Freie Universität Berlin

Habit Formation and the Pareto-Efficient Provision of Public Goods

Thomas Aronsson
Ronnie Schöb

School of Business & Economics
Discussion Paper

Economics

2017/1

Habit Formation and the Pareto-Efficient Provision of Public Goods*

Thomas Aronsson[a] and Ronnie Schöb[s]

January 2017

Abstract

This paper examines the implications of habit formation in private and public consumption for the Pareto-efficient provision of public goods, based on a two-period model with nonlinear taxation. If the public good supply is time-invariant, the presence of habit formation generally alters the standard rules for public good provision. In contrast, if the public good is a flow-variable such that the government directly decides on the level of the public good in each period, habit formation leads to a modification of the first best Samuelson condition only if the degrees of habituation differ for private and public consumption. Since habit formation affects the incentives to relax the self-selection constraint through public good provision, however, habituation alters the second-best analogue to the Samuelson condition also when the degrees of habituation in private and public consumption coincide.

Keywords: Public good provision, Samuelson condition, habit formation, optimal taxation.

JEL Classification: D60, H21, H41.

* The authors would like to thank David Granlund for helpful comments and suggestions. Aronsson would also like to thank the Swedish Research Council (ref 2016-02371) for generous research grants.

[a] Department of Economics, Umeå School of Business and Economics, Umeå University, SE – 901 87 Umeå, Sweden. E-mail: thomas.aronsson@econ.umu.se.

[s] School of Business & Economics, Freie Universität Berlin, D–14195 Berlin, Germany. E-mail: ronnie.schoeb@fu-berlin.de.

1. Introduction

This paper examines the implications of habituation in private and public consumption for the efficient provision of public goods in model-economies with nonlinear income taxation. The purposes are to examine how such adaptation modifies the policy rule for public provision, and identify conditions under which the standard first best and second best Samuelson conditions remain valid in the presence of habituation.

People adapt to most circumstances in life, and the degree to which people adapt can actually be substantial. For instance, a permanent increase in the consumption may only affect utility temporarily as the potential utility gains decline over time. According to Clark, Frijters, and Shields (2008), adaptation may eliminate as much as 60 percent of the initial positive effect on happiness of an increase in the individual income within two years.[1] Nevertheless, although the importance of adaptation has been widely recognized in the context of consumption and labor market behavior,[2] it has so far played a minor role in normative economic theory of taxation and public expenditure. In fact, Becker and Murphy (1988) argue that adaptation has no important implications for normative economic theory and, in particular, the insights gained from optimal taxation theory if people are fully aware of their adaptation-behavior when making their consumption choices.

Yet, recent research shows that adaptation in private consumption may have an influence on the optimal tax policy in second-best economies with skill heterogeneity, although it does not create a direct motive for correction (see Guo and Krause 2011 and Koehne and Kuhn 2014). The present paper supplements this research by examining public good provision when consumers adapt both in terms of their private and public consumption through internal habit formation. Our contribution is thus to characterize the effects that adaptation have on the optimality condition for a public good in such a framework. In general, adaptation alters the optimality conditions for public good provision. This is true both in a first best world where the government can use lump-sum taxes to finance public good provision, and in a second

[1] For further evidence on the importance of adaptation, see Lucas (2007), Diener et al. (2009), Luhmann et al. (2012), and Weimann, Knabe, and Schöb (2015). With respect to adaptation to public good consumption, Levinson (2013) finds that fluctuations of the current day's air quality affect happiness while changes in the local annual average do not. This can be interpreted as habituation to the public good air quality. Further, at least indirect evidence is given by Schkade and Kahneman (1998) who asked people to rate their own life satisfaction and the life satisfaction of someone similar in another region. It turned out that climate-related questions, i.e., the role of a particular public good, were typically thought of as more important for someone living in the other region. Apparently, the public good becomes more important in evaluating someone else’s well-being in an imaginary situation than for one’s own actual well-being. This seems to suggest that people do not account for adaptation to public good consumption when conceiving themselves in another situation while adapting when evaluating their own circumstances.

[2] See, e.g., Woittiez and Kapteyn (1998), Clark (1999), and Fuhrer (2000).

best world where asymmetric information prevents the government from raising revenue through type-specific lump-sum taxes.

Our study follows Pollak (1970) and the subsequent economics literature in describing adaptation in terms of internal habit formation. We consider a two-period model with heterogeneous and rational consumers, in which the government raises tax revenue to redistribute income and provide a public good, and where the consumers adapt both with respect to their private and public consumption. Whereas habit formation in private consumption works in the direction of over-provision of public goods relative to the standard policy rule (the Samuelson condition or second-best variant thereof), habit formation in public consumption works in the opposite direction. An interesting question is whether these two forces cancel out under certain conditions, such that standard policy rules are applicable in the presence of habit formation.

The policy implications of habit formation depend on how frequently the government can adjust the public good provision as well as on the degrees of habit formation in private and public consumption. We consider two polar cases. The first version of the model assumes that the government in the first period provides a fixed level of the public good to be consumed in both periods. This is interpretable in terms of a state-variable public good, where instantaneous contributions and depreciation have negligible effects on the stock (which is likely to be the case for certain types of infrastructure and environmental public goods such as national parks). We show that the efficiency condition for public good provision generally differs from the Samuelson condition (or second-best analogue thereof), meaning that the policy rules for public good provision explicitly depend on the intensities of habit formation in private and public good consumption. This is true also in the special case where the degrees of habituation in private and public consumption are the same. Indeed, under rather conventional assumptions about the properties of the utility function, the first best policy rule implies under-provision of the public good relative to the standard Samuelson condition, if the degrees of habituation in private and public consumption coincide. Only accidentally, in the extreme case where (i) the degrees of habituation in private and public consumption coincide and (ii) the marginal willingness to pay for the public good is constant over time in present value terms, will this model imply a standard Samuelson first best policy rule for public good provision, although based on a different reasoning than the corresponding policy rule that applies in the absence of any habit formation.

The second version of the model assumes that the supply of public goods can be adjusted over time, such that the government decides on the level of the public good in each period, which exemplifies a flow-variable public good. In this case, the conventional policy rule surfaces as long as the degrees of habituation in private and public consumption are the same. Therefore, in the case of a flow-variable good, it turns out that habit formation modifies the efficiency condition for public good provision only if the degrees of habituation differ for private and public good consumption.

In Sections 2 and 3 below, we use the two variants of the model to analyze how habit formation in private and public consumption affects the efficient provision of public goods. The model is based on the self-selection approach to optimal taxation originally developed by Stern (1982) and Stiglitz (1982), where revenue collection and redistribution are funded by nonlinear income taxes. In this respect, we follow Boadway and Keen (1993) who were the first to analyze public good provision in such a framework, and extend their analysis to an economy with habit formation. Such a general framework allows us to avoid the (often arbitrary) restrictions implicit in models with linear tax instruments. Section 4 concludes.

