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Jukka Pirttilä
Matti Tuomala

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Poverty alleviation and tax policy^{*}

by

Jukka Pirttilä^{**}

University of Cambridge and Bank of Finland

and

Matti Tuomala

University of Tampere

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^{*} We are grateful to seminar participants at the University of Cambridge for useful comments.

^{**} Corresponding author. Address: Clare Hall, Herschel Road, Cambridge CB3 9AL, UK.

Email: jop22@econ.cam.ac.uk

Abstract: This paper examines public good provision and tax policy – optimal non-linear income taxation and linear commodity taxation – when the government departs from purely welfarist objective function and seeks to minimise poverty. This assumption reflects much policy discussion and may help understand some divergences of practical tax policy from lessons in optimal tax analysis. In contrast to Atkinson and Stiglitz (1976), it may be optimal to use differentiated commodity tax rates, including the taxation of savings, even if preferences are separable in goods and leisure. The optimal effective marginal tax rate at the bottom of the distribution may be negative, suggesting that wage subsidy schemes can be optimal. Finally, optimal provision rules are derived for a public good under poverty minimisation.

Key words: Poverty, income taxation, commodity taxation

JEL classification: H21, H41, I32.

1 Introduction

The design and coverage of social policy has attracted much attention in recent policy debate, particularly in the EU countries. The Lisbon Council concluded in 2000 that ‘Steps must be taken to make a decisive impact on the eradication of poverty’. In traditional poverty measures and discussion, the concern is almost completely on (the lack of) *income*. The recent emphasis on social policy within the EU has, however, lead to the adoption of a wider set of indicators related to poverty and social exclusion. This social indicator approach (Atkinson et al 2002) covers not only poverty, but various other measures of well-being, such as health, housing conditions and education.

In contrast to this and much other policy discussion, where the emphasis is on income-poverty (and sometimes other measures of social situation), the traditional concern in public economics is related to *utility*. This is reflected in the use of social *welfare* functions as government’s objectives. Some of the concerns in much real-world policy discussion and optimal tax policy therefore clash. In particular, little if any attention is given on the leisure of the poor or the unemployed (interpreted as time beyond searching for job) in practical discussion.¹ One may wonder if the apparent difference in the objectives between much policy discussion and optimal tax analysis has some important bearings on the optimality of different policies. It therefore appears fruitful to depart from the standard welfarist tradition – that of maximising social welfare – and consider some non-welfarist objectives as well.

¹ This is of course a simplified way of putting things. Real-world policy discussion addresses issues such as working time regulations.

There are of course many possible alternatives of non-welfarism, such as the pioneering work by Sen (1985). In this paper we follow the approach taken in Kanbur, Keen and Tuomala (1994a) and focus on a particular form of non-welfarism, namely alleviation of poverty. Here, poverty is defined to capture either pure income poverty or it can be interpreted to include other measures as well, such as the social indicators suggested by Atkinson et al (2002). Poverty-alleviation provides a parsimonious form of social objectives and yet can capture key elements of the tone of policy discussion. We do not want to argue for preferring poverty alleviation to traditional welfarist types of objectives in normative terms; we rather want to explore the implications of poverty alleviation as a real-world related possibility for tax policy. It must also be remembered that the dividing line between welfarism and non-welfarism is not very clear.² Conventional tax analysis utilises social welfare functions with inequality aversion, which already implies a deviation of assessing individual welfare with the same function which the individual uses himself. In some sense, the social objective functions form a continuum in the welfarism – non-welfarism scale.

There are some earlier studies that examine optimal tax and transfer schemes under non-welfarist objectives.³ Kanbur and Keen (1989) analyse what kind of linear income tax schedules could be used to alleviate poverty. Kanbur, Keen and Tuomala (1994a) extend the analysis to a Mirrlees (1971) type of model to cover non-linear income taxation.⁴ Besley and Kanbur (1988) analyse commodity tax/subsidy rules (when no income taxation is available) for poverty alleviation. Besley and Coate (1992, 1995) consider income-maintenance schemes, especially the role of workfare, when the objective is to minimise the costs related

² We are grateful to Ravi Kanbur for pointing this out.

³ See Kanbur, Keen and Tuomala (1994b) and Bradbury (2002) for surveys.

⁴ A related analysis by Wane (2001) considers a case where poverty is a public ‘bad’ that enters the individuals utility function.

to these schemes. They all find that the some of the earlier results in tax analysis are no longer valid with non-welfarist objectives.

