Tagging with leisure needs

Pierre Pestieau* and Racionero†

April 2009

First Draft to be presented at the
Conference in Honour of Robin Boadway
Queen's University, Kingston, Ontario, 14-15 May 2009

Abstract

We study optimal redistributive taxes when individuals differ in two characteristics - earning ability and leisure needs– that are assumed to be imperfectly correlated. Individuals have private information about their abilities, but not necessarily about their needs. If there are two levels of needs and these are observable the population can be separated into two groups and needs may be used as a tag. We first assume that the social planner considers leisure needs as a characteristic that is relevant for compensation and characterize the optimal redistributive policy, and the extent of compensation for leisure needs, with tagging. It is worth noticing that, even if needs in leisure are observable, the amount required to fully compensate for leisure needs differs across ability types and depends on the unobservable ability of individuals. We also consider situations in which the social planner may deem individuals responsible for their leisure needs and characterize the optimal solution in this case.

Keywords: Optimal non-linear taxation, quasi-linear preferences, tagging, needs, responsibility.

JEL Classification: H21, H41

*CREPP, Université de Liège, CORE, PSE and CEPR.
†School of Economics, Australian National University, Australia.

We would like to thankparticipants at the Workshop in Welfare Economics at CORE, in particular F. Maniquet, for their helpful comments. Errors remain ours.

1 Introduction

In the standard optimal redistributive taxation framework individuals are assumed to differ in some private characteristic, such as ability, whose distribution is commonly known. The private nature of this characteristic imposes limits to the extent of redistribution that can be achieved. In particular, redistributive policy must be designed so that individuals are given proper incentives to reveal their true abilities The first paper to emphasize the role of information asymmetry was Mirrlees (1971) in a setting with a continuum of abilities. Stiglitz (1982) considered instead a discrete number of ability types and provided further insights on the role of the incentive compatibility constraints in optimal taxation.

Individuals may differ in more than one characteristic. Some authors have attempted to understand the implications of using information on additional individual characteristics. This question is particularly relevant when these additional characteristics can be observed. In a seminal paper in this area, Akerlof (1978) argued that such characteristics have a role to play in the design of optimal tax schemes if they are correlated with ability, and this even when the characteristics are not, in themselves, pertinent for redistribution. He considered a model in which high- and low-ability individuals could be grouped into two categories on the basis of an exogenously observable characteristic. One category consisted of low-ability types only and the other of both low- and high-ability types. He showed that, within his setting, "tagging" (i.e., conditioning the tax on the observable individual characteristic) increased social welfare. With a utilitarian social welfare function the two low-ability types ended up with different utility levels, with the person in the group consisting only of low-ability types enjoying a higher utility. Hence, tagging can be employed to reduce the cost of redistribution but might violate the principle of horizontal equity.

Other papers have extended this analysis. The literature has produced, however, very few clear-cut results on the implications of tagging on the properties of an optimal non-linear income tax schedule. Immonen et al (1998) studied the pattern of optimal marginal income tax rates in a model with continuous abilities and two tagged groups. Their analysis relied on simulations but they did not provide analytical results. More recently, Cremer et al (2009) have been able to derive analytical results in a model with a continuum of individuals that can be divided into two groups with different ability distributions over the same support. They did so assuming quasilinear preferences, a Rawlsian social welfare function, and a constant and identical elasticity of labour supply within and across the tagged groups. The tagging is based on a publicly and costlessly observable exogenous characteristic. Under those assumptions they show that the marginal income tax rates in the two tagged groups bracket the marginal tax rate when all individuals are pooled together, at all skill levels. In addition, they show that if the skills distribution in one group first-order stochastically dominates the other , tagging calls for redistribution from the former to the latter group. They are also able to provide solutions for income, consumption, and utility, for all individual types with and without tagging. They finally perform some simulations to illustrate tagging on the basis of age. As it has been pointed out above, tagging is often considered objectionable because it violates the principle of horizontal equity. They claim however that, from a lifetime perspective, tagging on the basis of age escapes this common objection.

The kind of characteristics considered by Cremer et al (2008) is, as in Akerlof (1978), exempt from welfare significance in themselves and are only incorporated in the design of the optimal tax scheme in order to extend the limits to redistribution caused by asymmetry of information on those characteristics that are pertinent for redistribution, such as ability. Boadway and Pestieau (2006) study the effects of tagging on redistributive taxation both when the observable characteristic does not have any normative value in itself (denominated henceforth "pure tagging") and the case when it does have welfare significance. In particular, they assume that households vary by needs, where differences in needs represent differences in the amount of resources required to achieve a given level of utility. Following Rowe and Woolley (1999) and Boadway and Pestieau (2003b), they consider the case in which needs reflect differences in consumption requirements. They compare the solutions obtained with pure tagging and tagging with consumption needs. They also analyze the effects on the extent of compensation for needs when tagging is not feasible, due to political constraints or ethical concerns with the violation of horizontal equity. In order to be able to provide qualitative results they assume quasilinear preferences and social welfare functions that exhibit constant absolute aversion to inequality, instead of the more common constant relative aversion. They provide analytical solutions both for the extreme maximin social objective and for social objectives characterized by positive but finite constant aversion to inequality. When the tag does not have welfare significance they show that, under reasonable circumstances, the tax system is more redistributive in the tagged group with the higher proportion of high-ability persons and that inter-group redistribution always goes from the group with higher proportion of high-ability types to that with a lower proportion. When individuals differ in consumption needs and these can be observed, full compensation for needs is optimal if a separate tax schedule applies to the two groups. The compensation for needs is indeed a component of the optimal inter-group lump-sum redistribution scheme and, within each group, the optimal tax schedule depends on the distribution of ability types in the group. When observable consumption needs cannot be used as a tag and individuals face a common tax schedule, there is generally imperfect needs compensation: both under- and over-compensation for needs can result depending on the correlation of needs with ability. Rowe and Woolley (1999) had previously suggested giving universal credit for expenditures on consumption needs as part of an optimal non-linear income tax system.

In a related paper, Boadway and Pestieau (2003a) distinguish two types of needs - consumption and leisure needs - and consider the possibility of the goverment observing them or not. They discuss the implications for the optimal tax problem of observing or not the different types of needs. They provide, but do not explore in details, a few results on tagging. With observable leisure needs, the maximin optimum would be characterized by a standard non-linear income tax schedule with the usual characteristics - non distortion at the top and distortion at the bottom - within each group, and a transfer from the low-needs to the high-needs group. The correlation between ability and needs would play a crucial role. If, for example, the more able individuals have low needs, the transfer across needs groups would be large and would consist of two parts: one accounting for differences in needs and one for differences in average productivity.

