably by value-for-money (VFM) ratios of benefits per dollar of public spending. This is widely unrecognised.

### 1.4 Structure of this paper

Section 2 and 3 below present factual background, Section 2 on framing the cost of public funding as a required rate of return and Section 3 on framing public funding and time preference as separate quantities.

Section 4 looks at fundamental assumptions and beliefs.

Section 5 reflects on why these wide differences have persisted for so long, and seem set to continue.

Section 6 concludes.

All references to rates of return and discount rates are in real terms.

## 2. Framing the cost of public funding as a required rate of return

Many economists frame the cost of taxation as a rate of return, imposing an increasing social cost until the funding is "paid off" from the value of the associated public service outputs. This rate of return defines the social discount rate.

The most common approach of this kind is the SOC approach outlined in Section 1, which has the great strength of simplicity, but at the cost of some limitations. It compares public spending and consumption impacts over time with a discount rate of typically around 7% and does not differentiate between contemporary public spending dollars and consumption dollars.

These limitations may often not matter much for CBA. The high discount rate typically gives much more weight to public investment spending than to later consumption benefits and

[2] As illustrated by the US Office of Management and Budget guidelines (OMB, 1992, 2003).

can rank options similarly to the STP approach. (The approaches are identical if an initial expenditure is being compare with a subsequent perpetuity of consumption benefit and the shadow price of public funding is equal the ratio of the SOC rate to the STP rate.)

However SOC rates are not consistent with evidence on society's concern about marginal consumption decades into the future.

Not differentiating between public spending dollars and consumption dollars means that a dollar of public spending is valued as a dollar of consumption. Yet it is widely accepted that taxation costs more than this.

This led Harberger (2007) to present a conference paper on the handling in CBA of government revenues. This compared electricity charges from the expansion of a state-owned power plant with a highway improvement to an untolled road. The projects had identical costs and the value of the net highway benefits such as time and fuel cost savings (in consumption dollars) was the same as the net revenues from electricity sales (in public revenue dollars). Harberger concluded that *"The cleanest, most straightforward way to take tax financing and the excess burden associated with it into account is to apply an extra charge or benefit of λ to each and every cash outflow or cash inflow from and to the public treasury"*.

This was a bold step, but too bold to be taken up. Abelson (2020) records that some SOC regimes do now consider very low marginal excess tax burdens (METBs) (Harberger's $\lambda$). However this does not fit easily into the SOC approach where the METB for initial public investment is handled by the high discount rate. Following it through would have required some reframing of the approach.

A conceptually more challenging example of both limitations of the SOC convention is cost effectiveness analysis (CEA). SOC discounting will point to lower than optimal investment and high than optimal operating costs. This may rarely matter much in practice, but the effect is hidden and SOC practitioners and those they advise may not all be aware of it. This "like with like" comparison of public spending streams is discussed in section 3.2.

Framing public funding as if it were like commercial financing also underlies the "financial economists' approach" to social discounting.

The best known output of the 1960s financial economics revolution is the Capital Asset Pricing Model (CAPM) for estimating returns to capital assets, especially stocks. This led in the late 1970s to the more generalised Consumption CAPM (CCAPM), to which reference is more often made in the context of public spending. [3]

Lucas (2014) reports that "the view that market rates should be used to discount risky government investments appears to be the predominant one among present-day financial economists". This is discussed in sections 3.3 and 4.2 below.

As noted in section 1.1, some experts accept STP discounting but also claim that premiums of a few percentage points should be added to reflect the cost of income-collated

[3] CAPM and the CCAPM, and their "beta" functions by which the equity market premium is multiplied to value the required return on a specific stock, are outlined in the Appendix.

consumption risks faced by public service beneficiaries. This too is addressed in sections 3.3 and 4.2.

# 3. Framing the cost of public funding and time preference as separate quantities

## 3.1. Social time preference

In STP discounting regimes STP for consumption is usually derived from the Ramsey equation, as the sum of two elements.

One element includes a factor for the extent to which the current population cares or should care about expected future marginal utility. It is often argued within academia that expected future marginal utility should not be discounted. Practitioners appear more often to believe that it should reflect informed public preferences. However evidence on these preferences (Frederick, 2003) supports no more than a small factor. This element may also include in practice a small factor for optimism bias risks that would not otherwise be included in normal project or policy appraisal.

The other, larger element quantifies the extent to which the utility of marginal consumption declines with increasing future incomes. The valuation of this element today is rarely very contentious. [4]

## 3.2. The cost of public funding in STP discounting regimes

At the national aggregate level the marginal cost of net public funding (MCPF) is the money collected from the private sector, plus the marginal excess tax burden (METB) of the costs of tax collection and enforcement and other economic impacts of taxation, so MCPF = 1 + METB.

