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Veblen's theory of the leisure class revisited: implications for optimal income taxation

Thomas Aronsson · Olof Johansson-Stenman

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Abstract Several previous studies have demonstrated the importance of relative consumption comparisons for public policy. Yet, almost all of them have ignored the role of leisure for status comparisons. Inspired by Veblen (The theory of the leisure class. Macmillan, New York, 1899), this paper assumes that people care about their relative consumption and that leisure has a displaying role in making relative consumption more visible, based on a two-type model of optimal income taxation. While increased importance of relative consumption typically implies higher marginal income tax rates, in line with previous research, the effect of leisure-induced consumption visibility is to make the income tax more regressive in terms of ability.

JEL Classification D62, H21, H23, H41

> Closely related to the requirement that the gentleman must consume freely and of the right kind of goods, there is the requirement that he must know how to consume them in a seemly manner. His life of leisure must be conducted in due form… Veblen (1899, Chap. 4)

T. Aronsson (✉)
Department of Economics, Umeå School of Business and Economics,
Umeå University, 90187 Umeå, Sweden
e-mail: thomas.aronsson@econ.umu.se

O. Johansson-Stenman
Department of Economics, School of Business, Economics and Law, University of Gothenburg,
40530 Göteborg, Sweden
e-mail: Olof.Johansson@economics.gu.se

1 Introduction

The Theory of the Leisure Class by Veblen (1899) remains the classic reference to the idea of "conspicuous consumption," according to which individuals signal wealth—or status more generally—via their consumption behavior. Today, a substantial body of empirical evidence suggests that people care about their *relative* consumption, i.e., their consumption relative to that of others—a possible indication of status seeking—and hence not just about their *absolute* consumption as in conventional economic theory.[1] There is also a rapidly growing literature showing how public policy ought to respond to the externalities and distributional challenges that relative consumption concerns give rise to.[2] Yet, and somewhat paradoxically given the title and content of Veblen's book, almost the entire literature dealing with optimal tax and expenditure responses to relative consumption comparisons has ignored the role of leisure in such comparisons.

In the present paper, we consider optimal redistributive income taxation and, in line with the ideas of Veblen (1899), assume that leisure has a displaying role in making relative consumption more visible. There are at least two aspects of such consumption visibility. First, the utility gain to an individual with higher relative consumption may increase with his/her own use of leisure. This is so because it takes time to be able to consume in a seemly manner. Second, the positional consumption externality that each individual imposes on others may increase with the time he/she spends on leisure. Intuitively, people will have a hard time noticing a person's new BMW if he/she works all the time. We discuss both of these aspects below, and show that only the latter directly affects the policy rules for marginal income taxation.

As far as we know, Aronsson and Johansson-Stenman (forthcoming) constitutes the only previous study on optimal policy responses to relative consumption concerns where leisure plays a role for relative social comparisons. In that study, individuals derive utility from their own consumption and use of leisure, respectively, relative to the consumption and use of leisure by other people. We shall return to their results below. In the present paper, though, we do not assume that individuals care about their own use of leisure relative to that of other people; instead, their own and others' use of leisure will matter in the sense of making their own and others' private consumption more visible. We believe that this approach is closer in spirit to the ideas put forward

[1] This empirical evidence includes happiness research (e.g., Easterlin 2001; Blanchflower and Oswald 2004; Ferrer-i-Carbonell 2005; Luttmer 2005; Clark and Senik 2010), questionnaire-based experiments (e.g., Johansson-Stenman et al. 2002; Solnick and Hemenway 2005; Carlsson et al. 2007; Corazzini et al. 2012), and, more recently, brain science (Fliessbach et al. 2007; Dohmen et al. 2011). See Samuelson (2004) and Rayo and Becker (2007) for evolutionary models consistent with relative consumption concerns. Stevenson and Wolfers 2008 constitute a recent exception in the happiness literature, claiming that the role of relative income is overstated.

[2] Earlier studies dealing with public policies in economies where agents have positional preferences address a variety of issues such as optimal taxation, public good provision, social insurance, growth, environmental externalities, and stabilization policy; see, e.g., Boskin and Sheshinski (1978), Layard (1980), Oswald (1983), Frank (1985, 2005, 2008), Ng (1987), Corneo and Jeanne (1997, 2001), Brekke and Howarth (2002), Abel (2005), Blumkin and Sadka (2007), Aronsson and Johansson-Stenman (2008, 2010), Wendner and Goulder (2008), Kanbur and Tuomala (2010), and Wendner (2010, 2011). Clark et al. (2008) provide a good overview of both the empirical evidence and economic implications of relative consumption concerns.

by Veblen about how the gentleman ought to conduct his life of leisure: "… it appears that the utility of both [conspicuous leisure and conspicuous consumption] alike for the purposes of reputability lies in the element of waste that is common to both. In the one case it is a waste of time and effort, in the other it is a waste of goods. Both are methods of demonstrating the possession of wealth,…" (Veblen (1899), Chap. 4). Hence, a poor individual's leisure is not conspicuous since it does not demonstrate "the possession of wealth."[3] As such, we also believe that the present approach provides a better description of reality.

Section 2 presents the basic model, which is based on the assumption that each individual compares his/her own consumption with a leisure-influenced average of other people's consumption, and analyzes the outcome of private optimization.[4] The decision-problem faced by the government is characterized in Sect. 3, where we utilize the two-type model with optimal nonlinear income taxation with asymmetric information between the government and the private sector—developed in its original form by Stern (1982) and Stiglitz (1982)—as our basic workhorse. This model provides a simple—yet very powerful—framework for capturing redistributive and corrective aspects of income taxation as well as for capturing the policy incentives caused by interaction between the incentive constraint and the desire to internalize positional externalities. The reason why such interaction is important is that policies designed to internalize positional externalities may either contribute to relax or tighten the incentive constraint. Moreover, pure externality correction may have redistributive implications at the margin, and the results of the present paper actually identify such implications.

The optimal taxation results and, in particular, how the optimal tax policy responds to relative consumption concerns are presented in Sect. 4. In line with earlier comparable literature (e.g., Oswald 1983; Tuomala 1990; Aronsson and Johansson-Stenman 2008, 2010), we find that increased concern for relative consumption typically implies higher marginal income tax rates for both ability types. However, the results also show that the displaying role of leisure gives rise to *regressive* income taxation in the sense of increasing the marginal income tax rate faced by the low-ability type while decreasing the marginal income tax rate faced by the high-ability type. The intuition behind the latter finding is that an increase in the use of leisure by the low-ability type contributes to reduce the positional consumption externality, whereas an increase in the use of leisure by the high-ability type leads to an increase in this externality. This is in con-

[3] Throughout the paper we will use the notion *conspicuous consumption* to mean something like consumption that demonstrates "the possession of wealth," in line with Veblen, whereas we will use the notion *relative consumption* as a more precise concept defined by the relation between the individual's and others' consumption.

[4] We do not attempt to explain *why* people derive utility from signaling wealth or status, as analyzed by, e.g., Rayo and Becker (2007). An alternative approach would be to start from conventional preferences where, instead, relative consumption has a purely instrumental value; see, e.g., Cole et al. (1992, 1998). Yet, while we share the view that signaling of some attractive characteristic constitutes a likely important reason for why people tend to care about relative consumption (see also Ireland (2001)), we believe that the considerably simpler modeling strategy of assuming that people's preferences depend directly on relative consumption has important advantages when analyzing optimal tax problems, as we would otherwise have been forced to make drastic simplifications.

trast to what is often claimed in the popular debate, namely that relative consumption concerns tend to imply a rationale for more progressive income taxation.

Section 5 extends the analysis by introducing a more general measure of reference consumption, which allows for comparisons upwards and downwards in the income distribution. Upwards comparisons in particular have been suggested by several authors, including Veblen (1899), who wrote: "All canons of reputability and decency, and all standards of consumption, are traced back by insensible gradations to the usages and habits of thought of the highest social and pecuniary class—the wealthy leisure class" (Chap. 5). This extension is shown to have important policy implications. For example, if individuals compare their own consumption solely with that of the high-ability type, then the consumption of the low-ability type does not give rise to any positional externalities, and there will consequently be no efficiency-based reason for taxing the income of the low-ability type. Relative consumption concerns would then induce a progressive—rather than a regressive—tax element regardless of the role of leisure. Section 6 provides some concluding remarks, while proofs are presented in the Appendix.

2 Individual preferences and optimization

In this section, we describe the individual preferences and outcome of private optimization in terms of consumption and labor supply. In accordance with earlier comparable literature on relative consumption comparisons, we assume that each individual of ability-type i compares his/her own private consumption, x^i, with a measure of reference consumption. However, contrary to the same earlier literature—and in accordance with Veblen (1899), we also assume that leisure, z^i, has a displaying role in making relative consumption more visible. To be more specific, we assume (i) that the utility gain to the individual of higher relative consumption increases with his/her own use of leisure and (ii) that the positional consumption externality that each individual imposes on other people tends to increase with the time he/she spends on leisure. The first aspect is captured simply by defining the "gain of relative consumption" by the function $h^i(z^i, \Delta^i)$, where Δ^i is the measure of relative consumption faced by ability-type i. We assume that $h^i_z > 0$ and $h^i_\Delta > 0$, where subindices denote partial derivatives. The second aspect is captured by allowing the reference consumption, Ω, to depend on the use of leisure. This will be described more thoroughly below.

