When Samuelson Met Veblen Abroad: National and Global Public Good Provision when Social Comparisons Matter[**]

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Abstract

This paper derives Pareto efficient policy rules for the provision of national as well as global public goods in a two-country world, where each individual cares about relative consumption within as well as between countries. Furthermore, we compare these policy rules with those that follow from a non-cooperative Nash equilibrium. The results show that both global and national public goods are systematically under-provided in Nash equilibrium under such relative consumption concerns.

Keywords: Public goods, relative consumption, inter-jurisdictional comparison, status, positional goods.

JEL Classification: D03, D62, H41.

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1. Introduction

We live in an increasingly globalized world. This is not least true for the environmental problem at the top of the political agenda worldwide, global warming, for which it essentially does not matter for the environment in a single country where in the world the emissions of for example CO2 are released; see, e.g., Stern (2007). It is also true culturally, since only half a century ago a large part of the world's population had only vague perceptions about living conditions in other countries than their own whereas today we know much more about our fellows in other countries as a result of increased travel and the technological advancements of TV and other media.

Arguably, this cultural globalization also has implications for social comparisons. In recent years, an economics literature dealing with the importance of relative consumption concerns, i.e., that we tend to value not only absolute consumption but also our consumption relative to that of others, has grown rapidly, in part influenced by the large corresponding literatures in social psychology and sociology. Yet, both the empirical literature on relative consumption and well-being[1] and the (predominantly) theoretical literature dealing with optimal policy-responses to relative consumption concerns[2] have almost exclusively been concerned with consumption comparisons within countries, and have hence ignored between-country comparisons. Becchetti et al. (2010) constitute a recent exception in the empirical literature. Their study examines the determinants of self-reported life satisfaction and is based on survey data for Western European countries from 1973 to 2002. By controlling for the determinants

[1] This 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, Esposito and Majorano, forthcoming) and, more recently, brain science (Fliessbach et al., 2007; Dohmen et al., 2011). There are also recent evolutionary models consistent with relative consumption concerns (Samuelson, 2004; Rayo and Becker, 2007). Stevenson and Wolfers (2008) constitute a recent exception in the happiness literature, claiming that the role of relative income is overstated.

[2] See, e.g., Boskin and Sheshinski (1978), Layard (1980), Ng (1987), Blomquist (1993), Corneo and Jeanne (1997, 2001), Ireland (2001), Brekke and Howarth (2002), Abel (2005), Wendner and Goulder (2008), Kanbur and Tuomala (2010), Wendner (2010, 2011), and Aronsson and Johansson-Stenman (2008, 2010, forthcoming). Clark et al. (2008) provide a good overview of both the empirical evidence and economic implications of relative consumption concerns.

of subjective well-being discussed in earlier literature, such as conventional relative income measures (one's income relative to that observed in reference groups based on education, age, and gender) and domestic GDP, the authors find that the distance between the domestic GDP and the GDP of the richest country in the data significantly reduces individual life-satisfaction, and that the importance of such cross-country comparisons has increased over time. As such, increased globalization indeed seems to affect the social comparisons inherent in subjective well-being.

There is also more indicative evidence. Based on different kinds of evidence, e.g., from the sociological literature, James (1987) argues that people in poor countries are most likely affected by the consumption in rich countries. Also, Friedman (2005) argues, based on his interpretation of available happiness data across countries and over time together with the rapidly increased spread of TV and other information technology, that the importance of cross-country consumption comparisons most likely increases over time, i.e., in line with the evidence presented by Becchetti et al. (2010). Consistent with this (although there are of course alternative explanations), Clark and Senik (2010) present evidence based on a recent survey of Europeans that respondents who did not have Internet access were less subject to income comparisons. Similarly, Clark and Senik (2011) argue in a recent survey of the happiness-consumption relationships that if the development of information and communication technologies "allow the inhabitants of low-income countries to be aware of the life-style and consumption possibilities of high-income country citizens, this is likely to generate feelings of relative deprivation."

However, we are not aware of any study dealing with the policy implications of relative consumption concerns both within and between countries. The present paper aims at filling part of this gap by analyzing the policy incentives underlying public good provision. To be more specific, the purpose is to analyze the Pareto efficient provision of national and global public goods in a world where people are concerned with relative consumption comparisons both with others in their own country and with people in other countries, and also compare the policy rules for efficient public provision with those that follow in a non-cooperative Nash equilibrium. As such, the present paper generalizes insights from Ng (1987), Brekke and Howarth (2002), Aronsson and Johansson-Stenman (2008), and Wendner and Goulder (2008),

who all study public good provision under relative consumption concerns in the context of one-country model economies, to a world with more than one country.