2. A Two-Period Model with a Time-Invariant Supply of Public Goods

Consider a two-period economy where the consumers derive utility from private consumption, leisure, and a public good. There are two types of consumers that differ in terms of innate ability. Ability is reflected in the before-tax wage rate, meaning that the high-ability type (type 2) earns a higher before-tax wage rate than the low-ability type (type 1). n^i denotes the number of individual of ability-type *i*. True ability (and, consequently, the before-tax wage rate) is private information. All individuals are assumed to share a common utility function, meaning that the utility facing any individual of ability-type *i* (i=1,2) is given by

$$U^i = U\left(c^i, \ell^i, x^i - \alpha c^i, g, G - \rho g\right). \tag{1}$$

In equation (1), c and x denote private consumption in the first and second period, respectively, while ℓ denotes leisure, defined as a time-endowment normalized to one minus the hours of work, g denotes the public good provision in the first period, and G the public good provision in the second period. The individual works in the first period and is retired in the second (meaning that the leisure-argument in the utility function refers to the first period). The utility function is increasing in each separate argument and strictly quasi-concave. Discounting – if it occurs – is implicit in this formulation.

We allow for habit formation both with respect to private and public consumption, where the parameters $\alpha \in [0,1]$ and $\rho \in [0,1]$ denote the intensities of habit formation. As such, $\alpha = 0$ indicates no habit formation at all whereas $\alpha = 1$ implies full habituation in private consumption. The interpretation of the parameter ρ is analogous in terms of public consumption.

Assuming a time-invariant public good provision to begin with, we have $G = g$. Therefore, although the benefit of public consumption is enjoyable in both periods, the public good remains in fixed quantity over the periods. The utility derived from public good consumption in the first period thus depends on the level of the public good, g, while it depends on $g(1-\rho)$ in the second period due to habituation. We assume that there is no habit formation with respect to leisure, as otherwise the utility derived from leisure when retired would depend on the leisure-consumption choice in the first period.[3]

The individual budget constraints can be written as

$$w^i l^i - T(w^i l^i) - s^i = c^i, \tag{2a}$$

$$s^i(1+r) - \Omega(rs^i) = x^i, \tag{2b}$$

for i=1,2, in which w^i denotes the before-tax wage rate, $l^i = 1 - \ell^i$ work hours, s^i saving, and r the interest rate. We assume that the production technology is linear such that the before-tax wage rates and the interest rate are fixed. The variables $T(w^i l^i)$ and $\Omega(rs^i)$ denote the labor income tax (paid when young) and the capital income tax (paid when old), respectively. These are general, nonlinear, tax functions, the parameters of which include type-specific marginal tax rates and lump-sum components. In a first best world with no asymmetric information (or other reasons to distort the labor supply and savings behavior), these tax functions will reduce to type-specific lump-sum taxes.

Since the government has access to general labor income and capital income taxes, it can implement any desired combination of work hours and saving for each ability-type, and thus effectively control l^i, c^i, and x^i for i=1,2, subject to relevant constraints. We can, therefore, characterize the social decision-problem such that the government (or social planner) chooses work hours and private consumption for each ability-type and the level of the public good to reach a Pareto efficient resource allocation subject to an overall resource constraint and self-selection constraint. We apply the conventional assumption that the government wants to

[3] As long as leisure time is (at least partly) used to gain experiences, this assumption accords well with empirical evidence discussed in Dunn, Gilbert, and Wilson (2011), according to which people seem to adapt more to material than experiential purchases.

redistribute from the high-ability to the low-ability type, meaning that the self-selection constraint that may bind is the one preventing high-ability individuals from mimicking the low-ability type. Based on these assumptions, the social decision-problem is written as follows:

$$\max_{l^i, c^i, x^i\,(i=1,2), g} \quad U\left(c^1, \ell^1, x^1 - \alpha c^1, g, g(1-\rho)\right)$$

such that

$$\mu: \quad U\left(c^2, \ell^2, x^2 - \alpha c^2, g, g(1-\rho)\right) \geq \bar{U}^2 \tag{3a}$$

$$\lambda: \quad U\left(c^2, \ell^2, x^2 - \alpha c^2, g, g(1-\rho)\right) \geq U\left(c^1, 1 - \frac{w^1}{w^2} l^1, x^1 - \alpha c^1, g, g(1-\rho)\right) \tag{3b}$$

$$\gamma: \quad \sum_i n^i w^i l^i - \sum_i n^i c^i - \sum_i \frac{n^i x^i}{1+r} - g = 0\,. \tag{3c}$$

This resource allocation problem means choosing work hours, private consumption, and public consumption to maximize utility of the low-ability type subject to the minimum utility restriction for the high-ability type in (3a). The weak inequality (3b) is the self-selection constraint ensuring that each high-ability individual weakly prefers the allocation intended for his/her type (the left hand side) over the allocation intended for the low-ability type. A potential mimicker receives the utility on the right hand side of the weak inequality (3b). In our model, where the government can observe both the labor and capital income at the individual level, such a mimicker will consume as much as the low-ability type in both periods. Yet, since the mimicker is more productive, he/she can earn the same income as the low-ability type with less effort; $w^1 / w^2 < 1$ denotes the relative wage rate, and $(w^1 / w^2) l^1 < l^1$ is interpretable as the number of work hours supplied by the mimicker. The resource constraint in equation (3c), finally, means that output is used for private and public consumption. μ, λ, and γ are Lagrange multipliers attached to each respective constraint.

By solving this problem, we can characterize the efficient provision of the public good. To simplify the notation, and present the results in a way comparable to earlier studies that do not allow for habituation, let us use $c_1^i = c^i$, $c_2^i = x^i - \alpha c^i$, $g_1 = g$, and $g_2 = g(1-\rho)$, in which case the utility function in equation (1) can be rewritten as follows:

$$U^i = U\left(c_1^i, \ell^i, c_2^i, g_1, g_2\right), \quad \text{for } i=1,2 \tag{1'}$$

while the utility facing the mimicker becomes $\hat{U}^2 = U\left(c_1^1, 1 - \frac{w^1}{w^2} l^1, c_2^1, g_1, g_2\right)$.

We can then define conventional first period marginal rates of substitution between the public good and private consumption such that

$$MRS^i_{g_1,c_1} = \frac{U^i_{g_1}}{U^i_{c_1}} \quad \text{for } i=1,2 \quad \text{and} \quad M\hat{R}S^2_{g_1,c_1} = \frac{\hat{U}^2_{g_1}}{\hat{U}^2_{c_1}}$$

where the hat symbol above the utility function (^) refers to the mimicker, as well as conventional second period marginal rates of substitution

$$MRS^i_{g_2,c_2} = \frac{U^i_{g_2}}{U^i_{c_2}} \quad \text{for } i=1,2 \quad \text{and} \quad M\hat{R}S^2_{g_2,c_2} = \frac{\hat{U}^2_{g_2}}{\hat{U}^2_{c_2}}.$$

The *MRS* functions are interpretable as *period-specific* marginal rates of substitution, with the marginal utility of private and public consumption in the other period held constant, i.e., measures of marginal willingness to pay commonly used in models without habit formation.

The first order conditions for the social decision-problem set out above can be found in the Appendix. The policy rule for efficient public good provision is presented in Proposition 1.