We will consider the two most common forms of relative consumption comparisons, namely the difference comparison and the ratio comparison.[5] The difference

[5] The technically convenient difference comparison is the most common approach in earlier studies and can be found in, e.g., Akerlof (1997), Corneo and Jeanne (1997), Ljungqvist and Uhlig (2000), Bowles and Park (2005), Carlsson et al. (2007), and Aronsson and Johansson-Stenman (2008, 2010), whereas Boskin and Sheshinski (1978), Layard (1980), and Wendner and Goulder (2008) exemplify studies based on the ratio comparison. An alternative would be comparisons of ordinal rank (Frank 1985; Hopkins and Kornienko 2004; Hopkins and Kornienko 2009). However, recent evidence by Corazzini et al. (2012) suggests that not only the rank but also the magnitudes of the (in their case income) differences play a role.

comparison form means that the relative consumption faced by an individual of ability-type i can be written as

$$\Delta^i = x^i - \Omega, \tag{1}$$

while the ratio comparison form means that the corresponding measure of relative consumption becomes

$$\Delta^i = x^i / \Omega. \tag{2}$$

Now, the reference consumption level, Ω, is assumed to be a leisure-influenced measure of others' consumption in the sense that the consumption carries a higher weight if accompanied with more use of leisure by the same person. Specifically,

$$\Omega = \frac{\sum_j n^j f(z^j) x^j}{\sum_j n^j f(z^j)},$$

where n^i denotes the number of individuals of ability-type i and the function $f(\cdot)$ is such that $f'(z^j) > 0$. This clearly means that increased use of leisure by a particular individual increases the weight that this individual's consumption carries in the measure of reference consumption.[6]

For further use, note that

$$\frac{\partial \Omega}{\partial x^i} = \frac{n^i f(z^i)}{\sum_j n^j f(z^j)}$$

and

$$\frac{\partial \Omega}{\partial z^i} = \frac{f'(z^i) n^i}{\sum_j n^j f(z^j)} \left(x^i - \frac{\sum_j n^j f(z^j) x^j}{\sum_j n^j f(z^j)} \right) = \frac{f'(z^i) n^i}{\sum_j n^j f(z^j)} (x^i - \Omega).$$

Therefore, $\partial \Omega / \partial x^i > 0$, while $\partial \Omega / \partial z^i > 0\,(< 0)$ for $x^i > (<)\, \Omega$. The relationship between Ω and z^i for high-ability individuals, whose consumption exceeds the reference consumption, can be given an interesting interpretation in terms of "conspicuous leisure": an increase in such individuals' use of leisure makes their consumption more visible, and hence signals their high wealth and/or high status more effectively. This, in turn, leads to an increase in the reference consumption and, therefore, in the positional consumption externality. Otherwise, if the individual's own consumption falls short of the reference consumption, increased use of leisure by this particular individual instead leads to a decrease in the reference consumption.

[6] An obvious example of such a function is $f(z^j) = z^j$, i.e., a simple proportional relationship. Yet, this special case has some unattractive features, e.g., that the consumption weight is zero when leisure is equal to zero. In reality, it makes more sense to assume that $f(0) > 0$, such that an individual's consumption affects the reference consumption also when the person works all the time, i.e., has zero leisure. The more general expression $f(z^j)$allows for this.

The utility function of ability-type i can then be written as

$$U^i = V^i(x^i, z^i, h^i(z^i, \Delta^i)) = v^i(x^i, z^i, \Delta^i) = u^i(x^i, z^i, \Omega). \tag{3}$$

The functions $V^i(\cdot)$ and $v^i(\cdot)$ are increasing in each argument, implying that $u^i(\cdot)$ is decreasing in Ω (a property that Dupor and Liu 2003 denote "jealousy") and increasing in the other arguments; $V^i(\cdot)$, $v^i(\cdot)$, and $u^i(\cdot)$ are assumed to be twice continuously differentiable in their respective arguments and strictly quasi-concave. We assume that each individual treats Ω as exogenous. The second equality follows because the direct effect of z^i on $h^i(\cdot)$—following from the assumption that the utility of relative consumption to the individual increases with his/her own use of leisure—will be fully internalized by the individual via the labor supply choice. Therefore, without loss of generality, we may replace $V^i(\cdot)$ with the "reduced form" $v^i(\cdot)$, in which the direct effect of z^i on $h^i(\cdot)$ is embedded in the marginal utility of leisure.[7]

The function $u^i(\cdot)$ represents the most general utility formulation and resembles a classic externality problem; here, we do not specify anything about the structure of the social comparisons. In fact, the analysis to be carried out below will, in part, be based on the function $u^i(\cdot)$. Yet, we need the more restrictive utility formulation based on the function $v^i(\cdot)$, where we specify in what way people care about relative comparisons, i.e., either through the difference form in Eq. (1) or the ratio form in Eq. (2), to establish a relationship between the optimal tax policy on the one hand and the degree to which the utility gain of higher consumption is associated with increased relative consumption on the other. The latter will be referred to as the "degree of positionality," to which we turn next.

By extending the definition in Johansson-Stenman et al. (2002) to allow for leisure-weighted consumption comparisons, we define the *degree of positionality* for ability-type i, α^i, as

$$\alpha^i \equiv \frac{v^i_\Delta \Delta^i_x}{v^i_x + v^i_\Delta \Delta^i_x}, \tag{4}$$

where $0 < \alpha^i < 1$ follows from our earlier assumptions; subindices denote partial derivatives, so $v^i_x \equiv \partial v^i/\partial x^i$, $v^i_\Delta \equiv \partial v^i/\partial \Delta^i$, and $\Delta^i_x = \partial \Delta^i/\partial x^i$. The parameter α^i can then be interpreted as the fraction of the overall utility increase for ability-type i from the last dollar spent that is due to increased relative consumption. Thus, when α^i approaches zero we are back to the conventional model where relative consumption does not matter at all, whereas in the other extreme case where α^i approaches one absolute consumption does not matter.

In the difference comparison case we then obtain

$$\alpha^i \equiv \frac{v^i_\Delta}{v^i_x + v^i_\Delta}, \tag{5}$$

7 This means that $V^i_z + V^i_h h^i_z = v^i_z$.

whereas the ratio comparison case implies

$$\alpha^i \equiv \frac{v^i_\Delta/\Omega}{v^i_x + v^i_\Delta/\Omega}. \tag{6}$$

The *average degree of positionality* becomes (in both the difference and the ratio case)

$$\bar{\alpha} = \frac{\sum_j n^j \alpha^j}{\sum_j n^j}, \tag{7}$$

where $0 < \bar{\alpha} < 1$. Empirical estimates of $\bar{\alpha}$ (yet based on models where leisure does not have a displaying role for consumption comparisons) vary considerably across studies, although many of them suggest that the average degree of positionality might be substantial (e.g., in the interval 0.2–0.8).[8] We will return to the implications of these estimates in Sect. 4.

Leisure is defined as $z^i = 1 - l^i$, i.e., as a time endowment, normalized to unity without loss of generality, less the hours of work, l^i. Let w^i denote the before-tax hourly wage rate and $T(w^i l^i)$ the income tax payment of ability-type i. The individual budget constraint is given by $w^i l^i - T(w^i l^i) = x^i$, implying the following first order condition for the number of hours of work:

$$u^i_x w^i \left[1 - T'(w^i l^i)\right] = u^i_z, \tag{8}$$

where $u^i_x \equiv \partial u^i/\partial x^i$, $u^i_z \equiv \partial u^i/\partial z^i$, and $T'(w^i l^i)$ is the marginal income tax rate. Note also that although each individual will take the reference consumption level as *exogenous*, this reference consumption level is still *endogenous* in the model.

Turning to the production side of the economy, we follow much earlier literature on optimal income taxation in assuming that output is produced by a linear technology, which is interpreted to mean that the before-tax wage rates are fixed. We briefly return to this assumption in sect. 4; see footnote 15.

3 The efficient tax problem

In the previous section, we examined the preferences and labor supply behavior for an arbitrary individual. Here, and throughout the paper, we will focus on the case with two types of individuals, where the low-ability type (type 1) is less productive than the high-ability type (type 2) in the sense that $w^1 < w^2$.

[8] See, e.g., Alpizar et al. (2005), Solnick and Hemenway (2005), Carlsson et al. (2007), and Wendner and Goulder (2008).

3.1 Constraints and social first order conditions

The objective of the government is to obtain a Pareto efficient resource allocation, which it accomplishes by maximizing the utility of the low-ability type subject to a minimum utility restriction for the high-ability type, a self-selection constraint and the budget constraint.[9] The informational assumptions are conventional. The government is able to observe income, while ability is private information. We follow the standard approach in assuming that the government wants to redistribute from the high-ability to the low-ability type. The self-selection constraint that may bind then becomes

$$U^2 = u^2(x^2, z^2, \Omega) \geq u^2(x^1, 1 - \phi l^1, \Omega) = \hat{U}^2, \tag{9}$$

where $\phi = w^1/w^2 < 1$ is the wage ratio, i.e., relative wage rate. The variable $\hat{U}^2$ denotes the utility of the mimicker, where ϕl^1 is interpretable as the number of work hours that the mimicker must supply to reach the same before-tax income as the low-ability type. Although the mimicker enjoys the same before-tax and disposable income as the low-ability type, he/she spends more time on leisure than the low-ability type, as the mimicker is more productive than the low-ability type.