The stream of lost consumption from marginal taxation will have an internal rate of return similar to the SOC discount rate. It also has a finite present value when discounted at the social time preference rate.[5] This quantifies the MCPF as an absolute number by which tax funded dollars should be multiplied before being added to or subtracted from consumption dollars.

This is very different from the financing of a commercial enterprise. Tax collection and investor financing both bring with them many legal and other obligations. And both are costly, one as a financial liability, the other as a burden on the economy (including displacement of commercially financed investment). The cost of public funding (excepting

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[4] This element is the product of the expected per capita income growth rate and the elasticity of the marginal utility of consumption (with sign reversed). Accumulating evidence over many years supports a value for the elasticity fairly close to 1.5 (Groom and Maddison, 2014). A value of 1, which implies a logarithmic utility function, is sometimes used for mathematical simplicity and perhaps sometimes to help achieve a "low" discount rate.

[5] The time stream of lost consummation cannot continue to increase at an exponential rate higher than the economic growth rate, which in a developed economy will virtually always be less that an STP rate estimated from the Ramsey equation. If this were not the case there would be a god case for setting the STP rate equal to the growth rate.

the generally low interest rate on public debt) is not however an accumulating rate of return.[6]

Early promoters of STP discounting recognised that the MCPF (usually described then as the opportunity cost of public spending) needed to be addressed (Feldstein, 1964; Layard, 1972). The usual assumption was that it needed an explicit shadow price, but no widely accepted method for deriving this ever emerged. Feldstein thirty years later was still encouraging work on it.

Practitioner and academic views on this shadow price range from 1 (Bos et al, 2019) to "more than 2" (Feldstein, 1999).[7] A widely quoted source is the extensive work of Dahlby (e.g. Dahlby, 2008) which suggests values in the region of 1.25. However this excellent and useful work is not measuring the full impact of marginal taxation on the economy.[8]

The METB attracted a flurry of interest in the US OMB after an Executive Order specifying a "one-in-two-out" rule for new regulations, like such conventions in Canada, the UK and Australia.[9] It also required that the total cost of regulation should not increase. A public consultation (OMB, 2019) noted that OMB guidance (OMB, 1994) specified an METB of 0.25, and said that research now suggested 0.4 to 0.5. However the consultation appears to have had little response, with minimal advice on METB valuation.

The METB and MCPF in STP discounting regimes are now sometimes overlooked, sometimes given an explicit value and sometimes handled by estimating VFM ratios of consumption benefits to public spending cost.

The VFM ratio approach is analytically and in some practical ways the best approach, but can appear more complex. A well developed practical example is outlined in Department for Transport (2017, pp 25-26, Boxes 5.1 and 5.2), where the VFM ratio categorisations are pragmatic but appear to serve well in practice. The procedure is discussed in section 4.3 below.

It is fairly uncontroversial that comparisons of *consumption* with later *consumption*, where there are *no differences in public spending*, need discounting at an STP rate and that then the MCPF is irrelevant.

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6 Government debt interest generally has no material relationship to the economic appraisal of a specific programme or project. The level of aggregate public spending and the balance between borrowing and taxation are issue of high level politics and macrocosmic management.

7 A critique of the contentious argument of Bos et al that taxation has on average no significant excess burden is provided by Boardman et al (2020, 15-18).

8 It is the reciprocal of the tax's efficiency as a source of revenue. If a 1% increase in a tax generates a revenue increase of 0.8% the tax's 'marginal cost of funds' (MCF) is 1/0.8 = 1.25. As the initial level of a tax approaches the top of its Laffer curve, where a rate increase raises no extra revenue, the MCF approaches infinity.

9 Executive Order 13771 of January 2017, one of several revoked on President Biden's Inauguration in January 2021.

However the MCPF is almost irrelevant also to "like with like" comparisons of *public spending* with later *public spending*, where there are *no differences in consumption*. [10]

This is another major difference between tax funding and investor financing. It is impossible to understand, and seems absurd, if the cost of tax funding is framed as a rate of return, But if this cost is framed as a shadow price relative to consumption the point can slip from absurd to obvious. This logic was set out fully in Feldstein (1970) and noted in Arrow and Kurz (1973, xxv), but produced no response at the time, perhaps because, to potential critics, it was too counterintuitive.

One counterargument made is that the government could invest money in financial markets and on average obtain a yield higher than the STP rate. But the same applies to the later public expenditure saving and so does not affect the argument: the earlier cost and the later saving have the essentially the same MCPF.

When STP discounting for CBA is institutionally unacceptable, there is a case for hybrid regimes specifying SOC discounting for most CBA and STP discounting for CEA. This would broadly follow the example of US OMB guidance, which recommends for CBA that, while STP discounting is "analytically preferred", the default guidance, in the absence of any robust shadow price for public spending, is to use an SOC approach with a discount rate of 7%. An STP rate (or a proxy for this) is specified for CEA and some other purposes (OMB, 1992, 2003).

