Discounting in Government Appraisal: The Case for a Two-Rate Framework in the UK

Working Paper

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Introduction

Government spending exchanges public money for 'social value'. According to HM Treasury (2022, p5), social value comprises "all significant costs and benefits that affect the welfare and wellbeing of the population". Thus, government appraisal differs from private-sector benefit-cost analysis (BCA) in that it considers social welfare as well as market outcomes. Social welfare effects are often qualitative in nature. Crime reduction, reduced travel time, and improvements in community wellbeing, for example, require complex methods to express in monetary terms. Discounting occurs once all the costs and benefits projected in each year of the project's lifetime have been monetised, and 'non-monetisable' costs and benefits have been qualitatively assessed [see Fig 1].

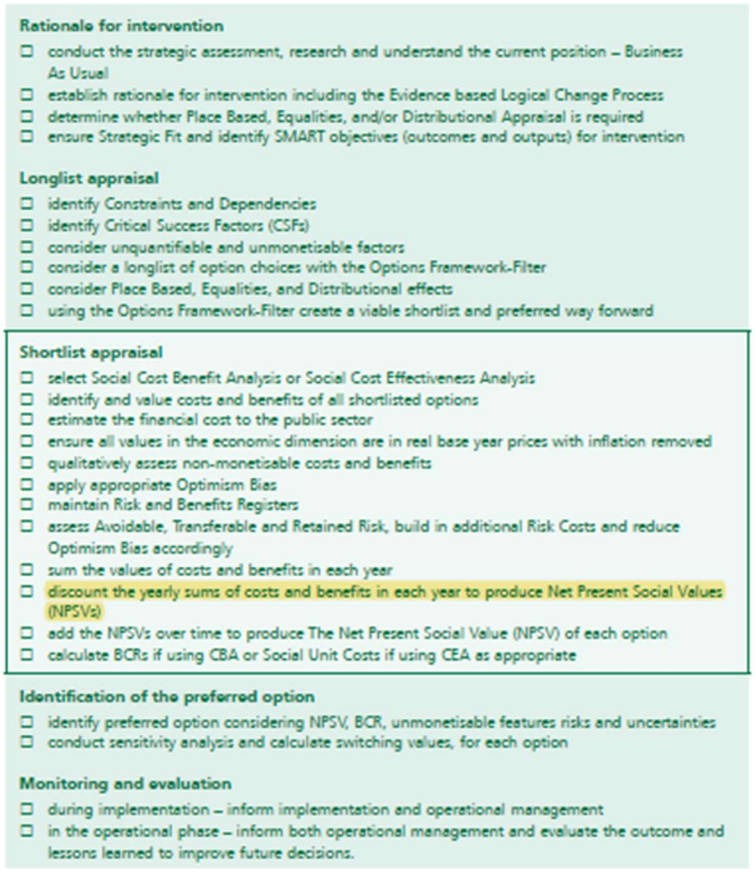

Figure 1 'Navigating the Appraisal Framework and the Shortlist', Box 11 in HM Treasury (2022) *The Green Book*, p39

Discounting converts the monetised values of future costs and benefits into ‘today's money’. This enables each project’s different cost and benefit flows to be expressed as a single net-present social value (NPSV) number for decision-making. Therefore, the choice of discount rate fundamentally influences project selection and resource allocation. This report argues that the UK should adopt a two-rate discounting framework, as introduced by Szekeres (2022; 2024), to resolve longstanding theoretical and practical problems with current single-rate approaches.

Context

The UK currently employs a declining discount rate (DDR) schedule based on the social time preference (STP) approach. The Green Book (HM Treasury, 2022) stipulates a discount rate of 3.5% in real terms for the first 30 years of a project, with declining rates for longer-term projects [see Fig 2].

Green Book long term discount rates

Period of years	0–30	31–75	76–125	126–200	201–300	301+
Standard rate as published in the Green Book	3.50%	3.00%	2.50%	2.00%	1.50%	1.00%

Figure 2 HM Treasury (2008, p. 7) ‘Intergenerational wealth transfers and social discounting: Supplementary Green Book guidance’

The recent Green Book review (HM Treasury, 2025) has identified concerns about the potential undervaluation of long-term transformational projects, recommending an independent review of the discount rate to ensure that a fair view is being taken of the long-term benefits that arise from ‘transformational’ investments. This approach has remained largely unchanged since it was introduced in 2003, despite significant shifts in economic conditions and academic understanding of discounting theory.

Among most advanced economies, there are two methods used to determine a discount rate for public-sector appraisal.

Exposition

Consider the following thought experiment, with elements borrowed from Spackman (2004, p. 467). Suppose that a government can spend £100 today that will deliver £X of social value 10 years from now. How large must X be for the investment to be in the public interest? This question captures the problem of *social opportunity cost* (SOC). What could that £100 produce if invested elsewhere?

Now let us invert the question. Suppose that a government can secure £100 of social value that will be delivered 10 years from now. How much should it be willing to invest today? This framing forces us to consider *social time preference (*STP). How much present consumption would society sacrifice for future welfare?