In this paper we analyse optimal non-linear income taxation, linear commodity taxation and public good provision when the government objective is to minimise income poverty. This mixed taxation framework has the attractive feature that it corresponds to the type of tax systems actually used. The available tax instruments in use in the mixed tax case are not just assumed, but derived from the presence of asymmetric information between the government and the tax payers. The government can observe individual income (although not directly income-earning ability), but observing the consumption of various goods, or implementing a non-linear tax schedule on them, is hardly realistic. We also follow much of the recent tax analysis where, on top of the income tax, the government has access to other forms to redistribute income – such as public goods (Boadway and Keen 1993), commodity taxation (Edwards, Keen and Tuomala 1994) and public provision of private goods (e.g. Blomquist and Christiansen 1998 or Boadway and Marchand 1995). Our analysis may also be seen as a robustness analysis of optimal tax results in the mixed tax case when the objective is to alleviate poverty.

The mixed tax framework pays particular interest on the role of commodity taxation and different commodity tax rates as a way to address poverty. Within the optimal tax analysis, there are a number of well-known rules for optimal commodity taxation, such as the Ramsey rule, depending on the instruments available for the government. In the mixed tax framework, the most influential result is that of Atkinson and Stiglitz (1976): when consumer preferences are separable between goods and leisure, uniform commodity taxation is optimal. This observation has considerably played down the potential role of differentiated commodity tax

rates as a redistributive device. Although such preference structure is not likely to be empirically valid (Browning and Meghir 1991), optimal tax theory is quite often seen to provide a limited role for commodity taxation in redistribution. Much policy advice has similarly argued that the scope of redistribution achieved by differentiated commodity tax rates is relatively minor and similar impacts could be more easily obtained by income-based targeting. To illustrate, representatives from the IMF fiscal affairs department seem to subscribe to this view (Ebrill et al 2001).⁵

Yet, most countries continue to use multiple commodity tax rates. For a case in point, Table 1 collects information on the different VAT rates currently applied in the EU member states. Boadway and Pestieau (2003) discuss how one could reconcile what we observe in practice and the message of the Atkinson-Stiglitz theorem. One obvious option is non-separability of preferences between goods and leisure. In this case, the insight from optimal tax analysis (such as Christiansen 1984 and Edwards et al 1994) is that commodity tax rates should be lower for goods which are substitutes for leisure / complements with labour supply. However, it seems difficult to explain many of the lower VAT rates reported in Table 1 with the help of this principle.⁶ Boadway and Pestieau (2003) also point out other theory results (related to differences of needs by households of different income and tax-evasion considerations) that can explain some part of the observed commodity tax structures. But it still seems plausible that the selection of many of commodities to the lower taxed groups, such as foodstuff, pharmaceutical products and social housing, may well have been motivated by the simple

⁵ Political economy considerations may also limit the desirable number of various VAT rates. With a large number of existing tax rates, interest groups may find it easier to lobby for further tax concessions.

⁶ Indeed, some commodities with lower tax rates (such as TV broadcasting and sporting events) are more likely to be complements with leisure. Subsidised or free public provision of day-care can, however, be motivated by complementarity with labour supply.

desire to alleviate the tax incidence on the poor. Our aim in this paper is to examine whether there is a theoretical case, based on poverty alleviation, for such favourable tax treatment.

Table 1 around here

When different commodities are interpreted as consumption at different points in time, the commodity tax results, cited above, can be related to the taxation of savings. Interpreted in this way, the Atkinson and Stiglitz (1976) result can be seen to imply that if the government has access to non-linear income taxation and consumer preferences are separable between goods and leisure, savings should be untaxed. This observation remains valid in a fully-specified, dynamic, OLG framework (Ordoover and Phelps 1979). Yet we observe consistently positive tax rates on savings in practice. While there are many reasons why capital income should be taxed (such as taxation of unobservable wealth (Cremer et al 2003) or taste differences (Saez 2002)), it is also interesting to investigate the implications of poverty alleviation on the taxation of savings.

We also examine optimal effective marginal tax rates (combined influence of income tax and commodity taxes) under poverty alleviation. Here, the interest is primarily on the influence of the change in government objectives on the optimal effective marginal tax rates at the lower end of the income scale: whether combined marginal subsidies from the tax system are optimal to boost the labour supply (and income) of the poor. Finally, we examine what sort of public good provision rule is desirable when public goods may be used as a part of income-alleviation package.