Why is this generalization interesting? First, as we referred to above, evidence suggests that between-country comparisons have become increasingly important for individual well-being. Yet, there are no earlier studies (at least not to our knowledge) dealing with the policy implications of such comparisons. As we will show below, within- as well as between-country comparisons affect the incentives underlying the provision of *both* national and global public goods. Second, it is particularly interesting to analyze the efficient provision of *global* public goods in such contexts due to the increased attention paid to global public goods in recent decades, where the global climate is the prime example. To implement the efficient provision of such public goods in real world economies, the policy incentives facing governments at the national level must also be addressed, which further motivates the distinction between the Pareto efficient allocation and non-cooperative Nash equilibrium.

In Section 2, we present the basic model. To keep the analysis as simple as possible, while still being able to analyze the main mechanisms, we assume a world with two countries, which may or may not be identical. Individuals derive utility from their own consumption of private and public goods, where the latter comprise both national and global public goods, as well as from their own private consumption relative to that of other people in their own country and abroad, respectively. By national public goods, we simply mean public goods with no international spillovers, such that people derive utility from these goods solely within the country that provides them, whereas global public goods can be benefitted from in all countries.

Section 3 presents efficient public good provision rules, with a particular emphasis on the elicitation format of people's marginal willingness to pay (WTP), which is shown to be important for how these policy rules are related to the Samuelson condition. These provision rules are expressed in terms of degrees of positionality, i.e., the degree to which relative consumption matters compared to absolute consumption. Section 4 presents the non-cooperative Nash equilibrium and, in particular, examines the provision of national and global public goods in that context. It is concluded that both national and global public goods tend to

be under-provided in Nash equilibrium under between-country relative consumption concerns. Section 5 concludes the paper.

2. The Model – Preferences and Concerns for Relative Consumption

The world consists of two countries, Country 1 and Country 2, each with a fixed population equal to n. A representative individual in Country *i* derives utility from private consumption, c^i, as well as from the consumption of a national public good, l^i, and a global public good, g. The global public good is, in turn, decomposed as $g = g^1 + g^2$, where g^i is the contribution to the global public good by Country *i* (but hence enjoyed in both countries). In addition, the individual cares about his/her relative consumption of the private good through two different comparisons:[3] relative consumption with respect to others' consumption in the individual's own country, $R^i = r^i(c^i, \overline{c}^i) = c^i - \overline{c}^i$, where $\overline{c}^i$ is average consumption in Country *i*, and relative consumption with respect to people in the other country, $S^i = s^i(c^i, \overline{c}^j) = c^i - \overline{c}^j$, where $\overline{c}^j$ is the average consumption in the other country, *j*.[4]

The utility function for an individual in Country *i* is then given by (for *i*=1,2)

[3] We follow convention in assuming that the publicly provided goods are completely non-positional. It is, nevertheless, possible to extend the model such that the benefits of public goods differ among individuals (perhaps due to differences in the access to these goods), and that individuals also care about their relative benefits of, or access to, the national public goods. We leave this for future research.

[4] That relative consumption is defined by the difference between the individual's own consumption and a corresponding measure of reference consumption is the most commonly used specification; see, 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, forthcoming). Alternative approaches include ratio comparisons (Boskin and Sheshinski, 1978; Layard, 1980; Abel, 2005; Wendner and Goulder, 2008) and comparisons of ordinal rank (Frank, 1985; Hopkins and Kornienko, 2004, 2009). Dupor and Liu (2003) consider a specific flexible functional form that includes the difference comparison and ratio comparison approaches as special cases. Mujcic and Frijters (in press) compare models based on difference comparisons, ratio comparisons and rank-based comparisons, applied on a questionnaire-experimental dataset, without being able to discriminate between them. Corazzini et al. (2012) find that absolute differences, and not only rank, matter. Although the analytical results presented here will of course depend on the specific form of the consumption comparisons, the main mechanisms discussed are present more generally.

$$
\begin{aligned}
U^i &= v^i\left(c^i, l^i, g, R^i, S^i\right) = u^i\left(c^i, l^i, g, \bar{c}^i, \bar{c}^j\right) \\
&= V^i\left((1-\alpha-\beta)c^i + \alpha R^i + \beta S^i, l^i, g\right) = V^i\left(c^i - \alpha\bar{c}^i - \beta\bar{c}^j, l^i, g\right),
\end{aligned} \tag{1}
$$

where v^i, u^i, and V^i are twice continuously differentiable and $\alpha, \beta > 0$. The function $v^i(\cdot)$ is a general utility formulation based on the difference comparisons described above, whereas $u^i(\cdot)$ is a convenient reduced form used in some of the calculations below. As mentioned, we assume that people care about relative consumption compared to others in their own country as well as in the other country, implying that $v_R^i, v_S^i > 0$, which also implies that people's utility will depend negatively on others' consumption such that $u_{\bar{c}^i}^i, u_{\bar{c}^j}^i < 0$. Subscripts denote partial derivatives.