For decades, economists have debated whether governments should set discount rates based on the logic of SOC or the logic of STP (see OECD, 2018, pp. 197-222). In an 'optimal' economy, the two rates would converge – given perfectly competitive and perfectly functioning markets, the rate of return that an investment must generate to be in the public interest (the SOC) becomes identical to the STP (see Boardman et al, 2017, pp. 242-244). In real-world economies, this alignment is disrupted by multiple distortions. Capital market taxes drive a wedge between interest rates paid and received, and market power imbalances and information asymmetries prevent capital from flowing to the most productive uses (*ibid*).

The UK's choice of STP reflects a normative stance that public investment should be evaluated based on social welfare considerations rather than purely financial opportunity costs.

SOC

Advocates of the SOC approach, first outlined by Hirshleifer et al (1963) and developed by Harberger (1972), argue that a public project should only be approved if it generates a return (in social value terms) at least as high as the return those funds would have generated in the private sector. The SOC rate is derived as a weighted average of the rate of return on investment foregone, expressed as return on investment (ROI), the value of foregone consumption, measured by the net-of-tax yield on savings, expressed as the consumption rate of interest (CRI), and the marginal cost of foreign borrowing, expressed as the cost of foreign borrowing (CFF):

$$SOCR = (a \cdot CRI) + (b \cdot ROI) + (c \cdot CFF)$$

Where a, b, and c are the respective weights or proportions of funds coming from each variable.

STP

Advocates of the STP approach argue that the discount rate should be determined by measuring society's time preference for marginal consumption. The STP rate (STPR) is usually derived from the Ramsey equation:

$$STPR = \delta + L + \mu g$$

Here, four parameters are estimated through a messy amalgamation of empirical inference and philosophical judgement [Fig 3 describes each parameter giving current UK estimates]:

Parameter	Current value	Description
δ	0.5%	**Rate of pure time preference**, representing the extent to which the current population's welfare is prioritised or deprioritised relative to the future population's welfare
L	1%	**Risk parameter**—a measurement of risk, which according to some economists covers only the probability of societal collapse,* while in the Green Book it also includes systematic and other risks
μ	1	**Elasticity of marginal utility with respect to consumption**,** defined (approximately) as the percentage change in marginal utility,*** divided by the percentage change in consumption
g	2%	**Expected growth rate of future per-capita consumption**

Figure 3 Sheperd (2020) 'A formula for success: reviewing the social discount rate'

Declining Discount Rates

The UK uses a declining discount rate (DDR) based on the Ramsey approach to STP. For projects with lifespans exceeding 30 years, the Green Book outlines a declining discount rate schedule [Fig 2], reflecting increasing uncertainty in the long-term values of Ramsey equation parameters as project lifespans extend.

The concept of DDRs is based on the original work of Weitzman (2001), who surveyed a panel of economists on their 'best point estimate' of the most appropriate discount rate for long-term projects. The respondents provided a wide range of opinions, to which Weitzman fitted a Gamma distribution, illustrating how the present values calculated at each respondent's rate diverge over different time frames. As the averaging of present values was extended further into the future, Weitzman found that only the lowest rates mattered, as higher rates shrank distant-

future values so much as to contribute almost nothing to the average. Thus, Weitzmann proposed that discount rates should shrink as project lifetimes increase.

Two-Rate Discounting Framework

As noted by Sharp (1981, p. 205), "it is difficult to disentangle the choice between differently timed streams of benefits from the problem of allocating investment funds efficiently between alternative projects". Szekeres (2022; 2024) has proposed an elegant solution that separates the two historically conflated functions of discounting.

In Szekeres' framework, capital costs and net benefits are treated separately. First, initial capital costs are discounted at the SOC rate, effectively a hurdle rate to ensure that public money is not expended on fiscally unsustainable projects. Then, the discounted capital costs replace the initial capital outlay in the project net flow. This modified all-inclusive net benefit flow is discounted using the STP rate (Szekeres, 2022, p. 2), to properly reflect society's preferences about consumption timing.

A further exposition of Szekeres' model will follow in a later update to this paper.

Argument

The Ramsey equation is tautological

Szekeres (2024) argues that the Ramsey equation is tautological, and that it cannot predict the STP rate. It is derived from a constant elasticity of substitution utility function, where the first-order condition for optimal consumption is:

$$\frac{1}{C_0^{\eta}} = \exp{(r-\delta)}\frac{1}{C_1^{\eta}}$$

The left side shows the marginal utility of consumption in Year 0, and the right side is the marginal utility of consumption in Year 1. Interest rate r represents the rate at which consumption can be transferred between one year and the other. δ indicates the change in value of consumption in the other year. In the Ramsey formula, which is reached by rearranging the natural logarithms of both sides, g represents the growth rate of consumption per year implicit in C_0 and C_1. In other words, the Ramsey formula is derived from the assumptions underlying the first-order condition – namely, that the agent's consumption path has been optimised by reference to a known r value. So, how could the Ramsey equation be used to find r?