## 3.3. Systematic risk, public service beneficiaries and equity investors

The SOC discounting convention was established well before CCAPM and long before the equity premium puzzle was recognised. So SOC advocacy rarely become entangled in dispute about the relevance of the equity premium puzzle to the social cost of public funding. Financial economists however often claim that commercial financing costs, usually including substantial equity premiums, are irreducible social costs of financing the activities in question. Few if any governments agree.

This section looks at the evidence. Section 4.2 looks at behavioural or cultural aspects.

Systematic risk in returns to equity falls on investors, who therefore require a rate of return premium. In the CCAPM this premium is equal to the consumption beta for financing that activity multiplied by the equity market premium over the risk-free rate. This premium is several times higher (the 'equity premium puzzle') than would be estimated from neoclassical analysis.

Application of such private financing data and conventions to public funding has intuitive appeal but its promotion usually overlook important questions.

One question is whether the equity premium puzzle could plausibly be relevant to the cost of income-correlated risk to public service beneficiaries.

Many parties facing income-correlated risk from government and commercial activities. In the commercial environment such risk falls on equity investors but also on corporate boards

[10] The MCPF is irrelevant to prioritisation the options. It does of course affect the significance of the absolute present value, if this is public spending dollars rather than consumption dollars.

and employees with, for example, higher bonuses in good times, and on customers, for whom the consumption-equivalent value from many purchases will fluctuate systematically with their income.[11]

With public funding, the relevant parties are tax payers, ministers and civil servants, and the beneficiaries of public services. It is hard to see significant systematic risk exposure for ministers or civil servants. The distribution of taxes is strongly correlated with income and this will affect the MCPF. However the only plausible feedback to taxpayers from the costs of systematic risk to public service beneficiaries would seem to be a behavioural impact as discussed in section 4.2.

Systematic risk often affects beneficiaries of public investment, much as it affects the customers of commercial enterprises. Markets take care of any perceived costs of systematic risk to commercial customers, but governments need to be directly concerned about its cost to public service beneficiaries. These costs however do not fall as a rate of return premium, but as a one-off impacts over time on the utility of the benefit.

Nonetheless many financial economists believe that commercial costs of capital apply directly to tax funding. And it is sometimes proposed that, to adjust for the consumption-correlated risk in public service benefits, a premium similar to the equity market premium should be added to STP discount rates. This is promoted by Gollier (2021) and has some wider support (Freeman and Groom, 2016, 14; Drupp et al, 2018). It is adopted by government in France.

A second, more general question is how relevant the equity puzzle is to *any* situations other than equity markets? The puzzle was identified in 1985 and generated an extensive literature. The first two decades of this literature are examined in an 80 page review by Mehra (2006). Few of the wide range of potential explanations appear relevant to situations other than equity markets and none to publicly funded benefits. Indeed from Rajnish Mehra's analysis it seems likely that a significant part of the puzzle is attributable to *non-risk* characteristics of equity markets.

One proposed explanation popular among financial economists is that of Epstein and Zin (1999). This excellent analysis addressed the conventional assumption in Mehra and Prescott that the coefficient of risk aversion is rigidly linked to the elasticity of intertemporal substitution. This means that an individual's averse to variation of consumption across different states *at a particular time* and to *consumption variation over time* will be the same. Epstein and Zin showed that a (recursive) form of consumption function can be constructed which breaks this link and presented this as an answer to the equity premium puzzle.

However the model depends on unobservable variables and it is difficult to assess how well it fits independent empirical data. To the extent that this can be done it does not perform very well. Mehra is especially critical of Epstein and Zin's use of the "market portfolio" as a proxy for the wealth portfolio, suggesting that this overstates the correlation between asset returns and the wealth portfolio and hence their claim to be a solution to the puzzle. But

[11] "Income" and "consumption" are in this context used interchangeably.

even if it were it would seem irrelevant to the systematic risk faced by public service beneficiaries.

The most plausible, major contribution to explaining the puzzle now appears to come from behavioural economics. Many financial investors will be closely aware of their gains and losses and there is much evidence to support the 'prospect theory' (Kahneman and Tversky, 1979), that losses relative to a reference point such as current wealth weigh more heavily than gains. Application of this concept to equity market returns has been developed with great care by Barberis and others (Barberis et al, 2011). It looks as if it may explain much of the puzzle. [12]

Mehra's own view, from his original work with Prescott and review twenty years later, would seem to be that the puzzle is specific to equity markets. Among other authorities Eugene Fama and Kenneth French appear to share this view (Barberis, 2015,20/21). Fama, an early and influential promoter of the 1960s financial economics revolution, expresses a view of the kind found in governments, that the often extremely large amplitude and duration of fluctuations in equity markets reduce the relevance of marginal neoclassical analysis and make a high risk premium unsurprising. Fama's response in 2009 to "Has the equity premium puzzle gone away?" was "There never was one. It is easy to show that this argument is silly.... the high volatility of stock returns ... means that getting a positive equity premium (of any size) is highly likely only for holding periods of 35 years (an investment lifetime) or more. Given this result, the historical equity premium does not seem too high".