As we are considering a pure redistribution problem under positional externalities, and by using $T(w^i l^i) = w^i l^i - x^i$ from the private budget constraints, it follows that the government's budget constraint can be written as

$$\sum_i n^i w^i l^i = \sum_i n^i x^i. \tag{10}$$

Therefore, and by analogy with earlier literature based on the self-selection approach to optimal income taxation, the marginal income tax rates can be derived by choosing the number of hours of work and private consumption for each ability-type based on the following Lagrangean:

$$\mathcal{L} = U^1 + \mu(U^2 - U_0^2) + \lambda(U^2 - \hat{U}^2) + \gamma\left(\sum_i n^i(w^i l^i - x^i)\right),$$

where U_0^2 is an arbitrarily fixed utility level for the high-ability type, while μ, λ, and γ are Lagrange multipliers. The first order conditions for z^1, x^1, z^2, and x^2 are then given by

[9] This approach is standard. An alternative would be to assume that the government is maximizing a general Bergson–Samuelson social welfare function (again subject to the relevant self-selection and budget constraint); cf. Aronsson and Johansson-Stenman (2010). This approach would give the same optimal policy rules for the marginal income tax rates as those derived below.

$$u_z^1 - \lambda\phi\hat{u}_z^2 - \gamma n^1 w^1 + \frac{\partial\mathcal{L}}{\partial\Omega}\frac{\partial\Omega}{\partial z^1} = 0, \quad (11)$$

$$u_x^1 - \lambda\hat{u}_x^2 - \gamma n^1 + \frac{\partial\mathcal{L}}{\partial\Omega}\frac{\partial\Omega}{\partial x^1} = 0, \quad (12)$$

$$(\mu + \lambda)u_z^2 - \gamma n^2 w^2 + \frac{\partial\mathcal{L}}{\partial\Omega}\frac{\partial\Omega}{\partial z^2} = 0, \quad (13)$$

$$(\mu + \lambda)u_x^2 - \gamma n^2 + \frac{\partial\mathcal{L}}{\partial\Omega}\frac{\partial\Omega}{\partial x^2} = 0, \quad (14)$$

in which we have used $\hat{u}^2 = u^2(x^1, 1 - \phi l^1, \Omega)$. As before, a subindex attached to the utility function represents a partial derivative. The partial derivative $\partial\mathcal{L}/\partial\Omega$ measures the partial welfare effect of increased reference consumption and will be analyzed more thoroughly below.

By adding the assumption that the private consumption of the high-ability type always exceeds the private consumption of the low-ability type, we have $x^1 < \Omega$ and $x^2 > \Omega$ and, as a consequence, $\partial\Omega/\partial z^1 < 0$ and $\partial\Omega/\partial z^2 > 0$. We interpret these properties such that the high-ability individuals' use of leisure is conspicuous in the sense that it makes their consumption more visible, and as such signals their high wealth and/or high status more effectively. In contrast, the low-ability individuals' use of leisure is not, as it contributes to making their low wealth and/or status more visible.

3.2 A general tax formula

Before presenting in the next section the optimal taxation results expressed in terms of positionality degrees, i.e., in terms of how much relative consumption matters, we will here present some results based on the most general utility specification given by the function $u^i(\cdot)$, which does not specify how the relative consumption comparisons are made.

Let $MRS_{z,x}^i \equiv u_z^i/u_x^i$ and $M\hat{R}S_{z,x}^2 \equiv \hat{u}_z^2/\hat{u}_x^2$ denote the marginal rate of substitution between leisure and private consumption for ability type i and the mimicker, respectively. By combining Eqs. (11) and (12) and Eqs. (13) and (14), respectively, with the private first order condition for the number of work hours given by Eq. (8), we show in the Appendix that the optimal marginal income tax rates can be written (for $i = 1, 2$) as

$$T'(w^i l^i) = \tau^i + \frac{1}{n^i\gamma w^i}\frac{\partial\mathcal{L}}{\partial\Omega}\left(\frac{\partial\Omega}{\partial z^i} - MRS_{z,x}^i\frac{\partial\Omega}{\partial x^i}\right). \quad (15)$$

Here, τ^i represents the marginal income tax formula implemented for ability-type i in the standard two-type model without positional preferences, i.e.,

$$\tau^1 = \frac{\lambda^*}{n^1 w^1}(MRS_{z,x}^1 - M\hat{R}S_{z,x}^2\phi) \quad \text{and} \quad \tau^2 = 0,$$

where $\lambda^* \equiv \lambda \hat{u}_x^2/\gamma > 0$. The intuition behind the formulas for τ^1 and τ^2 is that the government may relax the self-selection constraint by imposing a marginal income tax on the low-ability type (to make mimicking less attractive), whereas no such option exists with respect to the marginal income tax rate of the high-ability type. These effects are well understood from earlier research and will not be further discussed here.

Thus, relative consumption concerns lead to a simple additive modification of the conventional nonlinear tax formulas. As we can see from the second term on the right hand side of Eq. (15), the only reason why the presence of positional preferences directly affects the tax formula is that z^i and x^i directly affect Ω (our measure of reference consumption), i.e., that the consumption and leisure choices made by each individual directly affect the utility of relative consumption perceived by others. Therefore, this extra component is due solely to the fact that each individual imposes externalities on others. As we explained above, the assumption that the private utility gain of relative consumption increases with the individual's own use of leisure does not affect the policy rules for marginal income taxation, as this effect is already internalized at the individual level and does not justify policy intervention.[10]

4 Optimal income taxation results

In the previous section we presented an optimal income tax formulation in Eq. (15) in the rather general case where we have only assumed that individual utility depends (negatively) on Ω according to the function $u^i(\cdot)$ in Eq. (3). While it is interesting to see that the marginal income tax rates can be expressed in terms of a simple additive modification of the corresponding formulas derived in the conventional optimal income tax model, it is far from straightforward to interpret the modification per se.

To go further, we will in the present section make use of the function $v^i(\cdot)$, which specifies *how* each individual's utility depends on relative consumption comparisons, i.e., we will present the results for the cases where the relative consumption is based on the difference and ratio comparison forms, respectively. For pedagogical reasons, we begin by analyzing how the appearance of positional preferences affects the marginal income tax rates when the self-selection constraint does not bind, and then continue with the second best model.

4.1 First best taxation

In a first best economy, by which we mean an economy where the self-selection constraint does not bind, and which may be interpreted as a case where the government can redistribute between the individuals through ability-type specific lump-sum taxes, it follows that $\lambda = 0$. It is then straightforward to show that the partial welfare effect of increased reference consumption, i.e., the partial derivative $\partial \mathcal{L}/\partial \Omega$ in Eq. (15),

[10] However, this mechanism might of course affect the *levels* of the marginal income tax rates.

which we will refer to as the *positionality effect* in what follows, solely reflects the externalities that the relative consumption comparisons give rise to.

Consider first the positionality effect in the difference comparison case, where we show in the Appendix that

$$\frac{\partial \mathcal{L}}{\partial \Omega} = -\gamma N \frac{\bar{\alpha}}{1 - \tilde{\alpha}} < 0, \tag{16}$$

in which $N \equiv n^1 + n^2$ denotes the total number of individuals. In Eq. (16), $\bar{\alpha}$ is the average degree of positionality, as defined in Eq. (7), while

$$\tilde{\alpha} \equiv \frac{\sum_i \alpha^i n^i f(z^i)}{\sum_j n^j f(z^j)} \in (0, 1)$$

measures a leisure-influenced average of the degree of positionality through the function $f(z)$. This term arises here due to the assumption that the effect of x^i on Ω depends on the relative "leisure share," $n^i f(z^i)/\sum_j n^j f(z^j)$, of ability-type i. Clearly, the numerator of Eq. (16) reflects the sum of willingness to pay to reduce the externality, measured in terms of public funds, whereas the denominator is interpretable as a feedback effect. This feedback effect arises because Ω affects $\mathcal{L}$ indirectly through the first order conditions for x^1 and x^2, which are used in the derivation of Eq. (16). An interpretation is that the tax revenue raised by the government in response to a higher Ω will be returned to the consumers as an addition to the disposable income: in turn, this affects Ω and, therefore, $\mathcal{L}$.[11]

Similarly, the positionality effect in the ratio comparison case can be written as (again, see the Appendix for details)

$$\frac{\partial \mathcal{L}}{\partial \Omega} = -\gamma N \frac{\widehat{\alpha}}{1 - \widehat{\tilde{\alpha}}}, \tag{17}$$

where

$$\widehat{\alpha} = \frac{\bar{x}}{\Omega} \frac{\sum_i n^i x^i \alpha^i}{\sum_j n^j x^j} = \frac{\bar{x}}{\Omega}\left(1 + \mathrm{cov}\left(\frac{x}{\bar{x}}, \frac{\alpha}{\bar{\alpha}}\right)\right)\bar{\alpha}$$

and

$$\widehat{\tilde{\alpha}} = \frac{\sum_i n^i f(z^i) x^i \alpha^i}{\sum_j n^j f(z^j) x^j}.$$

Equation (17) has the same general structure as Eq. (16) with an analogous interpretation. By comparing Eqs. (16) and (17) we can first note that the positionality effect in both the difference and the ratio comparison case is proportional to the average degree

[11] We are grateful to one of the referees for suggesting this interpretation.

of positionality. Second, we can note that under ratio comparisons, and contrary to the difference comparison case, the positionality effect depends positively on the normalized covariance between consumption and the degree of positionality. Recalling that the positionality effect reflects the positional externalities, the intuition is that an individual's marginal willingness to pay for reducing others' consumption is independent of the individual's own consumption in the difference comparison case (except for indirect effects through α^i), whereas in the ratio comparison case an individual would be willing to pay more the larger the individual's consumption is. For similar reasons, the feedback effect (which works through $\tilde{\alpha}$ in the difference comparison case) is in the ratio comparison case working through $\widehat{\tilde{\alpha}}$, where each individual degree of positionality is not only weighted by the function $f(z^i)$, but also by individual consumption.