Proposition 1. *With a time-invariant public good, the Pareto efficient provision of the public good satisfies*

$$\begin{aligned} 1 = {} & \sum_i n^i MRS^i_{g_1,c_1}\left(1+\frac{\alpha}{1+r}\right) + \sum_i n^i MRS^i_{g_2,c_2}\left(1-\rho\right) \\ & + \frac{\lambda}{\gamma}\left[\hat{U}^2_{c_1}\left(MRS^1_{g_1,c_1} - M\hat{R}S^2_{g_1,c_1}\right) + \hat{U}^2_{c_2}\left(MRS^1_{g_2,c_2} - M\hat{R}S^2_{g_2,c_2}\right)\left(1-\rho\right)\right]. \end{aligned} \qquad (4)$$

Proof: See the Appendix I.

The left hand side of equation (4) represents the marginal rate of transformation between the public good and the private consumption good, which is normalized to unity (see equation [3c]). This is the direct marginal cost of providing the public good measured in terms of lost private consumption. Similarly, the right hand side is the direct marginal benefit (the first row) adjusted for the welfare effects of public good provision via the self-selection constraint (the second row). Since equation (4) is expressed in terms of conventional, period-specific marginal rates of substitution, it shows how the conventional measures of marginal benefit and adjustment through the self-selection constraint, respectively, ought to be modified in response to habit formation in both private and public consumption.

To interpret Proposition 1 in greater detail, it is convenient to start by considering a first best resource allocation, which coincides with the special case of our model where $\lambda = 0$.[4] Equation (4) then simplifies to read

$$1 = \sum_i n^i MRS^i_{g_1,c_1}\left(1+\frac{\alpha}{1+r}\right) + \sum_i n^i MRS^i_{g_2,c_2}\left(1-\rho\right). \tag{5}$$

In equation (5), the right hand side measures the sum of the individuals' marginal willingness to pay for the public good in the first and second period, respectively, and is clearly affected by habituation. As expected, we can see that habituation in private consumption works to scale up each individual's marginal willingness to pay for the public good in the first period through the factor $1+\alpha/(1+r) \geq 1$, compared to standard policy rules for public good provision. To see this more clearly, equations (A1) – (A5) in Appendix I can be used to derive the following relationship when $\lambda = 0$:

$$MRS^i_{g_1,c_1}\left(1+\frac{\alpha}{1+r}\right) = \frac{U^i_{g_1}}{U^i_{c_1} - \alpha U^i_{c_2}} \quad \text{for i=1,2.} \tag{6}$$

The right hand side of equation (6) is interpretable as the individual's total marginal willingness to pay for public consumption in the first period, *ceteris paribus*, which is higher the more the private consumption in the first period reduces the utility of private consumption in the second period. As a consequence, the total marginal utility lost when giving up one Euro of private consumption is smaller when we take account of habituation in private consumption. The scale factor $1+\alpha/(1+r)$ on the left hand side thus connects the conventional, period-specific measure of marginal rate of substitution (which is defined with the private consumption in the second period held constant) to the total marginal willingness to pay.

Similarly, habituation in public consumption scales down the marginal willingness to pay for the public good in the second period via the factor $1-\rho \leq 1$. The Samuelson condition must thus be modified to take account of the fact that part of today's utility gain of increased public consumption is lost by habit formation.

If the degrees of habituation in private and public consumption are equal such that $\alpha = \rho = \sigma$, equation (5) reduces to read

[4] If individual ability were observable, the self-selection constraint would become redundant.

$$1 = \sum_i n^i \left(MRS^i_{g_1,c_1} + MRS^i_{g_2,c_2} \right) + \sigma \sum_i n^i \left(MRS^i_{g_1,c_1} \frac{1}{1+r} - MRS^i_{g_2,c_2} \right), \tag{7a}$$

where the first term on the right hand side is the sum of all consumers' marginal willingness to pay for the public good (based on the period-specific marginal rates of substitution in both periods), while the second is proportional to the degree of habit formation. Therefore, in the absence of any habit formation, which is the special case where $\alpha = \rho = \sigma = 0$ in our model, equation (7a) is equivalent to the standard Samuelson condition, i.e.,

$$1 = \sum_i n^i \left(MRS^i_{g_1,c_1} + MRS^i_{g_2,c_2} \right). \tag{7b}$$

The reason as to why equations (7a) and (7b) differ is that habit formations in private and public consumption have different effects on the marginal willingness to pay for public goods even when the two degrees of habituation are the same. Whereas habit formation in private consumption works to scale up the current marginal willingness to pay for the public good, habit formation in public consumption works to scale down the future marginal willingness to pay. This points to an interesting – albeit somewhat unlikely – special case: if (i) the degrees of habit formation in private and public consumption are the same, and (ii) the sum of within-period marginal willingness to pay for the public good is constant over time in present value terms, i.e., $\sum_i n^i MRS^i_{g_2,c_2} = \sum_i n^i MRS^i_{g_1,c_1} / (1+r)$, then equation (7a) takes exactly the same form as equation (7b). A sufficient (not necessary) condition for (ii) to apply is that the marginal willingness to pay for the public good is constant over time for both types such that $MRS^i_{g_2,c_2} = MRS^i_{g_1,c_1} / (1+r)$ for i=1,2. In the special case satisfying (i) and (ii) simultaneously, therefore, the Samuelson condition for an economy without habituation coincides with the Samuelson condition that prevails when the two degrees of habituation are equal, because the different effects of habit formation in private and public consumption cancel out.

Yet, since the effective measure of public consumption in the second period is $g(1-\rho)$, a more likely scenario would be $MRS^i_{g_2,c_2} > MRS^i_{g_1,c_1}$. In fact, since the social first order conditions for private consumption imply $U^i_{c_1} > U^i_{c_2}$,[5] a sufficient (but not necessary) condition for the inequality $MRS^i_{g_2,c_2} > MRS^i_{g_1,c_1}$ to hold would be that the utility function given in equation (1') takes the following additively separable and time-invariant form in public consumption:

$$U^i = U\left(c^i_1, \ell^i, c^i_2, g_1, g_2\right) = u\left(c^i_1, \ell^i, c^i_2\right) + \phi(g_1) + \phi(g_2).$$

[5] See equations (A1) – (A4).

In this special but illuminating case, the first best efficient policy rule implies under-provision relative to the standard Samuelson condition if the degrees of habituation in private and public consumption coincide.