Returning to public funding, there appears to be no evidence to suggest that the cost of systematic risk to public service beneficiaries *cannot* be satisfactorily explained by neoclassical analysis, as by Little and Mirrlees (1969, 1990).

# 4. Fundamental assumptions and beliefs

Section 4.1 below discusses how schools of economists have framed their approaches to social discounting and the cost of public funding. Section 4.2 turns to attitudes on the relevance of the cost of commercial financing to the cost of public funding. Section 4.3 discusses handling of the cost of public funding in STP regimes, which despite its minimal academic profile is in practice no less important than the augment about discounting.

The issues here are of logic and psychology more than ethics or professional judgement.

## 4.1. Framing social discounting and the cost of public funding

Economists committed to the Harberger (SOC) and financial economists' approach are often convinced that social discounting and the cost of taxation should be derived directly from market data. This is consistent with the use of market valuations for most costs and benefits in public sector policy and project appraisal and with the frequent use of market proxy methods such as willingness-to-pay surveys to value non-marketed (e.g. environmental) impacts.

[12] Mehra's review and the work of Barberis and other authors are discussed in Spackman (2021).

The SOC approach derives a cost of capital specific to government. The financial economists' approach is that competitive financial markets reveal the market price of the private equity and debt financing of an activity and that governments' ability to tax cannot avoid this.

Both however are framing the problem by asking:

*"How can our understanding of the financing and spending of commercial enterprises best be applied to government funding and spending?"*

The Arrow/Feldstein framing takes a step back and asks only:

*"How should government funding and spending be appraised to maximise social welfare?"*

In most aspects of project and policy appraisal these two framings are very similar. But there are no close market analogues for taxation, nor for social time preference (market inters rates being subject to many powerful influences and being about private, not social preferences).

The two framings would still be broadly consistent if the STP rate were similar to commercial enterprise rates of retune, but this is never seriously argued. The difference, traditionally attributed to taxes, seems to be mainly attributable to the high equity premium.

Commitment to the Harberger/financial economists' framing is often associated with either explicit acceptance of or misunderstanding of its problematic implications. On the relevance of STP to the economic analysis of public projects or policies, Harberger suggests (Harberger and Just, 2012) that, if this is an issue, it should be handled outside CBA.

More fundamental is the assumption built into the commercial framing that the cost of public funding must have the form of a rate of return.

Under pressure on discounting over the very long term, Harberger said that "Where I feel strongly about this is where we are justifying the extraction of money over time, which has a demonstrable cost of 6%, 7%, 8%, or 10%, we should not then discount the resulting future benefit back at 2%." (Harberger and Just, pp21/22). But this 2% is nothing to do with the cost of funding. It is a (very long term) STP rate for consumption.

Many STP discounting regimes can be criticised for their handling of the cost of public funding. (It is widely ignored in very long term analysis, although in that field it may not matter much.) But the virtual absence of such criticism illustrates how far SOC and STP thinking have drifted apart.

Arrow's insight that the impacts on the economy of marginal taxation cannot grow indefinitely at a rate higher than the economic growth rate was perhaps the most important step in creating a framework that gave a higher value to tax revenue that to consumption and incorporated STP.

## 4.2. Commercial financing and public funding

The claim that commercial systematic risk premiums apply to the cost of tax funding is sometimes supported by a suggestion, as at the end of the quotation below, that

neoclassical estimates of the cost of systematic risk are implausibly low. The quotation uses the term CCAPM slightly unconventionally, to describe the effect of applying a neoclassical index of risk aversion:

*"... the CCAPM ... has emerged as the common language and practice of economists over the past four decades. The CCAPM has mostly failed to explain how financial markets value risk. For example, the equity-premium puzzle (Mehra & Prescott 1985) shows that the CCAPM predicts a systematic risk premium of* $\pi = 2 \times (3\%)^2 = 0.18\%$ *under the assumption of [index of risk aversion]* $\gamma = 2$ *and [volatility of log consumption]* $\sigma = 3\%$*, which is an order of magnitude smaller than the observed risk premium of assets with* $\beta = 1$*. On a more normative ground, considering such a small systematic risk premium looks very counterintuitive because doing so makes the riskiness of projects nearly irrelevant to their evaluation."* (Gollier and Hammitt, 2014, 291)

