The Normative Analysis of 'Tagging' Revisited: Dealing with Stigmatization*

Laurence Jacquet† and Bruno Van der Linden‡

December, 2003

Abstract

Should income transfers be conditional upon personal characteristics of the potential recipients (the so-called "tagging") or should they only be tied to reported incomes? This question is addressed in a partial equilibrium setting distinguishing two types of jobs and a distribution of worker types. In a system with tagging, there is clear evidence that the assessment of the eligibility of applicants creates stigmatization. By assumption, the intensity of stigma is exogenously distributed. Then, tagging is always suboptimal under a Rawlsian criterion. With a utilitarian criterion, the analysis shows that tax/transfer systems with and without tagging can solve the first-order optimality conditions. A numerical analysis suggests that tagging can only be recommended if the distribution of the intensity of stigmatization relative to earnings is highly concentrated on low values. However, this is only a necessary condition. Tagging is never optimal if the dispersion of abilities among the 'high-ability people' is too large or too narrow.

Key words : tagging, optimal taxation, welfare programs, stigmatization.

JEL Classification : H2, I3

---

*This research is part of two programs supported by the Belgian government (Interuniversity Poles of Attraction Programs PAI P4/01 and P4/32 financed by the Prime Minister's Office - Federal Office for Scientific, Technical and Cultural Affairs). We deeply thank Maurice Marchand and also Robin Boadway, Bart Cockx, Kate Cuff, Jean-Yves Duclos, Ginette Herman, Jean Hindriks, Etienne Lehmann and Philippe Van Parijs for very useful discussions and comments. Any remaining error could only be attributed to the authors.

†Institut de Recherches Economiques et Sociales, Département des Sciences Economiques, Université Catholique de Louvain, Place Montesquieu 3 B-1348 Louvain-la-Neuve Belgium. E-mail: jacquet@ires.ucl.ac.be.

‡Fonds National de la Recherche Scientifique and Institut de Recherches Economiques et Sociales, Département des Sciences Economiques, Université Catholique de Louvain. E-mail: vanderlinden@ires.ucl.ac.be

I Introduction

Income redistribution among individuals and assistance to the needy are typically implemented through the tax and/or the welfare systems. Tax authorities rely on reported income levels while welfare agencies can assess the eligibility of claimants on the basis of various personal characteristics (such as disability or 'employability'). It is typically argued that a combination of taxation and targeting ('tagging') on these personal characteristics leads to a better trade-off between the incentive costs of distortionary income taxes and the social welfare gains of redistribution. Put another way, tagging improves the ability to target transfers on those who need them most. This view is challenged in this paper which introduces the demeaning or stigmatizing effect of tagging.

The literature on optimal income taxation (see the seminal papers of Mirrlees 1971, and Stiglitz 1987) characterizes the optimal shape of marginal tax rates under imperfect information about the earning ability of the tax payers. This approach has been used to recommend a form of non linear negative income tax (Boadway and Keen, 2000). The notion of a negative income tax (NIT) appears first in the writing of Cournot (1838). It was proposed by Friedman (1962) as a way of trimming down the welfare state, and explored at more depth by James Tobin (1966, 1968). A negative income tax is a refundable tax credit with an explicit tax schedule which can be, but need not by definition be, linear. Another strand of the literature is concerned with optimal welfare programs (Akerlof 1978, Diamond and Sheshinski 1995, Parsons 1996, Boadway, Marceau and Sato 1999). In this literature, the welfare agencies know more than reported income levels and the aggregate distribution of abilities. They condition transfers on personal characteristics of potential recipients (the so-called tagging or targeting process), that provide some imperfect information about the earning ability. Akerlof deals with errors of type I (some of those who are entitled to the benefits are rejected). Parsons (1996) adds errors of type II (individuals not entitled are accepted). Both argue that tagging increases aggregate welfare. Moreover, as long as the disutility of work is not too large, Parsons (1996) shows that the optimal system should allow tagged people to work. In Akerlof (1978), Diamond and Sheshinski (1995) and Parsons (1996), tagging is costless. The accuracy of the tag and therefore the probabilities of errors are taken as given. Boadway, Marceau and Sato (1999) emphasize the role of social workers whose (imperfectly observable) effort affects the magnitude of these errors and induces administrative costs. They show that the choice between transferring income to the poor through tagging or via a non linear negative income tax system depends on the magnitude of administrative costs relative to the benefits of targeting.

In addition to their administrative costs, redistribution mechanisms based on tagging also raise issues of horizontal equity (which requires that those with equal status, whether measured by ability or some other appropriate scale, should be treated the same) and of political feasibility (Sen 1995). The more targeted the transfers towards the truly needy, the lower the support from the excluded middle income class. This can have detrimental effects on the actual level of redistribution (Gelbach and Pritchett 1996, De Donder and Hindriks 1998). Another problem with redistribution instruments conditional on a tag is the so-called 'poverty- or inactivity-trap' that leads to very high effective marginal tax rates on those who try to escape from tagged groups.

Other arguments against tagging are based on the evidence that non-take-up is important. Many reasons can be invoked to explain this phenomenon: Imperfect information of the eligible population, lack of literacy or numeracy, transaction costs related in particular to the time spent queuing and filling forms, the demeaning or stigmatizing effect of claiming benefits that require an assessment of personal characteristics. This paper deals with the latter explanation. This focus is motivated by the growing evidence that this phenomenon is important[1] and by the relative lack of interest for this explanation in the economic literature.[2]

Our theoretical setting is close to Akerlof (1978)'s paper. There are two types of workers, the low-ability workers (whose productivity can at the limit be zero -the "disability case"-) and the high-ability ones. As in the standard optimal taxation literature, each productive individual has access to a job which remunerates him according to his productivity. As in Akerlof, the targeted transfer, if any, is added to the labor earnings of tagged people. This contrasts with Parsons (1996) and Boadway, Marceau and Sato (1999). In their models, the population is subdivided between (non-working) disable and able people and only the latter are able to work. We deliberately neglect errors of type II and administrative costs linked to imperfect monitoring of social workers. By assumption, the latter do costlessly observe the ability of workers and can prevent high-ability workers

[1] Moffitt (1983) provides an econometric test for stigma in the U.S. Aid to Families with Dependent Children program. Using data from the 1976 wave of the Michigan Panel Study on Income Dynamics for the female-headed population, his model is estimated for the Aid to Families with Dependent Children program. His results show definite evidence of a stigma-related disutility of participation in welfare programs. Along these lines, a vast empirical literature has studied the non take-up of various types of welfare or means-tested benefits. In this literature, stigma is mentioned among the non-pecuniary participation costs. Among others: Ashenfelter (1983), Moffitt (1983), Blundell, Fry and Walker (1988), Blank and Ruggles (1996), Duclos (1995, 1997), Pudney, Hernandez and Hancock (2002), Terracol (2002), Hancock and Barker (2003), Hancock, Pudney, Barker, Hernandez, Suntherland (2003).

[2] In order to compare NIT and means-testing schemes, Besley (1990) introduces the non-recoverable "costs (psychic and pecuniary)" (p.119) that individuals incur when they claim means-tested benefits. Taking the alleviation of poverty as an appropriate social goal, Besley (1990) concludes that means-testing is superior. Besley and Coate (1992) explore the reasons for welfare stigma. In this analysis, welfare stigma emerges from a statistical discrimination behavior or from a resentment of taxpayers who have to finance assistance schemes. They conclude that under both mechanisms improved targeting will reduce the number of "undeserving claimants" and will reduce welfare stigma due to cheaters.

from benefiting from the assistance scheme. Under these assumptions, it is expected that the assistance scheme targeted on the less able is superior to a tax/transfer mechanism designed by the tax authority.

This paper shows that the introduction of stigmatization challenges the superiority of tagging. In ancient Greece, a "stigma" was a sign on the body of someone who was morally defective (for instance a slave or a criminal). This term was reintroduced by Goffman (1963) to refer to an attribute of a person that is deeply discrediting. A stigma is "a special kind of relationship between attribute and stereotype" (Goffman 1963, p.9) that at least calls into question the full humanity of someone in a given social and cultural context.

Responsibility (or controllability) and visibility of discrediting attributes are two important dimensions along which stigmatizing conditions differ. Individuals are more disliked, rejected and harshly treated when their stigma is perceived as under their responsibility, as controllable (Crocker, Major and Steele 1998). There is strong evidence that poor people are often to some extent held responsible for their condition (see e.g. Rainwater 1982). In this paper, we assume that being a low-ability and low-paid worker is the demeaning characteristic.