To simplify, we add some additional structure to the utility functions such that they can be written in the form of $V^i(\cdot)$. This implies in particular that the degrees of positionality, to be defined below, are the same in both countries, which simplifies the analytical expressions considerably without any important loss of generality; the main mechanisms shown are more robust and do not depend on these assumptions. Yet, as is evident from equation (1), people in different countries need not be identical regarding the underlying income levels, consumption levels, or preferences.

Before we derive the efficient provision rules, it will be proved useful to clearly introduce, following, e.g., Johansson-Stenman et al. (2002) and Aronsson and Johansson-Stenman (2008), the concept of degrees of positionality as reflections of the extent by which relative consumption matters for utility at the individual level. Yet, since we have two countries here, contrary to previous studies, we will have different measures for the extent to which relative consumption matters within the country and the extent to which relative consumption matters between countries.

Let us define *the degree of domestic positionality* for each resident in Country *i* as

$$\alpha^i = \frac{v_R^i r_c^i}{v_c^i + v_R^i r_c^i + v_S^i s_c^i} = \alpha \text{ , for } i=1,2. \quad (2)$$

The variable α^i reflects the fraction of the utility increase from the last dollar consumed by residents in Country *i* that is due to the increased relative consumption compared to others within their own country. Due to the form of $V^i(\cdot)$ as shown above, it is easy to show that the degree of domestic positionality is the same in both countries and equal to α in equation (1).

Similarly, we can define *the degree of foreign positionality* for each resident in Country *i* as

$$\beta^i = \frac{v_S^i s_{c^i}^i}{v_{c^i}^i + v_R^i r_{c^i}^i + v_S^i s_{c^i}^i} = \beta \text{ , for } i=1,2. \quad (3)$$

Hence, β^i reflects the fraction of the utility increase from the last dollar consumed by residents in Country *i* that is due to the increased relative consumption compared to people in the other country. Similar to above, the form of $V^i(\cdot)$ implies that also the degree of foreign positionality is the same in both countries and equal to β in equation (1).

The total degree of positionality is then correspondingly defined as

$$\gamma^i = \alpha^i + \beta^i = \alpha + \beta = \gamma \text{ , } \quad (4)$$

for i=1,2, meaning that γ reflects the fraction of the utility increase from the last dollar consumed that is due to the increased relative consumption of any kind, i.e., including comparisons with people both within and outside the individual's own country. Clearly, the conventional assumptions in economics, where only absolute consumption matters, are that $\alpha = \beta = \gamma = 0$. The other extreme case where only relative consumption matters, and hence absolute consumption does not matter at all for utility, implies that $\gamma = \alpha + \beta = 1$.

For simplicity, we also assume a linear technology and perfect competition, implying zero profits. The national budget constraint can then be written as (for i=1,2)

$$y^i = nc^i + p^l l^i + p^g g^i, \tag{5}$$

where y^i is the gross national income produced in Country i, which is used for private and public consumption. The variables p^l and p^g are interpretable in terms of the marginal rate of transformation between the associated public good and the private consumption good.

3. Pareto Efficient National and Global Public Good Provision

To derive the efficient provision rules, we will maximize utility of individuals in Country 1 while keeping utility fixed for people in Country 2, subject to an overall resource constraint. The corresponding Lagrangean can then be written

$$L = U^1 + \lambda\left(U^2 - \hat{U}^2\right) + \mu\left[\sum_{i=1}^{2}\left(y^i - nc^i - p^l l^i\right) - p^g g\right], \tag{6}$$

where $\hat{U}^2$ is the fixed minimum utility level for residents in Country 2, whereas λ and μ are the Lagrange multipliers associated with the minimum utility restriction and overall resource constraint, respectively. The first-order conditions with respect to private consumption in Countries 1 and 2, global public good provision, and national public good provision in Countries 1 and 2 are given by (if expressed in terms of the function $u^i(\cdot)$ defined in equation (1)):

$$u^1_{c^1} + u^1_{\bar{c}^1} + \lambda u^2_{\bar{c}^1} - \mu n = 0, \tag{7}$$

$$u^1_{\bar{c}^2} + \lambda u^2_{c^2} + \lambda u^2_{\bar{c}^2} - \mu n = 0, \tag{8}$$

$$u^1_g + \lambda u^2_g - \mu p^g = 0, \tag{9}$$

$$u^1_{l^1} - \mu p^l = 0, \tag{10}$$

$$\lambda u^2_{l^2} - \mu p^l = 0. \tag{11}$$

We will next present the optimal public good provision rules. Let us use the short notation

$$MRS_{lc}^{i} = \frac{u_{l^i}^{i}}{u_{c^i}^{i}}$$

for the marginal rate of substitution between the national public good and private consumption. Then the following result can be shown:

Proposition 1. *The efficient provision of the national public good in Country i is given by (for i=1,2)*

$$n\,MRS_{lc}^{i} = p^{l}\left(1-\alpha-\beta\right) = p^{l}\left(1-\gamma\right). \qquad (12)$$

Proof: See Appendix.