Lucas (2014) states that "Arrow and Lind [1970] defended [focusing on non-systematic risk] with the assertion that correlated risk is likely to be insignificant for many government investments" and quotes a stronger statement by Sandmo in 1972 that "Arrow and Lind assume that the returns on private and public investment are uncorrelated". Even the first of these statements is misleading. Arrow and Lind's coverage of systematic risk was 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. It should be noted that in most benefit-cost studies it is assumed that full employment will be maintained so that market prices can be used to measure benefits and costs. Consistency requires that this assumption be retained when considering risk as well. Further, if there is some positive correlation between the returns of an investment and other components of national income, the question remains as to whether this correlation is so high as to invalidate the previous result."* (Arrow and Lind, 1970, p 373)

This has aged, especially in its over-strong emphasis on macro-stability. However some of its readers may not fully appreciate the last sentence. Arrow and Lind would be applying a neoclassical estimation of this cost which, as noted by Gollier above, "makes the [systematic] riskiness of projects nearly irrelevant ..."

Lucas opens a section on "The economic case for using market discount rates" with the inaccurate statement that "The conclusions of Arrow and Lind rest on the presumption that government investments are free of aggregate risk". The point at issue is the magnitude and nature of the cost of systematic risk with public funding. No one questions its existence. The only "economic case" offered for using commercial rates of return for social time discounting is that this is the predominant view of financial economists. The 1960s revolution was impressive and generated justified pride and self-confidence among financial economists. However that work on financial markets did not extend to the very different economics of tax funding.

There is no evident awareness here of concepts such as social time preference not being a cost of capital, or of the neoclassical derivation of the cost of consumption-correlated risk as

an absolute cost, not a rate of return, or of potential explanations of the equity premium puzzle, or of the practicalities of how tax revenue feeds into government funding, or how government budgeting procedures constrain aggregate spending.

Returning to the SOC approach, this does see taxation as different from commercial financing. Advocates often claim to justify the approach by one or both of two arguments.

One is that taxation reduces commercial capital investment which would have produced a rate of return of at least high single figures and this is an opportunity cost of taxation. These statements are true, but they miss the point that this opportunity cost cannot grow indefinitely at a rate higher than the economic growth rate. [13] The MCPF, though hard to quantify precisely, has a finite present value.[14]

The other argument is that the governed could invest instead in financial markets and obtain a rate of return higher than the STP rate. This confuses the STP rate with a cost of capital. However it also confuses the roles of the public and private sectors. Governments do manage financial assets when there is a relevant financial objective, as with some public employee pension funds or a sovereign wealth fund, and they may hold shares in some enterprises for a political purpose. But an uncorrupt government is there to deliver public services, not generally to make itself or its customers rich by financial investment.

Sections 1, 2 and 3.3 referred to experts who accept STP discounting but also claim that "equity premiums" should be added to reflect the cost of consumption risks faced the public service beneficiaries. This appears to follow from a framing in which taxpayers are so similar to active equity investors that they "feel the pain" of the systematic risk faced by public service beneficiaries, multiply the consumption beta by the equity market premium and perceive this as an extra required rate of return on their tax payments. This may be plausible for some financial economist taxpayers.

## 4.3. Handling the MCPF in STP discounting regimes: VFM ratios

It seems unlikely that a widely accepted method for deriving an explicit value for the MCPF will emerge soon, if ever. However Section 3.2 discussed its handling by using VFM ratios, referencing a practical example.

This procedure is promoted, with some historical precedent, by Finkelstein and Hendren (2020). That study defines the ratio as the 'marginal value of public funds' for the specific policy or project proposal.[15]

As with the social discount rate, there is a historical problem here of framing that excludes important options. The issue is traditionally framed as "How should we value the shadow

[13] Another point missed is that that if the equity premium is a compensation for a cost of risk it does not contribute to any opportunity cost. However to emphasise this would divert attention from the more contentious financial economics question of how the equity market premium could be directly relevant to the cost of taxation.

[14] ` The only refutation of this seen by the author is an (unpublished) claim by a leading SOC advocate that expressing the cost of public funding as a ratio must be mistaken, because it gives results that differ from those when the cost is expressed as a rate of return. This illustrates the power of framing.

[15] Finkelstein and Hendren apply this to a field of policy appraisal some way from that of capital investment projects, which is the usual focus of debate on cost benefit analysis, but the logic is the same.

price for public funding and spending?". A step back would frame it as "How do we best deal with dollars of public funding and spending having a higher value than dollars of consumption?".[16]

The opportunity cost of spending from a constrained budget is the benefit per dollar of marginal spending from the budget. The principle has long been recognised. Marglin (1963, p278) noted that *"If the public investment objective function is constrained by a limited budget, the appropriate interpretation of [the MCPF] is as the value of budgetary slack"*. The point is noted more formally and more fully by Minken (2016).