The next section of the paper discusses poverty measurement in the many-good case. Section 3 introduces the model and examines optimal commodity tax rules, while Section 4 discusses effective marginal tax rates. Public good provision is analysed in Section 5. Section 6 concludes.

2. Poverty measurement

The standard approach of poverty measurement compares individual or household h 's income, y^h , to a poverty line z . We follow the approach by Kanbur et al (1994b), where poverty is measured by an index of

$$P = \int_0^{\infty} D(z, y)g(y)dy. \quad (1)$$

$D(z, y)$ denotes a deprivation index of individual earning income y and $g(y)$ denotes the density function of y . It is assumed that D is differentiable and takes positive values if individual's income is below the poverty line z and is zero otherwise. In addition, $D_y < 0$, in other words, poverty decreases as income increases. For our purposes, this very general type of poverty index is sufficient. For instance, formulation (1) encapsulates the aggregate poverty gap (if $D(z, y) = \max(z - y, 0)$).

In the simplest case, poverty is related to the lack of sufficient amount of one consumption good. We need to enlarge the set-up to cover a multiple good case as well. One starting point is a reference good bundle, to which actual consumption bundles are compared. In a general case, the reference good bundle may also include household labour supply. Denote this target

by a vector (x^*, L^*) , where x refers to N commodity goods and L denotes labour supply. For the moment, we skip the discussion on how the reference bundle is determined. We need to decide how the gap between the reference bundle and actual consumption is measured. For simplicity, we consider a deprivation measure $D[z, y(q, w)]$, where

$$z^h = s_x x^* - s_L^h L^* \quad (2)$$

and

$$y^h(q, w^h) = s_x x(q, w^h) - s_L^h L(q, w^h), \quad (3)$$

where q denotes consumer prices, w^h is household wage rate, and $x(q, w^h)$ and $L(q, w^h)$ depict the uncompensated commodity demand and labour supply, respectively. Equation (2) determines the poverty line z^h which is defined as the resources needed to attain the target vector, at some shadow prices (s_x, s_L) . Equation (3) determines, in turn, the resources that are actually at the disposal for household h . Kanbur et al (1994b) point out that if y increases with w , and z^h does not increase too rapidly with w (it would typically fall), then there exist a unique wage rate w^* at which $y(q, w^*) = z$. Poverty can then be measured by varying w so that

$$P = \int_0^{w^*} D[z, y(q, w)] f(w) dw. \quad (4)$$

One also needs to determine the shadow prices (s_x, s_L) used in calculating the target vector. Technological reasons would suggest using producer prices p , so that $p_x = p = q - t$, where t denotes commodity taxes. Emphasis on the purchasing power of the poor would support the use of consumer prices. But there can be other weights attached to different commodities. One

may include only some necessities with their producer prices, but goods that are not included in the target vector have zero weights. The social indicator approach by Atkinson et al (2002) may give some guidance on what sort of commodities are included in the target vector. The poverty line can then be interpreted as a broad measure consisting of basic consumption goods and goods that are deemed valuable to acquire (e.g. medicine, children's equipment, housing etc.)⁷.

In what follows, we abstract from labour-supply considerations in measuring the target commodity groups, and concentrate on income(expenditure)-poverty measures alone. As discussed in the introduction, this simplification is not done because we would advocate it. Rather, it captures the policymakers' tone of focusing on income instead of leisure enjoyed by the poor. Then, $z^h = sx^*$, and one may write the poverty index directly in terms of commodity demand as follows:

$$P = \int_0^{w^*} D[z, sx(q, w)] f(w) dw. \quad (5)$$

3. Optimal commodity taxation

We consider a Mirrlees type of an economy with a continuum of household differing in their income earning ability, i.e. their before-tax wage rate w . The household faces a non-linear

⁷ This approach is of course somewhat paternalistic, but it corresponds to the practice that not all of the goods are included in the poverty measure.

income tax schedule T so that its disposable income B is given $B = y - T(y)$, where $y = wL$ is the before-tax income of the household.

As in standard optimal tax analysis, poverty minimisation is constrained by asymmetric information between the government and the households. Individual's income earning abilities are private information and tax policy must be based on (observable) income instead. In designing the tax schedule, the government must therefore take into account the self-selection constraints of the individual. The policy tools include non-linear income tax T , commodity taxes t_i and provision of a public good, G . Thus, we analyse similar situation than in Mirrlees (1976) or in Tuomala (1990), but with a non-welfarist government objective.