In this paper we analyse tagging with leisure needs in further detail. We first assume that the social planner considers leisure needs as a characteristic that is relevant for compensation and characterize the optimal redistributive policy, and the extent of compensation for leisure needs, with tagging. It is worth noticing that, even if needs in leisure are observable, the amount required to fully compensate for leisure needs differs across ability types and depends on the unobservable ability of individuals. This is in contrast with the consumption needs case studied by Boadway and Pestieau (2006), where the amount of compensation for needs is independent of the ability level. This makes the analysis considerably more complicated. We also consider situations in which the social planner may deem individuals responsible for their leisure needs and characterize the optimal solution in this case.

The rest of the paper is organized as follows. In the next section we describe the model with two levels of ability and two levels of leisure needs, and describe the laissez-faire allocation. In section 3 we characterize the first best solution, when both ability and leisure needs are assumed to be observable. We characterize the second best optimum, with unobservable ability but observable leisure needs, in section 4. We do so for a relatively general social welfare function. In order to shed more light on the results we explore several simplified models: we concentrate first on three-types societies, like Akerloff (1978), but taking into account all the different possible combinations. We also provide the maximin results. It is worth noticing that we consider a quasilinear utility specification, similar to the one used by Boadway and Pestieau (2006), but with the key difference that needs appear in the non-linear disutility of labor term rather than the linear consumption term. In the absence of needs, however, the utility specification would be the same and their analysis of pure tagging does then carry over provided we impose similar restrictions on the social utility. In section 5, we discuss the issue of responsibility rather than compensation for leisure needs and explore the results using an alternative objective in which the social planner attemps to make the individuals responsible for their needs. A final section concludes.

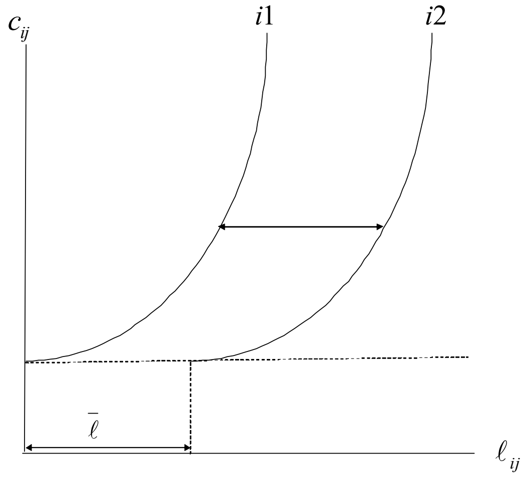
2 The model

We assume individuals differ in ability and leisure needs. We consider two types of ability w_i, with $w_2 > w_1$,where w_i corresponds to the wage rate of a type-i individual, and two levels of leisure needs, represented by $\overline{\ell}_j$, with $\overline{\ell}_1 > \overline{\ell}_2$. There is hence a priori four types of individuals ij. We assume the individual preferences can be represented by a quasilinear utility of the form:

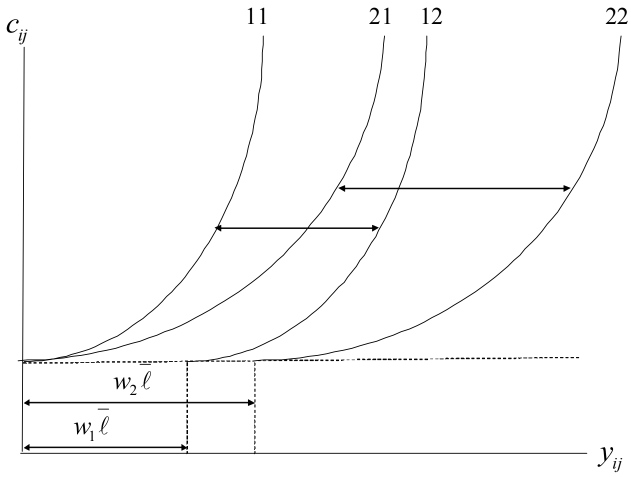
$$U_{ij} = c_{ij} - v\left(\ell_{ij} + \overline{\ell}_j\right) \qquad i, j = 1, 2 \tag{1}$$

where c_{ij} and ℓ_{ij} represent the consumption and the labor supply of individual ij, and the disutility of labor function $v\left(.\right)$ is assumed to be continuous, differentiable, strictly increasing and strictly convex function (i.e., $v' > 0$ and $v'' > 0$). In what follows we normalize the leisure need of the low-need individuals $\overline{\ell}_2$ to 0 and denote the leisure need of the high-need individual by $\overline{\ell}$ Accordingly, we refer to needy and non-needy individuals. The proportion of individuals with ability i and leisure need j in the full population is given by n_{ij}. Adding up accros all types we obtain:

$$\sum_i \sum_j n_{ij} = 1.$$



(a) Different needs in the (c,l) space



(b) Different ability and needs in the (c,y) space

Figure 1: Sets of indifference curves yielding the same level of utility

As pointed out by Boadway and Pestieau (2003a), the assumption that individual utilities are identical net of needs implies that utility levels are comparable among households. This avoids the conceptual problem of how to define the social planner's objective function when individual preferences are different and utilities are non-comparable. For an analysis of optimal redistribution with heterogeneous preferences, see Boadway et al (2002). We represent in Figure 1 sets of individual indifference curves that yield the same utility level. We do so in Figure 1(a) for two individuals with the same ability w_i and different needs in the (ℓ, c)-space. The two indifference curves are horizontally parallel and the horizontal distance is given by the amount of leisure need $\overline{\ell}$. The indifference curves of individuals with different ability and same needs have the same shape in this space. However, this is not longer the case in the (y, c)-space. In Figure 1(b) we represent a set of indifference curves for the four types that yields the same utility level to all. The indifference curve of an individual with lower ability is steeper than the indifference curve of a high-ability individual with the same needs (that is, the usual single crossing property applies within each needs group). The indifference curves of individuals with the same ability and different needs are horizontally parallel. and the horizontal distance is given by the value of the leisure needs, $w_i\overline{\ell}$, which is different for different ability levels. The four individuals' indifference curves would all have the same shape if represented in the $\left(\widehat{\ell}, c\right)$-space where, as in Boadway and Pestieau (2003a), $\widehat{\ell}_{ij} = \ell_{ij} + \overline{\ell}_j$ denotes the effective labor supply.