Public sector agencies in a developed economy usually have tightly constrained budgets. The MCPF can therefore be handled by prioritising CBAs by their ratios of consumption benefits to spending from the constrained budget. This has important advantages:

- It reinforces analysis that is needed anyway for planning the agency's spending;
- The "cut off" VFM ratio, broadly indicated as successive annual budgets are exhausted, is tailored to that agency's programme. The MCPF may not be the same for all agencies. Some, for example, may have untypical levels of non-monetisable cost or benefits.
- The cut-off VFM ratio will automatically adapt over time to changing economic and political priorities.
- Some finance ministries may oppose a specific MCPF as it reduces flexibility in negotiating budgets, but they cannot reasonably object to ranking by VFM ratios.

It also presents challenges, some of which arise from higher transparency and should improve the analysis:

- It can draw attention to issues of budget attribution.
- There are changes from conventional NPV terminology. Costs and benefits are defined not by their sign but by whether they are consumption or public spending. So there may be "negative benefits" (falls in consumption) and/or "negative costs" (public revenue or cost savings)
- Such VFM rankings are appropriate for CBA (comparing public spending with consumption), but not for CEA (comparing public spending with public expenditure savings). This may confuse some practitioners.

One reason for the procedure's low academic profile may be the fairly widespread belief that the social discount rate is a significant determinant of *aggregate* public spending (Gollier, 2021). However aggregate government budgets in developed economies are set at a very high political level, supported by macroeconomic modelling. They have regard to future national wellbeing, but the social discount rate becomes relevant at lower levels. It may slightly influence distribution of the aggregate budget across some government functions, such as flood management or transport, but its main role is in the distribution of spending within agencies, down to detailed design.

[16] It can be tempting from an academic perspective to see examination of cut-off VFM ratios as a method of estimating the MCPF for the budget. But that framing would probably be unhelpful in practice. It would complicate and reduce the flexibility of the VFM process.

## 5. Why do such major differences persist?

Many differences of view in economics, arising from personal ideology or pragmatic or technical judgement, may last indefinitely. Ideology does affect economists' approaches to the appraisal of public funding and spending, but the issues of concern in this paper appear to be essentially issues of framing and logic. So why do they persist?

The following suggested reasons draw on the author's time in the field since the 1960s, as a user, reviewer and drafter of government guidance, including many exchanges with experts of different views.

- The different views arise from historical differences in framing.
  As framing defines the *starting* point for considering an issue it can be impossible for experts with different framings to communicate. Exchanges tend to be restatements of each author's position, sometimes backed by a claim that many other economists agree (as in Lucas, 2014 and Hänsel et al, 2020).
- The often extreme institutional difficulty, in government administrations, of making changes in this field.
- The obvious similarities between governments and commercial enterprises.
  In investment appraisal and management most analytical challenges apply in similar ways to both environments. Discounting was established in large commercial enterprises in the 1960s. Commercial practice framed the Harberger SOC approach. The 1960s financial economics revolution developed great confidence in the power of its innovations in commercial financing, but differences between tax funding and commercial financing were never carefully examined.
- The complexity of the differences between commercial capital financing and decision making and taxation and political decision making.
  The analytical and institutional differences are profound, but mostly not obvious.
- The absence of a widely recognised way of quantifying or otherwise handling the MCPF in STP discounting regimes.
  Combined with persistent belief that "it's a matter of more research". The static consequences of tax changes are tricky. Many of the dynamic consequence are probably impossible to measure with useful precision.
- Confusion between the costing and pricing of public sector outputs.
  Government funded producers competing in commercial markets should generally not take competitive advantage of tax funding. However this paper is concerned with costing, not pricing.

## 6. Conclusion

Development since the 1960s of analysis of public spending ad regulation has been impressive. However social discounting and taxation are unusual in having no close market analogue and economists have been unable to agree even on how their handling should be framed. This is unfortunate, but it does not undermine the value of clear identification and

quantification of costs and benefits in real time, which is the main contribution of most public sector microeconomic analysis.

Many economists frame the cost of taxation as a rate of return, like the financing costs of a commercial enterprise. This can be satisfactory for many cost benefit analyses, but it takes no account of society's time preference for consumption and gives the same weight to contemporary consumption and public spending. This makes it not well-suited to other applications.

The framing developed by Arrow and others, in which the costs imposed by marginal taxation are quantified as a present value and the time discount rate is social time preference (STP) for consumption, generally fits the reality of tax funding and social preferences. But being so different form the familiar conventions of commercial financing it is less easy to present. It also suffers from the failure to develop, for cost benefit analysis, a widely accepted way of handling the cost of marginal taxation.

The best way of handling this cost appears in practice to be to prioritise CBA options by value-for-money ratios of consumption benefits to public spending. This deserves more practical and academic attention.

In a recent development, some financial economics experts accept STP discounting but propose that the equity premium puzzle (that the premium over the risk free rate is many times high than a neoclassical estimate) should also apply to the systematic risk faced by public service beneficiaries. This seems to arise from a perception that taxpayers feel the pain of public service beneficiaries and amplify it as if it fell on taxpayers' incomes as a return to equity investment. This may be plausible as a behavioural impact on some financial economist taxpayers.