Because of the need to deal with both non-linear and linear price structures, it is helpful to apply dual techniques to solve the optimisation problem. We utilise partial expenditure and indirect utility functions, first discussed by Mirrlees (1976), which are calculated for given income. Let the expenditure function for household be $E(q, L, w, v) = \min[q.x : u(x, L, w) = v]$ and the partially indirect utility function $v(q, B, L, w) = \max[u(x, L, w) : q.x = B]$, where $B = E$.

Household optimisation will be used to generate the incentive compatibility constraint for the government optimisation. Because we work with the dual approach, this can be achieved by differentiating the expenditure function E with respect to w . The interpretation is that once the income-earning ability increases, the individuals must be better off in the after-tax situation;

in other words, the expenditure needed for a given utility must decrease.⁸ The differentiation yields:

$$E'(w) = E_q \frac{dq}{dw} + E_v v'(w) + E_w \quad (6)$$

Based on the properties of indirect utility functions $v_q dq/dw + v_B dE/dw = 0$ or $-x dq/dw + dE/dw = 0$. Using this, (6) may be rewritten as

$$v'(w) + E_w/E_v = 0, \quad (7)$$

which serves as the self-selection constraint of the optimisation.

The resource constraint for this economy is

$$\int (wL - px^c) f dw = A, \quad (8)$$

where $x^c = x^c(q, y, v, w)$. The Lagrangean of the government optimisation problem can then be written as

$$\begin{aligned} L = & \int \{(-D[z, sx^c(q, L, v, w)] + \lambda(wL - px^c))f + \alpha v' + \alpha E_w/E_v\} dw \\ & = \int \{(-D[z, sx^c(q, L, v, w)] + \lambda(wL - px^c))f - \alpha v + \alpha E_w/E_v\} dw - \alpha(0)v(0) + \alpha(\infty)v(\infty), \end{aligned} \quad (9)$$

where the latter formulation follows from integrating $\alpha v'$ by parts. Maximising with respect to q yields the following first-order condition

$$- \int D_x sx_q^c f dw - \int \lambda px_q^c f dw + \alpha \{\partial(E_w/E_v)/\partial q\} dw = 0. \quad (10)$$

⁸ This is analogous to the incentive compatibility constraint in the standard Mirrlees model that indirect utility is increasing in w .

As shown in the Appendix, equation (10) can be rewritten as

$$t \int x_q^c f dw = - \int \pi(w) x_w(q, E, y, w) dw + \int \frac{1}{\lambda} D_x s x_q^c(q, L, v, w) f dw, \quad (11)$$

where $\pi = E_v^{-1} \alpha / \lambda > 0$ and $E_v = 1/v_E$. The expression in (10) is an implicit formulation for the optimal commodity tax structure. The left-hand side of this formulation measures, as pointed out by Mirrlees (1976), the extent to which commodity taxation encourages / discourages consumption of different commodities. The first term on the right is similar than in Mirrlees (1976). It links the ‘index of discouragement’ at the left to the differences in consumption of a particular good among people with different abilities, w . The second term at the right is novel and measures the impact of commodity taxation on poverty. Since $x_q^c < 0$, the term is positive, suggesting that the consumption of commodities that enter the deprivation function should be encouraged. This gives rise to the following proposition:

Proposition 1: *When the government minimises poverty, the consumption of goods that enter the deprivation measure and are favoured relatively strongly by low-ability households should be encouraged. Consumption of goods that are favoured relatively strongly by high-ability households should be discouraged.*

In terms of tax rates, commodity taxes should therefore be highest for goods for which the high-ability household have a relatively strong taste and lowest for goods for which the low-ability households have a relatively strong taste and that are included in the deprivation measure. It is interesting to note that encouragement of goods depends on two conditions whereas discouragement only depends on one.

The intuition for the first part of the result is straightforward. If a good is included in the deprivation index, a decrease in its price leads to an increase in its consumption, and thus to a reduction in poverty. On top of the income tax, it is optimal to introduce a small subsidy to directly reduce the cost of consumption of goods that are deemed necessary / important for poverty alleviation.