Equation (12) can be compared to the basic Samuelson (1954) rule where we instead have $n\,MRS_{lc}^{i} = p^{l}$. The modifying factor $\left(1-\alpha-\beta\right)=\left(1-\gamma\right)$ can be seen as the "degree of non-positionality." If each person in both countries receives one additional dollar, then their relative consumption is held constant. What then remains is the absolute, or the non-positional, utility effect. For the public good there is by definition no such leakage. This also explains why between-country comparisons of private consumption will affect the efficient provision of national public goods, despite that these goods (by the assumptions made earlier) have no spillover effects across jurisdictions. As such, the policy rule for efficient provision of national public goods derived by Aronsson and Johansson-Stenman (2008) for an economy without between-country comparisons, i.e., $n\,MRS_{lc}^{i} = p^{l}\left(1-\alpha\right)$, implies under-provision in the present context.

As noted by Aronsson and Johansson-Stenman (2008), when people care about relative consumption, it will matter for the interpretation of the Samuelson rule how people's marginal WTP for the public good is measured. In equation (12) above, MRS_{lc}^{i} reflects an individual's marginal WTP for an increased national public good provision *ceteris paribus*, i.e., given that others' consumption is held fixed. Alternatively, in the stated preference literature one often uses a so-called referendum payment vehicle; see, e.g., Arrow et al. (1993). In that case,

people are basically asked whether they would vote yes or no in a referendum implying not only a public good increase and that they would have to pay a certain amount (in terms of private consumption) for that increase, but also that other people in the society would have to pay the same amount. In a conventional model where only absolute consumption matters, it does in principle not matter whether peoples' marginal WTP is elicited *ceteris paribus* or is conditional on that others have to pay too. Yet, when relative consumption matters, this distinction is important: When others too have to pay there is an additional benefit to the individual, as an individual's relative consumption increases when others' consumption decreases.

Let us next define a measure of marginal WTP for the national public good, given that all others in the individual's own country will have to pay the same amount for the public good at the margin:

$$CMRS^i_{lc} = \frac{u^i_{l^i}}{u^i_{c^i} + u^i_{\bar{c}^i}},$$

where *CMRS* can be thought of as the *conditional MRS*, i.e., individual *MRS* conditional on the fact that all others in the own country will also have to pay the same amount on the margin for the public good increase. Based on equation (1) and the definitions of within-country and between-country positionality, we obtain

$$\frac{u^i_{\bar{c}^i}}{u^i_{c^i}} = -\alpha \text{ and } \frac{u^i_{\bar{c}^j}}{u^i_{c^i}} = -\beta .$$

We can then write the relationships between our marginal WTP measures as follows:

$$CMRS^i_{lc} = \frac{MRS^i_{lc}}{1-\alpha}. \qquad (13)$$

Using this in equation (12) we obtain the following result:

Corollary 1. *The efficient provision of the national public good in Country i can be expressed in terms of marginal WTP based on a referendum payment vehicle as follows (for i=1,2):*

$$n\, CMRS^i_{lc} = p^l \frac{1-\alpha-\beta}{1-\alpha} = p^l \left(1 - \frac{\beta}{1-\alpha}\right). \qquad (14)$$

This result means that the Samuelson rule expressed in terms of marginal WTPs elicited with the referendum method, $n\,CMRS_{lc}^{i} = p^{l}$, still implies an under-provision of the public good, compared to the efficient rule in (14). This can be compared to the corresponding finding in the one-country case analyzed by Aronsson and Johansson-Stenman (2008). In that case, it followed that utilizing a referendum-type payment vehicle implies that we return to the basic Samuelson rule, i.e., that the sum of marginal WTPs equals the marginal rate of transformation between the national public good and the private consumption good. Here, in contrast, although we move in the same direction, the Samuelson rule will still imply an under-provision compared to the efficiency rule. The reason is that people in the other country will obviously not have to pay for the public good increase; hence a public good increase will be accompanied by reduced relative consumption compared to with people in the other country.

Let us next consider the efficient provision rule for the global public good, and use the short notation

$$MRS_{gc}^{i} = \frac{u_{g}^{i}}{u_{c^{i}}^{i}}.$$

Proposition 2. *The efficient provision of the global public good is given by*

$$n\,MRS_{gc}^{1} + n\,MRS_{gc}^{2} = p^{g}\left(1-\alpha-\beta\right). \qquad (15)$$

Proof: See Appendix.