Now, let us use the short notation

$$\pi^i \equiv \frac{\partial \Omega}{\partial x^i} \Big/ \frac{n^i}{N} = \frac{N}{n^i} \frac{n^i f(z^i)}{\sum_j n^j f(z^j)}$$

to reflect how the measure of reference consumption changes in response to increased consumption by ability-type i, relative to the population share of ability type i. As such, π^i also reflects the relative leisure weight attached to x^i in the measure of reference consumption. Clearly, when $z^1 = z^2$ it follows that $\pi^1 = \pi^2 = 1$, and when $z^i > z^j$, it follows that $\pi^j < 1 < \pi^i$. By using equations (15), (16) and (17), along with the following variables (to be explained subsequently) for the difference and ratio cases, respectively,

$$\rho^i \equiv \frac{1 - \tilde{\alpha}}{\pi^i} + \bar{\alpha} > 0, \tag{18}$$

$$\widehat{\rho}^i \equiv \frac{1 - \widehat{\tilde{\alpha}}}{\pi^i} + \widehat{\alpha} > 0, \tag{19}$$

we can then derive the following results:

Proposition 1 *In the first best, where* $\lambda = 0$, *the marginal income tax rate implemented for ability-type i* ($i = 1, 2$) *can in the difference and ratio comparison cases, respectively, be written as*

$$T'(w^i l^i) = \frac{1}{\rho^i} \left(1 - \frac{x^i - \Omega}{w^i} \frac{f'(z^i)}{f(z^i)} \right) \bar{\alpha}, \tag{20}$$

$$T'(w^i l^i) = \frac{1}{\widehat{\rho}^i} \left(1 - \frac{x^i - \Omega}{w^i} \frac{f'(z^i)}{f(z^i)} \right) \widehat{\alpha}. \tag{21}$$

Proof See the Appendix.

To interpret Proposition 1, it is instructive to begin by considering the further simplified (and somewhat unrealistic) case where both ability types use the same amount of leisure, so $z^1 = z^2 = \bar{z}$, $\tilde{\alpha} = \bar{\alpha}$, $\Omega = \bar{x}$ and $\rho^i = \widehat{\rho}^i = 1$ for $i = 1, 2$, implying that Eqs. (20) and (21) reduce to

$$T'(w^i l^i) = \bar{\alpha} - \frac{x^i - \bar{x}}{w^i} \frac{f'(\bar{z})}{f(\bar{z})} \bar{\alpha}, \tag{22}$$

$$T'(w^i l^i) = \widehat{\alpha} - \frac{x^i - \bar{x}}{w^i} \frac{f'(\bar{z})}{f(\bar{z})} \widehat{\alpha}, \tag{23}$$

respectively, where $\Omega = \bar{x}$ implies $\widehat{\alpha} = \frac{\sum_i n^i x^i \alpha^i}{\sum_j n^j x^j} = \left(1 + \text{cov}\left(\frac{x}{\bar{x}}, \frac{\alpha}{\bar{\alpha}}\right)\right) \bar{\alpha}$.

Equation (22) refers to the difference comparison case, where the first term on the right hand side, $\bar{\alpha}$, is the average degree of positionality and contributes to increase the marginal income tax rate for both ability types. The intuition is that private consumption causes a *negative externality*, due to others' reduced relative consumption. When disregarding the effect on the reference consumption through the use of leisure, this externality would be $\bar{\alpha}$ per unit of consumption. In other words, other people's total willingness to pay for reducing an individual's consumption, per consumption unit, would be equal to $\bar{\alpha}$.

In the ratio comparison case in Eq. (23), the corresponding tax component, $\widehat{\alpha}$, would be larger than $\bar{\alpha}$ if the high-ability type is more positional than the low-ability type, and vice versa. The reason is that with ratio comparisons, people's willingness to pay for others' reduced consumption will depend positively on the individual's own consumption, unlike the difference comparison case. Therefore, the more positional the high-ability individuals, for a given average degree of positionality, the larger the total willingness to pay for a consumption reduction of a single individual, and the larger the externality-correcting tax.

The second term on the right hand side of Eqs. (22) and (23) arises because the use of leisure affects the externality that each individual imposes on others.[12] Since $x^1 < \bar{x}$ and $x^2 > \bar{x}$, this effect means that the tax system becomes regressive in the sense that $T'(w^2l^2) < \bar{\alpha} < T'(w^1l^1)$ under difference comparisons, and $T'(w^2l^2) < \widehat{\alpha} < T'(w^1l^1)$ under ratio comparisons. The interpretation is straightforward: an increase in the use of leisure by the low-ability type contributes to reduce the consumption externality, whereas an increase in the use of leisure by the high-ability type causes an increase in the consumption externality, *ceteris paribus*, i.e., $\partial\Omega/\partial z^1 < 0$ and $\partial\Omega/\partial z^2 > 0$. Therefore, and in addition to the conventional Pigouvian tax component associated with relative consumption comparisons, i.e., the first term on the right hand side, there is an incentive for the government to decrease the labor supply of the low-ability type and increase the labor supply of the high-ability type, which explains the regressive tax structure implicit in Eqs. (22) and (23).[13]

[12] Note that if the consumption externality that each individual imposes on others were independent of the individual's use of leisure, in which case $f'(z^i) = 0$ for $i = 1, 2$, then the second term on the right hand side of Eqs. (22) and (23) would vanish. In this case, therefore, Eqs. (22) and (23) reduce to $T'(w^i l^i) = \bar{\alpha}$ and $T'(w^i l^i) = \widehat{\alpha}$, respectively, for $i = 1, 2$; cf. Aronsson and Johansson-Stenman (2008).

[13] Note that we focus on the case where the high-ability type consumes more than the low-ability type. This assumption is clearly realistic in the second best case presented in Sect. 4.2 below. However, as noted

Consider next order of magnitudes and let us, based on Johansson-Stenman et al. (2002), assume that $\alpha^1 = \alpha^2 = \bar{\alpha} = 0.4$. Then it is immediately clear that $T'(w^1 l^1) > 0.4$ and $T'(w^2 l^2) < 0.4$ for both the difference and the ratio comparison cases. Note that these marginal tax rates are based on efficiency considerations alone, since the first best environment makes it possible for the government to redistribute across ability types without any social costs.

Now, returning to the more general Eqs. (20) and (21), where the use of leisure differs between ability-types, the effects described above are still present—in the large parenthesis—although the tax structure is no longer necessarily regressive in the sense that the low-ability type faces a higher marginal income tax rate than the high-ability type. The reason is that the factors of proportionality, $1/\rho^i$ and $1/\widehat{\rho}^i$, respectively, are ability-type specific. This component represents an adjustment of the tax structure due to that the relationship between x^i and Ω depends on the relative use of leisure by ability-type i, i.e., $\partial\Omega/\partial x^i = n^i f(z^i)/\sum_j n^j f(z^j)$. In other words, the greater this leisure-influenced weight attached to ability-type i, ceteris paribus, the more an increase in x^i will contribute to the positional consumption externality. Therefore, this mechanism works to increase the marginal income tax rate for the ability type who spends relatively more time on leisure and to decrease the marginal income tax rate for the ability-type who spends relatively less time on leisure at the optimum.

The following result is a direct consequence of Proposition 1:

Corollary 1 *If $z^1 \geq z^2$, the optimal first best income tax structure is regressive in the sense that $T'(w^2 l^2) < T'(w^1 l^1)$ for both the difference and the ratio comparison cases.*

The intuition behind the corollary is that if $z^1 \geq z^2$, then the proportionality factors in Eqs. (20) and (21) are such that $1/\rho^1 \geq 1/\rho^2$ and $1/\widehat{\rho}^1 \geq 1/\widehat{\rho}^2$, respectively, which reinforce the regressive tax components in Eqs. (22) and (23). If on the other hand $z^1 < z^2$, the proportionality factors work in the opposite direction, which means that the marginal income tax rate implemented for the low-ability type may either exceed, be equal to, or fall short of the marginal income tax rate implemented for the high-ability type. Therefore, a sufficient (not necessary) condition for a regressive tax structure is that the high-ability type supplies more labor than the low-ability type. This result can be compared to the finding in Aronsson and Johansson-Stenman (forthcoming), where both private consumption and leisure are positional goods, and where relative leisure concerns lead to a more progressive tax structure.[14]

Footnote 13 continued
by a referee, in a first best setting one can argue that the government may want to equalize consumption (although there are many Pareto efficient allocations). Yet, in order to facilitate straight forward comparisons between the first and the second best tax policy, we assume that $x^1 < x^2$. If $x^1 = x^2$, then the case for regressive marginal income taxation would of course disappear.

[14] In their study, the (conventional) negative externality caused by positional concerns is partly offset by a positive externality caused by leisure-positionality, since the latter means that an increase in the number of work hours by an individual contributes to reduce the average time spent on leisure in the economy as a whole (which is the reference measure for leisure in their framework). This positive externality is larger if caused by the low-ability type than by the high-ability type, which explains the tax progression result.