Since the starting point of income taxation alone also includes the possibility that all commodities are taxed equally, the result also suggests that a commodity tax structure with a basic VAT rate applicable to most commodities and lower rates applied to some basic commodities can be optimal, when the government seeks to alleviate poverty. Many of the real world commodity tax systems have such a feature. Allowing the government to minimise poverty may therefore explain many existing commodity tax structures, which have been hard to combine to messages of conventional tax theory.

The interpretation of the second part of the proposition is completely similar to earlier tax analysis. The government is still constrained by asymmetric information, and it must design its tax schedules so that individuals' incentive compatibility constraints are not violated. Christiansen (1984) shows that goods that are negatively related to labour supply should be taxed relatively more. Holding income constant, a reduction in hours worked can be achieved by an increase in skills. Therefore, a good for which people with higher abilities have stronger taste is negatively related to labour supply.

Edwards et al (1994) provide a straightforward intuition for why it would be optimal to introduce a subsidy to a good which is complementary with labour supply. Subsidising such a good reduces the incentives of high-ability households to work less, which is the distortion

stemming from income taxation. Therefore, the pre-existing distortions from the income taxation can be mitigated. Likewise, introducing a tax on a good complementary with leisure would reduce the valuation of leisure and lead to a increase in labour supply.

As shown originally by Atkinson and Stiglitz (1976), the incentive effect vanishes if consumer preferences are separable between goods and leisure. In this case, the demand of different commodities does not vary with the wage rate (or labour supply), and the first term at the right of (11) is always zero. However, even with separable preferences, the second term at the right in (11) may still be positive. This gives rise to the following observation.

***Corollary 1:** When the government seeks to minimise poverty, even with separable preferences between goods and leisure, non-uniform commodity taxation is still optimal.*

The Atkinson-Stiglitz result is often used as an argument against the use of differentiated commodity taxation as a redistributive device. Direct income transfers (as a part of an optimal income tax scheme) would be sufficient instead. In the present context, there is no reason to suppose that influencing income is better than affecting the consumption of the commodities. The poverty index depends directly on the consumption of some the commodities, and it is in the interest in the government to promote their consumption. This also implies that income-based targeting is not necessarily superior to targeting based on consumption goods.

Note finally that Corollary 1 can also be linked to the taxation of savings. When different commodities are interpreted as consumption in different points in time, the Atkinson and Stiglitz (1976) result implies that savings should not be taxed. But when the government objective is poverty minimisation, the tax schedule of savings also depends on which

commodities are included in the poverty measure. A plausible case in practice is one where the poverty index is measured based on current consumption. This measurement, which can be defended at least if poverty is transitory, would imply a relative encouragement of present over future consumption, in other words, a positive tax rate on savings.

4. Effective marginal tax rates

To obtain the necessary conditions for the effective marginal tax rates, (9) is differentiated with respect to v and L :

$$-D_x x_v^c f - \lambda p x_v^c f + \alpha \{\partial(E_w/E_v)\}/\partial v - \alpha' = 0, \quad (12)$$

$$\alpha(0) = \alpha(\infty) = 0, \quad (13)$$

$$-D_x p x_L^c f + \lambda(w - p x_L^c) f + \alpha \partial(E_w/E_v)/\partial L = 0. \quad (14)$$

The main condition for optimality, (14), may be rewritten as⁹

$$(1 - tx_B)q + w + tx_L = \frac{1}{f} \pi q_w + \frac{1}{\lambda} D_x p x_L^c, \quad (15)$$

where q is defined to be the marginal rate of substitution between income and expenditure on goods that are taxed on linear scale, i.e. $q = -E_y(q, L, v, w)$. The left-hand side of (15) measures the total increase in the tax liability (including commodity taxes and the income tax), or the effective marginal tax rate, of a household when income increases. This leads us to the next proposition and corollary:

⁹ See the Appendix for details.

Proposition 2: *When the government minimises poverty, the effective marginal tax rate is zero at the top of the income distribution but it may be positive or negative at the bottom of the income distribution.*

Corollary 2: *If some work is always desirable, and additional labour supply increases the demand for goods that are needed to alleviate poverty, then the effective marginal tax rate is negative at the bottom of the income distribution.*

Proof: Consider first the end point at the top of income distribution. Then the transversality condition in (13) implies that the first term at the right of (15) is zero. Assuming that the highest income earner is not poor, the second term is zero as well. At the bottom of income distribution, if some work is always desirable (no bunching)¹⁰, the first term at the right is again zero. However, in general the second term may be positive or negative. If $x_L > 0$, the second term is negative, since $D_x < 0$. *QED.*

Proposition 2 implies that the standard result in optimal tax analysis – there should be no distortion at the top – carries over to the present case with poverty minimisation. This is not surprising since the individual at the top is not the concern in poverty alleviation programs. But the result differs from standard welfarist tax analysis, where the marginal tax rate at the bottom of the income distribution is also zero.