As can be seen, this efficiency rule is equivalent to the one for the national public good with the only difference that we here have a positive marginal WTP for the public good in both countries. The logic behind the modifying factor due to relative consumption concerns, i.e., $\left(1-\alpha-\beta\right)$, is the same as for the national public good.

Here too we can define a corresponding marginal WTP measure for the global public good when this marginal WTP is elicited under the assumption that all others in the individual's own country also have to pay the same amount at the margin:

$$CMRS^{i}_{gc} = \frac{u^{i}_{g^i}}{u^{i}_{c^i} + u^{i}_{\bar{c}^i}} = \frac{MRS^{i}_{gc}}{1-\alpha}. \tag{16}$$

This together with equation (15) implies the following result:

Corollary 2. *The efficient provision of the global public good can be expressed in terms of marginal WTP based on a referendum payment vehicle as follows:*

$$n\,CMRS^{1}_{gc} + n\,CMRS^{2}_{gc} = p^{g}\,\frac{1-\alpha-\beta}{1-\alpha} = p^{g}\left(1-\frac{\beta}{1-\alpha}\right). \tag{17}$$

Hence, the global Samuelson rule expressed in terms of marginal WTPs elicited with the referendum method, $n\,CMRS^{1}_{gc} + n\,CMRS^{2}_{gc} = p^{g}$, will imply an under-provision of the efficient amount of the global public good.

Yet, with a global public good it makes sense also to consider a developed version of the national referendum payment vehicle, as follows: Assume that people are asked to vote yes or no to a referendum where a global public good increase is associated with a consumption decrease for all people, i.e., in both countries. The corresponding marginal WTP measure can then be expressed as

$$GMRS^{i}_{g,c} = \frac{v^{i}_{g^i}}{v^{i}_{c^i}} = \frac{u^{i}_{g^i}}{u^{i}_{c^i} + u^{i}_{\bar{c}^i} + u^{i}_{\bar{c}^j}} = \frac{MRS^{i}_{gc}}{1-\alpha-\beta}, \tag{18}$$

where *GMRS* can be thought of as the *globally* conditional *MRS*, i.e., individual *MRS* conditional on the fact that all others globally will also have to pay the same amount at the margin for the public good increase. By combining equations (15) and (18), we obtain:

Corollary 3. *The efficient provision of the global public good can be expressed in terms of marginal WTP based on a global referendum payment vehicle as follows:*

$$n\,GMRS^{1}_{g,c} + n\,GMRS^{2}_{g,c} = p^{g}\,. \qquad (19)$$

Corollary 3 thus implies that the Samuelson rule expressed in terms of marginal WTP based on a global referendum payment vehicle, such that all people in both countries will have to pay for a public good increase, is identical to the efficient rule.

4. Non-Cooperative Nash Equilibrium

So far we have solely been concerned with the Pareto efficient allocation. However, since national governments typically play a fundamental role for the provision of national as well as global public goods, a natural next step is to consider the behavior of each government based on a non-cooperative Nash equilibrium, such that each national government contributes to the public goods while treating the contributions made by the other government as exogenous at the equilibrium. Since we focus solely on economic efficiency in the present paper, and hence do not analyze distributional issues, we also (implicitly) assume that each government can raise lump-sum taxes in order to finance the public good provision. The corresponding Lagrangean for Country *i* can then be written

$$U^{i} + \sigma^{i}\left(y^{i} - nc^{i} - p^{l}l^{i} - p^{g}g^{i}\right), \qquad (20)$$

where σ^{i} is the Lagrange multiplier associated with the national resource constraint. The associated first-order conditions with respect to the private consumption, the contribution to the global public good, and the provision of the national public good, respectively, in Country *i* are given by:

$$u^{i}_{c^{i}} + u^{i}_{\bar{c}^{i}} - \sigma^{i} n = 0\,, \qquad (21)$$

$$u^{i}_{g} - \sigma^{i} p^{g} = 0\,, \qquad (22)$$

$$u^i_{l^i} - \sigma^i p^l = 0 . \qquad (23)$$

By combining (21) and (23), we immediately obtain the following result:

Proposition 3. *The non-cooperative Nash equilibrium implies the following rule for provision of a national public good in Country i (for i=1,2)*

$$n\, MRS^i_{lc} = p^l (1-\alpha), \qquad (24)$$

implying an under-provision compared to the efficient provision rule in Proposition 1.

The derivation of equation (24) is analogous to the derivation of equation (12). Note that this under-provision result holds despite the fact that the government takes into account relative consumption effects (within the country), and also despite the fact that we are dealing with a national public good, i.e., a good that individuals in Country *j* do not derive any utility from. The intuition for the under-provision is instead based on the fact that the government in Country *i* will not take into account that the reduced private consumption in Country *i* that will follow from increased public provision implies a benefit to individuals in Country *j*, i.e., a benefit that is not taken into account in the Nash equilibrium.