To cope with the prejudice and stereotypes triggered by their stigma, people often try to conceal the corresponding attributes. The institutional setting clearly affects the possibility of concealment. The handling of individual characteristics by tax authorities can be considered as fairly anonymous. In this paper, the tax authority only observes reported income. Moreover, in our theoretical setting, for some high-ability workers, it is optimal to work in "unskilled" jobs. So, as long as income taxation is the only instrument used for redistribution, having low earnings does not reveal that one is a low-ability individual. Things deeply change when tagging is introduced. It is implemented by social workers in welfare agencies who evaluate the eligibility of applicants. This assessment typically implies enquiries and tests of a searching and detailed kind. As it is made without errors, the assessment makes the demeaning characteristic visible and so it creates a stigma. Low-ability workers are endowed with an individual-specific parameter that measures the impact of stigma on their well-being. Stigmatization affects the decision to take up benefits. Low-ability people are aware of their eligibility but part of them possibly do not claim assistance benefits because they prefer not to be stigmatized. For the latter, the amount of transfer/tax depends then on the redistribution that can be implemented by the tax authority.

Our normative analysis deals with the optimality of tagging and, whether tagging is desirable or not, it aims at characterizing the optimal tax/transfer schedule. We contrast the conclusions reached with a utilitarian social welfare function, a maximin welfare criterion and two criteria only based on the utility derived from income (neglecting the consequences of stigmatization). So doing, we cover a wider range of normative criteria than Besley (1990).

The paper is organized as follows. Section II introduces assumptions and notations. Analytical results are presented in Section III. Since this normative analysis does not allow to reach clear-cut conclusions in the utilitarian case, a numerical analysis is summarized in Section IV. Section V concludes the paper.

II Assumptions and notations

By assumption, workers supply one unit of labor. Let us consider two types of individuals who differ in terms of their abilities indexed by j. The low-ability workers ($j = l$) are characterized by exogenous gross or pretax earnings, $w_l \geq 0$. If $w_l = 0$, these individuals are by assumption unable to work (say, because of a disability). The socio-psychological literature mentioned in the introduction motivates our assumption according to which having low abilities is demeaning. A high-ability worker ($j = h$) can either occupy a job designed for his ability (labelled a "skilled job") or he can have an occupation requiring low abilities (labelled an "unskilled job"). This choice is easily reinterpreted in the case where $w_l = 0$. Gross earnings in skilled jobs are given and denoted by w_h, with $w_h > w_l$. Therefore, as long as some high-ability workers choose an unskilled job, the level of gross earnings w_l does not reveal the demeaning characteristic of low ability. Compared to unskilled jobs, we assume that performing skilled work requires more effort. In this respect, high-ability workers are assumed to be heterogeneous. If they occupy a skilled job, their consumption level is c_h and their level of utility is $u(c_h) - \delta$, where δ, i.e. the disutility of working in a skilled job rather than an unskilled one, is distributed on the interval $[0, +\infty[$ according to the cumulative distribution $F(\delta)$ and the density function $f(\delta)$. By assumption, $f(\delta) > 0 \ \forall \delta \in [0, +\infty[$ with $\lim_{\delta \to +\infty} f(\delta) = 0$ and $u(c)$ is a continuous, differentiable, strictly increasing and strictly concave function with $\lim_{c \to 0} u'(c) = +\infty$. If instead a high-ability worker chooses an unskilled job, his consumption level is c_l and his utility level $u(c_l)$. Within the group of high-ability workers, δ captures differences in abilities that generate a dispersion in effort levels for those who perform skilled work. While δ is an individual attribute that no other agent can observe, $F(\delta)$ is common knowledge.[3]

[3]The assumption that δ is non negative could be criticized if δ is interpreted in a broader sense. The occupation requiring low abilities could be interpreted as poor jobs because they are the only type of occupation accessible to low-ability workers. The support of δ would then probably include negative values in order to deal with individuals for whom the negative status of these unskilled job outweighs

As is usually assumed, the tax authority does not observe the ability of a given individual. It only observes reported income. For simplicity, tax evasion is ruled out.[4] However, it knows the proportion of individuals with low ability γ ($0 \leq \gamma \leq 1$). As is standard in the optimal taxation literature, the occupational choice of the high-ability workers will limit the extent of redistribution which the tax authority can implement. To relax this self-selection constraint, let us then introduce welfare agencies. They occupy social workers who have access to more information than the tax authority. To adopt a simple setting where tagging would typically be advocated in the absence of stigmatization, let us assume idealized welfare agencies which costlessly and perfectly can assess the ability of claimants. So, welfare agencies only provide a targeted transfer to low-ability individuals. Not all of them will however claim the targeted benefit. This is not because of a lack of information or literacy. They are deterred by the intrusion of social workers in their private life (in order to check their eligibility). This assessment is detrimental because it makes their low ability visible. Some factors could reinforce or reduce the demeaning effect of such an assessment (for instance, the way claimants are treated by officials and social workers in welfare agencies). However, we leave such aspects for further research. The level of utility of low-ability individuals who choose to claim assistance benefits is written as:

$$u(c_l^T) - \sigma - \rho \tag{1}$$

where c_l^T equals w_l plus the targeted transfer net of tax liabilities, if any (the superscript T denotes the tagged status). Here σ is an individual parameter that represents the intensity of stigma. There is no reason to believe that claiming welfare benefit will affect all individuals in the same way. So, σ is by assumption distributed on the interval $[0, +\infty[$, according to the cumulative distribution $G(\sigma)$ and its associated density function $g(\sigma)$. It is assumed that $g(\sigma) > 0 \; \forall \sigma \in [0, +\infty[$ with $\lim_{\sigma \to +\infty} g(\sigma) = 0$. It is also assumed that the individual value of σ is unknown by all except the person herself. Yet, $G(\sigma)$ is common knowledge. The single-valued nonnegative parameter ρ indicates that low-ability workers have to exert more effort than high-ability ones in order to perform their unskilled job. If $w_l = 0$, obviously, low-ability people are not working and $\rho = 0$. Otherwise, we assume that $\rho > 0$. This also holds for low-ability individuals who do not claim the targeted

the penibility of effort required to perform a skilled job. Among other contributions, Bernheim (1994) and Ireland (2000) assume that people care about how they are judged by others. (In their papers, it is assumed that consumption signals are used to reach social status.) This interpretation would however not change the nature of our results as long as the support of δ is not restricted to negative values. So, we stick on the case where δ lies in $[0, +\infty[$.

[4]It is well-known that the possibility of misreporting income can significantly constrain the ability of the government to redistribute. See Cremer and Gahvari (1996), Marhuenda and Ortuño-Ortin (1997) and Chandar and Wilde (1998).

transfer. Their utility level is equal to

$$u(c_l) - \rho \tag{2}$$

where c_l denotes the consumption level of untagged low-ability workers.

The choice of taxes and transfers is equivalent to the determination of consumption bundles c_l^T, c_l and c_h. Since the unobservable parameters δ and σ are distributed on a wide (formally of infinite size) support, it simply becomes too costly to induce all high-ability individuals to work in skilled jobs[5] and to induce all type l individuals to claim the targeted transfer. So, whatever the allocation of consumption levels, there will be some finite cut-off levels $\widetilde{\delta}$ and $\widetilde{\sigma}$ such that only those high-ability individuals with $\delta < \widetilde{\delta}$ are occupied in skilled jobs and only those with $\sigma < \widetilde{\sigma}$ and a low ability opt for the targeted transfer. These cut-off values or threshold levels satisfy the following equalities:

$$u(c_h) - \widetilde{\delta} = u(c_l) \tag{3}$$

$$u(c_l^T) - \widetilde{\sigma} - \rho = u(c_l) - \rho \tag{4}$$

Table I displays the proportions of individuals in each position and Figure 1 summarizes the model.

Ability level (indexed by j)	claimants working in unskilled jobs(*)	non-claimants working in unskilled jobs(*)
low, $j = l$	$\gamma G(\widetilde{\sigma})$	$\gamma(1 - G(\widetilde{\sigma}))$
	working in skilled jobs	working in unskilled jobs (*)
high, $j = h$	$(1-\gamma)F(\widetilde{\delta})$	$(1-\gamma)(1 - F(\widetilde{\delta}))$

Table I: Distribution of individuals in the population

(*) if $w_l > 0$, otherwise they are inactive.