¹⁰ In the case where all are included in the labour market, the lowest marginal tax rate is only relevant for the lowest-earning individual and therefore the transversality condition can be directly applied.

The effective marginal tax rate at the bottom of the income distribution can in general be positive or negative. The intriguing case is the one dealt with in Corollary 2 where additional labour supply increases the possibilities for the households to buy goods. With the negative effective marginal tax rate, the government can motivate the poor individual to work more and earn more income. When no weight is given to the leisure of this individual, such policy is clearly desirable from the poverty alleviation point of view. The result can also be seen as a justification for various policies of wage subsidisation that are currently applied in some countries, either through cuts in employer's social security contributions or through systems such as the EITC in the US.

Kanbur et al (1994a) have derived similar results for the case where the government has access to income tax only. The novelty here is to calculate the effective marginal tax rates that includes both the income tax and commodity taxes. Typically one would assume that commodity taxes are on average positive, and therefore the result above would tend to reduce the marginal tax rates of the income tax only. However, in the present case the consumption of commodities that are relevant for poverty calculation should be subsidised. If no other commodity taxes are in use, the result in Proposition 2 would tend to increase the marginal tax rates relative to those derived in the case of no commodity taxes or subsidies. This result can perhaps be seen as a justification for the continuing usage by many governments of higher marginal tax rates, especially at high income levels, than would be suggested by much of the optimal tax literature (in particular early simulations). The concern about poverty may lead to a need to raise revenue by the income tax more than would be optimal from a purely welfarist perspective.

5. The optimal provision of public goods

Public goods may also reduce poverty, either directly or indirectly through the impact on consumer choice. The results below also hold for publicly provided private goods that are consumed to the same extent by the households. One may think of, loosely speaking, e.g. programmes against social exclusion or basic education spending. The deprivation index we consider in (5) is therefore reformulated as

$$P = \int_0^{w^*} D[z, sx(q, w, G), G] f(w) dw. \quad (16)$$

Note that in a first-best world, the rule for optimal provision of a public good would be

$$-\int D_G f dw = r, \quad (17)$$

where r is the producer price of the public good. According to (17) the marginal benefit from poverty reduction due to an increase in public good supply is to be equated to the marginal rate of transformation between the public good and private goods. This is in a sense a first-best ‘Samuelson rule’ in a non-welfarist framework.

In a second-best world with asymmetric information, the government must worry about the effects of public good provision on individuals’ incentives, in other words, the costs of raising revenue for the public good using distortionary taxation. Under welfarism, public good provision under non-linear taxation has been analysed in a number papers, such as Mirrlees (1976), Christiansen (1981) and Boadway and Keen (1993). Our aim here is to derive the optimality condition for public good provision under non-linear income taxation and linear commodity taxation when the government aims to minimise poverty.

To analyse this, suppose x , L and E are also functions of G , and the production constraint now includes the public good, in other words a term λrG is subtracted from the Lagrangean in (18). The Lagrangean is then maximised with respect to G , which yields the following first-order condition:

$$-\int (D_G + D_x s x_G^c) f dw - \int \lambda p x_G^c f dw - \lambda r + \alpha \{ \partial(E_w/E_v) / \partial G \} dw = 0. \quad (18)$$

Let us now define the marginal willingness to pay for the public good by the expression

$$\sigma = \frac{v_G}{v_k} = -E_G. \text{ As shown in the Appendix, expression (18) may then be rewritten as in}$$

equation (19):

Proposition 3: *When the government minimises poverty, the optimal provision of a public good is determined by*

$$-\frac{1}{\lambda} \int D_G f dw = r + \frac{1}{\lambda} \int D_x s x_G^c f dw - \int (1 - t x_k) \sigma f dw - \int t x_G f dw - \int \pi \sigma_w dw. \quad (19)$$

Despite its complicated look, the interpretation of the rule above is relatively straightforward, given the existing knowledge from the welfarist case. The left-hand side of (19) is again the marginal benefit in terms of poverty reduction, now weighted by the inverse of the Lagrange multiplier of government budget constraint (λ). This is to be equated to the marginal rate of transformation, r , and to a number of new terms. From these, the third term at the right refers to the individual marginal willingness to pay for the public good, reduced by a proportion equal to the derivative of commodity taxes with respect to income spent on them. The fourth term at the right is the direct tax revenue effect of G , while the fifth term measures how the

personal marginal willingness to pay varies with w . All these are exactly similar to those derived in the welfarist case.

