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Discounting and relative consumption

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ABSTRACT

We analyze optimal social discount rates when people derive utility from relative consumption, i.e. their own consumption level relative to the consumption level of others. We compare the *social*, *private*, and conventional *Ramsey* rates. Assuming a positive growth rate, we find that (1) the social discount rate exceeds the private discount rate if the importance of relative consumption increases with consumption, and that (2) the social discount rate is lower than the Ramsey rate given quasi-concavity in own and others' consumption and risk aversion with respect to others' consumption. Numerical calculations demonstrate that the latter difference may be substantial and have important implications for long run environmental issues such as global warming.

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Introduction

The theory and practice of discounting is central to economics (e.g., [Arrow and Lind, 1970](#); [Arrow et al., 1996](#); [Frederick et al., 2002](#)) and essential for dealing with very long-term phenomena. With the increased attention to environmental issues such as climate change, interest in discounting has experienced a revival (see [Gollier, 2010](#); [Gollier and Weitzman, 2010](#); [Weitzman, 2010](#); [Arrow et al., 2013](#) for recent contributions). For example, essentially the entire economics debate in the wake of the *Stern Review* ([Stern, 2006](#)) largely focused on the discount rate used—not on climate science or the assessment of costs and benefits of mitigation, for which there are still very large uncertainties (see, e.g., [Dasgupta 2007, 2008](#); [Dietz and Stern, 2007](#); [Nordhaus, 2007a, 2007b](#); [Weitzman, 2007a, 2007b](#); [Brekke and Johansson-Stenman, 2008](#); [Heal, 2008](#); [Sterner and Persson, 2008](#); [Cameron et al., 2009](#); [Howarth, 2009](#); [Karp and Tsur, 2011](#)). The primary reason is, of course, that most of the consequences of climate change will occur far into the future and thus the discount rate has a dramatic effect on their present value.

This paper is, as far as we know, the first to incorporate relative consumption effects into the theory of social discounting. Yet, the idea that humans value consumption in a social context and in relation to others' consumption is far from new. In fact, classical economists—such as Adam Smith, John Stuart Mill, and Alfred Marshall—emphasized such concepts, and modern research on the subject dates back at least to [Duesenberry \(1949\)](#). There is now a substantial body of empirical evidence suggesting that people not only derive utility from their absolute consumption but are also concerned with their own consumption relative to that of others.²

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² This includes happiness research (e.g., [Blanchflower and Oswald, 2004](#); [Ferreri-i-Carbonell, 2005](#); [Luttmer, 2005](#)), questionnaire-based experiments (e.g., [Johansson-Stenman et al., 2002](#); [Solnick and Hemenway, 2005](#); [Carlsson et al., 2007](#)), and brain science (e.g., [Fliessbach et al., 2007](#)). There are also

There is also a growing literature dealing with various kinds of optimal policy responses to such relative consumption effects.³ For example, [Aronsson and Johansson-Stenman \(2008, 2010\)](#) show, in a static and a dynamic model, respectively, that optimal marginal income taxes are likely to be substantially larger under relative consumption effects than in a conventional case, i.e., where people only care about their absolute consumption level.

[Arrow and Dasgupta's paper \(2009\)](#) is closest to ours, as it explicitly deals with the implications of relative consumption effects for intertemporal resource allocation. They show that concern for relative consumption does not necessarily lead people to consume more today than is socially optimal, since they are also concerned with relative consumption (and hence produce positional externalities) in the future; this is also shown in slightly different settings by [Wendner \(2010a, 2011\)](#). [Aronsson and Johansson-Stenman \(2014a\)](#) derive optimal provision rules for state-variable public goods (interpreted as the global climate) over time under relative consumption concerns. However, the issue of how discount rates are affected by relative consumption effects has not been analyzed before.