Let us now turn to the normative criteria used in this paper. This paper compares outcomes under four different normative criteria. The first two criteria take utility functions as they are. The utilitarian criterion is as usual a sum of the individuals' utility functions weighted by their share in the population. The maximin (or "Rawlsian") criterion will place all the weight on the most needy (in terms of utility). In our model, by definition of $\widetilde{\sigma}$, those who claim a targeted transfer are at least as well-off as those who do not. The latter benefit from a level of utility $u(c_l) - \rho$ which is lower than (or, if $w_l = \rho = 0$, equal to) the level that high-ability workers get if they opt for an unskilled job. So, $u(c_l) - \rho$ is

[5] This element distinguishes our model from standard model of redistribution which rely on the revelation principle to induce all individuals to report their true types in an optimum.

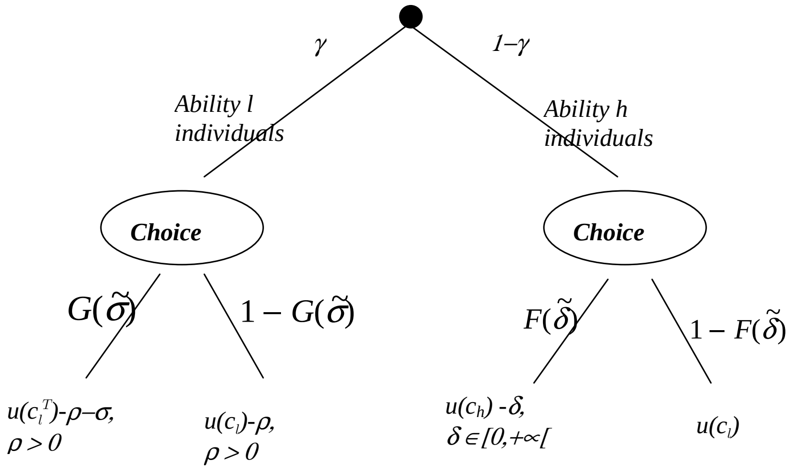

Figure 1: Summary of the model.

the appropriate criterion which should be maximized under the maximin (or "Rawlsian") objective. These first two criteria are standard in the literature. However, many authors have criticized this approach when individuals differ in several dimensions. For example, Fleurbaey and Maniquet (1999) have argued in favor of a distinction between "relevant" and "irrelevant" characteristics: Whereas the former call for compensation, the latter do not, because they are considered as falling within the responsibility of the individuals. In the same vein, Arneson (1990) defends a conception of social justice as equal opportunity for welfare. He also makes a distinction between the part of one's utility for which one is responsible and the part for which is not. What we are doing here is therefore to exclude from the normative criterion the parts of the utilities under control of people. The third normative criterion is then a sum of such corrected utility functions weighted by the share in the population. The fourth criterion places all weight on the corrected utility of the least well-off.

The interpretation given to σ, ρ and δ determines their inclusion or not into the welfare criterion. Up to now, this paper has privileged an interpretation where individuals are not responsible for their ability which can be interpreted as determined by their innate characteristics and their family background. The welfare stigma parameter, σ, is also out of the control of low-ability individuals. As Crocker, Major and Steele (1998) emphasizes, stigma is a devaluing social identity and such an identity is socially constructed. The characteristics that are demeaning are defined by society, sometimes by public authorities. The fact that σ is distributed within the low-ability population simply reflects a plausible heterogeneity (see footnote 7 of Besley and Coate 1992). It does not refer to a phenomenon that is under the responsibility of these people. The parameters δ and ρ are directly linked to differences in ability. Therefore, there are good reasons to include all these parameters in the utilitarian objective.

If σ, δ and ρ were interpreted in a very different way, namely as tastes for effort, individuals could be considered as responsible for their own value of σ, δ and ρ. So, income should not be transferred in order to compensate for high values of σ, δ and ρ. This principle could be translated into normative criteria where σ, δ and ρ are simply ignored.

Taking these alternatives into account, the following four criteria will be considered:

$$\begin{aligned} & W(c_l^T, c_l, c_h, \widetilde{\sigma}, \widetilde{\delta}) \equiv \\ & \gamma \left\{ [u(c_l^T) - \rho] G(\widetilde{\sigma}) - \int_0^{\widetilde{\sigma}} \sigma g(\sigma) d\sigma + [u(c_l) - \rho](1 - G(\widetilde{\sigma})) \right\} \\ & +(1-\gamma) \left\{ u(c_h) F(\widetilde{\delta}) - \int_0^{\widetilde{\delta}} \delta f(\delta) d\delta + u(c_l)(1 - F(\widetilde{\delta})) \right\} ; \end{aligned} \tag{5}$$

$$u(c_l) - \rho; \tag{6}$$

$$\gamma \left\{ u(c_l^T) G(\widetilde{\sigma}) + u(c_l)(1 - G(\widetilde{\sigma})) \right\} + (1-\gamma) \left\{ u(c_h) F(\widetilde{\delta}) + u(c_l)(1 - F(\widetilde{\delta})) \right\} ; \tag{7}$$

$$u(c_l). \tag{8}$$

Normative criterion (7) is only considered in Appendix 1.

III Normative analysis: Analytical results

This section focuses on first-order necessary conditions for an optimum under asymmetric information. As will become clear, these are not in general sufficient conditions for a global maximum. This section is organized as follows. First, taking the utilitarian criterion (5), we explain why the case with and without tagging can fulfil the first-order conditions with a utilitarian criterion. Second, analytical properties are derived with the maximin objective (6) and with criterion (8).

III.1 The utilitarian criterion

The ability characteristics (j, ρ and δ) and the stigma parameter (σ) are not observable. The threshold values $\widetilde{\delta}$ and $\widetilde{\sigma}$ result from decisions taken by the individuals conditional on the tax and transfer system (see Equations (3) and (4)). The government chooses the tax-transfer schedule that maximizes the utilitarian social welfare function (5) subject to Equations (3) and (4) and its budget constraint:

$$\phi(c_l^T, c_l, c_h, \widetilde{\sigma}, \widetilde{\delta}) \equiv \pi_l^T (w_l - c_l^T) + \pi_l (w_l - c_l) + \pi_h (w_h - c_h) = 0 \tag{9}$$

where $\pi_l^T = \gamma G(\widetilde{\sigma})$, i.e. the share of the population which is low-able and targeted, $\pi_l = \gamma(1-G(\widetilde{\sigma}))+(1-\gamma)(1-F(\widetilde{\delta}))$, i.e. the share of the population (high-ability persons as well as low-ability ones) which is occupied in unskilled jobs and $\pi_h = (1-\gamma)F(\widetilde{\delta})$, i.e. the share of the population which is high-able and in a skilled job. Without tagging ($\pi_l^T = 0$), only two consumption levels can be optimally chosen. It is expected that high-ability workers pay taxes ($w_h - c_h > 0$) and low-ability workers receive transfers ($w_l - c_l < 0$). Tagging allows to distinguish a third consumption level, namely c_l^T. It is expected that tagged individuals will receive a higher transfer than in the absence of tagging. Whether all low-ability individuals receive a transfer or only the tagged ones is an open question.

Let λ_1, λ_2, λ_3 be the multipliers associated with respectively the budget constraint (9), Equations (3) and (4). The Lagrangian maximization problem can be rewritten as:

$$\begin{aligned}
&\text{Max}_{c_l^T,\, c_l,\, c_h,\, \widetilde{\sigma},\, \widetilde{\delta}} \quad \pounds \equiv \\
&\gamma\left\{[u(c_l^T)-\rho]G(\widetilde{\sigma}) - \int_0^{\widetilde{\sigma}} \sigma g(\sigma)d\sigma + [u(c_l)-\rho](1-G(\widetilde{\sigma}))\right\} \\
&+(1-\gamma)\left\{u(c_h)F(\widetilde{\delta}) - \int_0^{\widetilde{\delta}} \delta f(\delta)d\delta + u(c_l)(1-F(\widetilde{\delta}))\right\} \\
&+\lambda_1[\pi_l^T(w_l-c_l^T) + \pi_l(w_l-c_l) + \pi_h(w_h-c_h)] \\
&+\lambda_2[u(c_h)-\widetilde{\delta}-u(c_l)] + \lambda_3[u(c_l^T)-\widetilde{\sigma}-u(c_l)] \qquad (10)
\end{aligned}$$