The novelty arises from the second term at the right, which is the effect of public good provision on poverty through the demand of commodities that are important for avoiding deprivation. If public good provision increases the demand for these goods, the second term at the right is negative, which reduces the cost of public good provision. Other things equal, public good should then be overprovided relative to (17). Of course, the public good may be overprovided as well relative to the welfarist case, where the first term in (19) is equal to zero. In fact, this is likely to be the case for public goods that are favourable in poverty alleviation.

Welfarist literature has established some decentralisation results about public good provision. In the decentralised case, the decisions related to public good supply need not depend on distributional concerns. Roughly speaking, when preferences between private and public goods and leisure are separable, the first-best Samuelson rule is valid even in the case where funds for the public good need to be raised with non-linear income taxation. It is not straightforward to apply these result to the present context, the main problem being that even the first-best rule (17) is different. One way to think about this is to analyse when the second-best rule given in Proposition 3 corresponds to the rule in (17). If preferences are separable between consumption (of private and public goods) and leisure, it can still be the case that $x_G^c \neq 0$.

6 Conclusions

This paper has analysed optimal non-linear income taxation, linear commodity taxation and public good provision when the government seeks to minimise poverty. The tone of much policy discussion and a recent emphasis on social policy and poverty, especially in the EU, motivate exploring the implications of such a non-welfarist approach. The results from optimal tax policy under poverty alleviation may therefore help understand further why real-world tax policy often differs from recommendations from optimal tax literature.

The analysis shows that relatively low commodity tax rates (or subsidies) should be placed on goods that are included in the poverty measure. This conclusion holds even if preferences are separable between goods and leisure. In contrast to the famous result by Atkinson and Stiglitz (1976), non-uniform commodity taxation can therefore be optimal in a large number of situations. Interpreted in a dynamic setting, the result also implies that savings should be taxed, if poverty measure favours present over future consumption. Concerning income taxation, the results show that the effective marginal tax rate at the bottom of the income distribution can differ from zero, and it is negative under plausible assumptions. This result can be seen as a justification for wage subsidy schemes, such as the EITC in the US, that are currently applied in some developed countries. Finally, the paper derived optimal public good provision rules in a ‘first-best’ and second-best situation under poverty alleviation.

The simple, parsimonious, deprivation index applied here may be too crude a formulation of a real-world government objective function. One important avenue would be to explore if there are political economy arguments – such as altruistic preferences or efficiency losses from poverty – that would motivate such a choice. What is sufficient for our qualitative results to

hold is, however, that, in addition to standard welfarist objectives, the government also cares about poverty. The social welfare function could therefore also be a weighted average of social welfare and poverty. Another important area for further research would be to analyse the quantitative importance of the results using simulations. However, to our knowledge, no computational results are available in the mixed tax case even under welfarist objectives.

Appendix

Derivation of equation (11):

Following Tuomala (1990), Slutsky symmetry and the fact that $qx_q^c = 0$ implies

$$px_q^c = (q - t)x_q^c = -tx_q^c = -(q - p)x_q^c. \quad (\text{A.1})$$

Using the properties of the expenditure function,

$$\begin{aligned} \partial(E_w / E_v) / \partial q &= (E_{wq} E_v - E_{vq} E_w) / E_v^2 = (x_w^c - (E_w / E_v) x_v^c) / E_v \\ &= E_v^{-1} (x_w^c + x_w^c u_w) = E_v^{-1} x_w(q, E, w) \end{aligned} \quad (\text{A.2})$$

Substituting (A.1) and (A.2) for (10) then gives the expression in equation (11).

Derivation of equation (15):

Bearing in mind the definition of q , the following properties hold:

$$\partial(E_w / E_v) / \partial L = E_v^{-1} \{E_{wL} - (E_w / E_v) E_{vL}\} = E_v^{-1} (E_{Lw} + E_{Lw} u_w) = -E_v^{-1} q_w(x, L, w) \quad (\text{A.3})$$

and

$$px_L^c = qx_L^c - (q - p)x_L^c = E_L - t(x_L + x_B E_L) = -(1 - tx_B)q - tx_L. \quad (\text{A.4})$$

Combining these with (14) enables one to write equation (15).

