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Sören Blomquist[†], Vidar Christiansen[‡]and Luca Micheletto[§]

Abstract

Several contributions in the optimal taxation literature have emphasized that, when individuals' preferences are not separable between leisure and other goods, it is desirable to supplement a nonlinear income tax with public provision of private goods. Moreover, it has also been shown that the choice between a topping-up and an opting-out scheme depends on whether the publicly provided good is a complement or substitute with leisure, with opting-out (topping-up) being the preferred scheme for goods which are substitutes (complements) for labor. In this paper, using the self-selection approach to tax analysis, we revisit these results in the presence of tax avoidance, and investigate how public provision interacts with the agents' incentives to engage in tax avoidance. Three results are obtained. First, we show that tax dodging opportunities imply that non-separability between labor and other goods is neither a necessary nor a sufficient condition to make public provision of private goods a welfare-enhancing policy instrument. Second, we show how tax dodging opportunities limit the scope for using topping-up provision schemes as a redistributive device. Finally, we show that, for most of the public provision schemes previously analyzed in the literature, being a welfare-enhancing policy instrument goes hand in hand with weakening the agents' incentives to shelter income from the tax authority. However, we also point out an important exception to this pattern.

Keywords: optimal nonlinear income tax; public provision of private goods; tax avoidance.

JEL Classification: H21, H26, H42

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1 Introduction

In the past couple of decades several contributions in the literature on optimal redistributive taxation have emphasized that one can get a Pareto-improvement by supplementing the income tax with public provision of private goods.[1] The intuition for the argument is straightforward. Suppose that the economy is populated by high- and low-skilled agents and that a government tries to redistribute from the former to the latter through a general income tax. Under the assumption that the government cannot observe "who is who", a high-skilled agent might be tempted to make himself eligible for the tax treatment intended for the low-skilled agents by earning the same pre-tax income as a low-skilled agent. Since a high-skilled agent is paid a higher wage rate than a low-skilled, such mimicking requires that the labor supply of the former falls short of the labor supply of the latter. Thus, if part of the transfer to the low-skilled agents is paid in-kind through the public provision of private goods, yielding benefits depending on labor supply, the incentives for high-skilled agents to behave opportunistically might be weakened. This in turn opens the way for the government to achieve a Pareto improvement and possibly a higher degree of redistribution.

Necessary conditions for the above result require that the private goods candidate for public provision are not (weakly) separable from labor in the agents' utility function and, once provided to an agent, cannot be resold to others. Albeit the mechanism underlying the desirability of public provision applies both to goods that are complementary with labor and goods that are complementary with leisure, the type of public provision scheme that is warranted in the two cases is different. In particular, topping-up (opting-out) schemes have been shown to be preferable for goods that are complementary with labor (leisure).[2]

In this paper, we reconsider the redistributive effects of public provision in a setting where agents can engage in tax avoidance. In doing so, we mainly focus on the provision of goods which are complements with labor. The reason is that the primary examples

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[1] See, e.g., Blomquist and Christiansen (1995), Boadway and Marchand (1995), Cremer and Gahvari (1997) and Pirttilä and Tuomala (2002).

[2] See Blomquist and Christiansen (1998).

of private goods that are publicly provided in real economies, like day care services or elderly care services, consist of goods which can be characterized as being complements with labor. Two main results are obtained. The first is that tax dodging opportunities imply that non-separability between labor and other goods is neither a necessary nor a sufficient condition to make public provision of private goods a welfare-enhancing policy instrument. The second result is that the availability of avoidance opportunities tends to erode the case for topping-up public provision schemes. This might help explaining a discrepancy between the theory and practice of public provision of private goods. In fact, despite that many important publicly provided goods are complements with labor, actual provision schemes often appear to be intentionally designed to limit the opportunities to supplement.

Finally, we investigate how public provision interacts with the agents' incentives to engage in tax avoidance and show that, for most of the public provision schemes which have been proposed in the literature, being a welfare-enhancing policy instrument goes hand in hand with weakening the agents' incentives to shelter income from the tax authority.

The plan of the paper is the following. In section 2 we analyze public provision private goods in a simple nonlinear tax model where agents have access to a common avoidance technology but are heterogeneous in terms of abilities. In section 3 we study how public provision of private goods interacts with the agents' avoidance decision. In section 4 we extend our model to a bi-dimensional setting where agents differ both in terms of ability and in terms of opportunities to engage in tax avoidance. Section 5 offers concluding remarks.

2   The Model

The economy has two types of agents distinguished by their (innate) earnings capacity. The difference in ability (output per unit of work effort) is reflected in the difference in wage rates (w). The wage rate of an agent of type k ($k = 1, 2$) is denoted w^k. The total population is normalized to unity and π^k represents the proportion of agents of type k in the population. Two goods (X_1 and X_2) are produced by a linear technology using labor

as the only input; units are chosen to make all producer prices equal to 1.[3] Preferences are represented by the quasi-concave utility function $u(x_1, x_2, h)$, where x_i denotes the consumption of commodity i and h denotes labor supply. All goods (including leisure) are assumed to be normal. Moreover, good one cannot be resold and is therefore a potential candidate for public provision.

The government aims at redistributing from those who are better off in the *laissez faire* equilibrium to those who are worse off. The informational structure of the problem is the following. The government knows the distribution of types in the population but it does not know the identity of the types. Therefore, type-specific lump-sum taxes are ruled out by assumption. The usual asymmetric information assumption is that the government can observe gross income, wh, but it cannot observe separately w and h. In our model, however, given that we allow for the possibility of tax avoidance, not even gross income is observable. The government has to rely on reported income, denoted by M, and has at its disposal a general income tax $T(M)$. To model income-misreporting, we follow the riskless approach introduced by Usher (1986) and used in a number of subsequent contributions.[4] Specifically, once agents have incurred a given cost, misreporting is done at no risk of detection in the case of (illegal) evasion. Misreporting is denoted by a defined by $a \equiv wh - M$. In principle, both under-reporting (positive a) and over-reporting (negative a) are conceivable depending on the shape of the tax schedule.[5] However, one can show that over-reporting never occurs in equilibrium. Thus, we can neglect negative values of a. The cost of misreporting is expressed by means of the function $g(a)$. For simplicity, not realism, we assume that the g-function is non-negative, increasing and strictly convex; we also assume that $g(0) = g'(0) = 0$.

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[3] The assumption of two commodities is made to keep notation simple. The model can easily be generalized to $N > 2$ commodities.

[4] See e.g. Mayshar (1991), Boadway et al. (1994), Kopczuk (2001), Slemrod (2001) and Chetty (2009).

[5] Over-reporting is an optimal strategy when an agent faces a negative marginal income tax rate. Over-reporting entails in this case a rise in income transfer.