4.2 Second best taxation

We will now return to the more general second best case with asymmetric information between the government and the private sector, where we assume that individual ability is private information, while income is observable to the government. As such, the government cannot redistribute between the individuals by using ability type-specific lump-sum taxes (as it could in Sect. 4.1). In our case, this means that a binding self-selection constraint ($\lambda > 0$) will modify the first best policy discussed above. We show in the Appendix that the positionality effect, i.e., the partial welfare effect of an increase in the level of reference consumption as represented by the partial derivative $\partial \mathcal{L}/\partial \Omega$ can be written as follows under difference comparisons and ratio comparisons:

$$\frac{\partial \mathcal{L}}{\partial \Omega} = -\gamma N \frac{\bar{\alpha}}{1-\tilde{\alpha}} + \lambda \hat{u}_x^2 \frac{\hat{\alpha}^2 - \alpha^1}{1-\tilde{\alpha}} = -\gamma N \frac{\bar{\alpha} - \alpha_d}{1-\tilde{\alpha}}, \tag{24}$$

$$\frac{\partial \mathcal{L}}{\partial \Omega} = -\gamma N \frac{\widehat{\alpha}}{1-\widehat{\tilde{\alpha}}} + \lambda \frac{x^1}{\Omega} \hat{u}_x^2 \frac{\hat{\alpha}^2 - \alpha^1}{1-\widehat{\tilde{\alpha}}} = -\gamma N \frac{\widehat{\alpha} - \widehat{\alpha}_d}{1-\widehat{\tilde{\alpha}}}, \tag{25}$$

respectively, where $\alpha_d \equiv \lambda \hat{u}_x^2 [\hat{\alpha}^2 - \alpha^1]/\gamma N$ and $\widehat{\alpha}_d \equiv \alpha_d x^1/\Omega$ are indicators of the difference in the degree of positionality between the mimicker and the low-ability type.

The first term on the right hand side of Eq. (24), i.e., $-\gamma N \bar{\alpha}/(1-\tilde{\alpha})$, reflects the consumption externality and is identical to the right hand side of Eq. (16) above and is, therefore, negative. The second term, $\gamma N \alpha_d/(1-\tilde{\alpha})$, reflects the difference in the degree of positionality between the mimicker and the low-ability type. This effect is positive if the mimicker is more positional than the low-ability type, i.e., if $\alpha_d > 0$, in which case an increase in Ω contributes to relax the self-selection constraint. On the other hand, if the low-ability type is more positional than the mimicker, meaning that $\alpha_d < 0$, then this component is negative, as an increase in Ω then contributes to tighten the self-selection constraint.

Similarly in the ratio comparison case, the first term on the right hand side of Eq. (25) is identical to the right hand side of Eq. (17) above, and the conditions for when the second term reflecting self-selection effects is positive or negative are the same as in the difference comparison case. However, note that the indicator of the difference in the degree of positionality between the mimicker and the low-ability type is here multiplied by the factor x^1/Ω. This adjustment is due to that each individual's marginal willingness to pay to avoid the externality depends directly on this individual's consumption in the ratio comparison case (which is given by x^1 both for low-ability individuals and mimickers).

To simplify the presentation, we introduce the following short notation for the second term in parenthesis in Eqs. (20) and (21):

$$\zeta^i \equiv \frac{f'(z^i)}{f(z^i)} \frac{x^i - \Omega}{w^i}.$$

As such, ζ^i reflects the relationship between Ω and z^i in the first best tax formulas as explained above. We can then derive the following results:[15]

Proposition 2 *The optimal second best marginal income tax rates, for the difference and ratio comparison cases, respectively, are given by (for* $i = 1, 2$*)*

$$T'(w^i l^i) = \tau^i + \frac{1-\tau^i-\zeta^i}{\rho^i}\bar{\alpha} - \frac{1-\tau^i-\zeta^i}{\rho^i}\frac{\rho^i-\bar{\alpha}}{\rho^i-\alpha_d}\alpha_d. \tag{26}$$

$$T'(w^i l^i) = \tau^i + \frac{1-\tau^i-\zeta^i}{\widehat{\rho}^i}\widehat{\alpha} - \frac{1-\tau^i-\zeta^i}{\widehat{\rho}^i}\frac{\widehat{\rho}^i-\widehat{\alpha}}{\widehat{\rho}^i-\widehat{\alpha}_d}\widehat{\alpha}_d. \tag{27}$$

Proof See the Appendix.

Once again, it is useful to start with the simplified case where both ability types use the same amount of leisure, so $z^1 = z^2 = \bar{z}$, $\tilde{\alpha} = \bar{\alpha}$, $\Omega = \bar{x}$ and $\rho^i = \widehat{\rho}^i = 1$ for $i = 1, 2$, in which Eqs. (26) and (27) reduce to

$$T'(w^i l^i) = \tau^i + (1-\tau^i-\zeta^i)\bar{\alpha} - (1-\tau^i-\zeta^i)(1-\bar{\alpha})\frac{\alpha_d}{1-\alpha_d}, \tag{28}$$

$$T'(w^i l^i) = \tau^i + (1-\tau^i-\zeta^i)\widehat{\alpha} - (1-\tau^i-\zeta^i)(1-\widehat{\alpha})\frac{\widehat{\alpha}_d}{1-\widehat{\alpha}_d}. \tag{29}$$

The three terms in Eqs. (28) and (29) reflect three different incentives for marginal income taxation: (i) an incentive to relax the self-selection constraint by exploiting that the mimicker and the low-ability type differ with respect to the use of leisure; (ii) an incentive to internalize the positional externality; and (iii) an incentive to relax the self-selection constraint by exploiting that the mimicker and the low-ability type may differ with respect to degree of positionality.[16] In Eqs. (20) and (21) above, only incentive (ii) was present.

The first term on the right hand side of Eqs. (28) and (29), τ^i, represents the marginal income tax rate that the government would implement in the standard two-type model without positional preferences. This component is likely to be positive for the low-ability type (at least if the form of the utility function does not differ among individuals) and zero for the high-ability type.

The second term reflects pure externality correction. For the low-ability type, this term is smaller than the right hand side of Eqs. (22) and (23); the difference being $\tau^i\bar{\alpha}$ and $\tau^i\widehat{\alpha}$, respectively. The intuition is that the fraction of an income increase that is already taxed away for other reasons does not give rise to positional externalities.

Finally, the third term of Eqs. (28) and (29) is negative if $\alpha_d > 0$, i.e., if the mimicker is more positional than the low-ability type. This is because lower marginal income

[15] Equations (26) and (27) actually apply more generally than in the setting used here and will also hold in the case where the before-tax wage rates are endogenous. Yet, τ^i would then also include an effect of the hours of work on the relative wage rate.

[16] A similar decomposition was derived by Aronsson and Johansson-Stenman (2008), yet without the displaying role of leisure examined here.

taxation leads to increased reference consumption, which causes a larger utility loss for the mimicker than for the low-ability type.[17] This, in turn, implies that the self-selection constraint is relaxed. By analogy, if the low-ability type is more positional than the mimicker, such that $\alpha_d < 0$, the third term is positive; in this case, a decrease in the level of reference consumption contributes to a relaxation of the self-selection constraint. Therefore, if $\alpha_d < 0$, the second and third terms on the right hand side of Eqs. (28) and (29) reinforce each other in the sense of jointly contributing to higher marginal income tax rates. Finally, if $\alpha_d = 0$ (in which case the mimicker and the low-ability type do not differ with respect to the degree of positionality), the third tax incentive vanishes; thus, positional concerns will only modify the second best tax formula through the corrective tax component, which is proportional to the average degree of positionality.

Note also that the tax regression result derived earlier will continue to hold under certain conditions also in the context of Eqs. (28) and (29). For instance, if the self-selection effect caused by positional concerns does not dominate the effect of the average degree of positionality, so that $\bar{\alpha} > \alpha_d$, and if $\tau^1 > 0$ (as in the original Stiglitz 1982 model), then $T'(w^1 l^1) > T'(w^2 l^2)$. This will be discussed more thoroughly below.[18]

Since Eqs. (28) and (29) are analogous, we base the remaining interpretations on Eq. (28). Note that the condition $\bar{\alpha} > \alpha_d$ always applies if the low-ability type is at least as positional as the mimicker, in which case $\alpha_d \leq 0$. The intuition is, of course, that the desire to internalize positional externalities and the incentive to relax the self-selection constraint via policy-induced changes in the reference consumption, i.e., incentives (ii) and (iii) referred to above, affect the optimal marginal income tax rates in the same direction. However, even if the mimicker were more positional than the low-ability type, meaning that $\alpha_d > 0$, the income tax structure would still be regressive in the sense mentioned above if the condition $\bar{\alpha} > \alpha_d$ applies. On the other hand, if $\bar{\alpha} < \alpha_d$, and if we continue to assume that $\tau^1 > 0$, then the marginal income tax rate implemented for the low-ability type need no longer exceed the marginal income tax rate implemented for the high-ability type; in fact, we cannot in this case determine whether the low-ability type faces a higher or lower marginal income tax rate than the high-ability type.

Returning to the general second best formulas in Eqs. (26) and (27), what remains is to analyze the effect of the variables ρ^i and $\widehat{\rho}^i$, which were equal to one in the simplified case where both ability types use the same amount of leisure. This component works in the same general way here as it did in the first best scenario discussed above, with one important exception: It matters for the qualitative effect of an increase or decrease in ρ^i whether $\bar{\alpha}$ exceeds or falls short of α_d in the difference comparison case. Similarly, the effect of an increase in $\widehat{\rho}^i$ in the ratio comparison case depends on

[17] Strictly speaking, this interpretation presupposes that $1 - \alpha_d > 0$ in Eq. (28) and $1 - \widehat{\alpha}_d > 0$ in Eq. (29), which we assume here.