Let us then return to the second best efficient policy rule in Proposition 1. The second line of equation (4) is a consequence of the self-selection constraint. The basic intuition behind this effect is well known from earlier research based on models without habituation. Indeed, without any habit formation, i.e., if $\alpha = \rho = 0$, our model reproduces (adapted for a two-period setting) the efficiency condition for public provision presented in Boadway and Keen (1993) for a second best economy with a binding self-selection constraint, i.e.,

$$1 = \sum_i n^i \left(MRS^i_{g_1,c_1} + MRS^i_{g_2,c_2} \right) + \frac{\lambda}{\gamma} \left[\hat{U}^2_{c_1} \left(MRS^1_{g_1,c_1} - M\hat{R}S^2_{g_1,c_1} \right) + \hat{U}^2_{c_2} \left(MRS^1_{g_2,c_2} - M\hat{R}S^2_{g_2,c_2} \right) \right]. \quad (8a)$$

A government may relax the self-selection constraint by exploiting that the low-ability type and the mimicker differ in terms of their marginal willingness to pay for the public good. More specifically, the second and third terms on the right hand side of equation (8a) imply over-provision (under-provision) relative to the first best Samuelson condition if leisure is substitutable for (complementary with) the public good, in the sense that the marginal willingness to pay decreases (increases) with the time spent on leisure. We can see that the first term in the second row of equation (4) takes the same form as in a standard model without habit formation, i.e., (8a), while, in contrast, the second term is scaled down by one minus the degree of habit formation in public consumption. Therefore, the policy rule for public provision does not change due to the mimicker's habit formation in private consumption.[6]

If people habituate in private and public consumption to the same extent such that $\alpha = \rho = \sigma > 0$, equation (4) can be rewritten to read

[6] This does not mean that habit formation in private consumption by the mimicker is unimportant. It enters the model implicitly via the first term on the right hand side of equation (4) evaluated for the low-ability type. By comparing equations (A7) and (A10) in Appendix I, we can see that

$$MRS^1_{g_1,c_1} \left(1 + \frac{\alpha}{\gamma n^1} \left(U^1_{c_2} - \lambda \hat{U}^1_{c_2} \right) \right) = MRS^1_{g_1,c_1} \left(1 + \frac{\alpha}{1+r} \right).$$

Therefore, the allocation implemented for the low-ability type is chosen to reflect how the mimicker habituates in private consumption. See equation (A1) in the Appendix.

$$1 = \sum_i n^i \left(MRS^i_{g_1,c_1} + MRS^i_{g_2,c_2} \right) + \sigma \sum_i n^i \left(MRS^i_{g_1,c_1} \frac{1}{1+r} - MRS^i_{g_2,c_2} \right) + \frac{\lambda}{\gamma} \left[\hat{U}^2_{c_1} \left(MRS^1_{g_1,c_1} - M\hat{R}S^2_{g_1,c_1} \right) + \hat{U}^2_{c_2} \left(MRS^1_{g_2,c_2} - M\hat{R}S^2_{g_2,c_2} \right) (1-\sigma) \right]. \tag{8b}$$

The first row of equation (8b) takes the same form as the right hand side of equation (7a). This component reduces to the (Samuelsonian) sum of marginal willingness to pay, i.e., $\sum_i n^i \left(MRS^i_{g_1,c_1} + MRS^i_{g_2,c_2} \right)$, if $\sum_i n^i MRS^i_{g_2,c_2} = \sum_i n^i MRS^i_{g_1,c_1} / (1+r)$.

However, in the second best model with a binding self-selection constraint, the policy rule for public provision differs from the standard policy rule also for an additional reason. This is seen by comparing the final term on the right hand side of equations (8a) and (8b), suggesting that the incentive faced by the government to offset mimicking in the future period is weaker under habit formation than in the absence of habit formation. As such, even if we were to assume that the period-specific marginal willingness to pay for the public good is constant in present value terms, the case with equal degrees of habituation in private and public consumption still necessitates an adjustment of the second best efficient policy rule due to the fact that habituation affects the incentives of becoming a mimicker. The intuition is, of course, that public consumption in the second period does not matter as much under habituation (where $\sigma > 0$) as it would in the absence of any habit formation (where $\sigma = 0$); neither for the true types nor for the mimicker. Note finally that this additional incentive to adjust the public good provision for habituation vanishes in the special case where leisure is weakly separable from the other goods in the utility function, in which $MRS^1_{g_1,c_1} = M\hat{R}S^2_{g_1,c_1}$ and $MRS^1_{g_2,c_2} = M\hat{R}S^2_{g_2,c_2}$ such that equations (7a) and (8b) coincide.

We summarize these conclusions in Corollary 1.

Corollary 1. *With equal degrees of habituation in private and public consumption such that* $\alpha = \rho > 0$, *the first best Pareto efficient policy rule typically means under-provision relative to the standard Samuelson condition. It coincides with the standard Samuelson condition if, and only if, the within-period marginal willingness to pay for the public good remains constant over time in present value terms. In a second best setting with a binding self-selection constraint, an additional reason to modify the provision rule must also be taken into account due to the fact that habit formation affects the incentives underlying mimicking.*

Note that Corollary 1 only applies when the degrees of habituation in private and public consumption are equal. If the two intensities of habituation do not coincide, we may either have under-provision or over-provision relative to policy rules derived in model-economies without any habit formation. According to Proposition 1 we notice that habit formation in private consumption works in the direction of over-provision of the public good relative to the standard Samuelson condition (or a second best analogue thereof), while habit formation in public consumption works in the direction of under-provision. Finally, the first best efficient policy rule for public provision in equation (5) also points at another interesting insight: if $MRS^i_{g_2,c_2} > MRS^i_{g_1,c_1}$ (which seems plausible based on the arguments given above), we must have $\alpha > \rho$ for equation (5) to coincide with the standard Samuelson condition. In this case, therefore, the applicability of the standard Samuelson condition presupposes that the intensity of habit formation is larger for private than for public consumption; not that the two intensities are the same.

3. A Model with Variable Public Good Supply

This section considers the case where the public good is a flow-variable, the level of which may vary between periods. As before, habit formation in private consumption contributes to over-provision and habit formation in public consumption to under-provision, *ceteris paribus*, relative to a standard policy rule. Yet, contrary to the results presented above, we find that the standard Samuelson condition remains valid for flow-variable types of public goods as long as the degrees of habit formation in private and public consumption are the same.

The preferences and constraints faced by each individual are the same as before. The only difference is that the public good varies over time, meaning that G may differ from g in equation (1). By using $c_1^i = c^i$, $c_2^i = x^i - \alpha c^i$, $g_1 = g$, and $g_2 = G - \rho g$ in the utility function (1') we can then define the following period-specific marginal rates of substitution for each true ability-type (i=1,2) and the mimicker, as before:

$$MRS^i_{g_1,c_1} = \frac{U^i_{g_t}}{U^i_{c_1}},\ M\hat{R}S^2_{g_1,c_1} = \frac{\hat{U}^2_{g_1}}{\hat{U}^2_{c_1}},\ MRS^i_{g_2,c_2} = \frac{U^i_{g_2}}{U^i_{c_2}},\text{ and }\ M\hat{R}S^2_{g_2,c_2} = \frac{\hat{U}^2_{g_2}}{\hat{U}^2_{c_2}},$$

where the sub-script attached to the utility function denotes partial derivative.

Based on the same assumptions as in Section 2, the social decision-problem can now be written as

$$\max_{l^i,c^i,x^i\,(i=1,2),g,G} \quad U\left(c^1,\ell^1,x^1-\alpha c^1,g,G-\rho g\right)$$

such that

$$\mu: \quad U\left(c^2, \ell^2, x^2 - \alpha c^2, g, G - \rho g\right) \geq \bar{U}^2 \tag{9a}$$

$$\lambda: \quad U\left(c^2, \ell^2, x^2 - \alpha c^2, g, G - \rho g\right) \geq U\left(c^1, 1 - \frac{w^1}{w^2} l^1, x^1 - \alpha c^1, g, G - \rho g\right) \tag{9b}$$

$$\gamma: \quad \sum_i n^i w^i l^i - \sum_i n^i c^i - \sum_i \frac{n^i x^i}{1+r} - g - \frac{G}{1+r} = 0\,. \tag{9c}$$

The social first order conditions for private consumption take the same form as in Section 2 and are given by equations (A1) – (A4) in the Appendix I, while the first order conditions for g and G are given in equations (A11) and (A12), respectively, in Appendix II. The solution to this problem gives the efficiency conditions for the public good, which are presented in Proposition 2.