In a market economy, each individual chooses c_{ij} and ℓ_{ij} to maximize (1) subject to the budget constraint $c_{ij} = w_i \ell_{ij}$. Hence,

$$\max_{\ell_{ij}} \quad U_{ij} = w_i \, \ell_{ij} - v\left(\ell_{ij} + \overline{\ell}_j\right) \qquad i, j = 1, 2.$$

The first order condition (hereafter FOC) is:

$$FOC\left(\ell_{ij}\right) : w_i - v'\left(\ell_{ij} + \overline{\ell}_j\right) = 0 \rightarrow v'\left(\ell_{ij} + \overline{\ell}_j\right) = w_i$$

Hence,

$$\begin{aligned} v'\left(\ell_{ij} + \overline{\ell}_j\right) &= w_i \rightarrow \ell_{i2} = \ell_{i1} + \overline{\ell} \rightarrow \ell_{i2} < \ell_{i1} \rightarrow y_{i2} < y_{i1}, \\ v'\left(\ell_{2j} + \overline{\ell}_j\right) &= w_2 > v'\left(\ell_{1j} + \overline{\ell}_j\right) = w_1 \rightarrow \ell_{2j} > \ell_{1j} \rightarrow y_{2j} > y_{1j}. \end{aligned}$$

All individuals with the same ability provide the same effective labor supply. However, the amount of hours worked in the labor market, and appropriately remunerated, is lower for the needy individuals. Hence, the needy individuals earn a lower income. Among those individuals with the same needs, we have the standard result that those with higher ability work more and earn a higher income. High-ability non-needy individuals work and earn the most. Low-ability needy individuals work and earn the least. It is not possible to disentangle a priori the relationship between high-ability needy individuals and low-ability non-needy individuals (i.e., y_{21} and y_{12}). The precise relationship depends on the particular ability and need gaps, as well as the specific functional form regarding the disutility of labor. In any case, within each ability group, needy individuals earn less than non-needy individuals. It seems in principle fair to compensate for differences in needs within ability groups, and for differences in ability overall. We represent the laissez-faire allocation in Figure 2, both in the (ℓ, c)-space and the (y, c)-space.

3 First best

As a benchmark we analyze the first-best solution. The problem of the planner who fully observes individual characteristics is expressed by the following Lagrangian:

$$\pounds = \sum_i \sum_j n_{ij} \left[G\left[c_{ij} - v\left(\ell_{ij} + \overline{\ell}_j\right)\right] + \mu\left(w_i \ell_{ij} - c_{ij}\right)\right],$$

where μ is the Lagrange multiplier associated with the budget constraint. Given the quasi-linearity of individual utilities, we use a strictly concave social utility transformation $G(\cdot)$ to reflect different degrees of aversion towards inequality.

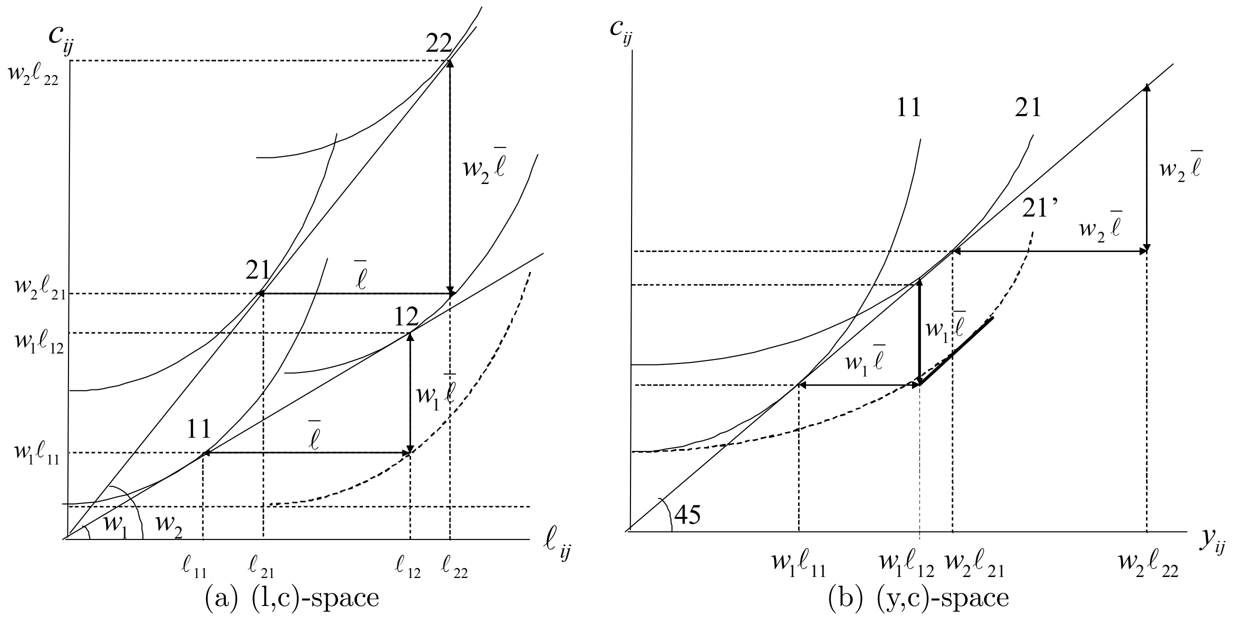


Figure 2: Laissez-faire allocation

The FOCs yield:

$$G'_{ij} = \mu \quad \forall ij,$$
$$\frac{v'\left(\ell_{1j}+\overline{\ell}_j\right)}{w_1} = \frac{v'\left(\ell_{2j}+\overline{\ell}_j\right)}{w_2} = 1.$$

Hence,

$$\begin{aligned} w_1 &= v'\left(\ell_{1j}+\overline{\ell}_j\right) < v'\left(\ell_{2j}+\overline{\ell}_j\right) = w_2 \rightarrow \ell_{1j} < \ell_{2j}, \text{ and} \\ w_i &= v'_{i1}\left(\ell_{i1}+\overline{\ell}\right) = v'_{i2}\left(\ell_{i2}\right) \rightarrow \ell_{i1}+\overline{\ell} = \ell_{i2} \rightarrow \ell_{i1} < \ell_{i2}. \end{aligned}$$

Among two individuals with the same needs, the most productive will work more. Two individuals with the same ability will supply the same effective amount of labour $\widehat{\ell}$. Again, those with higher needs will work less in the market place but in the first-best all individuals achieve the same level of utility regardless their ability or needs. Hence,

$$c_{ij} - v\left(\widehat{\ell}_{ij}\right)$$

is equal for all ij. How can this first best allocation be decentralised? In addition to the traditional redistribution between ability groups there will be redistribution within each ability group from non-needy to needy individuals. What makes compensation for leisure needs more complicated is that, unlike the case of consumption needs, the compensation for leisure needs within ability groups is different for the two ability groups and depends on the ability rate w_i.