From the assumptions on the utility function, the optimal c_l^T, c_l and c_h are necessarily positive. If, at the optimum, $\widetilde{\sigma} = 0$, by Equation (4), $c_l^T = c_l$. Therefore, no low-ability person will choose to claim the targeted transfer.[6] In that sense, tagging is not optimal. On the contrary, if at the optimum $\widetilde{\sigma} > 0$, by Equation (4), $c_l^T > c_l$, i.e. tagging is optimal. Constraints (3) and (4) can be rewritten respectively as $\phi_1(c_l, c_h, \widetilde{\delta}) = 0$ and $\phi_2(c_l^T, c_l, \widetilde{\sigma}) = 0$. It can be checked that ϕ_1 and ϕ_2 are quasiconcave. The necessary but not sufficient condition for ϕ to be quasiconcave are fulfilled. Trivially the objective $W(c_l^T, c_l, c_h, \widetilde{\sigma}, \widetilde{\delta})$ is in general not strictly quasiconcave nor quasiconcave. So, a vector $(c_l^T, c_l, c_h, \widetilde{\sigma}, \widetilde{\delta}, \lambda_1, \lambda_2, \lambda_3)$ satisfying the following first-order conditions is not necessarily an optimum. These conditions are nevertheless instructive. The first-order conditions can be written as[7]:

$$(\pi_l^T + \lambda_3)u'(c_l^T) = \lambda_1 \pi_l^T \qquad (11)$$

$$(\pi_l - \lambda_2 - \lambda_3)u'(c_l) = \lambda_1 \pi_l \qquad (12)$$

$$(\pi_h + \lambda_2)u'(c_h) = \lambda_1 \pi_h \qquad (13)$$

[6] Those characterized by $\sigma = 0$ are actually indifferent between claiming the targeted transfer and working in an unskilled job.

[7] The constraint qualifications have been checked.

$$\widetilde{\sigma}\frac{\partial \pounds}{\partial \widetilde{\sigma}} = 0 \text{ and } \frac{\partial \pounds}{\partial \widetilde{\sigma}} \leq 0 \tag{14}$$

$$\text{with } \frac{\partial \pounds}{\partial \widetilde{\sigma}} = \lambda_1 \gamma g(\widetilde{\sigma})[c_l - c_l^T] - \lambda_3 \tag{15}$$

$$\widetilde{\delta}\frac{\partial \pounds}{\partial \widetilde{\delta}} = 0 \text{ and } \frac{\partial \pounds}{\partial \widetilde{\delta}} \leq 0 \tag{16}$$

$$\text{with } \frac{\partial \pounds}{\partial \widetilde{\delta}} = \lambda_1(1-\gamma) f(\widetilde{\delta})[w_h - c_h - (w_l - c_l)] - \lambda_2 \tag{17}$$

and Equations (3) and (4). The following property can be derived from these conditions.

Proposition 1 *The inverse of the marginal cost of public funds is equal to the marginal cost of increasing by a unit the utility of each individual in each group weighted by the share in the population:*

$$\frac{1}{\lambda_1} = \frac{\pi_l^T}{u'(c_l^T)} + \frac{\pi_l}{u'(c_l)} + \frac{\pi_h}{u'(c_h)} \tag{18}$$

Proof. The proof is straightforward by adding Equations (11), (12) and (13).

A similar expression is also present in Diamond and Sheshinski (1995). ■

Note that this equation is true whether $\widetilde{\sigma} > 0$ or $\widetilde{\sigma} = 0$, i.e. whether the targeted system prevails at the optimum or not.

Having scrutinized the first-order conditions, it turns out that both the case with tagging ($\widetilde{\sigma} > 0$) and the one without tagging ($\widetilde{\sigma} = 0$) can verify these conditions. The rest of this section is divided into three parts. First, we explain intuitively why $\widetilde{\sigma} = 0$ can be optimal, when this property should not hold and why $\widetilde{\delta}$ has to be positive. Then, theoretical properties are derived when tagging is optimal and finally, when it is not.

III.1.1 Basic mechanisms affecting $\widetilde{\sigma}$ and $\widetilde{\delta}$

Let us first show analytically that $\widetilde{\sigma} = 0$ satisfies the first-order condition $\frac{\partial \pounds}{\partial \widetilde{\sigma}} = 0$. From Equations (11) and (15), we can rewrite:

$$\frac{\partial \pounds}{\partial \widetilde{\sigma}} = \frac{1}{u'(c_l^T)} \pi_l^T [u'(c_l^T) - \lambda_1] + \lambda_1 \gamma g(\widetilde{\sigma})[c_l - c_l^T] \tag{19}$$

From (4), taking c_l constant, a marginal increase in $\widetilde{\sigma}$ requires an increase in c_l^T such that $\frac{dc_l^T}{d\widetilde{\sigma}} = \frac{1}{u'(c_l^T)}$. The social marginal value of giving dc_l^T to all welfare claimants is $\pi_l^T u'(c_l^T)$ while, $\pi_l^T \lambda_1$ is the social marginal cost of the corresponding increase in public expenditures. Finally, $\lambda_1 \gamma g(\widetilde{\sigma})[c_l - c_l^T]$ is the net cost due to marginal individuals shifting from c_l to the higher c_l^T. If $\widetilde{\sigma} = 0$, the fraction of the tagged population, π_l^T, is zero. Moreover $c_l = c_l^T$. Hence, from (15), $\frac{\partial \pounds}{\partial \widetilde{\sigma}} = 0$. The intuition behind this property is the following. By (4), the marginal individuals who enter the tagged population are always indifferent because their utility levels are the same whether they are tagged or not. Hence there is no direct impact on the utilitarian criterion W. Their earnings, w_l, and hence their contribution to aggregate output are also the same. Moreover, in $\widetilde{\sigma}=0$, $c_l^T=c_l$. A marginal increase in $\widetilde{\sigma}$ has therefore no impact on net resources.[8]

Under which circumstances, is it plausible that a positive value of $\widetilde{\sigma}$ also solves the first-order conditions? It will turn out that the shape of the distributions of σ and δ is critical. From the discussion above, a necessary condition is that $\frac{\partial \pounds}{\partial \sigma}$ be >0 for some positive values of $\widetilde{\sigma}$. From (19), $\widetilde{\sigma}$ should increase if:

$$G(\widetilde{\sigma})\frac{dc_l^T}{d\widetilde{\sigma}}[u'(c_l^T)-\lambda_1]>g(\widetilde{\sigma})[c_l^T-c_l]\lambda_1 \tag{20}$$

As $\widetilde{\sigma}$ starts increasing from zero, $c_l^T-c_l$ increases too and it is sensible to assume that c_l^T also grows (otherwise there would be less redistribution from the high-ability to the low-ability people). The right-hand side of (20) is proportional to $c_l^T-c_l$. So, as $\widetilde{\sigma}$ increases, it becomes more difficult to fulfill (20). Now, $\frac{dc_l^T}{d\widetilde{\sigma}}$ increases as $\widetilde{\sigma}$ grows. A decline of $\frac{g(\widetilde{\sigma})}{G(\widetilde{\sigma})}$ as $\widetilde{\sigma}$ rises helps to fulfill (20) for some positive values of (19). A distribution for which $\frac{g(\sigma)}{G(\sigma)}$ is decreasing is said to have decreasing monotone reversed hazard (or failure) rate. Equivalently, the log of the cumulative distribution function, G, has to be concave. This condition is satisfied by most of the usual distributions.[9]

The distribution of δ also affects the chances of finding a positive value of $\widetilde{\sigma}$ that solves the first-order conditions. From Equations (13) and (17), we can rewrite:

$$\frac{\partial \pounds}{\partial \widetilde{\delta}}=\frac{(1-\gamma)F(\widetilde{\delta})}{u'(c_h)}[u'(c_h)-\lambda_1]-\lambda_1(1-\gamma)f(\widetilde{\delta})[c_h-w_h-(c_l-w_l)] \tag{21}$$

If $\widetilde{\delta}=0$, $F(\widetilde{\delta})=0$ and $c_h=c_l$ therefore $\frac{\partial \pounds}{\partial \widetilde{\delta}}\mid_{\widetilde{\delta}=0}=-\lambda_1(1-\gamma)f(0)(w_l-w_h)>0$ So, $\widetilde{\delta}$ has to be positive. As long as $\widetilde{\delta}$ should increase, one has

$$F(\widetilde{\delta})\frac{dc_h}{d\widetilde{\delta}}[u'(c_h)-\lambda_1]>\lambda_1 f(\widetilde{\delta})[c_h-w_h-(c_l-w_l)] \tag{22}$$

The structure of this expression and the one of (20) are similar. If many high-ability workers are characterized by low values of δ, $\widetilde{\delta}$ will be such that a large proportion of high-ability individuals will work in skilled jobs. This reduces the marginal cost of public funds, λ_1, and from (20), increases the probability that a positive value of $\widetilde{\sigma}$ be optimal.

Section IV will be devoted to numerical simulations. The latter will provide additional insights on situations where tagging is or not optimal. Meanwhile, the analytical properties derived in each environment will be presented.