2.1 A pure income tax optimum

The problem of choosing the income tax schedule can be stated as the problem of selecting two pairs of reported income and net-of-tax reported income (M^k, B^k), where by definition $B^k = M^k - T(M^k)$, $k = 1, 2$.[6] The government's problem is to design a Pareto-efficient tax arrangement, whereby the policy variables are chosen so as to maximize the utility of a given type of agents, subject to the other type's utility being fixed at a pre-set level, and subject to self-selection and revenue constraints. The self-selection constraints arise since the government must design the tax system so that each ability type (weakly) prefers the (M, B)-bundle intended for him/her to that intended for the other type. An agent that misrepresents his type is called a mimicker.

Before formalizing the government's problem, we address the optimization problem solved by the agents. It is helpful to divide this problem into three stages. In the first stage, for given values of labor supply, reported income and tax, the agent chooses the consumption bundle, i.e. chooses the amount of x_i. In the second stage the agent chooses labor supply conditional on how much income to report and the corresponding tax. Finally, in the third stage, the agent determines how much income to report. To consider the first stage, define $Z = wh - M + B - g(wh - M)$, i.e. the disposable income available for consumption after tax and net of sheltering cost. Write the utility function as $u(x_1, Z - x_1, h)$. Maximizing u with respect to x_1 yields the conditional demand function $x_1(Z, h)$ and the utility level can be expressed as $u(x_1(Z, h), Z - x_1(Z, h), h) = v(Z, h)$. Maximizing $v(Z, h) = v(wh - M + B - g(wh - M), h)$ with respect to h in the second stage, yields the first order condition:[7]

$$\frac{dv}{dh} = \frac{\partial v}{\partial Z} w(1 - g') + \frac{\partial v}{\partial h} = 0, \tag{1}$$

and the second order condition $d^2v/dh^2 < 0$.

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[6] Note that the term "disposable income" will be reserved for the income available for purchasing the two goods as defined below.

[7] Notice that, since M and B are exogenously given in the second stage, in this stage there is "full avoidance at the margin", namely $(da/dh)_{dM=0} = w$.

The first order condition implies that h becomes a function $h(M, B; w)$. This gives the indirect conditional utility function $V(M, B; w)$. In the final stage the level of reported income is chosen maximizing $V(M, B; w)$ subject to the link between M and B implied by the income tax schedule: $B = M - T(M)$. This allows us to implicitly define the marginal income tax rate faced by an agent as:

$$T'(M) = 1 + \frac{\partial V/\partial M}{\partial V/\partial B} = 1 - MRS_{MB}, \tag{2}$$

where MRS_{MB} denotes the marginal rate of substitution between M and B.

Notice also that, by invoking the envelope theorem, we have $\partial V/\partial M = -(1 - g')\,\partial u/\partial x_2$ and $\partial V/\partial B = \partial u/\partial x_2$. Therefore, we also have:

$$1 + \frac{\partial V/\partial M}{\partial V/\partial B} = g', \tag{3}$$

implying:

$$T'(M) = g'(a).^{8} \tag{4}$$

Using $V^k(M, B)$ to denote $V(M, B; w^k)$, the government's problem can be stated as:

$$\max_{M^1, B^1, M^2, B^2} V^1(M^1, B^1)$$

subject to:

$$V^2(M^2, B^2) \geq \overline{V}^2 \qquad (\delta)$$

$$V^2(M^2, B^2) \geq V^2(M^1, B^1) \qquad (\lambda)$$

$$\sum_{k=1}^{2} (M^k - B^k)\pi^k \geq R, \qquad (\mu)$$

where Lagrange multipliers are within parentheses, the first constraint requires a minimum utility for the high-skilled agents, the second is the self-selection constraint preventing high-skilled agents from finding it in their self interest to mimic the low-skilled agents,

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[8] Both (3) and (4) crucially hinge on our assumptions about the cost of avoidance function, and in particular on the assumption that $g(0) = g'(0) = 0$.

and the last constraint is the government's budget constraint, with R being an exogenous revenue requirement.[9]

Using a "hat" to denote a variable pertaining to a mimicker, standard manipulations of the first order conditions of the government's problem allow deriving the following results:

$$1 + \frac{\partial V^2/\partial M^2}{\partial V^2/\partial B^2} = 0; \tag{5}$$

$$1 + \frac{\partial V^1/\partial M^1}{\partial V^1/\partial B^1} = \frac{\lambda \partial \widehat{V}/\partial B^1}{\mu \pi^1} \left(\frac{\partial \widehat{V}/\partial M^1}{\partial \widehat{V}/\partial B^1} - \frac{\partial V^1/\partial M^1}{\partial V^1/\partial B^1} \right). \tag{6}$$

Using (2) and (5) implies the standard result that the marginal tax rate faced by the high-skilled agents is equal to zero. By (4) this also means that $g'\left(a^2\right) = 0$, and accordingly $a^2 = 0$. Thus, the high-skilled agents truthfully report their earned income.[10]

The usual monotonicity property guarantees that the indifference curve of a high-skilled mimicker is flatter than the corresponding curve for a true low-skilled agent. Therefore, the term within brackets in (6) is positive;[11] invoking (2), we can conclude that (6) implies a positive marginal tax rate for the low-skilled agents. By (4), this also means that $g'\left(a^1\right) > 0$, namely $a^1 > 0$. Thus, the low-skilled agents under-report part of their earned income.

2.2 Supplementing the income tax with public provision

Previous contributions analyzing the desirability of in-kind transfers in nonlinear income taxation models have disregarded the possibility that agents misreport their earned income to the tax authority. In such a setting it has been shown how, when the publicly provided ration cannot be resold and agents' preferences are not (weakly) separable between labor

[9] The other self-selection constraint can be safely neglected due to the assumption that the government redistributes from the high-skilled- to the low-skilled agents.

[10] This result deserves some comments since its relevance might easily be misperceived. The result descends from the fact that it is optimal not to distort the bundle offered to the most skilled agents, since nobody is tempted to mimic them. Since in our simple setting we have only two types of agents, we also get that high-skilled agents truthfully report their earned income. However, in a richer setting with several types of agents, or in a model with a continuum of types, the no-distortion no-avoidance result would only apply to a tiny fraction of the population. Its role would then appear more modest that in the two type model where all high-skilled individuals are by assumption at the very top of the skill distribution.

[11] We provide below a formal proof of the fact that the monotonicity property is satisfied in our model.

and other goods, in-kind transfers represent a welfare-enhancing policy instrument.[12] It has also been shown that the optimal provision scheme is of an opting-out type when the publicly provided good is a complement with leisure, whereas topping-up schemes ought to be preferred for goods which are complements with labor.[13]

However, with respect to this normative result, there seems to be a discrepancy between the theory and practice of public provision of private goods. In fact, even though the bulk of the goods which are publicly provided in real economies can be regarded as being complements with labor, actual provision schemes often appear to be intentionally designed to limit the opportunities to supplement. As we will clarify below, allowing for the possibility of tax avoidance can help reconciling the theoretical prescriptions with the practice of public provision. In particular, once dodging opportunities are accounted for, a preference for schemes which limit the opportunities to supplement can be justified on purely normative grounds.