There seems little early prospect of substantial change in current views. This would need mainstream financial economics to recognise more clearly the differences between investor financing and taxation. It would also need the global teaching of social discounting to recognise the important strengths and limitation of both SOC and STP regimes. But framing, once set in an expert's mind or institutional culture, tends to become a given starting point to be defended, not questioned.

## Acknowledgements

The author is widely indebted for advice and discussion around the content of this paper, in particular, recently, to Mark Moore, David Maddison, Peter Abelson, Tim Dalton, Mark Freeman and Mike Parsonage.

## References

Abelson, Peter. 2020. "A Partial Review of Seven Official Guidelines for Cost-Benefit Analysis", *Journal of Benefit Cost Analysis*, 11.2:272–293

Arrow, Kenneth. 1966. "Discounting and public investment criteria". In A.V. Kneese and S.C. Smith (eds.) *Water Resources Research,* pp. 13-32, Johns Hopkins Press, Baltimore.

Arrow, Kenneth, and Mordecai Kurz. 1973. *Public Investment: The Rate of Return and Optimal Fiscal Policy*. Washington, DC: Resources for the Future.

Arrow, Kenneth and Robert Lind. 1970. "Uncertainty and the Evaluation of Public Investment Decisions," *American Economic Review*, 60: 364-78.

Barberis, Nicholas, Ming Huang and Tano Santos. 2001. "Prospect Theory and Asset Prices" *The Quarterly Journal of Economics*, 116.1: 1-53

Barberis, Nicholas. 2015. "Prospect Theory Applications in Finance", Yale University, March. https://www.coursehero.com/file/85136726/harvard-2015-barberispdf/ (accessed 30 August, 2021)

Boardman, A., Greenberg, D., Vining, A., & Weimer, D. 2020. "Efficiency without Apology: Consideration of the Marginal Excess Tax Burden and Distributional Impacts in Benefit–Cost Analysis", *Journal of Benefit-Cost Analysis, 11*(3), 457-478.

Bos, F., van der Pol, T., and Romijn, G. 2019. "Should Benefit-Cost Analysis Include a Correction for the Marginal Excess Burden of Taxation?" *Journal of Benefit-Cost Analysis*, 10(3): 379–403.

Brealey, Richard, Ian Cooper, and Michel Habib. 1997. "Investment Appraisal in the Public Sector." *Oxford Review of Economic Policy*, 13(4): 12–28.

Dahlby, Bev. 2008. *The Marginal Cost of Public Funds: Theory and Application*. Cambridge, MA: MIT.

Department for Transport. 2015. "Value for Money Framework." https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918479/value-for-money-framework.pdf (accessed 22 July 2021)

Epstein, L. G. and Zin, S.E. 1991. "Substitution, risk aversion, and the temporal behavior of consumption and asset returns: An empirical analysis". *Journal of Political Economy,* 99, 263‑286.

Feldstein, Martin. 1964a. "Net Social Benefit Calculation and the Public Investment Decision" *Oxford Economic Papers*, l.16: 114-131

Feldstein, Martin. 1964b. 'The social time preference rate in cost-benefit analysis' *The Economic Journal*, 74:360-79.

Feldstein, Martin. 1970. 'Choice of Technique in the Public Sector: A Simplification' *The Economic Journal,* 80 (323): 985-990.

Feldstein, Martin. 1973. "The inadequacy of weighted discount rates". Extract dated 1973 reproduced in Layard (1972), from paper on 'Financing in the evaluation of public expenditure' for the then forthcoming Smith, Warren and John Culbertson (eds) (1974) *"Public finance and stabilization policy: Essays in honor of Richard A. Musgrave"*, Amsterdam, North-Holland Pub. Co.

Feldstein, Martin. 1999. "Tax Avoidance and the Deadweight Loss of the Income Tax", *The Review of Economics and Statistics*, 81.4, 674-680

Finkelstein, Amy and Nathaniel Hendren. 2020. "Welfare Analysis Meets Causal Inference*", Journal of Economic Perspectives*, 34.4

Frederick, Shane. 2003." Measuring Intergenerational Time Preference: *Are* Future Lives Valued Less?" *The Journal of Risk and Uncertainty*, 26.1: 39-53

Freeman, Mark and Ben Groom. 2016. "Discounting for Environmental Accounts", Report for the Office for National Statistics, Chantry Educational Services,

https://www.ons.gov.uk/file?uri=/economy/environmentalaccounts/methodologies/naturalcapital/discountingforenvironmentalaccounts1.pdf (accessed 1 September 2021)

Frederick. Shane. 2003. "Measuring Intergenerational Time Preference: *Are* Future Lives Valued Less?" *The Journal of Risk and Uncertainty*, 26.1, 39–53

Gollier, Christian. 2021. "The Welfare Cost of Ignoring the Beta", Fondazione Eni Enrico Mattei (FEEM) Working Paper No. 3.2021 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3802456 (accessed 25 July 2021)

Gollier, Christian, and Jim Hammitt. 2014. "The Long-Run Discount Rate Controversy." *Annual Review of Resource Economics*, 6: 273–295

Groom, Ben, and David Maddison. 2019. "New Estimates of the Elasticity of Marginal Utility for the UK." *Environmental and Resource Economics*, 72: 1155–1182.