[8] It should be mentioned that $\widetilde{\sigma}=0$ can also solve the first-order conditions when $w_l>0$ and the tagged population does not work. It can be shown that this property holds for sufficiently moderate values of ρ.

[9] A sufficient condition for G to be log-concave is that the density to be log-concave. Families of distributions that always have log-concave density functions include the uniform, the normal, the logistic, the extreme-value, the chi-square, the chi, the exponential and the Laplace distributions. But some families of distributions do not have log-concave density for all their parameter values. Still they may have a log-concave distribution function. This is the case with the Gamma, the power function and the Weibull distributions for instances. See Bagnolo and Bergström (1989).

III.1.2 Analytical properties under tagging ($\widetilde{\sigma} > 0$)

The relative value of c_l^T and c_h is a major issue here. The next lemma will allow to reach clear-cut conclusions later on.

Lemma 2 *If* $\widetilde{\sigma} > 0$:

$$\frac{1}{u'(c_l)} \leq \frac{\theta}{u'(c_l^T)} \leq \frac{1}{u'(c_h)} \text{ with strict inequalities if } \widetilde{\delta} > 0, \tag{23}$$

$$\text{where } \theta = \frac{\pi_l^T}{\pi_l^T + \lambda_3}[\frac{1 - \pi_l^T - \lambda_3}{1 - \pi_l^T}] \lesseqgtr 1.$$

Proof. Equation (11) can be rewritten as:

$$\frac{1}{\lambda_1} = \frac{\pi_l^T}{\pi_l^T + \lambda_3} \frac{1}{u'(c_l^T)} \tag{24}$$

Putting this in (18) and dividing by $\pi_l + \pi_h \equiv 1 - \pi_l^T$ yields:

$$\frac{\theta}{u'(c_l^T)} = \frac{x}{u'(c_l)} + \frac{1 - x}{u'(c_h)} \tag{25}$$

where $x = \frac{\pi_l}{\pi_l + \pi_h}$ is the probability of occupying an unskilled job conditional on being untagged ($0 < x < 1$) and $\theta = \frac{\pi_l^T}{\pi_l^T + \lambda_3}[\frac{1-\pi_l^T-\lambda_3}{1-\pi_l^T}]$. Hence, θ is nonnegative. According to the sign of λ_3, θ can be higher or lower than 1. Since $\widetilde{\delta} \geqslant 0$, Equation (3) ensures that $u(c_h) \geqslant u(c_l)$. Therefore, $\frac{\theta}{u'(c_l^T)}$ lies (strictly) between $\frac{1}{u'(c_l)}$ and $\frac{1}{u'(c_h)}$ (if $\widetilde{\delta} > 0$). ■

Proposition 3 *If* $\widetilde{\sigma} > 0$, *then consumption levels are ordered in the following way:*

$$c_h > c_l^T > c_l \tag{26}$$

Proof. First, $\widetilde{\sigma} > 0$ and Equation (4) insures that $c_l^T > c_l$. Hence, $u'(c_l^T) < u'(c_l)$. Second, from (18), $\lambda_1 > 0$. So, since $g(\widetilde{\sigma}) > 0$, the first-order conditions (14)-(15) imply that $\lambda_3 < 0$. Therefore, $\theta > 1$. This and Lemma 2 yield that $u'(c_h) < u'(c_l^T)$. Hence, putting these two results together, one has : $u'(c_h) < u'(c_l^T) < u'(c_l)$. This is equivalent to (26). ■

So, under tagging, tagged individuals are optimally assigned consumption rights that are greater than those assigned to untagged low-ability individuals and lower than those assigned to high-ability individuals occupied in skilled jobs. This result is in line with Parsons (1996), p.192. As a consequence of (26), the transfer allocated to the tagged low-ability individuals, i.e. $c_l^T - w_l$, is higher than the transfer (or the tax) paid to (by) the untagged low-ability individuals $c_l - w_l$.

Proposition 4 *If* $\widetilde{\sigma} > 0$, *the tax levied on those occupied in skilled jobs is strictly higher than the tax paid by workers occupied in unskilled jobs:* $w_h - c_h > w_l - c_l$.

Proof. Section III.1.1 has shown $\widetilde{\delta} > 0$, then, Equations (16) and (17) imply that the sign of λ_2 is the one of $w_h - w_l - (c_h - c_l)$. The latter is apparently ambiguous because $w_h - w_l$ and $c_h - c_l$ are both positive (see Proposition 3). By contradiction, it can however be shown that λ_2 is positive. Let us assume that $w_h - c_h \leq w_l - c_l$. Then $\lambda_2 \leq 0$. Recalling that $\lambda_3 < 0$, $u'(c_l) < \lambda_1$ is then a consequence of (13). However, from (11), $u'(c_l^T) > \lambda_1$. Combining these two results leads to $u'(c_l^T) > u'(c_l)$ or $c_l^T < c_l$, which is in contradiction with Proposition 3. Therefore, $\lambda_2 > 0$, which implies that $w_h - c_h > w_l - c_l$. ■

Proposition 5 *If $\widetilde{\sigma} > 0$, it cannot be ruled out that untagged individuals with low ability pay taxes.*

Proof. From the budget constraint (9), it can be shown that:

$$w_l - c_l = \pi_l^T (c_l^T - c_l) - \pi_h [w_h - c_h - (w_l - c_l)] \tag{27}$$

From Propositions 3 and 4, both $c_l^T - c_l$ and $w_h - c_h - (w_l - c_l)$ are positive. Hence, the sign of $w_l - c_l$ is ambiguous. In other words, the gross income of untagged low-ability and high-ability individuals can be increased (in case of a transfer: $w_l - c_l < 0$) or decreased (in case of a tax: $w_l - c_l > 0$) by the optimal tax-transfer system. ■

III.1.3 Analytical properties when tagging does not prevail ($\widetilde{\sigma} = 0$)

Appendix 3 proves that the first-order conditions admit a solution such that $\widetilde{\sigma} = 0$ if F is log-concave (in case of logarithmic utility functions). Some quite intuitive propositions can be shown when $\widetilde{\sigma} = 0$. They are illustrated in Figure 2 which allows to compare this case (the upper-part of the figure) with the previous one.

Proposition 6 *If $\widetilde{\sigma} = 0$, then consumption levels are ordered in the following way:*

$$c_h > c_l = c_l^T \tag{28}$$

Proof. This property follows immediately from $\widetilde{\sigma} = 0$, $\widetilde{\delta} > 0$ (see Section III.1.1) and Equation (4). ■

Under full information, consumption levels are equalized. Under asymmetric information, c_h can no longer be equal to c_l. Otherwise, all high-ability individuals would work in an unskilled job.

Proposition 7 *If $\widetilde{\sigma} = 0$, $w_h - c_h > w_l - c_l$, with $w_h - c_h > 0$ and $w_l - c_l < 0$.*

Proof. The proof of this proposition follows the same lines as the proof of Proposition 4 above. From Proposition 4, $\widetilde{\delta} > 0$ (see Section III.1.1) and the result $\lambda_1 > 0$, since

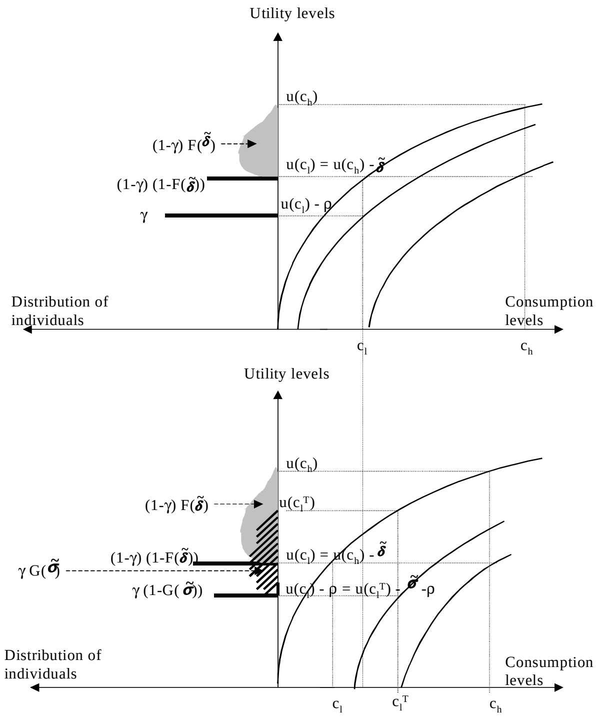

Figure 2: Graphical presentation of the optimal solutions: Without tagging (the upper-part) and with tagging.