[18] Notice that if $\bar{\alpha} = \alpha_d$, Eq. (28) reduces to the tax formula in the standard two-type model, i.e. $T'(w^i l^i) = \tau^i$. In this case, the tax structure will also be regressive (given that $\tau^1 > \tau^2$), yet for reasons other than positional concerns. A similar argument applies to Eq. (29) if $\widehat{\alpha} = \widehat{\alpha}_d$.

whether $\widehat{\alpha}$ exceeds or falls short of $\widehat{\alpha}_d$. To see this more clearly, let us rewrite Eqs. (26) and (27) as

$$T'(w^i l^i) = \tau^i \frac{\rho^i - \bar{\alpha}}{\rho^i - \alpha_d} + (1 - \zeta^i) \frac{\bar{\alpha} - \alpha_d}{\rho^i - \alpha_d}, \tag{30}$$

$$T'(w^i l^i) = \tau^i \frac{\widehat{\rho}^i - \widehat{\alpha}}{\widehat{\rho}^i - \widehat{\alpha}_d} + (1 - \zeta^i) \frac{\widehat{\alpha} - \widehat{\alpha}_d}{\widehat{\rho}^i - \widehat{\alpha}_d}. \tag{31}$$

To interpret Eq. (30), which is derived under the assumption of difference comparisons, suppose that $\tau^1 > 0$, meaning that the low-ability type would face a positive marginal income tax rate in the absence of any positional concerns. For the high-ability type, the marginal income tax rate reduces to the second term on the right hand side because $\tau^2 = 0$ by the assumptions made earlier. Now, since $\zeta^1 < 0$ and $\zeta^2 > 0$, and by adding the assumption that $\bar{\alpha} > \alpha_d$, we again find that the condition $\rho^1 \leq \rho^2$ implies that the marginal income tax rate implemented for the low-ability type exceeds that implemented for the high-ability type.

In the ratio comparison case, it correspondingly follows from Eq. (31) that if $\widehat{\alpha} > \widehat{\alpha}_d = \alpha_d x^1/\Omega$, then $\widehat{\rho}^1 \leq \widehat{\rho}^2$ implies a higher marginal income tax rate for the low-ability type than for the high-ability type. Moreover, we show in the Appendix that the condition $\bar{\alpha} > \alpha_d$ implies $\widehat{\alpha} > \widehat{\alpha}_d$. Therefore, the following result is an immediate consequence of Proposition 2:

Corollary 2 *If $\tau^1 > 0$, $\bar{\alpha} > \alpha_d$, and $z^1 \geq z^2$, then the income tax structure is regressive in the sense that $T'(w^1 l^1) > T'(w^2 l^2)$ for both the difference and the ratio comparison cases.*

The intuition behind Corollary 2 is straightforward: If $\tau^1 > 0$ and $\bar{\alpha} > \alpha_d$, we may relax the self-selection constraint *and* internalize the positional externality by implementing a higher marginal income tax rate for the low-ability type than for the high-ability type.[19] An important mechanism behind this result—captured by the variables $\zeta^1 < 0$ and $\zeta^2 > 0$—is that increased use of leisure by the low-ability type contributes to reduce the positional externality, whereas increased use of leisure by the high-ability type leads to an increase in the positional externality, *ceteris paribus*.

5 Extension: a more general measure of reference consumption

The analysis carried out so far assumes that the appropriate measure of reference consumption at the individual level is given by a leisure-influenced consumption average for the economy as a whole, Ω, defined in Sect. 2. This approach is analogous to earlier literature on public policy and relative consumption, where the average consumption

19 To our knowledge, there is no empirical evidence on the basis of which one can sign α_d. Hence, it remains an open question whether low-ability individuals are more or less positional than potential mimickers. Yet, recall that the (highly plausible) condition $\bar{\alpha} > \alpha_d$ might be fulfilled even if the mimicker is more positional than the low-ability type.

typically constitutes the reference point. However, it is plausible that individuals may differ in their contributions to the reference consumption also for reasons other than through the displaying role of leisure discussed above. For instance, Veblen (1899), Duesenberry (1949), and Schor (1998) have argued for the importance of an asymmetry, such that "low-income groups are affected by consumption of high-income groups but not vice versa" (Duesenberry 1949, p. 101). This is also consistent with the empirical findings of Bowles and Park (2005) that more inequality in society tends to imply more work hours. Recent empirical evidence by Corazzini et al. (2012) suggests that people compare both upwards and downwards, but that the upward comparison effect is stronger. In the context of optimal taxation and relative consumption, Aronsson and Johansson-Stenman (2010) and Micheletto (2011) address such "upward comparisons" as an alternative to the conventional mean-value comparison yet without considering the displaying role of leisure discussed here.

In this section, we allow for the asymmetry mentioned above while still retaining the displaying role of leisure. To simplify the presentation, we will solely focus on the difference comparison case in this section, although the qualitative insights are valid also more generally. Moreover, we will continue to assume that the reference consumption measure is the same for all individuals. Consider the following generalized measure of reference consumption (which replaces the measure Ω used in earlier sections):

$$\breve{\Omega} \equiv \frac{\sum_j n^j \beta^j f(z^j) x^j}{\sum_j n^j \beta^j f(z^j)},$$

where $\beta^i \in [0, 1]$ for $i = 1, 2$, and $\sum_j \beta^j = 1$. The parameter β^i represents the weight given to ability-type i's contribution to reference consumption. In other words, we allow the ability types to differ with respect to their influences on the reference point. Note that $\beta^2 = 1$ implies that $\breve{\Omega} = x^2$, meaning that each individual only compares himself/herself with the high-ability type. Similarly, $\beta^1 = 1$ gives $\breve{\Omega} = x^1$, in which case each individual only compares himself/herself with the low-ability type. The analysis carried out in previous sections may, in turn, be interpreted as the special case where $\beta^1 = \beta^2 = 0.5$.

With the variable $\breve{\Omega}$ at our disposal, it is straightforward to generalize the expressions for the marginal income tax rates in Proposition 2. Define

$$\breve{\alpha} \equiv \sum_i \alpha^i \frac{n^i \beta^i f(z^i)}{\sum_j n^j \beta^j f(z^j)} \in (0, 1),$$
$$\breve{\rho}^i = \frac{\sum_j n^j \beta^j f(z^j)}{\beta^i f(z^i) N}(1 - \breve{\alpha}) + \bar{\alpha} > 0, \text{ and}$$
$$\breve{\zeta}^i = \frac{1}{w^i} \frac{f'(z^i)}{f(z^i)}(x^i - \breve{\Omega}),$$

which replace the variables $\tilde{\alpha}$, ρ^i, and ζ^i, respectively, in the previous section, and consider the following result:

Proposition 3 *With the generalized measure of reference consumption, $\breve{\Omega}$, the marginal income tax rates can be written as (for $i = 1, 2$)*

$$T'(w^i l^i) = \tau^i \frac{\breve{\rho}^i - \bar{\alpha}}{\breve{\rho}^i - \alpha_d} + (1 - \breve{\zeta}^i) \frac{\bar{\alpha} - \alpha_d}{\breve{\rho}^i - \alpha_d}. \quad (32)$$

Proof See the Appendix.

Equation (32) has been written using the same format as Eq. (30), as this makes it easy to relate Eq. (32) to Corollary 2. Equation (32) can be interpreted in the same general way as Eq. (30); however, given that $\tau^1 > 0$ and if $\bar{\alpha} > \alpha_d$, as we assumed in the interpretation of Eq. (30), the sufficient condition for a regressive tax structure in Corollary 2, i.e., $z^1 \geq z^2$, must here be replaced with $\breve{\rho}^1 \leq \breve{\rho}^2$. Even if the high-ability type were to supply more labor than the low-ability type, this condition becomes less likely to hold the larger the β^2 relative to β^1. Therefore, with "upward comparisons" in the sense that the leisure-weighted consumption by the high-ability type has a more than proportional influence on the measure of reference consumption, the case of regressive taxation becomes somewhat weaker than before. To see this, let us consider the two special cases with $\beta^1 = 1$ and $\beta^2 = 1$, respectively. The following result is an immediate consequence of Proposition 3:

Corollary 3 *Suppose that $\tau^1 > 0$ and $\bar{\alpha} > \alpha_d$. Then, if*

(i) $\beta^1 = 1$, *the marginal income tax rates can be written as*

$$T'(w^1 l^1) = \tau^1 \frac{n^1(1 - \alpha^1)}{n^1(1 - \alpha^1) + N(\bar{\alpha} - \alpha_d)} + \frac{N(\bar{\alpha} - \alpha_d)}{n^1(1 - \alpha^1) + N(\bar{\alpha} - \alpha_d)} > 0$$

$T'(w^2 l^2) = 0$, *and if*

(ii) $\beta^2 = 1$, *the marginal income tax rates become*

$$T'(w^1 l^1) = \tau^1 > 0$$

$$T'(w^2 l^2) = \frac{N(\bar{\alpha} - \alpha_d)}{n^2(1 - \alpha^2) + N(\bar{\alpha} - \alpha_d)} > 0.$$

Corollary 3 means that if each individual (of both ability types) only compares his/her own consumption with that of other low-ability individuals, then the tax structure is regressive in the sense that $T'(w^1 l^1) > T'(w^2 l^2)$ independently of whether the high-ability type supplies more labor than the low-ability type. However, from a practical policy perspective beyond the two-type model, the regressivity of the marginal income tax component that is unrelated to positional concerns, i.e., $\tau^1 > \tau^2 = 0$, should not be over-interpreted. This is because simulations have shown that in an economy with many ability types, yet without any positional concerns, there is no general pattern showing that lower-ability types should face higher marginal tax rates than higher-ability types; see, e.g., Kanbur and Tuomala (1994). On the other hand, the pattern of the tax component that is related to correction for positional externalities, the main concern here, can be extended to a model with several types.