Hänsel, Martin C., Moritz A. Drupp, Daniel J. A. Johansson, Frikk Nesje, Christian Azar, Mark C. Freeman, Ben Groom and Thomas Sterner. 2020. "Climate economics support for the UN climate targets", *Nature Climate Change*

Harberger, Arnold. 1969. "Professor Arrow on the social discount rate" in Somers, Gerald and W. Donald Wood (eds) (1969) "Cost-Benefit Analysis of Manpower Policies." *Proceedings of a North American Conference, Industrial Relations Centre, Queen's University, Kingston, Ontario*, pp 81-8. Extract reproduced in Layard (1972) entitled "The Opportunity cost of Public Investment Financed by Borrowing".

Harberger, Arnold. 1972. "Professor Arrow on the Social Discount Rate", in *Project Evaluation,* Palgrave Macmillan, London, pp 123-131

Harberger, Arnold and Rischard Just, 2012. "A Conversation with Arnold Harberger", Annual Review of Resource Economics, 4: 1-26

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica, 47*, 263-291

Layard, Richard (ed).1972. *"Cost-Benefit Analysis"*, Penguin Books, Harmondsworth, England; Baltimore, Md, USA; and Ringwood, Victoria, Australia.

Little, I. M. D., and James A. Mirrlees. 1969. "*Manual of Industrial Project Analysis", vol. 11.* Paris: OECD Development Centre.

Little, I, and J. Mirrlees. 1990. "Project Appraisal and Planning Twenty Years On" Proceedings of the World Bank Annual Conference on Development Economics https://documents1.worldbank.org/curated/en/581361468740162733/pdf/multi-page.pdf (accessed 28 July 2021)

Lucas, Deborah. 2014. Rebutting Arrow and Lind: Why Governments Should Use Market Rates for Discounting, *Journal of Natural Resources Policy Research*, 6(1): 85–91.

Marglin, Stephen. 1963. "The Opportunity Costs of Public Investment" *The Quarterly Journal of Economics*, 77(2):274-289

Mehra, Rajnish. 2006. "The Equity Premium Puzzle: A Review", *Foundations and Trends in Finance*, 2.1: 1-81.

Mehra, Rajnish and Edward Prescott. 1985. "The Equity Premium: A Puzzle" *Journal of Monetary Economics*, 15: 145-161.

Minken, Harald. 2016. “Project selection with sets of mutually exclusive alternatives.” *Economics of Transportation*, 6:11-17

OMB. 1992, Circular A-94 “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.” https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A94/a094.pdf (accessed 26 July 2021).

OMB. 2003. Circular A-4, “Regulatory Analysis”. https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/ (accessed 26 July 2021).

OMB. 2019. “Marginal Excess Tax Burden as a Potential Cost Under E.O. 13771”, OMB-2017-0002-0055_content (1).pdf (accessed 28 July 2021)

Spackman. 2021. “Social discounting and the equity premium” Centre for Climate Change Economics and Policy Working Paper No. 386

# Appendix: Traditional and consumption CAPM

Traditional CAPM is expressed as

$$E(Ri) = R_f + \beta_{mi}\{E(R_m) - R_f\}$$

where

$E(Ri)$ is the expected rate of return on asset $i$

$R_f$ is the risk-free interest rate

$E(R_m)$ is the expected average market rate of return

$\beta_{mi}$ is the market beta for asset $i = \text{cov}(R_i,R_m)/\text{var}R_m$.

The term in curly brackets is the equity market premium.

If the return to the asset varies proportionately to the market average return $\beta_{mi} = 1$ and the estimated asset premium is equal to the market premium.

Consumption CAPM defines beta as

$\beta_{ci}$ is the consumption beta for asset $i = \text{cov}(R_i,R_c)/\text{cov}(R_m,R_c)$

where

$R_c$ is the consumption growth rate.

If the return to the asset varies proportionately to consumption $\beta_{Ci} = 1$. As with the traditional CAPM, the estimated asset premium is equal to the equity market premium.

Thus, while benefits of public spending or regulation are likely to have consumption betas higher than market betas, the question of whether the equity market premium is materially relevant to public funding applies equally to both forms of CAPM.