Boadway and Pestieau (2003a) show that full compensation for consumption needs would require a rather simple tax-transfer scheme. In order to fully compensate for needs in consumption $\overline{c}$, and achieve the same effective consumption $\widehat{c} = c - \overline{c}$ for all the individuals with the same ability, a lump-sum transfer of $(n_{12} + n_{22})\,\overline{c}$ needs to be provided to each needy individual and a lump-sum tax of $(n_{11} + n_{21})\,\overline{c}$ raised from each non-needy individual, regardless of their abilities.

In our case, since the valuation of the leisure needs are different by ability class a transfer of equal magnitude to both ability types within the needy group, would not allow full compensation. If we call T_{i1} the net transfer to individual $i1$ (where i stands for the two different ability types within the needy group) and T_2 the net transfer from non-needy individuals, regardless of ability, we have that, in order to fully compensate for needs within ability groups:

$$\begin{aligned} T_{11} &= w_1\overline{\ell} + T_2, \\ T_{21} &= w_2\overline{\ell} + T_2. \end{aligned}$$

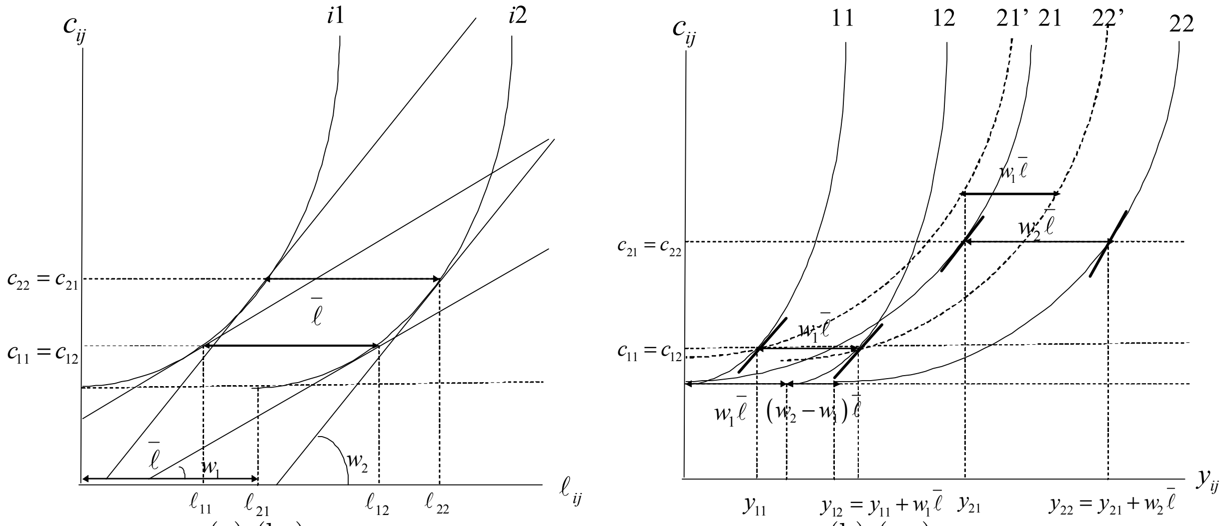
The sum of the net transfers should be equal to zero to fulfill the budget constraint:

$$n_{11}T_{11} + n_{21}T_{21} + (n_{12} + n_{22})\,T_2 = 0.$$

The equilibrium set of transfers is,

$$\begin{aligned} T_2 &= -\left(n_{11}w_1\overline{\ell} + n_{21}w_2\overline{\ell}\right) < 0, \\ T_{11} &= \left[(n_{12} + n_{22})\,w_1 - n_{21}\,(w_2 - w_1)\right]\overline{\ell}, \text{ and} \\ T_{21} &= \left[(n_{12} + n_{22})\,w_2 + n_{11}\,(w_2 - w_1)\,\overline{\ell}\right] > 0. \end{aligned}$$

Both non-needy individuals pay a lump-sum tax. High-ability needy individuals receive a lump-sum transfer but low-ability non needy individuals may pay a lump-sum tax or receive a lump-sum transfer. For the latter to be the case $(n_{12} + n_{22})\,w_1 > n_{21}\,(w_2 - w_1)$, which might be satisfied if the proportion of high-ability needy individuals and/or the productivity gap are sufficiently low. The first best allocation is depicted in Figure 3, both in the (ℓ, c)-space and the (y, c)-space. In the this last space the set of indifference curves - 11, 12, 21 and 22 - yield the same utility level.



(a) (l,c)-space (b) (y,c)-space

Figure 3: First best allocation

4 Tagging with leisure needs

In a second best framework with imperfect information we need to incorporate self-selection constraints (hereafter SSCs) to induce individuals to reveal their true types. When needs are observable, the relevant SSCs are the ones that relate individuals of different ability in each needs group (i.e., preventing 21 from mimicking 11 and 22 from mimicking 12). Note that in Figure 3(b) a type 21 individual would be better off with the treatment designed for a type 11, at indifference curve 21'. Similarly a type 22 individual would be better off with the treatment designed for 12, at indifference curve 22'. Note also that the horizontal distance between the indifference curves of the high-ability individuals in the first best allocation is $w_2\bar{\ell}$, while the horizontal distance between two high-ability individuals attempting to mimick the low-ability individuals in their respective groups is $w_1\bar{\ell}$, which would mean that in such an event 22 is better off than 21.