Proposition 2. *With a variable public good supply, the Pareto efficient provision of the public good satisfies*

$$1 = \frac{1}{1+\rho/(1+r)}\left[\sum_i n^i MRS^i_{g_1,c_1}\left(1 + \frac{\alpha}{1+r}\right) + \lambda_1^*\left(MRS^1_{g_1,c_1} - M\hat{R}S^2_{g_1,c_1}\right)\right] \tag{10a}$$

$$1 = \sum_i n^i MRS^i_{g_2,c_2} + \lambda_2^*\left(MRS^1_{g_2,c_2} - M\hat{R}S^2_{g_2,c_2}\right) \tag{10b}$$

where $\lambda_1^* = \lambda \hat{U}^2_{c_1}/\gamma$ *and* $\lambda_2^* = \lambda \hat{U}^2_{c_2}(1+r)/\gamma$.

Proof: see the Appendix II.

Equation (10b) is a conventional condition for public good provision, i.e., it takes the same form as in the absence of habit formation. The intuition is, of course, that there is no additional period beyond period 2, in which an increase in G causes disutility. The policy rule for public good provision in the first period, given by equation (10a), differs from equation (4) – the efficiency condition for a time-invariant public good – in how the degree of habit formation in public consumption enters.

More specifically, with a variable supply of the public good, the efficient supply in the second period imposes additional structure on the effects of habit formation in public consumption. This is because public provision in the second period satisfies equation (10b). When deriving equation (10a), in Appendix II, we have thus used that the first order condition for public good provision in the second period implies that the following must hold: $\rho U^1_{g_2} + \rho\mu U^2_{g_2} + \rho\lambda\left[U^2_{g_2} - \hat{U}^2_{g_2}\right] = \rho\gamma/(1+r)$. As a consequence, the disutility caused by habit formation in public consumption, which influences the public provision in the first period, is directly proportional to the marginal utility cost of public funds, γ, when the public good provision in the second period satisfies equation (10b). In other words, the marginal utility loss caused by habituation in public consumption, which contributes to reduce the first period supply of the public good, is directly proportional to the marginal benefit of public consumption in the second period (with ρ being the factor of proportionality).

As before, an interesting special case arises when the degrees of habituation are equal, i.e., $\alpha = \rho \in [0,1]$. The following results refer to the efficient provision of the public good in the first period, and are direct consequences of Proposition 2:

Corollary 2. *With a variable public good supply, and if* $\alpha = \rho \in [0,1]$, *we obtain the following efficiency condition for public provision in the first period:*

$$1 = \sum_i n^i MRS^i_{g_1,c_1} + \lambda_1^{**}\left(MRS^1_{g_1,c_1} - M\hat{R}S^2_{g_1,c_1} \right), \tag{11a}$$

where $\lambda_1^{**} = \lambda \hat{U}^2_{c_1} / [\gamma(1+\rho/(1+r)]$. *In the special case where individual productivity is observable, such that* $\lambda = 0$, *equation (11a) reduces to read*

$$1 = \sum_i n^i MRS^i_{g_1,c_1} . \tag{11b}$$

Corollary 2 comprises all possible cases where habituation is the same for private and public consumption. When the self-selection constraint is not operative, the corresponding policy rule in equation (11b) always coincides with the conventional Samuelson condition, i.e., it takes the same form as in model-economies without any habit formation. Therefore, with a time-variant public good supply, the conventional first best policy surfaces as long as the degrees of habit formation in private and public consumption are the same. Note also that this conclusion does not require any additional assumption on how the marginal willingness to pay for the public good changes over time, as would be required to derive the corresponding result with a time-invariant public good. This illustrates a fundamental difference between a time-variant and time-invariant public good: with a time-variant public good, the effects on the policy rule of habituation in private and public consumption always cancel out as long as the two degrees are equal. Only when the degrees of adaptation to private and public consumption differ systematically, the standard policy rule for public good provision ought to be modified to account for habituation behavior.

A similar, albeit not identical, conclusion follows in a second best economy with a binding self-selection constraint. Equation (11a) is the standard efficiency condition for public provision in a second best economy with a binding self-selection constraint derived by Boadway and Keen (1993), with the only exception that the social marginal value of a relaxation of the self-selection constraint takes a slightly different form here. This is so because habituation affects the incentives faced by a potential mimicker and thus also the value that the government attaches to a relaxation of the self-selection constraint. By using equations (A1)–(A4) and (A12) in the Appendix, we can eliminate the quotient of Lagrange multipliers from the formula for λ_1^{**} in equation (11a) and derive the following real shadow price of a relaxation of the self-selection constraint:

$$\lambda_1^{**} = \frac{\lambda \hat{U}_{c_1}^2}{\gamma\left(1+\rho/(1+r)\right)} = \frac{U_{c_1}^1}{U_{c_2}^1}\left(\frac{1-MRS_{g_2,c_2}^2 n^2 - M\hat{R}S_{g_2,c_2}^2 n^1}{(1+r)\left(MRS_{g_2,c_2}^1 - M\hat{R}S_{g_2,c_2}^2\right)}\right)\frac{1}{1+\rho/(1+r)} - n^1\frac{1+\alpha/(1+r)}{1+\rho/(1+r)}. \quad (12)$$

Note that equation (12) is not a reduced form; the within-period marginal rates of substitution between the public good and private consumption depend on the degrees of habituation. It shows, instead, how the formula for the shadow price changes due to habituation and – in the context of equation (11a) – also how the policy rule for public good provision is modified when the consumers habituate in private and public consumption.

To interpret equation (11a) in the light of equation (12), suppose that $\alpha = \rho$, which is the condition on which Corollary 2 is based, and $\lambda_1^{**} > 0$. In this case, if $MRS_{g_1,c_1}^1 - M\hat{R}S_{g_1,c_1}^2 > 0$ (< 0), equations (11a) and (12) suggest that habituation modifies the policy rule in the sense of counteracting the incentive to relax the self-selection constraint through over-provision (under-provision) of the public good relative to the first best Samuelson condition. The intuition is that habit formation in public consumption – by reducing the total marginal willingness to pay for public goods – makes public good provision a less useful instrument to relax the self-selection constraint, *ceteris paribus*. Yet, it is important to emphasize that this comparison refers to policy rules; not levels of the public good. Our concern is to compare the policy rule under habituation with the second best efficient policy rule for public provision in a model without any habit formation. As explained above, we cannot in general say anything about levels, since the within-period marginal rates of substitution between the public good and private consumption are also affected by habit formation.