We can also note that a government that wants to implement the Nash equilibrium can do so simply by applying the Samuelson rule expressed in terms of marginal WTPs based on a referendum payment vehicle, i.e., a payment vehicle such that individual WTP is measured conditional on that all others in the individual's home country will also have to pay the same amount for the public good increase, such that

$$n\, CMRS^i_{lc} = p^l . \qquad (25)$$

Finally, turning to the national contribution to the global public good, we combine equations (21) and (22) to obtain the following result:

Proposition 4. *The non-cooperative Nash equilibrium implies the following rule for contribution to a global public good in Country i (i=1,2):*

$$n\, MRS_{gc}^{i} = p^{g}\left(1-\alpha\right), \qquad (26)$$

implying an under-provision compared to the efficient provision rule in Proposition 2.

Equation (26) is derived in the same general way as equation (15) above. By comparing (15) with (26), we can conclude that this under-provision result follows for two different reasons. First, and most straightforward, there is an under-provision due to free-riding, i.e., each country will not take into account the benefit that the public good causes to people in the other country. Second, there is a benefit through the same mechanism as described above for the national public good, namely that Country *i* will not take into account that the reduction in the domestic private consumption needed to finance the contribution to the global public good leads to increased relative consumption in Country *j*, a benefit of public provision that is not taken into account in the Nash equilibrium. As a consequence, the under-provision problem associated with national contributions to global public goods is more severe when individuals have positional preferences than in a standard model where utility is determined solely by the absolute consumption.

5. Conclusions

In this paper, we have derived Pareto efficient rules for the provision of national as well as global public goods in a two-country world where each individual cares about relative private consumption in both a national (compared to other people in the same country) and international (compared to people in other countries) perspective. We have also compared the policy rules for efficient provision with those that follow in a non-cooperative Nash equilibrium, which is based on the assumption that each national government treats the public provision by the other country as exogenous.

We would like to emphasize two conclusions from the analysis. First, the results show that not only global public goods are under-provided in Nash equilibrium (as in standard models

without positional concerns); national governments also systematically under-provide national public goods in Nash equilibrium under relative consumption concerns. Furthermore, this holds despite our assumption that national public goods do not spill over across jurisdictions. The intuition is, instead, that an individual country does not take into account that the reduction in the domestic private consumption needed to finance the increased public provision leads to increased relative consumption in other countries.

Second, and for the same basic reason, the under-provision problem associated with global public goods is more severe here than in the absence of relative consumption concerns. In light of the recent empirical evidence discussed in the introduction, which suggests that between-country comparisons have increased in importance during the last decades, it is tempting to be provocative and argue that globalization in combination with relative consumption concerns have weakened the national incentives to contribute to global public goods. Yet, we settle for a more modest conclusion that is fully supported by our analysis: that relative consumption concerns based on between-country comparisons imply under-provision of global public goods in Nash equilibrium even *in the absence of* the (well documented) free-rider problem associated with the public goods *per se*.

References

Abel, A. B. (1990) Asset Prices under Habit Formation and Catching Up with the Joneses. *American Economic Review, Papers and Proceedings* **80**, 38-42.

Abel, A. B. (2005) Optimal Taxation When Consumers Have Endogenous Benchmark Levels of Consumption. *Review of Economic Studies* **72**, 1-19.

Akerlof, G. A. (1997) Social Distance and Social Decisions. *Econometrica* **65**, 1005-1027.

Alpizar, F., F. Carlsson and O. Johansson-Stenman (2005) How Much Do We Care About Absolute versus Relative Income and Consumption? *Journal of Economic Behavior and Organization* **56**, 405-421.

Aronsson, T. and O. Johansson-Stenman (2008) When the Joneses' Consumption Hurts: Optimal Public Good Provision and Nonlinear Income Taxation. *Journal of Public Economics* **92**, 986-997.

Aronsson, T. and O. Johansson-Stenman (2010) Positional Concerns in an OLG Model: Optimal Labor and Capital Income Taxation. *International Economic Review* **51**, 1071-1095.

Aronsson, T. and O. Johansson-Stenman (in press) Conspicuous Leisure: Optimal Income Taxation when both Relative Consumption and Relative Leisure Matter. *Scandinavian Journal of Economics*

Arrow, K., R. Solow, E. Leamer, P. Portney, R. Radner and H. Schuman (1993) Report of the NOAA Panel on Contingent Valuation. *Federal Register* **58**, 4601-14.

Blanchflower, D.G. and Oswald, A.J. (2004) Well-being over time in Britain and the USA'. *Journal of Public Economics* **88**, 1359-1386.

Blomquist, S. (1993) Interdependent Behavior and the Effect of Taxes. *Journal of Public Economics* **51**, 211-218.

Boskin, M. J. and E. Sheshinski (1978) Individual Welfare Depends upon Relative Income. *Quarterly Journal of Economics* **92**, 589-601.