The second-best problem is then:

$$\max_{c_{ij}, y_{ij}} \quad \sum_i \sum_j n_{ij} G \left[c_{ij} - v\left(\frac{y_{ij}}{w_i} + \bar{\ell}_j \right) \right]$$

s.t.

$$
\begin{aligned}
(\mu) &: \sum_i \sum_j n_{ij} \left(y_{ij} - c_{ij}\right) \geq 0 \\
(\lambda_1) &: c_{21} - v\left(\frac{y_{21}}{w_2} + \overline{\ell}\right) \geq c_{11} - v\left(\frac{y_{11}}{w_2} + \overline{\ell}\right) \\
(\lambda_2) &: c_{22} - v\left(\frac{y_{22}}{w_2}\right) \geq c_{12} - v\left(\frac{y_{12}}{w_2}\right)
\end{aligned}
$$

where λ_j stand for the Lagrange multipliers associated with SSCs within each needs group j (with $j = 1, 2$) The FOCs are:

$$FOC\left(c_{11}\right) : n_{11}\left(G'_{11} - \mu\right) - \lambda_1 = 0 \tag{2}$$

$$FOC\left(y_{11}\right) : -n_{11}\left(G'_{11}\frac{1}{w_1}v'\left(\frac{y_{11}}{w_1} + \overline{\ell}\right) - \mu\right) + \lambda_1\frac{1}{w_2}v'\left(\frac{y_{11}}{w_2} + \overline{\ell}\right) = 0 \tag{3}$$

$$FOC\left(c_{12}\right) : n_{12}\left(G'_{12} - \mu\right) - \lambda_2 = 0 \tag{4}$$

$$FOC\left(y_{12}\right) : -n_{12}\left(G'_{12}\frac{1}{w_1}v'\left(\frac{y_{12}}{w_1}\right) - \mu\right) + \lambda_2\frac{1}{w_2}v'\left(\frac{y_{12}}{w_2}\right) = 0 \tag{5}$$

$$FOC\left(c_{21}\right) : n_{21}\left(G'_{21} - \mu\right) + \lambda_1 = 0 \tag{6}$$

$$FOC\left(y_{21}\right) : -n_{21}\left(\left(G'_{21} + \frac{\lambda_1}{n_{21}}\right)\frac{1}{w_2}v'\left(\frac{y_{21}}{w_2} + \overline{\ell}\right) - \mu\right) = 0 \tag{7}$$

$$FOC\left(c_{22}\right) : n_{22}\left(G'_{22} - \mu\right) + \lambda_2 = 0 \tag{8}$$

$$FOC\left(y_{22}\right) : -n_{22}\left(\left(G'_{22} + \frac{\lambda_2}{n_{22}}\right)\frac{1}{w_2}v'\left(\frac{y_{22}}{w_2}\right) - \mu\right) = 0 \tag{9}$$

From (2), (4), (6) and (8) we obtain:

$$G'_{11} = \mu + \frac{\lambda_1}{n_{11}} \quad , G'_{12} = \mu + \frac{\lambda_2}{n_{12}}, \quad G'_{21} = \mu - \frac{\lambda_1}{n_{21}} \text{ and } G'_{22} = \mu - \frac{\lambda_2}{n_{22}}. \tag{10}$$

The relationship between the utility level achieved by individuals of the same ability and different needs depends on the ratio of the value of the Lagrange multiplier (the strength of the SSC in the group) to the proportion of individuals of that ability level in each group (the larger or smaller relative presence of a particular type in the population):

$$
\begin{aligned}
G'_{11} &\geq G'_{12} \Leftrightarrow \frac{\lambda_1}{n_{11}} \leq \frac{\lambda_2}{n_{12}}, \\
G'_{21} &\geq G'_{22} \Leftrightarrow \frac{\lambda_1}{n_{21}} \leq \frac{\lambda_2}{n_{22}}.
\end{aligned}
$$

Rerranging the FOCs,

$$v'\left(\frac{y_{21}}{w_2} + \overline{\ell}\right) = v'\left(\frac{y_{22}}{w_2}\right) = w_2,$$

$$v'\left(\frac{y_{11}}{w_1}+\overline{\ell}\right)<w_1 \text{ and } v'\left(\frac{y_{12}}{w_1}\right)<w_1,$$

$$\mu=\sum_i\sum_j n_{ij}G'_{ij}.$$

The second-best levels of y_{22} and y_{21}coincide with the first-best ones and both individuals supply the same effective amount of labor $\widehat{\ell}$ There is no efficiency gain in distorting the labour supply choice of the high-ability individuals. This does not mean they achieve the same utility level, as mentioned above because they might end up with different consumption levels. Both low-ability individuals are distorted at the margin and supply a lower effective labor than in the first-best but the relationship between the effective amounts labor supplied by the two low-ability individuals is ambiguous:

$$v'\left(\frac{y_{11}}{w_1}+\overline{\ell}\right) \gtrless v'\left(\frac{y_{12}}{w_1}\right).$$

With this level of generality it is difficult to give more precise results due to the fact that we do not have explicit expressions for the Lagrange multipliers in terms of the parameters, particularly the distribution of types. We focus first on societies which are composed by three types. With 3 types necessarily one of the groups is composed by individuals of the same ability, and their level of ability becomes thus publicly known. This is similar to the kind of population considered originally by Akerloff (1978). We also explore the consequences of adopting a particular social objective - the maximin - when all 4 types of individuals are present in the society. This particular social objective has been commonly employed in the literature on tagging. For instance, Cremer et al (2009) assume that the social planner is Rawlsian and Boadway and Pestieau (2006) restrict the analysis to social objectives characterized by constant absolute aversion to inequality, among which the maximin outcome is amply discussed.

4.1 3-types societies

There are four different combinations of 3-types societies: {11,12,22}, {11,12,21}, {11,21,22} and {12,21,22}. We formally analyse the first case and briefly mention the results for the other three.

When only individuals of types 11, 12 and 21 are present in the population, we are able to ascertain that all individuals we observe having leisure needs are low-ability types, and take this information into account in the design of the optimal tax system. There is now only one relevant self-selection constraint, the one that links high- and low-ability types in the non-needy group and from (10) we know that $u_{22} > u_{11} > u_{12}$ as long as $\lambda_2 > 0$ (i.e., the relevant self-selection constraint is binding). Therefore,

$$c_{22} - v\left(\frac{y_{22}}{w_2}\right) > c_{11} - v\left(\frac{y_{11}}{w_1} + \overline{\ell}\right) > c_{12} - v\left(\frac{y_{12}}{w_1}\right).$$

A low-ability needy individual is made better off because the social planner can identify her as being low-ability by observing her leisure needs. This is consistent with Akerloff (1978)'s findings.