To show this, assume that good one is a complement with labor and that the government is contemplating to use public provision of good one as an additional policy instrument on top of the nonlinear income tax. Assume also that the public provision scheme is of the topping-up type, with the publicly provided ration denoted by $\overline{x}_1$ and its user charge taken to be one, namely the market price of good one.[14] In a model without tax avoidance such a public provision scheme would certainly be Pareto-improving upon a pure income tax optimum. The intuition for the result is as follows. In the absence of tax avoidance, a mimicker and a true low skilled agent get the same disposable income; the only difference between them is that the mimicker, earning a higher wage rate, works less. Thus, unless preferences are separable between labor and other goods, a mimicker and a true low skilled agent will spend the same disposable income in different ways. In particular, a mimicker will consume a lower amount of complementary-to-labor goods than a

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[12] See footnote 1.

[13] See Blomquist and Christiansen (1998). The distinction between the two types of schemes hinges on the possibility for agents to supplement the publicly provided ration with private purchases in the market. Topping-up schemes allow for this possibility whereas with opting-out schemes an individual must either accept the provided quantity or opt out and buy the desired quantity in the market.

[14] The charge can be chosen arbitrarily since the nonlinear income tax can always accommodate it as long as the ration is compulsory. This follows because a charge for a compulsory ration is simply a poll tax.

low-skilled. If the government starts publicly providing a good which is complementary to labor, a mimicker would be the agent whose individual purchase of the publicly provided good will first be fully crowded out. As long as the government sets a level of the ration which is lower than or equal to the amount of the good consumed by a mimicker in the absence of public provision, the welfare effect of the in-kind transfer is nil. If, however, the level of the ration is raised slightly above this threshold, a mimicker is made worse off while all other agents are unaffected, since for them the ration is infra-marginal.[15] This means that the self-selection constraint is relaxed; therefore, the government can implement a Pareto-improving reform.

From the reasoning above, it is clear that the key for the desirability of the topping-up provision scheme is the fact that a mimicker works less than a low-skilled, whereas they are identical in terms of disposable income. However, as we will now illustrate, both circumstances are challenged by the introduction of tax avoidance. In fact, on one hand tax avoidance implies that the mimicker's disposable income is larger than that of a low-skilled agent. On the other hand, it also implies that his labor supply might be higher too.

Consider first the disposable income $Z = wh - M + B - g(wh - M)$. Since mimicking means reporting the same M, a mimicker would have a (weakly) smaller disposable income than the low-skilled type ($\widehat{Z} \leq Z^1$) if and only if he had (weakly) smaller true earnings: $w^2 \widehat{h} \leq w^1 h^1$, which requires that $\widehat{h} < h^1$. A further implication would be that a mimicker would under-report a (weakly) smaller amount ($\widehat{a} \leq a^1$).[16] Denote by m the marginal rate of substitution between consumption Z and leisure, defined as:

$$m(Z, h) = -\frac{\partial v(Z, h)}{\partial h} \bigg/ \frac{\partial v(Z, h)}{\partial Z}.$$

Where (material) consumption and leisure are both normal goods, $\partial m(Z, h)/\partial Z > 0$ and $\partial m(Z, h)/\partial h > 0$. It then follows from the inequalities above that where a mimicker has the smaller disposable income, $\widehat{m} < m^1$, and accordingly $\widehat{m}/w^2 < m^1/w^1$. However,

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[15] Notice that a high-skilled non-mimicker has necessarily a larger disposable income and a larger labor supply than a mimicker. Thus, a high-skilled non-mimicker will consume more than a mimicker of all normal goods that are complementary with labor.

[16] Or over-report a (weakly) larger amount.

this finding contradicts the assumption that agents are optimizing. In fact, from the first order condition for the choice of h we obtain:

$$-\frac{1}{w}\frac{\partial v\left(Z,h\right)}{\partial h}\bigg/\frac{\partial v\left(Z,h\right)}{\partial Z}=m/w=1-g'\left(a\right).$$

From the assumption that the g-function is convex, we have that $\widehat{a}\leq a^1$ implies $g'\left(\widehat{a}\right)\leq g'\left(a^1\right)$, and hence $1-g'\left(\widehat{a}\right)\geq 1-g'\left(a^1\right)$. It follows immediately that $\widehat{m}/w^2\geq m^1/w^1$, so that we can conclude that the finding that $\widehat{m}/w^2<m^1/w^1$ violates the condition for optimizing behavior. Thus, we are led to dismiss the initial assumption that $w^2\widehat{h}\leq w^1h^1$ and conclude that, on the contrary, the mimicker's disposable income (consumption expenditure) exceeds that of a true low-skilled agent.[17]

Therefore, even assuming that a mimicker works less than a low-skilled agent, his actual consumption of a complementary-to-labor good might be larger than that of a low-skilled agent since he has a larger budget to spend.

Let's now consider in detail how the labor supply depends on the wage rate of agents. At any given (M,B)-bundle an agent's problem is: $\max\limits_{x_1,x_2,h} u\left(x_1,x_2,h\right)$ s.t.: $\sum\limits_{i=1}^{2}x_i=wh-M+B-g\left(wh-M\right)$. This is a utility maximization problem subject to a smooth nonlinear budget constraint. We are used to comparative statics for linear budget constraints and know how to interpret such comparative statics. Blomquist (1989) shows how the comparative statics for a nonlinear budget constraint can be expressed in terms of comparative statics for a linear budget constraint. This is accomplished by linearizing the budget constraint and then taking account of how local prices change as a parameter of interest is varied. In the present case we define the local (marginal) price of leisure as $w^*=w(1-g')$. As w changes the local price of leisure will change. Drawing on the example on p. 287 in Blomquist (1989) we find that the comparative statics for dh/dw can be written as

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[17] Having shown that $\widehat{a}>a^1$ allows us to provide a simple proof of the fact that the standard agent-monotonicity condition is satisfied in the (M,B)-space. For this purpose, notice that by rewriting (3) as $(\partial V/\partial M)/(\partial V/\partial B)=g'-1$, we can equivalently rewrite the right side of (6) as $\lambda\left(\partial\widehat{V}/\partial B^1\right)\left[g'\left(\widehat{a}\right)-g'\left(a^1\right)\right]/\mu\pi^1$. Since we have shown that $g'\left(\widehat{a}\right)>g'\left(a^1\right)$, we can conclude that $\left(\partial\widehat{V}/\partial M^1\right)/\left(\partial\widehat{V}/\partial B^1\right)>\left(\partial V^1/\partial M^1\right)/\left(\partial V^1/\partial B^1\right)$, which is what is required by the agent-monotonicity condition.

$$\frac{dh}{dw} = k\left\{\frac{\partial w^*}{\partial w}\left(\frac{\partial h}{\partial w^*}\right)_{\bar{u}} + h(1-g')\frac{dh}{dB}\right\},$$

where k has been defined as $k \equiv 1/\left[1 + w^2 g''\left(\partial h/\partial w^*\right)_{\bar{u}}\right]$.