Moreover, if each individual solely compares his/her own consumption with that of high-ability individuals—which is arguably more realistic and in line with some earlier research mentioned above—then externality correction works in the direction of a more progressive income tax structure. Therefore, the marginal income tax rate implemented for the low-ability type may either exceed or fall short of the marginal income tax rate implemented for the high-ability type.

Note also that in the first best special case, in which $\tau^1 = \alpha_d = 0$, we have $T'(w^1l^1) > T'(w^2l^2)$ if $\beta^1 = 1$ and $T'(w^1l^1) < T'(w^2l^2)$ if $\beta^2 = 1$. This means that upward comparisons give rise to a pattern of externality correction that works in the direction of a more progressive income tax structure.

6 Conclusion

As far as we know, this is the first paper that has highlighted a displaying role of leisure in the context of relative consumption comparisons when theoretically analyzing optimal taxation. In line with Veblen (1899), we assume that leisure has a displaying role in making relative consumption more visible. Our main results are summarized as follows. First, increased consumption positionality typically implies higher marginal income tax rates for both ability types. Second, the consumption-displaying role of leisure provides an argument for regressive income taxation in the sense that it contributes to increased marginal income taxation of the low-ability type and decreased marginal income taxation of the high-ability type. This is in contrast to the findings of Aronsson and Johansson-Stenman (forthcoming), where concern for relative leisure implies an argument for progressive taxation. It is also in contrast to a common statement in the popular debate, namely that concern for relative consumption provides an argument in favor of more progressive income taxation. Third, the levels of optimal marginal income tax rates—as well as whether the tax system ought to be progressive or regressive—are largely dependent on how the measure of reference consumption is determined. For example, if agents tend to compare their own consumption more with that of high-ability than low-ability individuals, this will influence the optimal tax structure in a progressive direction.

Future research may take several directions, and we briefly discuss some of these directions below. First, our analysis assumes a competitive labor market and full employment. However, as equilibrium unemployment is an important phenomenon in real-world market economies, the use of leisure might not always be the outcome of an optimal choice by the individual. It is, therefore, also relevant to combine the study of optimal taxation in economies with positional preferences (at least if leisure plays a role in this particular context) with imperfect competition in the labor market. Second, instead of assuming that all aspects of private consumption are subject to positional concerns (as we do here), another approach would be to distinguish between positional and non-positional goods in the context of a mixed tax problem, where the government has access both to a nonlinear income tax and linear commodity taxes. Clearly, if the idea that leisure makes relative consumption more visible is applied to such a framework, the principle of targeting would not apply. The reason is that the ability types differ with respect to their contributions to the positional externality, in which case a linear commodity tax is not a flexible enough instrument for externality correction. Even if the commodity taxes were optimally chosen, our conjecture is that the income tax is still likely to play a role reminiscent of that in the present paper, and the mechanisms underlying the regressive income tax component would still remain.[20] Third, the model here is of course, for analytical reasons, very stylized. While the basic insights could be generalized to the case of many consumer types, as long as one can apply sufficiently many marginal tax rates, the analytical results would not hold when there are restrictions to, say, two or three different marginal tax rates. For this and other generalizations we believe that simulations studies will provide important insights regarding quantitative effects in more realistic settings. Finally, there is clearly also room for more empirical research regarding relative consumption comparisons in general, and regarding how reference consumption levels are determined and the role of leisure in particular.

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Appendix

Derivation of Eq. (15)

Let us start with the marginal income tax rate facing the low-ability type. Combine Eqs. (11) and (12) to derive

$$MRS^1_{z,x}\left(\lambda\hat{u}^2_x + \gamma n^1 - \frac{\partial\mathcal{L}}{\partial\Omega}\frac{\partial\Omega}{\partial x^1}\right) = \lambda\phi\hat{u}^2_z + \gamma n^1 w^1 - \frac{\partial\mathcal{L}}{\partial\Omega}\frac{\partial\Omega}{\partial z^1}. \tag{A1}$$

Using $T'(w^1 l^1)w^1 = w^1 - MRS^1_{z,x}$ from Eq. (8), substituting into Eq. (A1) and rearranging, we obtain the expression for the marginal income tax rate of the low-ability type. The marginal income tax rate of the high-ability type can be derived analogously. □

[20] This conjecture is also based on insights from Micheletto (2008), who considers the problem of the optimal tax mix based on a model with general consumption externalities, as well as on Eckerstorfer (2011) and our own preliminary work dealing with relative consumption concerns with more than one consumer good, yet without any consumption-displaying role of leisure.

Derivation of Eqs. (16) and (24)

Start by differentiating the Lagrangean with respect to Ω

$$\frac{\partial \mathcal{L}}{\partial \Omega} = u^1_\Omega + (\mu + \lambda)u^2_\Omega - \lambda \hat{u}^2_\Omega. \tag{A2}$$

From Eq. (3) it follows in the difference comparison case according to Eq. (1) that $u^i_\Omega = -v^i_\Delta$ for $i = 1, 2$, and $\hat{u}^2_\Omega = -\hat{v}^2_\Delta$. We can then use Eq. (5) to derive

$$u^i_\Omega = -\alpha^i u^i_x \quad \text{for } i = 1, 2 \tag{A3}$$
$$\hat{u}^2_\Omega = -\hat{\alpha}^2 \hat{u}^2_x. \tag{A4}$$

Substituting Eqs. (A3) and (A4) into Eq. (A2) gives

$$\frac{\partial \mathcal{L}}{\partial \Omega} = -\alpha^1 u^1_x - (\mu + \lambda)\alpha^2 u^2_x + \lambda \hat{\alpha}^2 \hat{u}^2_x. \tag{A5}$$

Solving Eq. (12) for u^1_x and Eq. (14) for $(\mu + \lambda)u^2_x$ and substituting into Eq. (A5) gives

$$\frac{\partial \mathcal{L}}{\partial \Omega} = -\alpha^1 \left(\lambda \hat{u}^2_x + \gamma n^1 - \frac{\partial \mathcal{L}}{\partial \Omega} \frac{\partial \Omega}{\partial x^1} \right) - \alpha^2 \left(\gamma n^2 - \frac{\partial \mathcal{L}}{\partial \Omega} \frac{\partial \Omega}{\partial x^2} \right) + \lambda \hat{\alpha}^2 \hat{u}^2_x. \tag{A6}$$

Using $\partial \Omega / \partial x^i = n^i f(z^i) / \sum_j n^j f(z^j)$ for $i = 1, 2$, substituting into Eq. (A6), collecting terms, and rearranging gives Eq. (24). We can then derive Eq. (16) as the special case where $\lambda = 0$. □

Derivation of Eqs. (17) and (25)

From Eqs. (2) and (3) it follows in the ratio comparison case that $u^i_\Omega = -v^i_\Delta x^i / \Omega^2$ for $i = 1, 2$, and $\hat{u}^2_\Omega = -\hat{v}^2_\Delta x^2 / \Omega^2$. We can then use Eq. (6) to derive

$$u^i_\Omega = -\alpha^i \frac{x^i}{\Omega} u^i_x \quad \text{for } i = 1, 2 \tag{A7}$$
$$\hat{u}^2_\Omega = -\hat{\alpha}^2 \frac{\hat{x}^2}{\Omega} \hat{u}^2_x. \tag{A8}$$

Substituting equations (A7) and (A8) into Eq. (A2) gives

$$\frac{\partial \mathcal{L}}{\partial \Omega} = -\alpha^1 \frac{x^1}{\Omega} u^1_x - (\mu + \lambda)\alpha^2 \frac{x^2}{\Omega} u^2_x + \lambda \hat{\alpha}^2 \frac{x^1}{\Omega} \hat{u}^2_x. \tag{A9}$$

Substituting Eq. (12) for u_x^1 and Eq. (14) for $(\mu+\lambda)u_x^2$ as above gives

$$\frac{\partial \mathcal{L}}{\partial \Omega} = -\alpha^1 \frac{x^1}{\Omega}\left(\lambda \hat{u}_x^2 + \gamma n^1 - \frac{\partial \mathcal{L}}{\partial \Omega}\frac{\partial \Omega}{\partial x^1}\right) - \alpha^2 \frac{x^2}{\Omega}\left(\gamma n^2 - \frac{\partial \mathcal{L}}{\partial \Omega}\frac{\partial \Omega}{\partial x^2}\right) + \lambda \hat{\alpha}^2 \frac{x^1}{\Omega}\hat{u}_x^2. \tag{A10}$$

Using $\partial\Omega/\partial x^i = n^i f(z^i)/\sum_j n^j f(z^j)$ for $i = 1, 2$, substituting into Eq. (A10), collecting terms, and rearranging gives