We can also study the marginal tax rates and the extent of compensation for leisure needs. Type-22 individuals face a zero marginal tax rate and type-12 individuals face a positive marginal tax rate. This is consistent with the more general results shown above. When all needy individuals are low-ability, and we apply separate tax schedules to needy and non-needy, there is no reason to impose a positive marginal tax rate on type-11 individuals:

$$w_1 = v'\left(\frac{y_{11}}{w_1} + \overline{\ell}\right) > v'\left(\frac{y_{12}}{w_1}\right).$$

The effective labour supply of needy individuals is higher, but they are more than fully compensated for their leisure needs through a larger consumption:

$$c_{11} - c_{12} > v\left(\frac{y_{11}}{w_1} + \overline{\ell}\right) - v\left(\frac{y_{12}}{w_1}\right).$$

This situation is depicted in Figure 4. The lines 11, 12 and 22 represent the utility levels achieved by the these three types of individuals in the second best allocation. The dashed lines 12' and 22' represent the indifference curves in situations where types 12 and 22 would obtain the same utility level as type 11. Clearly type-12 individuals are worse-off and type-22 individuals better off than type-11.

If all non-needy individuals are low-ability instead, which is the case where the society is composed by types 11, 12, and 21, there is no benefit in distorting the labor supply decision of type-12 individuals. The effective labor supply of type-11 is low, relative to type-12 individuals ($\ell_{11}+\overline{\ell} < \ell_{12}$) but type-11 also received considerably less consumption and end up being worse-off than type-12: $u_{21} > u_{12} > u_{11}$.

In societies composed by two kinds, needy and non-needy, of high-ability individuals and one kind of low-ability individual, the relationship between the level of utility achieved by the high-ability types depends on whether the low-ability types is needy or non-needy. As shown generally above, there is non-distortion at the margin on both high-ability types and

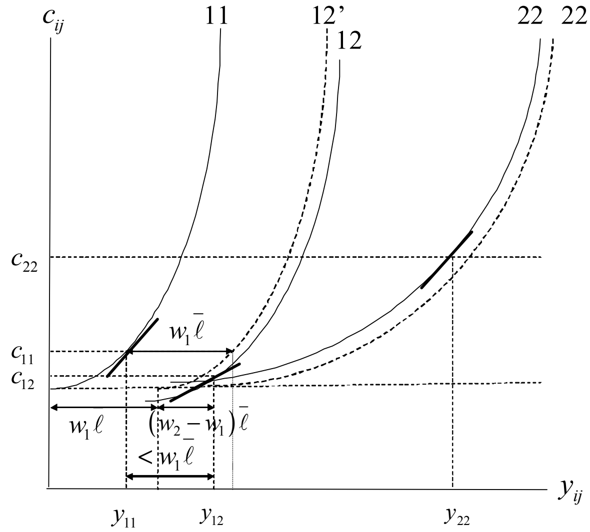


Figure 4: Second best allocation in the 11,12,22 society

they provide the same effective amount of labor. However, they are allocated different amounts of consumption depending on the group they belong to. If the low-ability type is needy, the non-needy individuals are identified as high-ability types and $u_{21} > u_{22} > u_{11}$. If the low-ability type is non-needy, the needy individuals are identified as high-ability types and $u_{22} > u_{21} > u_{12}$.

4.2 Maximin

We now explore the consequences of adopting a maximin social objective. As mentioned above, this objective has been commonly assumed in the literature on tagging. In our case, the maximin solution can be obtained by solving the following problem:

$$\max_{c_{ij},y_{ij}} c_{11} - v\left(\frac{y_{11}}{w_1} + \overline{\ell}\right)$$

s.t.

$$\begin{aligned}
(\mu) &\ :\ \sum_i \sum_j n_{ij}\left(y_{ij} - c_{ij}\right) \geq 0 \\
(\lambda_1) &\ :\ c_{21} - v\left(\frac{y_{21}}{w_2} + \overline{\ell}\right) \geq c_{11} - v\left(\frac{y_{11}}{w_2} + \overline{\ell}\right) \\
(\lambda_2) &\ :\ c_{22} - v\left(\frac{y_{22}}{w_2}\right) \geq c_{12} - v\left(\frac{y_{12}}{w_2}\right) \\
(\gamma) &\ :\ c_{12} - v\left(\frac{y_{12}}{w_1}\right) \geq c_{11} - v\left(\frac{y_{11}}{w_1} + \overline{\ell}\right)
\end{aligned}$$

where γ stands for the Lagrange multiplier associated with the constraint that relates both low-ability types. The public information on leisure needs implies that the two low-ability types can be separated. There is then no incentive compatibility constraint linking the two-low ability types but instead a constraint that ensureas that the utility of type-12 individuals does not fall below the utility of type-11 ones. The FOCs associated with the consumption variables yield:

$$\mu = 1, \quad \lambda_1 = n_{21}, \quad \lambda_2 = n_{22} \text{ and } \gamma = (n_{12} + n_{22}).$$

Therefore, all the constraints bind. It is worth noticing that $u_{11} = u_{12}$ in the maximin outcome, regardless of the distribution of abilities in the needy and non-needy groups. However, the relationship between the effective amount of labour they supply depends on the distribution of abilities in each needs groups according to the FOCs associated with y_{11} and y_{12} :

$$\begin{aligned} \frac{1}{w_1} v'\left(\frac{y_{11}}{w_1} + \overline{\ell}\right) - 1 &= \frac{n_{21}}{n_{11}} \left[\frac{1}{w_2} v'\left(\frac{y_{11}}{w_2} + \overline{\ell}\right) - \frac{1}{w_1} v'\left(\frac{y_{11}}{w_1} + \overline{\ell}\right)\right], \\ \frac{1}{w_1} v'\left(\frac{y_{12}}{w_1}\right) - 1 &= \frac{n_{22}}{n_{12}} \left[\frac{1}{w_2} v'\left(\frac{y_{12}}{w_2}\right) - \frac{1}{w_1} v'\left(\frac{y_{12}}{w_1}\right)\right]. \end{aligned}$$

In the extreme distributional cases where all high-ability individuals belong to the same group, it is easy to show that if the high-ability individuals are non-needy then $\ell_{11} + \overline{\ell} > \ell_{12}$, whereas $\ell_{11} + \overline{\ell} < \ell_{12}$ when all high-ability individuals are needy. In any case, the low-ability individual who is pushed to work a relatively larger effective time (inclusive of their her need) is compensated by a higher consumption that equates both utility levels. The high-ability individual achieves a higher level of utility.[1]