We will in most of the paper build on a general utility formulation, meaning that our results are not due to a particular functional form. Still, we will keep the model as simple as possible allowing us to focus on the implications of relative consumption concerns, and for example abstract from within-generation inequality, population growth rates and various uncertainties. In the section "Private and social discount rates", we analyze the question of whether and, if so, how the *social* discount rate (when positional externalities are taken into account) is lower or higher than the *private* discount rate (when people do not take into account that their consumption affects others—although they still take into account that they themselves are affected by others' consumption). We show that an important condition derived by [Arrow and Dasgupta \(2009\)](#) for when private and social consumption paths coincide over time translates to the condition for when the private and social discount rates are the same. We then explore the conditions when the social discount rate exceeds the private one, and vice versa. We express these conditions in terms of the *degree of positionality*, a measure reflecting the extent to which relative consumption matters. For a positive growth rate, we show that if the degree of positionality increases with the consumption levels, consistent with some empirical evidence, then the social discount rate exceeds the private one. We also show that this discrepancy can be internalized by time-varying consumption taxes.

In the section "Comparisons with the conventional Ramsey discounting rule", we continue by analyzing a related but distinct issue—relevant from a climate policy perspective—namely whether, and if so how, the conventional optimal social discounting rule, the so-called Ramsey discounting rule ([Ramsey, 1928](#)), should be modified in the presence of relative consumption effects.⁴ The conventional Ramsey discounting rule says that the optimal discount rate equals the pure rate of time preference plus the product of the individual degree of relative risk aversion multiplied by the growth rate. Hence, this formulation does not take into account that others' consumption will also change in the future.

The formula describing the optimal social discount rate in the presence of relative consumption effects can be written in a form similar to the Ramsey formula. The only difference is that the individual degree of relative risk aversion is replaced by what we denote here as the *social* degree of relative risk aversion. By this we mean a corresponding measure of risk aversion had the individual made a risky choice on behalf of his or her whole generation. Assuming a positive consumption growth rate, we show that the social discount rate is lower than the Ramsey discount rate, if preferences are quasi-concave in own and reference consumption (consisting of others' average consumption) and concave in reference consumption. The latter means that individuals prefer that others have a certain consumption level compared to the case where others' consumption is uncertain with the same expected value. We show moreover that the social discount rate is higher than the private rate if the degree of positionality increases with consumption. Taken together, this implies that the social discount rate is *higher* than the private rate but *lower* than the Ramsey rate, if the degree of positionality increases with consumption and preferences reflect risk aversion with respect to reference consumption and are quasi-concave with respect to own and reference consumption. It is worth emphasizing that we throughout the paper assume identical individuals who in equilibrium consume the same amount in each time period. This implies that the identified effects of relative consumption concerns for the optimal discount rate do not at all depend on assumptions of inequality, or aversion to inequality.

Finally, we illustrate quantitatively in the section "Numerical illustration and orders of magnitude" how the overall long-term social discount rates suggested by [Stern \(2006\)](#) and [Weitzman \(2007b\)](#) would be modified when taking relative consumption effects into account. We conclude that these modifications may be substantial with commonly used functional forms and reasonable parameter values, and that they are potentially very important for the economics of climate change. The "Conclusion and discussion" offers some final remarks and observations.

(footnote continued)

recent evolutionary models consistent with relative consumption concerns ([Samuelson, 2004](#); [Rayo and Becker, 2007](#)). [Stevenson and Wolfers \(2008\)](#) constitute an exception in the happiness literature, claiming that the role of relative income is overstated.

³ See, e.g., [Boskin and Sheshinski \(1978\)](#), [Layard \(1980\)](#), [Oswald \(1983\)](#), [Ng \(1987\)](#), [Brekke and Howarth \(2002\)](#), [Abel \(2005\)](#), and [Wendner and Goulder \(2008\)](#). [Clark et al. \(2008\)](#) provide a good overview of both the empirical evidence and economic implications of relative consumption concerns.

⁴ Other papers have dealt with the issue of whether, and if so how, the externalities induced by relative consumption effects affect the consumption pattern over time; see e.g. [Wendner \(2010b\)](#) and references therein.

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