Derivation of equation (19):

Note first that with the definition $\sigma = \frac{v_G}{v_k} = -E_G$,

$$\partial(E_w / E_v) / \partial g = (E_{wg} E_v - E_{vg} E_w) / E_v^2 = E_v^{-1} (E_{wg} - E_{vg} v') = E_v^{-1} \sigma_w \quad (\text{A.5})$$

The Slutsky equation for the public good is

$$x_g = x_g^c + x_B E_g. \quad (\text{A.6})$$

Then

$$px_g^c = (q - t)x_g^c = E_g - t(x_g + x_B E_g) = (1 - tx_B)E_g - tx_g. \quad (\text{A.7})$$

Using (A.5) and (A.7) the first-order condition for the public good may be rewritten as in (19).

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Category	B	DK	D	EL	E	F	IRL	I	L	NL	A	PT	FIN	S	UK
Standard rate	21	25	16	18	16	19,6	21	20	15	19	20	17	22	25	17,5
1 Foodstuff	6 12 std	Std	7 std	8	4 7	5,5 std	0 12,5 std	4 10	3	6	10	5 12 17	17	12 std	0 std
2 Water supplies	6	Std	7	8	7	5,5	ex.	10	3	6	10	5	std	std	0 std
3 Pharmaceutical products	6 std	Std	Std	8 std	4 std	5,5 std	0	10 std	3 std	6 std	std	5 17	8	std 0	0 5 std
4 Medical equipment for the disabled	6 std	Std	7	8	7	5,5	0	4 std	3	19	std	17	std ex	std ex	0 5
5 Transport of passengers	6 0 ex	Ex 0	7 std	8	7	5,5	Ex	Ex 10	Ex 3	Ex 6 std	10	5	8	6 0	0
6 Books, newspapers, periodicals	6 0	Std 0	7	4	4	2,1 5,5 std	0 12,5	4	3	6	10	5	8 0 std	6	0
7 Shows, radio, tv	Ex 6 std	Std	Ex 7 std	Ex 4 8 std	Ex 7 std	2,1 5,5 std	Ex 12,5 std	4 10 std	3 std ex	6 std	Ex 10	Ex 5 17	8	6 std	std
8 Writers and composers royalties	6 std ex	Ex	7	8	7	5,5	Std	Ex std	3	Std 6 ex	std 10	17 ex	ex	6	std
9 Social housing	12	Std	std 7	8	4	5,5 std	12,5	4 10	3 std	Std	std	Ex 5	std 17	std ex	std 5 0
10 Agricultural inputs	6 12 std	Std	7	8	7	5,5	12,5	4 10 std	3	6	std 10	5	std 17	std	std

Category	B	DK	D	EL	E	F	IRL	I	L	NL	A	PT	FIN	S	UK
11 Hotel accommodation	6 ex	Std	Std	8	7	5,5	12,5	10	3	6	10	5	8	12	Std
12 Sporting events	6 ex	Std 25	Std	8	7 std	Std	ex	10 std	3 ex	6	std	5	8 ex	Ex 6	Std
13 use of sporting facilities	6 ex	Ex std	Ex	8	Ex std	Std	12,5	Std	3	6 ex	std ex	5	8	6 ex	Ex Std
14 Social services	6 21 ex	Std	7	8	7	Std	Ex	Ex 4 10 std	3 std ex	Std	0 10	17 ex	Ex	Ex std	Ex
15 Cremation services	6	Ex	Std	8	7	Std	std ex	Std	3	Ex	std	ex	ex	ex	Ex
16 Medical and dental care	6 std ex	Ex	7 ex	8	7	std 5,5	Ex Std	Ex	3 ex	Ex std	10 ex	Ex 5	ex	ex	Ex
17 Collection of domestic waste and street cleaning	Std	Std	Ex std	8	7	std 5,5	Ex std	10	3	Std ex	10	Ex 5	std	std	0 std

Table 1: Application of reduced VAT rates by EU member states to categories of goods and services. Situation at 1st May 2002. Ex=exemption, std=standard rate, 0=zero rate (exemption of tax paid at preceding stage). Source: European Commission.