Here $\left(\partial h/\partial w^*\right)_{\bar{u}}$ is the substitution effect of a variation in the slope of a linear budget constraint. We know that this substitution effect is positive. The term dh/dB is the income effect for a linear budget constraint and is negative if leisure is a normal good. Since $\left(\partial h/\partial w^*\right)_{\bar{u}}$ and g'' are both positive, $0 < k < 1$. Finally, $\partial w^*/\partial w = 1 - g' - whg''$. Although the substitution effect for a linear budget constraint, $\left(\partial h/\partial w^*\right)_{\bar{u}}$, is positive, the substitution effect for the nonlinear budget constraint, which is given by $k\frac{\partial w^*}{\partial w}\left(\frac{\partial h}{\partial w^*}\right)_{\bar{u}}$ can be negative. This happens if $\partial w^*/\partial w = 1 - g' - whg'' < 0$. Alternatively, defining the elasticity of the marginal cost of avoidance with respect to earned income as $\eta\left(wh\right) = whg''/g'$, the substitution effect is negative when $\eta > \left(1 - g'\right)/g'$. Thus, we see that the sign of dh/dw depends on the size of the income- and substitution effects for a linear budget constraint, and also on the curvature of the g function. A sufficient condition for dh/dw to be negative is that $\partial w^*/\partial w = 1 - g' - whg'' \leq 0$. Then both the substitution and income effects are negative. However, if $\partial w^*/\partial w = 1 - g' - whg''$ is positive and the substitution effect $\left(\partial h/\partial w^*\right)_{\bar{u}}$ is sufficiently large, it is possible that dh/dw is positive.

Summarizing, we can distinguish the following three cases:

- $\partial w^*/\partial w \leq 0$. Then a mimicker's labor supply will fall short of the labor supply of a true low-skilled agent;

- $\partial w^*/\partial w > 0$ and $\left(\partial h/\partial w^*\right)_{\bar{u}}\left(\partial w^*/\partial w\right) < -h(1-g')dh/dB$. In this case the income- and substitution effects push in opposite directions but the former dominates. A mimicker's labor supply will fall short of the labor supply of a true low-skilled agent;

- $\partial w^*/\partial w > 0$ and $\left(\partial h/\partial w^*\right)_{\bar{u}}\left(\partial w^*/\partial w\right) > -h(1-g')dh/dB$. In this case the income- and substitution effects push in opposite directions but the latter dominates. A mimicker's labor supply will then exceed the labor supply of a true low-skilled agent.[18]

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[18] Strictly speaking, we have assumed that, when increasing the wage rate from w^1 to w^2, none of

With tax avoidance, a mimicker's demand for complementary-to-labor goods may then exceed that of a low-skilled agent. If this happens, the case for a public provision device of the kind presented above breaks down. We recall that this was a scheme allowing topping up in the market. With the mimicker being the larger consumer, public provision will have to be abandoned or a different provision scheme will have to be adopted, as discussed in Blomquist and Christiansen (1998, p. 406). The public provision level should be limited and one should block the option to top up in the market. Both measures would go against the interests of the mimicker who wants large consumption. The mimicker will either have to accept an inferior consumption bundle within the public scheme or forgo the public provision by opting out of the public scheme.

In general, the demand for good one will depend both on the disposable income and the labor supply. As special cases the demand may only depend on one argument.

Where the demand only depends on disposable income, a mimicker will have the larger consumption (under assumption of normality of good one). In this case a topping-up provision scheme can never improve upon a pure income tax optimum. However, supplementing the income tax with an opting-out provision scheme will certainly be welfare-improving. It is noteworthy that, in contrast to the findings of previous literature which has neglected tax avoidance, public provision schemes may be a useful addition to the armory of policy instruments even when labor is weakly-separable from other goods in the agents' utility function.

Another special case is where the good is a necessary input in order to work such that there is a strict relationship between x_1 and h: $x_1 = x_1(h)$, with $\partial x_1/\partial h > 0$. An example might be day care needed by parents in order to work.[19] Previous literature has concluded that these are ideal candidate goods for being publicly provided through either topping-up schemes or, as more recently emphasized,[20] through schemes where all agents get their entire demand for the good satisfied through the public provision scheme.

the effects considered above change sign. Notice that the closer we get to a continuum-type model, the more innocuous the assumption is. The reason is that, in a continuum-type model, each of the binding self-selection constraints involve adjacent agents whose difference in wage rates tends to zero.

[19] See, for instance, Blomquist and Micheletto (2009) and Blomquist et al. (2010).

[20] See Blomquist et al. (2010).

Even though with tax avoidance we can no longer be sure that $\hat{x}_1 < x_1^1$, the fact that the demand for X_1 does not depend on disposable income suggests that tax avoidance is in this case less likely to revert the order between the amount demanded by a mimicker and the one demanded by a true low-skilled. In this case a topping-up public provision scheme still stands a good chance of being a welfare-enhancing device through its effect on the self-selection constraint.

Finally, consider the general case where the demand depends on both disposable income and labor supply, and assume that good X_1 is a normal good which is complementary with labor ($\partial x_1/\partial Z > 0$ and $\partial x_1/\partial h > 0$). Denoting by $\epsilon_{h,w}$ the elasticity of labor supply with respect to the wage rate (i.e. $\epsilon_{h,w} \equiv (w/h)\,(dh/dw)$), we can distinguish the following cases:[21]

- where $dh/dw \geq 0$, we have that $dx_1/dw > 0$;

- where $dh/dw < 0$ and $h(1 - g')\,(1 + \epsilon_{h,w})\,\partial x_1/\partial Z > -\,(\partial x_1/\partial h)\,(dh/dw)$, we have $dx_1/dw > 0$;

- where $dh/dw < 0$ and $h(1 - g')\,(1 + \epsilon_{h,w})\,\partial x_1/\partial Z < -\,(\partial x_1/\partial h)\,(dh/dw)$, we have $dx_1/dw < 0$.

We see that the conditions that are conducive to x_1 being decreasing in w (thus warranting a topping-up public provision scheme for X_1) are that the income effect on x_1 is small, h is a decreasing function of w (reflecting a small and conceivably negative substitution effect and a strong income effect), and x_1 is strongly complementary with h.

The following proposition summarizes the main findings of this subsection.

Proposition 1 *In a model with income tax avoidance:*

i) non-separability between labor and other goods is neither a necessary nor a sufficient condition to make public provision of private goods a welfare-enhancing policy instrument;

ii) even though the mimicker's labor supply is not necessarily larger than that of a true low-skilled, the fact that a mimicker avoids more than a true low-skilled implies that he

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[21] Notice that $\epsilon_{h,w} > -1$. This is because, as we have shown above, $d\,(wh)\,/dw > 0$.

will have a larger amount of income available for consumption. This tends to make the mimicker a larger consumer of all normal goods; consequently, irrespective of the relationship between leisure and the demand for a given good, it also tends to make opting-out provision schemes superior to topping-up schemes.