4. Summary and Discussion

This paper analyzes the implications of habit formation in private and public consumption for the Pareto efficient provision of public goods. The purpose is to examine whether, and how, habit formation affects the incentives underlying public good provision. We examine two versions of the model: one in which the public good is fixed over time (with an interpretation in terms of a state-variable) and the other where the government directly decides on the supply of the public good in each period (with the interpretation in terms of a flow-variable). We also distinguish between a first best resource allocation and a second best allocation where information asymmetries prevent the government from reaching the first best.

The take home message of the paper is summarized as follows. In general, habituation in public consumption leads to under-provision and habituation in private consumption to over-provision of the public good relative to the Samuelson condition (or second best analogue to the Samuelson condition). This holds irrespective of whether the public good is fixed or varies over the periods. An interesting special case arises when the degrees of habituation in private and public consumption are the same, in which the two versions of the model give quite different results. First, with a variable public good supply, the first best policy rule will in this case coincide with the standard Samuelson condition, i.e., the same condition as in the absence of any habit formation. The intuition is that the direct effects of habituation on the policy rule for public good provision will cancel out in this special case. However, if individual productivity is private information (meaning that the government is unable to raise revenue through type-specific lump-sum taxes), this special case implies a minor deviation from the standard policy rule for a flow-variable public good, since habituation also affects the incentives for the government to relax the self-selection constraint through public good provision. Second, with a time-invariant public good supply, the special case with equal degrees of habituation in private and public consumption does not in general imply that standard policy rules for public good provision surface. As we saw above, the first best policy rule for this special case typically means under-provision relative to the standard Samuelson condition.

Several extensions of the analysis carried out above are interesting for future research. One would be to extend the analysis to models where consumers are heterogeneous in terms of habit formation. Insights from behavioral economics also indicate that it might be fruitful to examine whether public good provision is a useful policy tool through which the government can correct for behavioral mistakes such as myopic habits.[7] Both these issues are clearly worth papers of their own, and we hope to address them in future research.

Appendix I: Time-Invariant Supply of Public Goods

The Lagrangean corresponding to the social decision-problem is given by

$$\begin{aligned} L &= U\left(c^1, \ell^1, x^1 - \alpha c^1, g, g(1-\rho)\right) + \mu\left[U\left(c^2, \ell^2, x^2 - \alpha c^2, g, g(1-\rho)\right) - \bar{U}^2\right] \\ &+ \lambda\left[U\left(c^2, \ell^2, x^2 - \alpha c^2, g, g(1-\rho)\right) - U\left(c^1, 1 - \frac{w^1}{w^2} l^1, x^1 - \alpha c^1, g, g(1-\rho)\right)\right]. \\ &+ \gamma\left[\sum_i n^i w^i l^i - \sum_i n^i c^i - \sum_i \frac{n^i x^i}{1+r} - g\right] \end{aligned}$$

By using the short notations $c_1^i = c^i$, $c_2^i = x^i - \alpha c^i$ (i=1,2), $g_1 = g$, and $g_2 = g(1-\rho)$, the social first order conditions for private and public consumption can be written as

$$\frac{\partial L}{\partial c^1} = U_{c_1}^1 - \alpha U_{c_2}^1 - \lambda(\hat{U}_{c_1}^2 - \alpha \hat{U}_{c_2}^2) - \gamma n^1 = 0 \tag{A1}$$

$$\frac{\partial L}{\partial x^1} = U_{c_2}^1 - \lambda \hat{U}_{c_2}^2 - \frac{\gamma n^1}{1+r} = 0 \tag{A2}$$

$$\frac{\partial L}{\partial c^2} = (\mu + \lambda)(U_{c_1}^2 - \alpha U_{c_2}^2) - \gamma n^2 = 0 \tag{A3}$$

$$\frac{\partial L}{\partial x^2} = (\mu + \lambda) U_{c_2}^2 - \frac{\gamma n^2}{1+r} = 0 \tag{A4}$$

$$\frac{\partial L}{\partial g} = U_{g_1}^1 + U_{g_2}^1(1-\rho) + (\mu+\lambda)[U_{g_1}^2 + U_{g_2}^2(1-\rho)] - \lambda[\hat{U}_{g_1}^2 + \hat{U}_{g_2}^2(1-\rho)] - \gamma = 0 \tag{A5}$$

where subscripts attached to the utility function denote partial derivatives, i.e., $U_{c_1}^i = \partial U^i / \partial c_1^i$, $U_{c_2}^i = \partial U^i / \partial c_2^i$, $U_{g_1}^i = \partial U^i / \partial g_1$, and $U_{g_2}^i = \partial U^i / \partial g_2$ for i=1,2.

Proof of Proposition 1

By using equations (A1) – (A4), equation (A5) can be written as

$$\begin{aligned} &\frac{U_{g_1}^1}{U_{c_1}^1}\left[\alpha U_{c_2}^1 + \lambda(\hat{U}_{c_1}^2 - \alpha \hat{U}_{c_2}^2) + \gamma n^1\right] + \frac{U_{g_2}^1(1-\rho)}{U_{c_2}^1}\left[\lambda \hat{U}_{c_2}^2 + \frac{\gamma n^1}{1+r}\right] \\ &\frac{U_{g_1}^2}{U_{c_1}^2 - \alpha U_{c_2}^2}\gamma n^2 + \frac{U_{g_2}^2(1-\rho)}{U_{c_2}^2}\frac{\gamma n^2}{1+r} - \lambda[\hat{U}_{g_1}^2 + \hat{U}_{g_2}^2(1-\rho)] - \gamma = 0. \end{aligned} \tag{A6}$$

Rearranging equation (A6), and rewriting the first term in the second row, gives

[7] The implications of myopic habits for optimal income taxation have been examined in different contexts by Tuomala and Tenhunen (2013) and Aronsson and Schöb (forthcoming).

$$\begin{aligned}
&\frac{U^1_{g_1}}{U^1_{c_1}}\gamma n^1+\frac{U^1_{g_1}}{U^1_{c_1}}\alpha\left[U^1_{c_2}-\lambda\hat{U}^2_{c_2}\right]+\frac{U^1_{g_2}(1-\rho)}{U^1_{c_2}}\frac{\gamma n^1}{1+r}\\
&+\frac{U^2_{g_1}}{U^2_{c_1}}\frac{U^2_{c_1}}{U^2_{c_1}-\alpha U^2_{c_2}}\gamma n^2+\frac{U^2_{g_2}(1-\rho)}{U^2_{c_2}}\frac{\gamma n^2}{1+r}\\
&+\lambda\hat{U}^2_{c_1}\left[\frac{U^1_{g_1}}{U^1_{c_1}}-\frac{\hat{U}^2_{g_1}}{\hat{U}^2_{c_1}}\right]+\lambda\hat{U}^2_{c_2}\left[\frac{U^1_{g_2}}{U^1_{c_2}}-\frac{\hat{U}^2_{g_2}}{\hat{U}^2_{c_2}}\right](1-\rho)-\gamma=0.
\end{aligned}\tag{A7}$$