5 Responsibility

We have assumed so far that needy individuals deserve compensation for their needs, even if the absence of full information on abilities implies in most cases imperfect compensation for leisure needs.[2] Compensation for leisure needs would seem fair if the need stems from some type of disability or health condition that the individual has to take care of before she can become an

[1] When all low-ability individuals belong to a single type (say, needy), those individuals belonging to the other type (say, non-needy) can be identified as high-ability ones. If all non-needy individuals are high-ability ones, there is no SSC in the non-needy group that sets a minimum bound on type 22's utility. Hence, we must ensure type-22's utility does nof fall bellow type-11. This constraint binds and $u_{21} > u_{22} = u_{11}$. If the low-ability type is non-needy, the needy individuals are identified as high-ability types and $u_{22} > u_{21} = u_{12}$.

[2] In the case of consumption needs analyzed by Boadway and Pestieau (2006), full compensation for needs arises as long as the social planner is allowed to tag.

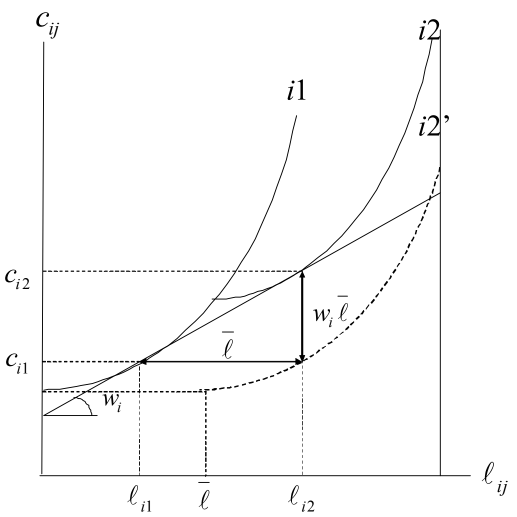
active participant in the labor market. It is unclear, however, that the social planner would wish to compensate individuals for all possible types of leisure needs. In this section we consider the effects, on the optimal tax schedule, of considering the individuals responsible for their needs.

We choose to capture responsibility for leisure needs in the social objective by rescaling type-ij individual utility by a factor $w_i\bar{\ell}_j$. This has an axiomatic justification in the social choice literature that studies compensation and responsibility. Fleurbaey (1995) analysed the concept of responsibility, and the way it appears in economic theory and in egalitarian theories of justice, rather broadly. Fleurbaey and Maniquet (2006, 2007) deal with compensation and responsibility in a framework that is more closely related to ours. They explore the optimal income tax problem when individuals differ in ability and preferences for leisure. They consider fairness principles, which capture the notions of compensation and responsibility, and analyze the implications of incorporating them on the characteristics of the social objectives that are consistent with them, and on the characteristics of the resulting optimal tax schemes. In particular, Fleurbaey and Maniquet (2006) consider a fairness requirement that has to do with providing opportunities and respecting individual preferences. They mention that, according to Dworkin (1981), when all agents have the same wage rate, it can be argued that there is no need for redistribution, as they all have access to the same labor-consumption bundles, and any income difference is then a matter of personal preferences. In Figure 6 we apply this principle to heterogeneous leisure needs rather than preferences but with the same aim of considering the individuals responsible for their needs. A type-$i1$ individual works $\ell_{i1}+\bar{\ell}$, earns y_{i1} and consumes c_{i1}, whereas a type-$i2$ individual works $\ell_{i1}+\bar{\ell}$, earns $y_{i2}=y_{i1}+w_i\bar{\ell}$ and consumes $c_{i1}+ w_i\bar{\ell}$ (i.e., the needy individual earns and consumes $w_i\bar{\ell}$ less than the needy one). The fact that two individuals with the same ability and different needs end up at different allocations along the same budget constraint is not problematic when we consider the needy individual responsible for the shortfall. Note that under compensation for leisure needs the indifference curves $i1$ and $i2'$ represented the same utility level for types $i1$ and $i2$, respectively, whereas under responsibility, it is now the indifference curves $i1$ and $i2$ that capture the same utility level for these two types.

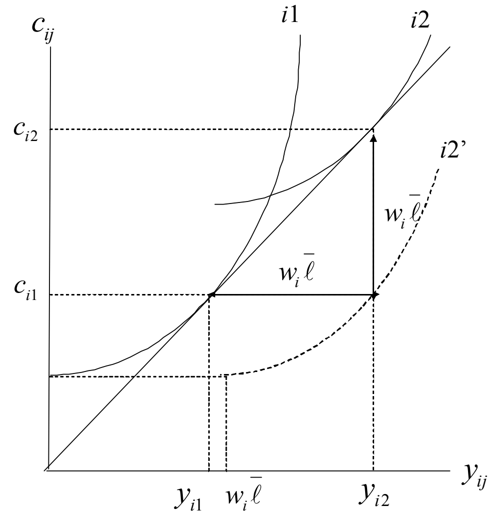
The Lagrangian in the first best problem is now

$$\pounds = \sum_i \sum_j n_{ij} \left[G\left[c_{ij} - v\left(\frac{y_{ij}}{w_i} + \bar{\ell}_j \right) + w_i\bar{\ell}_j \right] + \mu \left(w_i\ell_{ij} - c_{ij} \right) \right],$$

The FOCs yield $G'_{ij}=\mu \quad \forall ij$, $v'\left(\ell_{1j}+\bar{\ell}_j\right)=w_1$ and $v'\left(\ell_{2j}+\bar{\ell}_j\right)=w_2$. The labor supply of



(a) (l,c)-space



(b) (y,c)-space

Figure 5: Compensation versus responsibility for leisure needs

each type coincides with what was obtained before in the first-best problem with compensation for leisure needs. However, now it is not $c_{ij} - v\left(\widehat{\ell}_{ij}\right)$ but $c_{ij} - v\left(\widehat{\ell}_{ij}\right) + w_i\bar{\ell}_j$ which are equalized across all individuals:

$$c_{i1} - v\left(\frac{y_{i1}}{w_i} + \bar{\ell}\right) + w_i\bar{\ell} = c_{i2} - v\left(\frac{y_{i2}}{w_i}\right)$$

which implies $c_{i2} - c_{i1} = w_i\bar{\ell}$.and, hence, no compensation for leisure needs.