$\lambda_2 > 0$ and $\lambda_2 = \lambda_1(1-\gamma)f(\widetilde{\delta})[(w_h - c_h) - (w_l - c_l)]$, $w_h - c_h > w_l - c_l$. Moreover, from the budget constraint, it is immediately seen that $w_h - c_h$ and $w_l - c_l$ have opposite signs. ■

III.1.4 Perfect information

Under perfect information, it can easily be shown that tagging is not optimal. Intuitively, whether they claim or not the targeted transfer, the low-ability individuals have the same productivity, w_l. Since tagging has a detrimental effect on the utility level, it would be desirable to avoid it provided that this does not reduce the capacity of redistributing income. Under the assumption of perfect information, this condition is verified. This result prevails with all types of criteria.[10]

III.2 The maximin welfare criterion

If the utilitarian objective is replaced by the Rawlsian one, the consumptions levels should maximize (6) subject to the budget constraint and the two conditions (3) and (4) defining

[10]Under the unrealistic assumption of full information, stigma function is nil. Following our definition of stigmatization, it could however be argued that it is maximal: Under full information, low-ability people are unable to hide their lack of ability.

the cut-off levels. Intuitively, introducing tagging allows to increase the transfer given to the targeted individuals. Yet, to finance this, more high-ability workers have to opt for a skilled job. Therefore, the consumption level of people occupied in unskilled job has to decrease. This means a reduction of the well-being of the least well-off: Those who have low-abilities and do not claim the targeted transfer. This cannot be recommended in a maximin perspective. We can rigorously show that the Rawlsian optimum definitely requires $\widetilde{\sigma} = 0$. It can be verified (see Appendix 2 for details) that:

$$\frac{\partial c_l}{\partial \widetilde{\sigma}} = \frac{1}{u'(c_l)} \left[\frac{\frac{\pi_l}{u'(c_l)} + \frac{\pi_h}{u'(c_h)} - \gamma g(\widetilde{\sigma}) \left(c_l^T - c_l \right)}{\frac{\pi_l^T}{u'(c_l^T)} + \frac{\pi_l}{u'(c_l)} + \frac{\pi_h}{u'(c_h)}} - 1 \right]$$

This partial derivative is zero at $\widetilde{\sigma} = 0$ and is negative for any $\widetilde{\sigma} > 0$. Put differently, extending the size of the tagged population from $\widetilde{\sigma} > 0$ to $\widetilde{\sigma} + d\widetilde{\sigma}$ implies that the untagged low-ability group be worse off. Since this group has already the lowest level of utility, a Rawlsian cannot accept such an extension. Conversely, for any $\widetilde{\sigma} > 0$, a marginal decrease in $\widetilde{\sigma}$ has a positive effect on c_l. This holds true until $\widetilde{\sigma} = 0$. The same conclusion obviously also holds if the criterion is applied when σ, δ and ρ are not included in the social welfare function, so that (8) or the lowest consumption level, namely c_l, is maximized.

IV A numerical analysis under utilitarianism

This section focuses on the utilitarian criterion (5). With a log-concave distribution for δ, there always exists a solution ($\widetilde{\sigma} = 0$, $\widetilde{\delta} > 0$) to the first-order conditions (see Appendix 3). In addition, there can exist (at least) one other solution such that $\widetilde{\sigma} > 0$, $\widetilde{\delta} > 0$. Then, several local optima are observed. Numerical methods are therefore needed to see when tagging is optimal and when it is not. The following numerical exercise emphasizes the crucial role of the densities of σ and δ. The numerical analysis shows that tagging is only optimal when the distribution of σ is characterized by a density highly concentrated on low values of σ (i.e. simultaneously, small mean and variance), where 'low' should be understood relatively to $u(w_l)$. However, a distribution sufficiently concentrated on relatively low values of σ is only a necessary condition because the distribution of δ also plays a crucial role. In some cases, where σ is highly concentrated on low values, tagging is not optimal because the distribution of the ability parameters, δ, covers either a very large or a very narrow range of values.

This section illustrates and explains these results. The presentation is organized as follows. First, we rewrite and calibrate the model. Second, we illustrate how the parameters' space can be divided into an area where tagging is optimal and another where a utilitarian would avoid it. It is shown that very restrictive assumptions on the distributions of σ and

δ are needed in order to conclude that tagging is optimal. Third, we conduct a sensitivity analysis.

IV.1 Calibration and reformulation of the model

Combining constraints (3), (4), (9) and the utilitarian criterion (5), it is convenient to rewrite the problem as:

$$W(c_l, \widetilde{\sigma}, \widetilde{\delta}) \equiv \gamma \left[\widetilde{\sigma} G(\widetilde{\sigma}) - \int_0^{\widetilde{\sigma}} \sigma g(\sigma) d\sigma \right] +$$

$$+(1-\gamma) \left[\widetilde{\delta} F(\widetilde{\delta}) - \int_0^{\widetilde{\delta}} \delta f(\delta) d\delta \right] + u(c_l) - \gamma\rho \tag{29}$$

with

$$c_l = \frac{w_l + (1-\gamma)F(\widetilde{\delta})(w_h - w_l)}{1 + \gamma G(\widetilde{\sigma})[\frac{c_l^T}{c_l} - 1] + (1-\gamma)F(\widetilde{\delta})[\frac{c_h}{c_l} - 1]} \tag{30}$$

Equations (30) can be rewritten as $\phi_3(c_l, c_l^T, c_h, \widetilde{\sigma}, \widetilde{\delta}) = 0$. Using a logarithmic utility function, $u(.) \equiv \log_k(.)$ with $k > 1$ and again Equations (3), (4), it is convenient to rewrite ϕ_3 as:

$$c_l(\widetilde{\sigma}, \widetilde{\delta}) = \frac{w_l + (1-\gamma)F(\widetilde{\delta})(w_h - w_l)}{1 + \gamma G(\widetilde{\sigma})(k^{\widetilde{\sigma}} - 1) + (1-\gamma)F(\widetilde{\delta})(k^{\widetilde{\delta}} - 1)} \tag{31}$$

Substituting (31) into the objective function (29), the problem then becomes a two dimensional problem $(\widetilde{\sigma}, \widetilde{\delta})$.

Let δ and σ be distributed according to Gamma distributions.[11] Figure 3 represents Gamma densities with parameter r respectively equal to 0.2; 0.42; 1; 1.5 and 3. These values allow to illustrate the variety of shapes of the Gamma density. Moreover, $r = 0.42$ will be a critical value for our results. As r decreases below 1, the density, $f(x)$, becomes quickly negligible when x increases. This phenomenon captures what is here meant by "concentration". This notion is a relative one. It depends on the values of w_h and w_l and on the shape of $u(.)$.

Let r_δ, r_σ be the parameters characterizing Gamma distributions respectively for δ and σ. To emphasize the role of these parameters, the density and distribution function can be rewritten as $F(\widetilde{\delta} \mid r_\delta)$, $f(\widetilde{\delta} \mid r_\delta)$, $G(\widetilde{\sigma} \mid r_\sigma)$ and $g(\widetilde{\sigma} \mid r_\sigma)$ in (29) and (31).

With two levels of skills, one can hardly base our assumption about w_h and w_l on actual wage distributions. Hence, we take $w_h = 100$, $w_l = 20$ and develop in Subsection

[11] A positive random variable follows a Gamma law of parameter r if its density is given by:

$$f(x) = \frac{1}{\Gamma(r)} \exp(-x) x^{r-1}$$

The parameter r of a Gamma distribution is equal to the mean and the variance of the distribution.

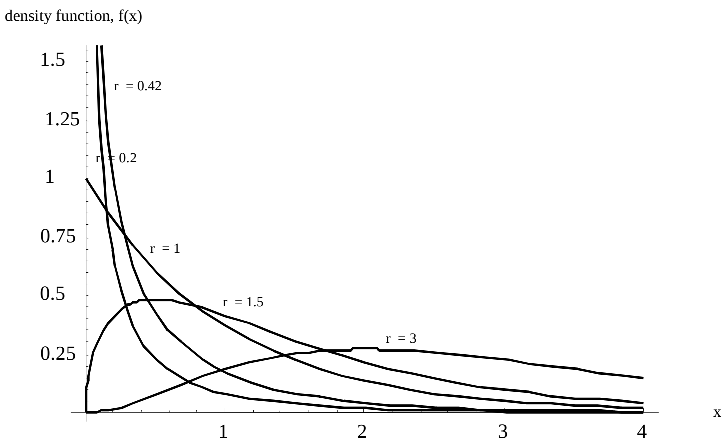

Figure 3: Gamma density functions.