All ‘normative’ approaches to finding the STP rate, Szekeres claims, replace the empirically revealed preferences of individuals (how much people *actually* value future welfare against present consumption) with “the preference of someone with authority to know better, be they politicians, social planners, or anyone else with the authority to decide” (2024, p. 13). He critiques the Ramsey equation in particular as “an intellectual construct useful in devising an authoritarian STPR” (p. 14).

DDRs are Based on a Logical Fallacy

Szekeres (2020) points out that Weitzman's method is underpinned by a logical fallacy. Weitzman's definition of present value (PV) is expressed as:

$$A(t) \stackrel{\text{def}}{=} \int_0^\infty e^{-x}\, f(x)d(x)$$

Where $f(x)$ is the probability density assigned to each rate d. He then defines the 'certainty-equivalent' discount rate ρ_t for time t as:

$$\rho_t = -\frac{1}{t}\ln A(t) = -\frac{1}{t}\ln\left(\int_0^\infty e^{-xt} f(x)dx\right)$$

The crucial takeaway is that as t increases, ρ_t declines towards the lowest plausible rate in $f(x)$.

However, Szekeres has shown that Weitzman's averaging method for present values contains a logical fallacy. Based on the textbook definition of PV, Szekeres (2020, p. 7) derives the following expression:

$$A(t) \stackrel{\text{def}}{=} \frac{1}{\int_0^\infty e^{xt} f(x)d(x)}$$

The logical fallacy lies in Weitzman's approach to averaging discount factors rather than properly calculating present values. As Szekeres demonstrates, this violates the fundamental definition of present value and leads to systematically biased results that artificially support declining discount rates.

Two-Rate Discounting Solves the Longstanding Debate

The two-rate method correctly computes capital costs through the SOCR while using the STPR for intertemporal weighting of net benefits. This separation eliminates the theoretical inconsistencies that plague single-rate approaches. Projects must first pass the feasibility hurdle by generating returns sufficient to cover their opportunity cost (SOCR threshold), while welfare impacts are properly measured by discounting net benefits at society's time preference rate (STPR).

Crucially, Szekeres demonstrates that the two-rate method is mathematically equivalent to the Shadow Price of Capital (SPC) approach advocated by some economists, but is far simpler to implement and more transparent in its assumptions. The SPC approach requires complex adjustments to initial investment costs based on assumptions about reinvestment rates and infinite time horizons, while the two-rate method achieves the same theoretical rigour with straightforward calculations.

Why and how the UK can adopt a two-rate framework

The case for UK adoption rests on several compelling foundations. First, the theoretical superiority is clear. The current UK DDR schedule, while attempting to address concerns about long-term project valuation, remains theoretically problematic. It applies different rates to identical cash flows simply based on their timing, without regard to the underlying economic fundamentals that should drive discount rate selection. The two-rate method provides clearer guidance for project evaluation by establishing that any project must exceed both hurdle rates to be welfare-enhancing. It simplifies sensitivity analysis by allowing risk to be addressed directly through scenario analysis rather than adjusting discount rates. Most importantly, implementation does not require the complex calculations associated with SPC approaches.

Additionally, the method aligns with current UK policy priorities. The Green Book review (2025) emphasises the need to better capture long-term transformational benefits and avoid potential biases against innovative projects. The two-rate method directly addresses these concerns by providing a more accurate framework for long-term project evaluation. For environmental and climate projects – increasingly important in UK policy – it offers a particular advantage by providing a framework for properly evaluating projects based on their ability to generate returns exceeding the opportunity cost of capital while acknowledging society's preferences about intergenerational equity.

A crucial question is how the SOC and STP rates should be calculated under a UK-specific Szekeres framework. My research into this problem is ongoing.

Conclusions

The adoption of Szekeres' two-rate discounting framework represents an opportunity for the UK to address fundamental flaws in current discounting methodology while supporting more effective public investment decisions. Single-rate approaches conflate distinct economic problems and lead to systematic biases in project evaluation. The two-rate method provides clearer guidance, reduces complexity, and aligns with policy objectives for transformational investment.

The timing is opportune. The Green Book review has identified concerns about current discounting practice and committed to an independent review of the STPR. Rather than merely adjusting parameters within a flawed framework, the UK should embrace a theoretically superior approach that properly separates the measurement of opportunity cost from the reflection of time preferences. Adopting a two-rate framework would position the UK as an international leader in discount rate methodology. This could influence global practice and contribute to more effective, evidence-based public investment decisions worldwide. The method's ability to properly value long-term transformational projects while maintaining fiscal discipline makes it particularly suitable for addressing contemporary challenges such as climate change.

My future research output will address:

[1] Exactly how Szekeres' model can be calibrated for UK-specific use cases

[2] What methods ought to be used to calculate appropriate STP and SOC rates within a two-rate framework

[3] How specific policy objectives can be addressed through the adoption of a two-rate discounting framework

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