3   Avoidance effects of public provision schemes

Even if what ultimately matters for the desirability of public provision is to assess whether it can raise social welfare or not, it might also be of interest to investigate how public provision affects the agents' incentives to engage in tax avoidance. The answer to this question is very simple when one considers public provision schemes of the type that traditionally has been analyzed in the literature, namely topping-up or opting-out schemes. For these schemes the result stated by Proposition 2 holds.

Proposition 2 *Whenever topping-up or opting-out public provision schemes are welfare-enhancing upon a pure nonlinear income tax optimum in the presence of tax avoidance, they also exert an avoidance-discouraging effect.*

The key to understand the above result is that, in an optimal nonlinear income tax model, public provision is welfare-enhancing only insofar as it helps relaxing the binding self-selection constraints faced by the government. Moreover, the only reason to let a given group of agents face a non-zero marginal tax rate is to prevent mimicking by other agents. Thus, when a topping-up or an opting-out public provision scheme can be used to weaken a binding self-selection constraint, the government can exploit public provision in order to lower the marginal tax rate faced by agents of a given skill type, without fearing that higher-skilled agents will be tempted to mimic. But given that in equilibrium the agent's avoidance behavior is governed by condition (4), a reduction in the marginal tax rate implies that the optimal level of avoidance will be reduced too.

As stressed in Proposition 2, this simple link between the welfare effect of public provision and its effect on the incentives to shelter income from the tax authority applies to topping-up and opting-out schemes, but does not necessarily characterize all conceivable

public provision schemes. This can be easily illustrated by considering the public provision scheme which was recently analyzed in Blomquist et al. (2010). Following them, assume that the candidate for public provision, X_1, is a good that does not enter as an argument in the agents' utility function but that is a complementary-to-labor private good which has to be acquired by agents in order to work in the market. More precisely, assume that the demand for good X_1 is given by a function f such that $x_1 = f(h)$, with $f' > 0$. Moreover, assume that the public provision scheme is such that agents can get free of charge as much as they need of the good, with public budget balance attained by adjusting the labor income tax schedule. As shown by Blomquist et al. (2010) in a model without tax avoidance, supplementing the nonlinear income tax with such a public provision scheme is unambiguously welfare-enhancing. In a two-type model with tax avoidance, such a scheme would still be welfare-enhancing provided that, at the pure income tax optimum, the labor supply of a high skilled mimicker falls short of the labor supply of a true low-skilled agent. As we know from the analysis of section 2, this might or might not happen. However, for the sake of argument, assume that it is indeed the case that at the pure income tax optimum the labor supply of a high skilled mimicker falls short of the labor supply of a true low-skilled agent. A public provision scheme à la Blomquist et al. (2010) would then be welfare-enhancing but it is likely not to lead to a reduction in the marginal tax rate faced by low-skilled agents. The reason is that under such a scheme the marginal tax rate can be thought of as the sum of two distinct components: a distortionary component required to deter mimicking from other types and a non-distortionary component required to internalize the real resource cost of the good that the agents use when marginally increasing their labor supply. As we will illustrate below, even though it is still true that when public provision is welfare-enhancing the government is free to lower the purely distortionary component of the marginal tax rate, a public provision scheme à la Blomquist et al. (2010) requires, for pure efficiency reasons, to raise the marginal tax rate by an amount which, albeit nondistortionary, can lead to an overall increase in the marginal tax rate.

Formally, given a utility function of the form $u(x_2, h)$, the agent's indirect utility at a given (M, B)-bundle and in the absence of public provision can be obtained as:

$$V(M, B) = \max_a u\left(B + a - g(a) - f\left(\frac{M + a}{w}\right), \frac{M + a}{w}\right), \tag{7}$$

where we have retained the assumption that the unitary resource cost of the good which needs to be acquired in order to work is equal to one.

The first order condition is:

$$\left[1 - g'(a^*) - \frac{f'\left(\frac{M + a^*}{w}\right)}{w}\right]\frac{\partial u}{\partial x_2} = -\frac{1}{w}\frac{\partial u}{\partial h}. \tag{8}$$

Taking into account that the marginal tax rate faced by an agent is implicitly given by (2), and that by the envelope theorem it is $\frac{\partial V}{\partial M} = \frac{1}{w}\frac{\partial u}{\partial h} - \frac{\partial u}{\partial x_2}\frac{1}{w}f'$ and $\frac{\partial V}{\partial B} = \frac{\partial u}{\partial x_2}$, we have:

$$T'(M) = 1 + \frac{\partial V}{\partial M}\Big/\frac{\partial V}{\partial B} = 1 - \frac{1}{w}f' + \frac{1}{w}\frac{\partial u}{\partial h}\Big/\frac{\partial u}{\partial x_2}. \tag{9}$$

When a public provision scheme à la Blomquist et al. (2010) is introduced, the agent's indirect utility at a given $\left(\widetilde{M}, \widetilde{B}\right)$-bundle can be obtained as:

$$V\left(\widetilde{M}, \widetilde{B}\right) = \max_a u\left(\widetilde{B} + a - g(a), \frac{\widetilde{M} + a}{w}\right), \tag{10}$$

with the associated first order condition:

$$\left[1 - g'(a^{**})\right]\frac{\partial u}{\partial x_2} = -\frac{1}{w}\frac{\partial u}{\partial h}. \tag{11}$$

Therefore, one gets:

$$T'\left(\widetilde{M}\right) = 1 + \frac{\partial V}{\partial \widetilde{M}}\Big/\frac{\partial V}{\partial \widetilde{B}} = 1 + \frac{1}{w}\frac{\partial u}{\partial h}\Big/\frac{\partial u}{\partial x_2}. \tag{12}$$

Let's assume now that $\widetilde{M}$ and $\widetilde{B}$ are chosen such that $\widetilde{M} = M$ and $\widetilde{B} = B - f\left(\frac{M + a^*}{w}\right)$. If the agent were to keep his behavior unchanged (i.e. if $a^{**} = a^*$), both his consumption and his leisure would be unaffected by the reform. However, comparing (8) and (11) one

can easily recognize that if a^* was a solution to (8), the avoidance level that solves (11) has to be greater than a^*. Another way to look at this effect of the public provision scheme is to compare (9) and (12) and to notice that the right hand side of the latter is scaled up by f'/w as compared to the right hand side of the former. This reflects the fact that, after the introduction of the public provision scheme, the agents no longer pay a market price for the good that they need to acquire in order to work. Given that agents do not pay in the market for the marginal cost of X_1, a purely efficiency argument calls for raising their marginal tax rate in order to internalize the marginal resource cost of the publicly provided good. However, this increase in the marginal tax rate, albeit non-distortionary and merely efficiency-restoring, strengthen the agents' incentives to engage in tax avoidance (given that in equilibrium agents equate the marginal cost of avoidance with the marginal tax rate), unless more than compensated by the reduction in the distortionary component which is allowed by the mimicking-discouraging effect of public provision. Taking into account that the magnitude of the nondistortionary component that needs to be added to the marginal tax rate is larger the smaller is the wage rate of an agent, we can state the following Proposition.