IV.3 a sensitivity analysis. We assume a logarithmic utility function with a basis k equal to 2 ($u(w_h) = \log_2(w_h) = 6.64$ and $u(w_l) = \log_2(w_l) = 4.32$) and develop also a sensitivity analysis in Subsection IV.3. The proportion of low-ability individuals, γ, is assumed to be equal to 0.5. The role of γ is also discussed in Subsection IV.3. The hypothesis about ρ is not critical. Here, $\rho = 0.02$.

IV.2 The effect of r_σ and r_δ

Methodology

Let $W(\widetilde{\sigma}, \widetilde{\delta}, r_\sigma, r_\delta)$ denote (29) after substitution of (31). The optimum $(\widetilde{\sigma}, \widetilde{\delta})$ verifies

$$\frac{\partial W}{\partial \widetilde{\sigma}}(\widetilde{\sigma}, \widetilde{\delta}, r_\sigma, r_\delta) = 0 \tag{32}$$

and

$$\frac{\partial W}{\partial \widetilde{\delta}}(\widetilde{\sigma}, \widetilde{\delta}, r_\sigma, r_\delta) = 0 \tag{33}$$

This system is highly nonlinear. Therefore, according to the chosen initial values and the numerical method used, a solution to (32)-(33) need not be a global optimum. So, for each pair (r_σ, r_δ), the objective function (29) (with c_l defined by (31)) is evaluated for a wide range of values of the endogenous variables $(\widetilde{\sigma}, \widetilde{\delta})$. This allows us to check whether the solution found to (32)-(33) is the global optimum.

The above system defines an implicit relationship between the optimal values of $\widetilde{\sigma}, \widetilde{\delta}$ and r_σ and r_δ. This system is however too complex to be studied analytically.

Since (32) and (33) characterize an optimum, we can totally differentiate them with respect to $\widetilde{\sigma}, \widetilde{\delta}$, r_δ and r_σ as

$$\frac{\partial^2 W}{\partial \widetilde{\sigma}^2} d\widetilde{\sigma} + \frac{\partial^2 W}{\partial \widetilde{\delta} \partial \widetilde{\sigma}} d\widetilde{\delta} = -\frac{\partial^2 W}{\partial r_\sigma \partial \widetilde{\sigma}} dr_\sigma - \frac{\partial^2 W}{\partial r_\delta \partial \widetilde{\sigma}} dr_\delta \tag{34}$$

and

$$\frac{\partial^2 W}{\partial\widetilde{\sigma}\partial\widetilde{\delta}}d\widetilde{\sigma}+\frac{\partial^2 W}{\partial\widetilde{\delta}^2}d\widetilde{\delta}=-\frac{\partial^2 W}{\partial r_\sigma\partial\widetilde{\delta}}dr_\sigma-\frac{\partial^2 W}{\partial r_\delta\partial\widetilde{\delta}}dr_\delta \tag{35}$$

This formulation will be helpful in the numerical analysis to study the effect(s) of small changes in r_σ and r_δ. From (35), we have:

$$d\widetilde{\delta}=-\frac{\frac{\partial^2 W}{\partial\widetilde{\sigma}\partial\widetilde{\delta}}}{\frac{\partial^2 W}{\partial\widetilde{\delta}^2}}d\widetilde{\sigma}-\frac{\frac{\partial^2 W}{\partial r_\sigma\partial\widetilde{\delta}}}{\frac{\partial^2 W}{\partial\widetilde{\delta}^2}}dr_\sigma-\frac{\frac{\partial^2 W}{\partial r_\delta\partial\widetilde{\delta}}}{\frac{\partial^2 W}{\partial\widetilde{\delta}^2}}dr_\delta \tag{36}$$

Then, the effects of dr_σ and dr_δ on $d\widetilde{\sigma}$ are respectively:

$$\frac{d\widetilde{\sigma}}{dr_\sigma}=\frac{\frac{\partial^2 W}{\partial\widetilde{\delta}\partial\widetilde{\sigma}}\frac{\partial^2 W}{\partial r_\sigma\partial\widetilde{\delta}}-\frac{\partial^2 W}{\partial r_\sigma\partial\widetilde{\sigma}}\frac{\partial^2 W}{\partial\widetilde{\delta}^2}}{\frac{\partial^2 W}{\partial\widetilde{\sigma}^2}\frac{\partial^2 W}{\partial\widetilde{\delta}^2}-(\frac{\partial^2 W}{\partial\widetilde{\sigma}\partial\widetilde{\delta}})^2} \tag{37}$$

$$\frac{d\widetilde{\sigma}}{dr_\delta}=\frac{\frac{\partial^2 W}{\partial\widetilde{\delta}\partial\widetilde{\sigma}}\frac{\partial^2 W}{\partial r_\delta\partial\widetilde{\delta}}-\frac{\partial^2 W}{\partial r_\delta\partial\widetilde{\sigma}}\frac{\partial^2 W}{\partial\widetilde{\delta}^2}}{\frac{\partial^2 W}{\partial\widetilde{\sigma}^2}\frac{\partial^2 W}{\partial\widetilde{\delta}^2}-(\frac{\partial^2 W}{\partial\widetilde{\sigma}\partial\widetilde{\delta}})^2} \tag{38}$$

The effects of dr_σ and dr_δ on $d\widetilde{\delta}$ are:

$$\frac{d\widetilde{\delta}}{dr_\sigma}=-\frac{\frac{\partial^2 W}{\partial\widetilde{\sigma}\partial\widetilde{\delta}}}{\frac{\partial^2 W}{\partial\widetilde{\delta}^2}}\frac{d\widetilde{\sigma}}{dr_\sigma}-\frac{\frac{\partial^2 W}{\partial r_\sigma\partial\widetilde{\delta}}}{\frac{\partial^2 W}{\partial\widetilde{\delta}^2}} \tag{39}$$

$$\frac{d\widetilde{\delta}}{dr_\delta}=-\frac{\frac{\partial^2 W}{\partial\widetilde{\sigma}\partial\widetilde{\delta}}}{\frac{\partial^2 W}{\partial\widetilde{\delta}^2}}\frac{d\widetilde{\sigma}}{dr_\delta}-\frac{\frac{\partial^2 W}{\partial r_\delta\partial\widetilde{\delta}}}{\frac{\partial^2 W}{\partial\widetilde{\delta}^2}} \tag{40}$$

The signs of these expressions are in general ambiguous. In the following numerical exercise, the components of (37) to (40) will be evaluated. This information will be useful to understand how and why $\widetilde{\sigma}$ and $\widetilde{\delta}$ vary with respectively r_σ and r_δ.

A necessary condition for the optimality of tagging: a low r_σ

In a (r_δ, r_σ) space, Figure 4 displays the area where tagging is optimal (see the shaded area). It highlights that tagging can only be optimal for low values of r_σ. This result turns out to be true in all reported and unreported simulations. When r_σ decreases, the distribution of σ is more concentrated on low values. In our example, tagging can never be optimal if $r_\sigma > 0.42$.[12] This illustrates the idea of concentration: Very few people have an σ which is nonnegligible compared to $u(w_l)$.

This first result is quite intuitive. If stigmatization is considered as a negligible phenomenon (in the sense that the density of σ is concentrated on very low values of σ

[12] If $r_\sigma = 0.42$, 45.8% of the low-ability workers have an σ above 0.2 and 9.7% of the low-ability workers have an σ above 1.2. The utility from the gross wage in a unskilled job is $u(w_l) = 4.3$, and therefore, $\sigma = 0.2$ (respectively $\sigma = 1.2$) is only 4.6% (respectively 27.8%) of $u(w_l)$, which is relatively low.