Bowles, S. and Y.-J. Park (2005) Inequality, Emulation, and Work Hours: Was Thorsten Veblen Right? *Economic Journal* **15**, F397-F413.

Becchetti, L., S. Castriota and E. Giachin Ricca (2010) Beyond the Joneses: Inter-Country Income Comparisons and Happiness. University of Tor Vergata, Working Paper.

Brekke, K.-A. and R. B. Howarth (2002) *Affluence, Well-Being and Environmental Quality*. Cheltenham, Edward Elgar.

Carlsson, F., O. Johansson-Stenman and P. Martinsson (2007) Do You Enjoy Having More Than Others? Survey Evidence of Positional Goods. *Economica* **74**, 586-598.

Clark, A. E., P. Frijters and M. A. Shields (2008) Relative Income, Happiness and Utility: An Explanation for the Easterlin Paradox and other Puzzles. *Journal of Economic Literature* **46**, 95-144.

Clark, A.E. and C. Senik (2010) Who Compares to Whom? The Anatomy of Income Comparisons in Europe. *Economic Journal* **120**: 573-594.

Clark, A.E., and Senik, C. (2011) Will GDP Growth Increase Happiness in Developing Countries?" In R. Peccoud (Ed.), *Measure For Measure: How Well Do We Measure Development?* Paris: STIN.

Corazzini, L., Esposito, L. and F. Majorano (2012) Reign in Hell or Serve in Heaven? A Cross-country Journey into the Relative vs Absolute Perceptions of Wellbeing. *Journal of Economic Behavior and Organization* **81**(3), 715-730.

Corneo, G. and O. Jeanne (1997) Conspicuous Consumption, Snobbism and Conformism. *Journal of Public Economics* **66**, 55-71.

Corneo, G., and O. Jeanne (2001) Status, the Distribution of Wealth, and Growth. *Scandinavian Journal of Economics* **103**, 283-293.

Dohmen, T, A. Falk, K. Fliessbach, U. Sunde, and B. Weber (2011) Relative versus absolute income, joy of winning, and gender: Brain imaging evidence. *Journal of Public Economics* **95**, 279-285.

Dupor, B. and W. F. Liu (2003) Jealousy and overconsumption. *American Economic Review* **93**, 423-428.

Easterlin, R.A. (1995) Will Raising the Incomes of All Increase the Happiness of All? *Journal of Economic Behavior and Organization* **27**, 35-47.

Easterlin, R.A. (2001) Income and Happiness: Towards a Unified Theory. *Economic Journal* **111**, 465-484.

Ferrer-i-Carbonell, A. (2005) Income and Well-being: An Empirical Analysis of the Comparison Income Effect. *Journal of Public Economics* **89**, 997-1019.

Fliessbach, K., Weber, B., Trautner, P., Dohmen, T., Sunde, U., Elger, C.E, Falk, A. (2007) Social comparison affects reward-related brain activity in the human ventral striatum, *Science* **318**, 1305-1308.

Frank, R. H. (1985) The Demand for Unobservable and Other Nonpositional Goods. *American Economic Review* **75**, 101-16.

Friedman, B. M. (2005) *The Moral Consequences of Economic Growth*, New York: Alfred A. Knopf.

Hopkins, E. and T. Kornienko (2004) Running to Keep in the Same Place: Consumer Choice as a Game of Status. *American Economic Review* **94**, 1085-1107.

Ireland, N. J. (2001) Optimal Income Tax in the Presence of Status Effects. *Journal of Public Economics* **81**, 193-212.

James, J. (1987). Positional Goods, Conspicuous Consumption and the International Demonstration Effect Reconsidered. *World Development* **4**, 449-462.

Johansson-Stenman, O., F. Carlsson and D. Daruvala (2002) Measuring Future Grandparents' Preferences for Equality and Relative Standing. *Economic Journal* **112**, 362-383.

Kanbur, R. and M. Tuomala (2010) Relativity, Inequality and Optimal Nonlinear Income Taxation. Working paper, Cornell University.

Layard, R. (1980) Human Satisfaction and Public Policy. *Economic Journal* **90**, 737-750.

Ljungqvist, L. and H. Uhlig (2000) Tax Policy and Aggregate Demand Management Under Catching Up with the Joneses. *American Economic Review* **90**, 356-366.

Luttmer, E. F. P. (2005) Neighbors as Negatives: Relative Earnings and Well-Being. *Quarterly Journal of Economics* **120**, 963-1002.

Mujcic, R. and P. Frijters (in press) Economic Choices and Status: Measuring Preferences for Income Rank, *Oxford Economic Papers*.

Ng, Y.-K. (1987) Relative Income Effects and the Appropriate Level of Public Expenditure. *Oxford Economic Papers* **39**, 293-300.