Equation (A2) implies

$$U^1_{c_2}-\lambda\hat{U}^2_{c_2}=\frac{\gamma n^1}{1+r}.\tag{A8}$$

Similarly, combining equations (A3) and (A4) gives

$$\frac{U^2_{c_1}}{U^2_{c_1}-\alpha U^2_{c_2}}=\frac{(1+r)U^2_{c_2}+\alpha U^2_{c_2}}{(1+r)U^2_{c_2}}=1+\frac{\alpha}{1+r}.\tag{A9}$$

Substituting equations (A8) and (A9) into equation (A7) gives

$$\begin{aligned}
&\frac{U^1_{g_1}}{U^1_{c_1}}\left[1+\frac{\alpha}{1+r}\right]\gamma n^1+\frac{U^1_{g_2}(1-\rho)}{U^1_{c_2}}\frac{\gamma n^1}{1+r}\\
&+\frac{U^2_{g_1}}{U^2_{c_1}}\left[1+\frac{\alpha}{1+r}\right]\gamma n^2+\frac{U^2_{g_2}(1-\rho)}{U^2_{c_2}}\frac{\gamma n^2}{1+r}\\
&+\lambda\hat{U}^2_{c_1}\left[\frac{U^1_{g_1}}{U^1_{c_1}}-\frac{\hat{U}^2_{g_1}}{\hat{U}^2_{c_1}}\right]+\lambda\hat{U}^2_{c_2}\left[\frac{U^1_{g_2}}{U^1_{c_2}}-\frac{\hat{U}^2_{g_2}}{\hat{U}^2_{c_2}}\right](1-\rho)-\gamma=0
\end{aligned}\quad .\tag{A10}$$

which is equation (4) in Proposition 1.■

Appendix II: Variable Public Good Supply

The Lagrangean is given by

$$\begin{aligned}
L=&\,U\left(c^1,\ell^1,x^1-\alpha c^1,g,G-\rho g\right)+\mu\left[U\left(c^2,\ell^2,x^2-\alpha c^2,g,G-\rho g\right)-\bar{U}^2\right]\\
&+\lambda\left[U\left(c^2,\ell^2,x^2-\alpha c^2,g,G-\rho g\right)-U\left(c^1,1-\frac{w^1}{w^2}l^1,x^1-\alpha c^1,g,G-\rho g\right)\right].\\
&+\gamma\left[\sum_i n^i w^i l^i-\sum_i n^i c^i-\sum_i\frac{n^i x^i}{1+r}-g-\frac{G}{1+r}\right]
\end{aligned}$$

The social first order conditions for c^i and x^i (i=1,2) remain as in equations (A1) – (A4), while the social first order conditions for g and G can be written as

$$\frac{\partial L}{\partial g}=U^1_{g_1}-\rho U^1_{g_2}+\mu\left[U^2_{g_1}-\rho U^2_{g_2}\right]+\lambda\left[U^2_{g_1}-\rho U^2_{g_2}-\left(\hat{U}^2_{g_1}-\rho\hat{U}^2_{g_2}\right)\right]-\gamma=0\tag{A11}$$

$$\frac{\partial L}{\partial G}=U^1_{g_2}+\mu U^2_{g_2}+\lambda\left[U^2_{g_2}-\hat{U}^2_{g_2}\right]-\frac{\gamma}{1+r}=0\tag{A12}$$

where we have used the short notation $g_1 = g$ and $g_2 = G - \rho g$.

Proof of Proposition 2

Starting with the policy rule for the second period provision, *G*, we can substitute equations (A2) and (A4) into equation (A12) to derive

$$\frac{U_{g_2}^1}{U_{c_2}^1}\left[\lambda \hat{U}_{c_2}^2 + \frac{\gamma n^1}{1+r}\right] + \frac{U_{g_2}^2}{U_{c_2}^2}\frac{\gamma n^2}{1+r} - \lambda \hat{U}_{g_2}^2 - \frac{\gamma}{1+r} = 0. \tag{A13}$$

Rearrangements give

$$\frac{U_{g_2}^1}{U_{c_2}^1}\frac{\gamma n^1}{1+r} + \frac{U_{g_2}^2}{U_{c_2}^2}\frac{\gamma n^2}{1+r} - \lambda \hat{U}_{c_2}^2\left[\frac{U_{g_2}^1}{U_{c_2}^1} - \frac{\hat{U}_{g_2}^2}{\hat{U}_{c_2}^2}\right] - \frac{\gamma}{1+r} = 0, \tag{A14}$$

which is equivalent to equation (10b) in Proposition 2. Turning to the optimal provision in the first period, *g*, note first that equation (A12) implies

$$\rho U_{g_2}^1 + \rho\mu U_{g_2}^2 + \rho\lambda\left[U_{g_2}^2 - \hat{U}_{g_2}^2\right] = \frac{\rho\gamma}{1+r} = 0.$$

Substituting into equation (A11) gives

$$U_{g_2}^1 + \mu U_{g_1}^2 + \lambda\left[U_{g_1}^2 - \hat{U}_{g_1}^2\right] - \gamma\left(1 + \frac{\rho}{1+r}\right) = 0. \tag{A15}$$

By using equations (A1) and (A3), equation (A15) can be rewritten as

$$\frac{U_{g_1}^1}{U_{c_1}^1}\left[\alpha U_{c_2}^1 + \lambda(\hat{U}_{c_1}^2 - \alpha \hat{U}_{c_2}^2) + \gamma n^1\right] + \frac{U_{g_1}^2}{U_{c_1}^2 - \alpha U_{c_2}^2}\gamma n^2 - \lambda \hat{U}_{g_1}^2 - \gamma\left(1 + \frac{\rho}{1+r}\right) = 0. \tag{A16}$$

Rearranging equation (A16) gives

$$\begin{aligned}&\frac{U_{g_1}^1}{U_{c_1}^1}\gamma n^1 + \frac{U_{g_1}^1}{U_{c_1}^1}\alpha\left[U_{c_2}^1 - \lambda \hat{U}_{c_2}^2\right] + \frac{U_{g_1}^2}{U_{c_1}^2}\frac{U_{c_1}^2}{U_{c_1}^2 - \alpha U_{c_2}^2}\gamma n^2 \\ &+ \lambda \hat{U}_{c_1}^2\left[\frac{U_{g_1}^1}{U_{c_1}^1} - \frac{\hat{U}_{g_1}^2}{\hat{U}_{c_1}^2}\right] - \gamma\left(1 + \frac{\rho}{1+r}\right) = 0.\end{aligned} \tag{A17}$$

Finally, using equations (A8) and (A9) in equation (A17) gives equation (10a) in Proposition 2.■

References

Aronsson, Thomas and Ronnie Schöb (forthcoming) “Consumption Adaptation, Anticipation-Bias and Optimal Income Taxation”, *Journal of Public Economic Theory.*

Atkinson, Anthony B., and Nicholas H. Stern (1974): “Pigou, taxation and public goods”, *The Review of Economic Studies* 41, 119-128.

Boadway, Robin and Michael Keen (1993): “Public Goods, Self-Selection and Optimal Income Taxation”, *International Economic Review* 34, 463–478.

Clark, Andrew E. (1999): “Are wages habit-forming? Evidence from micro data”, *Journal of Economic Behavior and Organization* 39, 179-200.