Proposition 3 *When a public provision scheme à la Blomquist et al. (2010) is welfare-enhancing upon a pure nonlinear income tax optimum in the presence of tax avoidance, it is conceivable that the agents' incentives to engage in tax avoidance will be strengthened as the tax on marginal income will now reflect the work-related costs, and the latter effect is stronger the lower is the market wage rate of a worker.*

An interesting feature of Proposition 3 is that it allows emphasizing that, from a welfaristic standpoint, it would be misleading to gauge the desirability of public provision on the basis of its effect on tax avoidance. The key aspect is whether or not mimicking can be made less attractive by using a public provision scheme.

4 Allowing for bi-dimensional heterogeneity

In this section we extend our analysis of the effects of public provision by considering a setting where agents also differ in terms of access to avoidance opportunities. More precisely, we first consider a three-type model with one type of high-skilled agents and two types of low-skilled agents, those who can engage in tax sheltering (hereafter called "avoiders") and those who cannot engage in tax sheltering (hereafter called "non-avoiders"). Later we will extend the analysis to a four-type model where also high-skilled are heterogeneous in terms of avoidance opportunities.[22]

However, in tackling the bi-dimensional heterogeneity problem, we simplify the analysis by restricting attention to the public provision of a complementary-to-labor private good the demand for which only depends on the labor supply of agents.[23] Moreover, we will focus on a provision scheme where agents get free of charge as much as they need of the good, with public budget balance attained by adjusting the labor income tax schedule. The reason for doing so is that, as shown by Blomquist et al. (2010), this is the optimal provision scheme in the absence of tax avoidance.

Assume that, for each unit of labor supply, agents need to acquire one unit of a private good that does not enter directly into the agent's utility function. Assume also that the unit cost and the market price of this complementary-to-labor private good is p, and that agents derive utility from a composite consumption good and incur disutility from working, $u(c, h)$. In the absence of public provision, and for any given bundle in the (M, B)-space, avoiders choose a to maximize $u\left(B + a - g(a) - p\frac{M+a}{w}, \frac{M+a}{w}\right)$, whereas non-avoiders don't have this option and get a utility given by $u\left(B - p\frac{M}{w}, \frac{M}{w}\right)$. The first thing to notice is that if one considers the indifference curves in the (M, B)-space of two equally skilled agents, but one being avoider and the other not, the indifference curves for the non-avoider are more convex than those for the avoider. The slope is the same at any bundle where the indifference curve for the non-avoider has unitary slope (since at those

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[22] One might for instance interpret the difference in the access to avoidance opportunities as a reflection of a difference in occupational status, such as that between self-employed and employees.

[23] As emphasized by Blomquist et al. (2010), this modelling assumption fits reasonably well some prominent examples of private goods that are publicly provided in real economies.

bundles the potential avoiders have no incentives to misreport their income). To the left, the indifference curve for the avoider is steeper since the avoider is under-reporting income (therefore having both higher consumption and higher labor supply);[24] to the right, the indifference curve for the avoider is flatter since the avoider is over-reporting income.[25]

Ideally, the government would like to offer different bundles to the low-skilled avoiders and the low-skilled non-avoiders. To realize that this is the case, consider the following. In a standard two-type optimal nonlinear taxation model (without avoidance) the low-skilled agents face a positive marginal tax rate in order to discourage the high-skilled agents from mimicking. Now, if we introduce low-skilled avoiders and assume that they are pooled together with the low-skilled non-avoiders, we would get that the avoiders enjoy a higher utility (since they under-report part of their income whereas the other group of low-skilled agents cannot do that). Thus, under reasonable social preferences for redistribution, the government would like to transfer resources from the low-skilled avoiders to the low-skilled non-avoiders. However, Figure 1 below shows that the presence of high-skilled agents (with the associated binding self-selection constraint requiring them not to mimic low-skilled agents) prevents the government from being able to separate the two types of low-skilled agents.[26]

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[24] At these bundles the implicit marginal tax rates faced by agents is positive; thus, those who have the opportunity will under-report their true income ($a > 0$). The marginal rate of substitution between M and B is given by $\frac{p}{w} - \frac{1}{w}\frac{\partial u/\partial h}{\partial u/\partial c}$. With both h and c being larger for the avoider, the marginal rate of substitution (and therefore the slope of the indifference curve in the (M, B)-space) is higher for the avoider.

[25] At these bundles the implicit marginal tax rates faced by agents is negative; thus, those who have the opportunity will over-report their true income ($a < 0$). The marginal rate of substitution between M and B is given by $\frac{p}{w} - \frac{1}{w}\frac{\partial u/\partial h}{\partial u/\partial c}$. With both h and c being smaller for the avoider, the marginal rate of substitution (and therefore the slope of the indifference curve in the (M, B)-space) is smaller for the avoider.

[26] For the moment it is not crucial to specify whether the high-skilled agents can engage in tax avoidance or not.
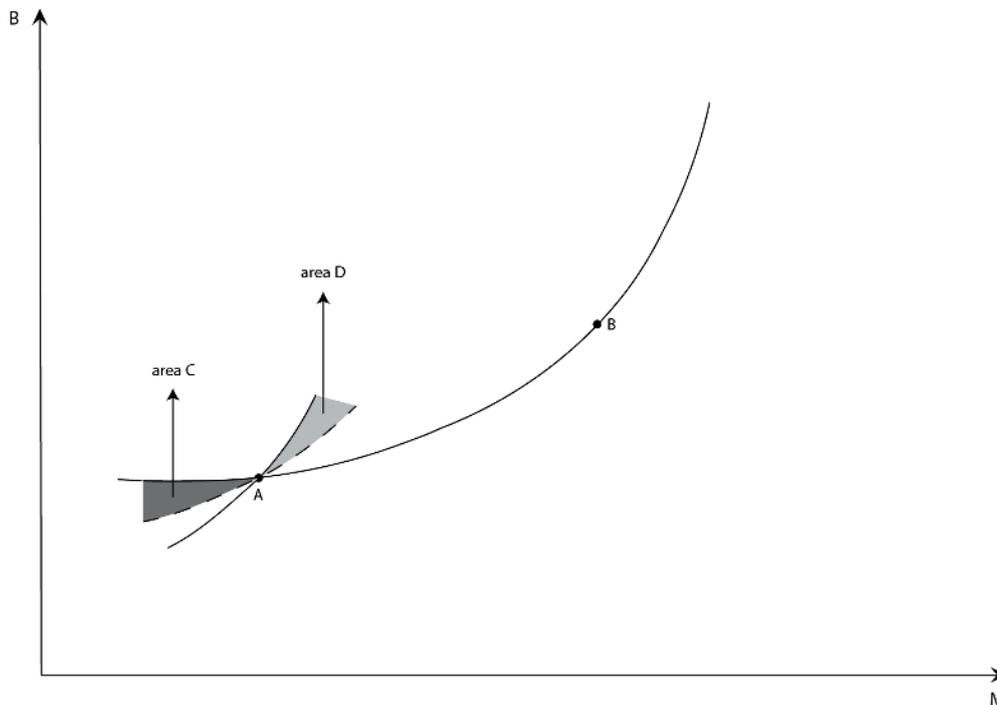
Figure 1