Oswald, A. (1983) Altruism, jealousy and the theory of optimal non-linear taxation. *Journal of Public Economics* **20**, 77–87.

Rayo, L. and G. S. Becker (2007) Evolutionary Efficiency and Happiness. *Journal of Political Economy* **115**, 302-337.

Samuelson, P. A. (1954) The Pure Theory of Public Expenditure. *Review of Economics and Statistic*s **36**, 387-389.

Samuelson, L. (2004) Information-Based Relative Consumption Effects. *Econometrica* **72**, 93-118.

Senik, C. (2009) Direct evidence on income comparisons and their welfare effects, *Journal of Economic Behavior and Organization* **72**, 408-424.

Solnick, S. and D. Hemenway (2005) Are positional concerns stronger in some domains than in others? *American Economic Review, Papers and Proceedings* **45**, 147-151.

Stern, N. H. (2007). *The Economics of Climate Change: The Stern Review*. Cambridge, UK, Cambridge University Press.

Stevenson, B. and J. Wolfers (2008). Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox. *Brookings Papers on Economic Activity*, Spring 2008, 1–87.

Stutzer, A. (2004) The role of income aspirations in individual happiness. *Journal of Economic Behavior and Organization* **54**, 89-110.

Tuomala, M. (1990) *Optimal income tax and redistribution*. Clarendon Press, Oxford.

Wendner, R. (2010) Conspicuous Consumption and Generation Replacement in a Model with Perpetual Youth. *Journal of Public Economics* **94**, 1093-1107.

Wendner, R. (2011) Will the Consumption Externalities' Effects in the Ramsey Model Please Stand Up? *Economics Letters* 111, 210-212.

Wendner, R. and L. H. Goulder (2008) Status Effects, Public Goods Provision, and the Excess Burden, *Journal of Public Economics* **92**, 1968-1985.

Appendix

Proofs of Propositions 1 and 2

Let us start with Proposition 1. Combining equations (7) and (8) gives

$$\lambda = \frac{u^1_{c^1} + u^1_{\bar{c}^1} - u^1_{\bar{c}^2}}{u^2_{c^2} + u^2_{\bar{c}^2} - u^2_{\bar{c}^1}}, \tag{A1}$$

while combining equations (7) and (10) implies

$$u^1_{c^1} + u^1_{\bar{c}^1} + \lambda u^2_{\bar{c}^1} = n u^1_{l^1} / p^l . \tag{A2}$$

Substituting (A1) i.nto (A2), we have

$$n\frac{u^1_{l^1}}{p^l} = u^1_{c^1} + u^1_{\bar{c}^1} + \frac{u^1_{c^1} + u^1_{\bar{c}^1} - u^1_{\bar{c}^2}}{u^2_{c^2} + u^2_{\bar{c}^2} - u^2_{\bar{c}^1}} u^2_{\bar{c}^1} . \tag{A3}$$

Reorganizing equation (A3) and using the *MRS* definition implies

$$n^1 MRS^1_{lc} = p^l \left(1 + \frac{u^1_{\bar{c}^1}}{u^1_{c^1}} + \frac{1 + \dfrac{u^1_{\bar{c}^1} - u^1_{\bar{c}^2}}{u^1_{c^1}}}{1 + \dfrac{u^2_{\bar{c}^2} - u^2_{\bar{c}^1}}{u^2_{c^2}}} \frac{u^2_{\bar{c}^1}}{u^2_{c^2}} \right). \tag{A4}$$

Using finally, through equation (1) and the positionality definitions, that

$$\frac{u^1_{\bar{c}^1}}{u^1_{c^1}} = \frac{u^2_{\bar{c}^2}}{u^2_{c^2}} = -\alpha \text{ and } \frac{u^1_{\bar{c}^2}}{u^1_{c^1}} = \frac{u^2_{\bar{c}^1}}{u^2_{c^2}} = -\beta ,$$

we obtain equation (12) in Proposition 1.

Turning to Proposition 2, we combine equations (7) and (9) to derive

$$\left(u^1_{c^1} + u^1_{\bar{c}^1} + \lambda u^2_{\bar{c}^1}\right) p^g = \left(u^1_g + \lambda u^2_g\right) n\,. \tag{A5}$$

It is easy to show from the positionality definitions and (A1) that $\lambda = u^1_{c^1} / u^2_{c^2}$. Substituting into equation (A5) and collecting terms implies

$$n\frac{u^1_g}{u^1_{c^1}} + n\frac{u^2_g}{u^2_{c^2}} = p^g\left(1 + \frac{u^1_{\bar{c}^1}}{u^1_{c^1}} + \frac{u^2_{\bar{c}^1}}{u^2_{c^2}}\right). \tag{A6}$$

Using the *MRS* and positionality definitions then implies equation (15) in Proposition 2.