Clark, Andrew E., Paul Frijters, and Michael A. Shields (2008): “Relative income, happiness, and utility: An explanation for the Easterlin paradox and other puzzles”, *Journal of Economic Literature* 46, 95-144.

Diener, Ed, Richard E. Lucas, Ulrich Schimmack, and John F. Helliwell (2009): *Well-Being for Public Policy*, Oxford: Oxford University Press.

Dunn, Elizabeth W.; Daniel T. Gilbert and Timothy D. Wilson (2011): “If money doesn’t make you happy, then you probably aren’t spending it right”, *Journal of Consumer Psychology* 21, 115-125.

Fuhrer, Jeffrey, C. (2000) “Habit formation in consumption and its implications for monetary-policy models”, *American Economic Review* 90, 367-390.

Gaube, Thomas (2000): “When do distortionary taxes reduce the optimal supply of public goods?” *Journal of Public Economics* 76, 151-180.

Guo, Jang-Ting and Alan Krause (2011): “Optimal nonlinear taxation with habit formation” *Journal of Public Economic Theory* 13, 463–480.

Koehne, Sebastian and Moritz Kuhn (2014): “Optimal taxation in a habit formation economy” *Journal of Public Economics* 122, 31-39.

Levinson, Arik (2013): *Happiness, behavioral economics, and public policy*, NBER Working Paper No. 19329.

Lucas, Richard E. (2007): “Adaptation and the set-point model of subjective well-being - Does happiness change after major life events?” *Current Directions in Psychological Science* 16(2), 75-79.

Luhmann, Maike, Wilhelm Hofmann, Michael Eid and Richard E. Lucas (2012): “Subjective well-being and adaptation to life events: A meta-analysis”, *Journal of Personality and Social Psychology* 102, 592-615.

Pollak, Robert A. (1970): “Habit Formation and Dynamic Demand Functions”, *Journal of Political Economy* 78, 745-763.

Schkade, David A. and Daniel Kahneman (1998): “Does living in California make people happy? A focusing illusion in judgments of life satisfaction”, *Psychological Science* 9, 340–346.

Tuomala, Matti and Sanna Tenhunen (2013): “On the Design of Optimal Non-linear Tax/Pension Systems with Habit Formation”, *International Tax and Public Finance* 20, 485-512.

Weimann, Joachim, Andreas Knabe and Ronnie Schöb (2015): *Measuring Happiness. The Economics of Happiness*, Cambridge: MIT Press.

Woittiez, Isolde and Arie Kapteyn (1998): “Social interaction and habit formation in a model of female labor supply”, *Journal of Public Economics* 70, 185-205.

Diskussionsbeiträge - Fachbereich Wirtschaftswissenschaft - Freie Universität Berlin
Discussion Paper - School of Business and Economics - Freie Universität Berlin

2016 erschienen:

2016/1	BARTELS, Charlotte und Maximilian STOCKHAUSEN Children's opportunities in Germany – An application using multidimensional measures *Economics*
2016/2	BÖNKE, Timm; Daniel KEMPTNER und Holger LÜTHEN Effectiveness of early retirement disincentives: individual welfare, distributional and fiscal implications *Economics*
2016/3	NEIDHÖFER, Guido Intergenerational Mobility and the Rise and Fall of Inequality: Lessons from Latin America *Economics*
2016/4	TIEFENSEE, Anita und Christian WESTERMEIER Intergenerational transfers and wealth in the Euro-area: The relevance of inheritances and gifts in absolute and relative terms *Economics*
2016/5	BALDERMANN, Claudia; Nicola SALVATI und Timo SCHMID Robust small area estimation under spatial non-stationarity *Economics*
2016/6	GÖRLITZ, Katja und Marcus TAMM Information, financial aid and training participation: Evidence from a randomized field experiment *Economics*
2016/7	JÄGER, Jannik und Theocharis GRIGORIADIS Soft Budget Constraints, European Central Banking and the Financial Crisis *Economics*
2016/8	SCHREIBER, Sven und Miriam BEBLO Leisure and Housing Consumption after Retirement: New Evidence on the Life-Cycle Hypothesis *Economics*
2016/9	SCHMID, Timo; Fabian BRUCKSCHEN; Nicola SALVATI und Till ZBIRANSKI Constructing socio-demographic indicators for National Statistical Institutes using mobile phone data: estimating literacy rates in Senegal *Economics*

2016/10 JESSEN, Robin; ROSTAM-AFSCHAR, Davud und Sebastian SCHMITZ
How Important is Precautionary Labor Supply?
Economics

2016/11 BIER, Solveig; Martin GERSCH, Lauri WESSEL, Robert TOLKSDORF und Nina KNOLL
Elektronische Forschungsplattformen (EFP) für Verbundprojekte: Bedarfs-, Angebots- und Erfahrungsanalyse
Wirtschaftsinformatik

2016/12 WEIDENHAMMER, Beate; Timo SCHMID, Nicola SALVATI und Nikos TZAVIDIS
A Unit-level Quantile Nested Error Regression Model for Domain Prediction with Continuous and Discrete Outcomes
Economics

2016/13 TZAVIDIS, Nikos; Li-Chun ZHANG, Angela LUNA HERNANDEZ, Timo SCHMID, Natalia ROJAS-PERILLA
From start to finish: a framework for the production of small area official statistics
Economics

2016/14 GASTEIGER, Emanuel
Do Heterogeneous Expectations Constitute a Challenge for Policy Interaction?
Economics

2016/15 HETSCHKO, Clemens; Ronnie SCHÖB und Tobias WOLF
Income Support, (Un-)Employment and Well-Being
Economics

2016/16 KÖNIG, Johannes und Carsten SCHRÖDER
Inequality-Minimization with a Given Public Budget
Economics

2016/17 ENGLER, Philipp und Juha TERVALA
Welfare Effects of TTIP in a DSGE Model
Economics

2016/18 BREYEL, Corinna und Theocharis GRIGORIADIS
Foreign Agents? Natural Resources & the Political Economy of Civil Society
Economics

2016/19 MÁRQUEZ-VELÁZQUEZ, Alejandro
Growth Impacts of the Exchange Rate and Technology
Economics

2016/20 DULLIEN, Sebastian; Barbara FRITZ, Laurissa MÜHLICH
The IMF to the Rescue: Did the Euro Area benefit from the Fund's Experience in Crisis fighting?
Economics

2016/21 WESTERMEIER, Christian
Estimating Top Wealth Shares Using Survey: Data-An Empiricist's Guide
Economics

2016/22 NEIDHÖFER, Guido und Maximilian STOCKHAUSEN
Dynastic Inequality Compared: Multigenerational Mobility in the US, the UK, and Germany
Economics

2016/23 ENGLER, Philipp und Wolfgang STREHL
The Macroeconomic Effects of Progressive Taxes and Welfare
Economics

2016/24 JESSEN, Robin
Why has Income Inequality in Germany Increased from 2002 to 2011?: A Behavioral Microsimulation Decomposition
Economics

2016/25 NACHTIGALL. Daniel
Climate policy under firm relocation: The implications of phasing out free allowances
Economics

2016/26 BÖNKE, Timm; Marten v. WERDER und Christian WESTERMEIER
How Inheritances Shape Wealth Distributions: An International Comparison
Economics