In Figure 1 the dashed line indicates the indifference curve for the low-skilled non-avoiders; the steepest indifference curve passing through the A-bundle pertains to the low-skilled avoiders. All low-skilled agents are pooled at the A-bundle and the high-skilled agents are located at the B-bundle. Starting from this equilibrium, we can ask whether it is possible to get a Pareto-improvement by separating the two types of low-skilled agents. For this purpose, let's keep fixed the utility of the high-skilled agents and that of the low-skilled avoiders, and consider whether it is possible to raise the utility of the low-skilled non-avoiders by offering them a bundle different from A. One way to raise the utility of the low-skilled non-avoiders would be to offer them a bundle in the area labelled D. However, this would violate the self-selection constraint requiring high-skilled agents to be prevented from mimicking. An alternative way to raise the utility of the low-skilled non-avoiders would be to offer them a bundle in the area labelled C. There are two problems in this case: on one hand the government's revenue would be reduced if the low-skilled non-avoiders were to relocate in this area;[27] on the other hand, if the low-skilled non-

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[27] This happens because at the A-bundle the slope of the indifference curve of the low-skilled non-avoiders

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avoiders were offered a bundle in the area labelled C, the low-skilled avoiders would have an incentive to choose that bundle too.

Having shown that all the low-skilled agents are pooled together at a pure income tax optimum, let's consider the introduction of a public provision scheme of the type described at the beginning of this section. It is easy to realize that it would favor the low-skilled avoiders more than the low-skilled non-avoiders (since they are pooled together but the avoiders supply more labor).[28] This feature of the public provision scheme is unattractive.

To assess the effect of the provision scheme on the self-selection constraint, two cases need to be distinguished. Where the high-skilled agents do not have avoidance opportunities, the provision scheme softens the self-selection constraint. This occurs because a mimicker is forced to pay for more than the publicly provided good that he consumes. However, where the high-skilled agents have avoidance opportunities, it is conceivable that the ability of this type of provision scheme to relax the self-selection constraint is being eroded since high-skilled mimickers may not be working less than the low-skilled agents. Indeed, if they work strictly longer hours, this particular public provision scheme will tighten rather than soften the self-selection constraint with detrimental effects on welfare.

Before proceeding to the four-type model, notice that an opting-out scheme could overcome the problems of the provision scheme considered above. The reason is that an opting-out scheme could be tailored to the need of the low-skilled non-avoiders, therefore making the bundle intended for them less tempting both for the low-skilled avoiders and the high-skilled. Thus, it would allow separating the low-skilled non-avoiders from the low-skilled avoiders in a way that favors the former without inducing mimicking from the high-skilled agents.

Consider now a four-type model where also high-skilled agents are differentiated in terms of avoidance opportunities. One possibility is that, at a pure income tax optimum,

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is smaller than one (their labor supply is distorted downwards to prevent mimicking from the high-skilled agents).

[28] To balance the public budget for the introduction of the public provision scheme, one needs to reduce the after-tax incomes associated with the bundles offered to the various agents. Suppose that the after-tax income of the bundle for the high-skilled agents is reduced by an amount equal to the cost of the publicly provided good that they consume, so that their utility is left unaffected. The reduction in the after-tax income of the bundle for the low-skilled agents, required to achieve public budget balance, will then necessarily entail a cross subsidy from the low-skilled non-avoiders to the low-skilled avoiders.

all high-skilled agents are pooled together and faced with no distortion in order to extract the maximum amount of revenue from them. There is a strong case for this outcome since both efficiency and equity are achieved as far as high-skilled agents are concerned.[29] The situation is illustrated in Figure 2 where there is bunching of high-skilled agents at point B and a cluster of low-skilled at A.[30]
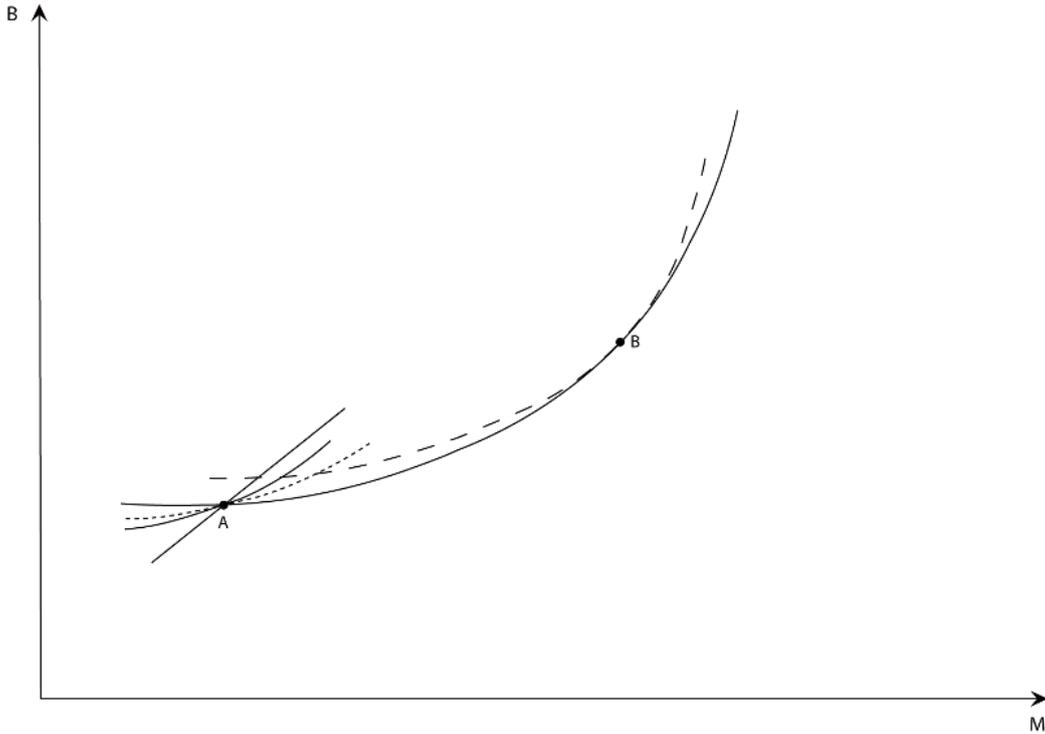

Figure 2

Given that the indifference curve for the high-skilled non-avoiders is more convex than the one for the high-skilled avoiders, the relevant binding self-selection constraint would be the one requiring the high-skilled avoiders not to mimic the (pooled) low-skilled agents. As above, the public provision scheme considered in Blomquist et al. (2010) would exacerbate the self-selection constraint if the high-skilled avoiders were to supply, as mimickers, more labor than the low-skilled agents.