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial \Omega} &= -\frac{\frac{\gamma N}{\Omega}\frac{\sum_j n^j x^j \alpha^j}{\sum_j n^j x^j}\frac{\sum_j n^j x^j}{N} - \lambda \frac{x^1}{\Omega}\hat{u}_x^2(\hat{\alpha}^2 - \alpha^1)}{1 - \frac{\sum_j n^j f(z^j) x^j \alpha^j}{\sum_j n^j f(z^j)}} \\ &= -\frac{\gamma N \frac{\bar{x}}{\Omega}\frac{\sum_j n^j x^j \alpha^j}{\sum_j n^j x^j} - \lambda \frac{x^1}{\Omega}\hat{u}_x^2(\hat{\alpha}^2 - \alpha^1)}{1 - \frac{\sum_j n^j f(z^j) x^j \alpha^j}{\sum_j n^j f(z^j) x^j}}.\end{aligned} \tag{A11}$$

Using finally that

$$\widehat{\alpha} = \frac{\bar{x}}{\Omega}\frac{\sum_i n^i x^i \alpha^i}{\sum_j n^j x^j}$$

$$\widehat{\tilde{\alpha}} = \frac{\sum_i n^i f(z^i) x^i \alpha^i}{\sum_j n^j f(z^j) x^j}$$

$$\widehat{\alpha}_d = \alpha_d \frac{x^1}{\Omega} = \frac{\lambda \hat{u}_x^2[\hat{\alpha}^2 - \alpha^1]}{\gamma N}\frac{x^1}{\Omega}$$

gives Eq. (25), whereas Eq. (17) follows as the special case where $\lambda = 0$. □

Proofs of Propositions 1 and 2 for the difference comparison case

Substituting Eq. (24) into Eq. (15) while using

$$\frac{\partial \Omega}{\partial x^i} = \frac{n^i f(z^i)}{\sum_j n^j f(z^j)} \quad \text{and} \quad \frac{\partial \Omega}{\partial z^i} = \frac{n^i f'(z^i)}{\sum_j n^j f(z^j)}(x^i - \Omega)$$

gives

$$T'(w^i l^i) = \tau^i - \frac{N}{n^i w^i}\frac{\bar{\alpha} - \alpha_d}{1 - \tilde{\alpha}}\left(\frac{n^i f'(z^i)(x^i - \Omega)}{\sum_j n^j f(z^j)} - MRS_{z,x}^i \frac{n^i f(z^i)}{\sum_j n^j f(z^j)}\right). \tag{A12}$$

Using $MRS_{z,x}^i = w^i(1 - T'(w^i l^i))$, substituting into Eq. (A12), solving for $T'(w^i l^i)$, and using the definition of π^i, we obtain

$$T'(w^i l^i) = \frac{\tau^i}{1+\pi^i \frac{\bar{\alpha}-\alpha_d}{1-\tilde{\alpha}}} - \pi^i \frac{\frac{\bar{\alpha}-\alpha_d}{1-\tilde{\alpha}} \frac{f'(z^i)(x^i-\Omega)}{w^i f(z^i)}}{1+\pi^i \frac{\bar{\alpha}-\alpha_d}{1-\tilde{\alpha}}} - \pi^i \frac{\frac{\bar{\alpha}-\alpha_d}{1-\tilde{\alpha}}}{1+\pi^i \frac{\bar{\alpha}-\alpha_d}{1-\tilde{\alpha}}}. \tag{A13}$$

Finally, using $\zeta^i \equiv \frac{f'(z^i)}{f(z^i)} \frac{x^i-\Omega}{w^i}$ and the definition of ρ^i from Eq. (18), together with some straightforward algebraic manipulations, implies that Eq. (A13) can be rewritten as Eq. (26) in Proposition 2. The special case where $\tau^i = 0$ and $\lambda = 0$, which also means that $\alpha_d = 0$, gives Eq. (20) in Proposition 1. □

Proofs of Propositions 1 and 2 for the ratio comparison case

Substituting Eq. (25) into Eq. (15), while using the expressions for $\partial\Omega/\partial x^i$ and $\partial\Omega/\partial z^i$ above, gives

$$T'(w^i l^i) = \tau^i - \frac{N}{n^i w^i} \frac{\widehat{\alpha} - \alpha_d \frac{x^1}{\Omega}}{1-\widehat{\tilde{\alpha}}} \left[\frac{n^i f'(z^i)}{\sum_j n^j f(z^j)}(x^i - \Omega) - MRS^i_{z,x} \frac{n^i f(z^i)}{\sum_j n^j f(z^j)} \right]. \tag{A14}$$

Using $MRS^i_{z,x} = w^i(1 - T'(w^i l^i))$, substituting into Eq. (A14), solving for $T'(w^i l^i)$ and using the definitions of π^i and ζ^i, we obtain

$$T'(w^i l^i) = \frac{\frac{1}{\pi^i}(1-\widehat{\tilde{\alpha}})\tau^i}{\frac{1-\widehat{\tilde{\alpha}}}{\pi^i} + \widehat{\alpha} - \widehat{\alpha}_d} - \frac{\widehat{\alpha}(\zeta^i - 1)}{\frac{1-\widehat{\tilde{\alpha}}}{\pi^i} + \widehat{\alpha} - \widehat{\alpha}_d} + \frac{\widehat{\alpha}_d(\zeta^i - 1)}{\frac{1-\widehat{\tilde{\alpha}}}{\pi^i} + \widehat{\alpha} - \widehat{\alpha}_d}. \tag{A15}$$

Finally, using $\widehat{\rho}^i \equiv \frac{1-\widehat{\tilde{\alpha}}}{\pi^i} + \widehat{\alpha}$ together with some straightforward algebraic manipulations implies that Eq. (A15) can be rewritten as Eq. (27) in Proposition 2. The special case where $\tau^i = 0$ and $\lambda = 0$, which also means that $\alpha_d = 0$, gives Eq. (21) in Proposition 1. □

Proof of Corollary 2

Corollary 2 follows immediately from Proposition 2 in the difference comparison case. It also follows immediately from Proposition 2 in the ratio comparison case if it can be shown that the condition $\bar{\alpha} > \alpha_d$ implies $\widehat{\alpha} > \widehat{\alpha}_d = \alpha_d x^1/\Omega$. This will now be shown:

$$\begin{aligned}
\widehat{\alpha} - \widehat{\alpha}_d &= \frac{\bar{x}}{\Omega}\left(1 + \operatorname{cov}\left(\frac{x}{\bar{x}}, \frac{\alpha}{\bar{\alpha}}\right)\right)\bar{\alpha} - \frac{x^1}{\Omega}\alpha_d \\
&= \frac{\bar{x}}{\Omega}\left(1 + \operatorname{cov}\left(\frac{x}{\bar{x}}, \frac{\alpha}{\bar{\alpha}}\right)\right)(\bar{\alpha} - \alpha_d) + \frac{\alpha_d}{\Omega}\left(\bar{x}\left(1 + \operatorname{cov}\left(\frac{x}{\bar{x}}, \frac{\alpha}{\bar{\alpha}}\right)\right) - x^1\right).
\end{aligned}$$

Therefore, $\bar{\alpha} > \alpha_d$ would then imply $\widehat{\alpha} > \widehat{\alpha}_d$ if $\bar{x}(1 + \operatorname{cov}(\frac{x}{\bar{x}}, \frac{\alpha}{\bar{\alpha}})) - x^1 > 0$.

This condition holds since $x^2 > x^1$ implies

$$\bar{x}\left(1+\mathrm{cov}\left(\frac{x}{\bar{x}},\frac{\alpha}{\bar{\alpha}}\right)\right)-x^1=\frac{\sum_i n^i\alpha^i x^i}{\sum_j n^j\alpha^j}-x^1>0.$$

□

Proof of Proposition 3

Substituting Eq. (24) into Eq. (15) and using

$$\frac{\partial\breve{\Omega}}{\partial x^i}=\frac{n^i\beta^i f(z^i)}{\sum_j n^j\beta^j f(z^j)} \quad \text{and} \quad \frac{\partial\breve{\Omega}}{\partial z^i}=\frac{n^i\beta^i f'(z^i)}{\sum_j n^j\beta^j f(z^j)}(x^i-\breve{\Omega}),$$

we can derive the expression

$$T'(w^i l^i)=\tau^i-\frac{N}{n^i w^i}\frac{\bar{\alpha}-\alpha_d}{1-\breve{\alpha}}\left[\frac{n^i\beta^i f'(z^i)(x^i-\breve{\Omega})}{\sum_j n^j\beta^j f(z^j)}-MRS^i_{z,x}\frac{n^i\beta^i f(z^i)}{\sum_j n^j\beta^j f(z^j)}\right]. \tag{A16}$$

We can then use Eq. (A16) to derive Eq. (32) in exactly the same way as we used Eq. (A12) to derive Eq. (26) in the proof of Proposition 2 above. □

Proof of Corollary 3

In Corollary 3, it follows that $\partial\breve{\Omega}/\partial x^1=1$ and $\partial\breve{\Omega}/\partial x^2=\partial\breve{\Omega}/\partial z^1=\partial\breve{\Omega}/\partial z^2=0$ if $\beta^1=1$, while $\partial\breve{\Omega}/\partial x^2=1$ and $\partial\breve{\Omega}/\partial x^1=\partial\breve{\Omega}/\partial z^1=\partial\breve{\Omega}/\partial z^2=0$ if $\beta^2=1$. With this modification, the marginal income tax rates in the corollary can be derived in the same way as we derived Eq. (32). □

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