The second best problem and the associated FOCs are similar in form to those obtained with compensation, the only difference being that the argument of $G'(.)$ in the FOCs includes now the rescaling factor $w_i\bar{\ell}_j$. It is worth noticing that, although the social planner employs it in the social objective, the rescaling factor does not appear in the SSCs. All high-ability individuals face zero marginal tax rates. The effective labor supply is the same for both high-ability types (i.e., $\ell_{21} + \bar{\ell} = \ell_{22}$) and concides with the one obtained in the first best. In any case the relationship between the utility levels, which now include the rescaling factor $w_i\bar{\ell}_j$, is determined by comparing λ_1/n_{21} and λ_2/n_{22}. Both low-ability individuals face positive marginal tax rates, and the relationship between their utility levels depends on the relationship between λ_1/n_{11} and λ_2/n_{12}.

Boadway and Pestieau (2006) did not consider making individuals responsible for their consumption needs. Nevertheless, it could be similarly argued that, even though it may seem fair to compensate individuals for certain kinds of consumption needs (for instance, certain expenses on health care), there may be other kinds of consumption needs that the individuals may be held responsible for. It is worth recalling that, in their framework, consumption needs appear in the linear term of the quasi-linear utility specification and the magnitude of the need is the same regardless of ability type. It is quite straightforward to show that, in such a setting, tagging with responsibility for needs would yield the same result, concerning marginal income tax rates, as pure tagging (i.e., tagging when the observable characteristic has no welfare significance). The only difference is that the allocations of needy individuals are shifted down by the amount of the consumption need $\overline{c}$.

In our case responsibility for leisure needs does not lead to the pure tagging outcome because a uniform rescaling down of consumption of needy individuals does not imply that both ability types are made responsible for their needs to the same extent. This is best illustrated by the maximin outcome. With responsibility for needs,

$$c_{12} - v\left(\frac{y_{12}}{w_1}\right) = c_{11} - v\left(\frac{y_{11}}{w_1} + \overline{\ell}\right) + w_1\overline{\ell}.$$

The needy low-ability individuals are made responsible for their leisure needs when their consumption is shifted down by the amount $w_1\overline{\ell}$. The allocation of high-ability individuals is shifted down by the same amount due to the SSC that links both needy individuals. This means that the needy high-ability individuals are not made fully responsible for their leisure needs, which would require shifting down their consumption by $w_2\overline{\ell}$.

6 Conclusions

In this paper we have studied the optimal redistributive tax scheme when individuals differ in two characteristics, earning ability and leisure needs, which were assumed to be imperfectly correlated. Individuals have private information about their abilities, but needs are observable. The population can then be separated into two groups and needs can be used as a tag. We first assumed that the social planner considered leisure needs as a characteristic relevant for compensation and characterized the optimal redistributive policy, and the extent of compensation for leisure needs, with tagging. Even if needs in leisure are observable, the amount required to fully compensate for leisure needs differs across ability types and depends on the unobservable ability of individuals. We have also considered situations in which the social planner deemed individuals responsible for their leisure needs and characterized the optimal solution in this case. We showed, using the maximin illustration with four types, that attempting to make individuals responsible for their leisure needs does not correspond to pure tagging, as it would be the case with linear consumption needs. Even if needy low-ability individuals were made fully responsible for their needs, it is not possible to make needy high-ability individuals fully responsible.

References

[1] Akerloff, G.A.(1978), The Economics of "Tagging" as Applied to the Optimal Income Tax, Welfare Programs, and Manpower Training, *American Economic Review*, 68, 8-19.

[2] Boadway, R. and P. Pestieau (2006), Optimal taxation with tagging, *Annales d'Economie et de Statistique*, 83-84, 123-50.

[3] Boadway, R. and P. Pestieau (2003a), Optimal redistribution and needs, in Michael Ahlheim, Heinz-dieter Wenzel and Wolfgang Weigard (eds.), *Steuerpolitk-Von der Theorie zur Praxis, Fetschrift fur Manfred Rose* (Berlin Springer-Verlag), 1-14.

[4] Boadway, R. and P. Pestieau (2003b), Indirect Taxation and Redistribution: the Scope of the Atkinson-Stiglitz Theorem in Imperfect Economics, *Essays in Honor of Joseph Stiglitz*, R. Kanbur and R. Arnott (eds), MIT Press.

[5] Boadway, R., M. Marchand, P. Pestieau and M. Racionero (2002), Optimal redistribution with heterogeneous preference for leisure, *Journal of Public Economic Theory*, 4, 475-498.

[6] Cremer, H., F. Ghavari, and J-M Lozachmeur (2009), Tagging and Income Taxation: Theory and Application, *American Economic Association - Economic Policy*, forthcoming.

[7] Cremer, H., P. Pestieau and J-Ch. Rochet (2001), Direct versus indirect taxation. The design of the tax structure revisited, *International Economic Review*, 42, 781-99.

[8] Dworkin, R. (1981), What is Equality? Part 2: Equality of Resources, *Philosophy and Public Affairs*, 10, 283-345.

[9] Fleurbaey, M. (1995), Equality and responsibility, *European Economic Review*, 39, 683-689.

[10] Fleurbaey, M. and F. Maniquet (2006), Fair income tax, *Review of Economic Studies*, 73, 55-83.

[11] Fleurbaey, M. and F. Maniquet (2007), Help the low-skilled or let the hardworking thrive? A study of fairness in optimal income taxation, *Journal of Public Economic Theory*, 9, 467-500.

[12] Immonen, R., R. Kanbur, M. Keen and M. Tuomala (1988), Tagging and Taxing: The Optimal Use of Categorical and Income Information in Designing Tax/Transfer Schemes, *Economica*, 65, 179-192.

[13] Lozachmeur, J-M. (2006), Optimal age specific income taxation, *Journal of Public Economic Theory*, 8, 911-922.

[14] Mirrlees, J. (1971), An exploration in the theory of optimal taxation, *Review of Economics Studies*, 38, 175-208.

[15] Rowe, N. and F. Woolley (1999), The Efficiency Case for Universality, *Canadian Journal of Economics*, 32, 613-629.

[16] Stiglitz, J.E. (1982), Self-Selection and Pareto Efficient Taxation, *Journal of Public Economics* , 17, 213-240.