However, there might be circumstances where a pure income tax optimum is not characterized by pooling all high-skilled agents at an undistorted bundle. Especially when

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[29] This implies that the all high-skilled agents would get the same utility (they would have the same consumption and the same labor supply). Thus, the government would have no reason to wish to redistribute from one type of high-skilled agents to the other type.

[30] The indifference curves drawn as solid (dashed) lines are for avoiders (non-avoiders).

the proportion of potential avoiders is small among high-skilled agents, renouncing the attractive properties of pooling the high-skilled at an undistorted bundle may be more than offset by benefits in other respects. To realize the potential for such favorable effects, consider again Figure 2. We notice that the slopes of the indifference curves of the low-skilled types through A are less than unity, which is the slope of the 45-degree line drawn through A. Moving the bunching point north-east along the steeper indifference curve (of the low-skilled avoiders) will increase tax revenue (with the reported income M increasing more than the net-of-tax reported income B). Obviously, such a move is only feasible if the high-skilled agents with avoidance opportunities are allowed to mimic, i.e. if they are pooled with the low-skilled agents. The new equilibrium is depicted in Figure 3 where high-skilled non avoiders locate at bundle B whereas all other agents are located at bundle A.
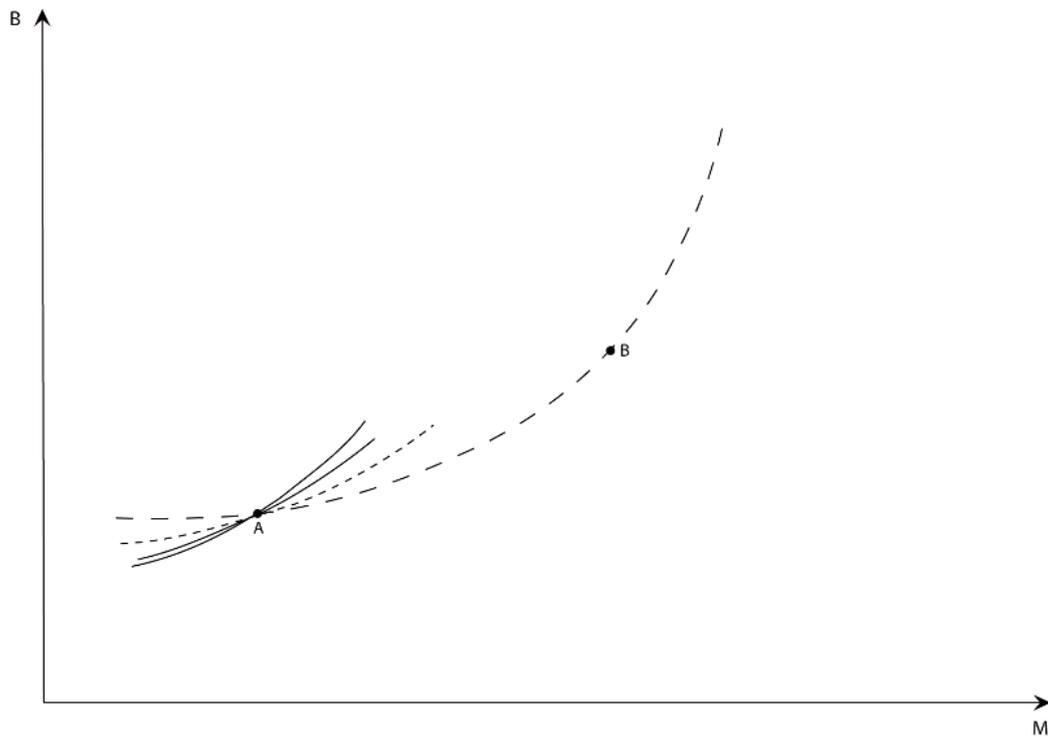

Figure 3

In this new equilibrium more resources will have to be allocated to the high-skilled avoiders, but if the proportion of this group of high-skilled agents is negligible, the cost will be insignificant and dominated by the increase in tax revenue pointed out above. In

general, there will be a trade-off between the two opposing effects but still the change in the pooling equilibrium will be favorable on balance with a sufficiently small number of high-skilled agents capable of avoidance. In these circumstances we are back to the case where the provision scheme considered in Blomquist et al. (2010) would undoubtedly slacken the remaining self-selection constraint.[31] Moreover, especially if the labor supply of the high-skilled avoiders is lower than the labor supply of the low-skilled non-avoiders at the pure income tax optimum, the introduction of the public provision scheme may also imply that it becomes once again desirable to pool all the high-skilled agents at an undistorted bundle.[32]

Finally, we can notice that, irrespective of whether the high-skilled avoiders are pooled or not with the low-skilled agents at the pure income tax optimum, an opting-out scheme offers advantages over the provision scheme considered above. Once again, the reason is that an opting-out scheme can be tailored to the need of the low-skilled non-avoiders.

5   Concluding Remarks

In this paper we have reconsidered the desirability of public provision of private goods as a redistributive device in optimal nonlinear income tax models.

We have shown that tax avoidance implies that non-separability between labor and other goods is neither a necessary nor a sufficient condition to make public provision of private goods a welfare-enhancing policy instrument.

A second result is that the availability of avoidance opportunities tends to make opting-out provision schemes welfare-superior to topping-up schemes. Given that the empirical evidence indicates that tax dodging opportunities depend on features of a country's economic structure such as the extent to which earned income is subject to information reporting from third parties and the average size of firms (see, e.g., Kleven et al. (2009) and Kleven et al. (2011)), a potential policy implication of our analysis is that topping-

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[31] However, it would still be the case that the public provision scheme has the unappealing effect of favoring the low-skilled avoiders more than the low-skilled non-avoiders. Moreover, depending on the labor supply of the high-skilled avoiders, it can also favor them more than the low-skilled agents.

[32] This is due to the fact that the public provision scheme softens the incentive for the high-skilled avoiders to mimic the low-skilled agents.

up public provision schemes have a better chance of being welfare-enhancing in countries where the share of self-employed is relatively small and the average size of firms is relatively big.

Finally, we have investigated how public provision interacts with the agents' incentives to engage in tax avoidance and have shown that, for most of the public provision schemes previously studied in the literature, being a welfare-enhancing policy instrument goes hand in hand with softening the agents' incentives to shelter income from the tax authority. However, we have also pointed out an important exception to this pattern.

Our modelling of tax avoidance has been very crude. In some cases the marginal net tax-saving is less than the marginal gross tax-saving (T') because part of the income tax avoided is appropriated by the government through some other tax channel. For instance, where income shifting takes place, income taxed at a high marginal rate T' may be transformed at a real resource cost $g(a)$ to income taxed at a lower marginal rate t. Then the marginal private cost of the (gross) tax-saving T' is $t + g'$, where only the latter term (g') is a social cost. This way of modelling avoidance would allow studying how the government's design of a given tax interacts with the incentives for agents to avoid other taxes.

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