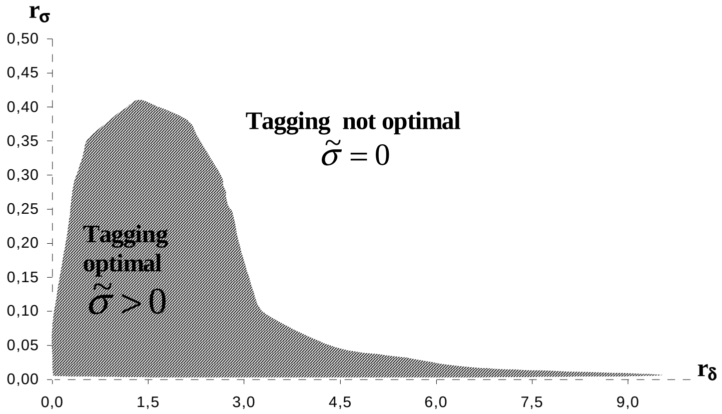

Figure 4: Simulations' results. Values of the means (and the variance) of σ and δ for which tagging is optimal.

relatively to $u(w_l)$), then the model confirms the traditional result in the tagging literature (Akerlof 1978, Parsons 1996). This literature shows that if a portion of the low-ability people can be costlessly tagged (i.e. without administrative costs nor prejudices due to stigma), the total utilitarian welfare is raised by giving an allowance targeted on this sub-population. There is an incentive to do so because the benefits paid to tagged low-ability workers (c_l^T) provide no work disincentive to the high-ability workers so that the former sub-population can be treated more generously. In our model, with a density of σ sufficiently concentrated on very low values of σ relatively to $u(w_l)$, the prejudice due to stigma is much lower than the disadvantages linked to a redistributive system purely administered by the tax authority. Then, the traditional result holds: tagging is optimal. However, a distribution of the intensity of stigmatization highly concentrated around relative low values is only a necessary condition. Simulations' results will show that the dispersion of abilities among those who can perform skilled jobs also plays a crucial role.

A look in the area where tagging is optimal

Looking at the area where tagging is optimal, we will describe what happens when r_σ (respectively r_δ) increases. The methodology previously defined and simulations will allow to locally study the signs of Expressions (37) to (40). Due to space limitation, we explain general features by considering a few examples.

What happens in the interior of the tagging region when r_σ increases? Table II displays the main features of the optima when r_σ increases and r_δ is fixed to 1.3. As the dispersion and the mean of the intensity of stigmatization gets wider, c_l increases (starting from values below w_l), c_l^T somewhat decreases, therefore, π_l^T declines, π_l increases and π_h decreases. In the area where tagging is optimal, $\widetilde{\sigma}$ and $\widetilde{\delta}$ decrease with r_σ. $\forall r_\sigma \in [0.1; 0.42[$, we compute that $\frac{\partial^2 W}{\partial r_\sigma \partial \widetilde{\sigma}} < 0$, $\frac{\partial^2 W}{\partial \widetilde{\delta}^2} < 0$, $\frac{\partial^2 W}{\partial \widetilde{\delta} \partial \widetilde{\sigma}} > 0$, $\frac{\partial^2 W}{\partial r_\sigma \partial \widetilde{\delta}} < 0$ and $\frac{\partial^2 W}{\partial \widetilde{\sigma}^2} \frac{\partial^2 W}{\partial \widetilde{\delta}^2} > (\frac{\partial^2 W}{\partial \widetilde{\sigma} \partial \widetilde{\delta}})^2 > 0$. Remembering (37), this explains why $\frac{d\widetilde{\sigma}}{dr_\sigma} < 0$. The sign of these effects can then be introduced in (39) to understand why $\frac{d\widetilde{\delta}}{dr_\sigma} < 0 \; \forall r_\sigma \in [0.1; 0.42[$.

$(r_\delta = 1.3)$	Welfare level	Cutoff levels		Consumption levels			Proportions of population		
	$\mathbf{W}$	$\widetilde{\boldsymbol{\sigma}}$	$\widetilde{\boldsymbol{\delta}}$	$\mathbf{c}_h$	$\mathbf{c}_l$	$\mathbf{c}_l^T$	$\boldsymbol{\pi}_h$	$\boldsymbol{\pi}_l$	$\boldsymbol{\pi}_l^T$
$r_\sigma = 0.1$	5.22	1.82	2.09	62.3	14.6	51.8	0.40	0.10	0.50
$r_\sigma = 0.2$	5.18	1.44	1.84	64.1	17.9	48.6	0.38	0.13	0.49
$r_\sigma = 0.3$	5.16	0.77	1.49	68.7	24.5	41.7	0.34	0.22	0.44
$r_\sigma = 0.4$	5.15	0.04	1.28	73.8	30.8	31.6	0.30	0.54	0.16
$r_\sigma = 0.42$	5.15	0	1.26	188.3	31	31	0.30	0.70	0

Table II: Simulations' results when the variance and the mean of the intensity of stigmatization (r_σ) increases and $r_\delta = 1.3$.

$(r_\sigma = 0.2)$	Welfare level	Cutoff levels		Consumption levels			Proportions of population		
	$\mathbf{W}$	$\widetilde{\boldsymbol{\sigma}}$	$\widetilde{\boldsymbol{\delta}}$	$\mathbf{c}_h$	$\mathbf{c}_l$	$\mathbf{c}_l^T$	$\boldsymbol{\pi}_h$	$\boldsymbol{\pi}_l$	$\boldsymbol{\pi}_l^T$
$r_\delta = 0.1$	5.80	0	0.51	68.4	48.2	48.2	0.47	0.53	0
$r_\delta = 0.2$	5.73	0.30	0.74	67.7	40.4	49.9	0.46	0.13	0.41
$r_\delta = 0.5$	5.56	1.10	1.37	64.1	24.9	53.2	0.45	0.07	0.48
$r_\delta = 1$	5.32	1.48	1.78	63.5	18.5	51.5	0.41	0.1	0.49
$r_\delta = 1.5$	5.10	1.36	1.84	64.7	18	46.3	0.36	0.16	0.48
$r_\delta = 2$	4.90	1.06	1.82	66.8	18.9	39.5	0.27	0.26	0.47
$r_\delta = 3$	4.60	0.28	1.75	73.2	21.8	26.4	0.13	0.47	0.40
$r_\delta = 3.5$	4.51	0.003	1.76	75.6	22.2	22.3	0.08	0.75	0.17
$r_\delta = 4$	4.44	0	1.84	76.7	21.4	21.4	0.06	0.94	0

Table III: Simulations' results when r_δ increases and $r_\sigma = 0.2$.

What happens in the interior of the tagging region when r_δ increases? Let us take the case where $r_\sigma = 0.2$ and consider a few values of r_δ. For sufficiently low values of r_δ (here 0.1), the distribution of δ is very concentrated on low values. With moderate differences $c_h - c_l$, nearly all high-ability workers opt for a high-skill occupation. Given the available resources, stigmatization can be avoided by giving relatively high levels of transfer to all low-ability workers. For $r_\delta \in [0.2; 0.5]$, Table III indicates that c_l^T increases, c_l decreases and π_l decreases. So, as the dispersion and the mean of δ increases, tagging is first used more intensively. From the values taken by the components of (38), $\frac{d\widetilde{\sigma}}{dr_\delta}$ is positive but less and less so as r_δ increases into the interval $[0.2; 1.05[$. Around $r_\delta = 1.05$, still exploiting (38), $\frac{d\widetilde{\sigma}}{dr_\delta}$ becomes negative. Actually, for high values of r_δ (relatively to $u(w_h) - u(w_l)$), the share of high-ability workers with a high δ becomes so large that redistribution has to decrease. The substitution away from skilled jobs accelerates drastically (see the evolution of π_h in Table III). Looking at the values of $\frac{d\widetilde{\delta}}{dr_\delta}$ in (40) allows to understand why the optimal value of $\widetilde{\delta}$ does not vary monotonically with r_δ. This effect and the change in the distribution function nevertheless lead to a monotonic decline in π_h. The well-being of those earning w_l is therefore more heavily weighted in the welfare function. Therefore, c_l increases and c_l^T decreases. In other words tagging is less and less used ($c_l^T - c_l \to 0$). This numerical result confirms the intuition provided in Subsection III.1.1.

To sum up, even if the intensity of stigmatization is highly concentrated around low values in comparison with $u(w_l)$, tagging is not optimal if the distribution of the disutility in skilled jobs is either very concentrated on low values or on the contrary if it has a large variance (and large mean).

To end this subsection, let us briefly consider two very specific sub-regions in the (r_δ, r_σ) space. The former is a zone where (quasi-) egalitarianism is observed and the second is a zone of "laissez-faire" (no or nearly no redistribution). The former is characterized by very low values of r_δ, the latter by very high ones. If r_δ is very low, say $r_\delta \in [0, 0.1]$, abilities are nearly not dispersed among those who can perform skilled jobs and egalitarianism in consumption levels prevails. Moreover, this phenomenon is observed in a region where both tagging and non tagging are observed. Let us briefly comment on these two sub-regions in turn. First, when $\widetilde{\sigma} > 0$, namely when r_σ is very small, a low differential in incomes, $c_h - c_l$ and $c_l^T - c_l$ is sufficient to induce all high-ability workers to work in skilled jobs ($\pi_h \to 1-\gamma$) and all the low-able to claim the targeted transfer ($\pi_l^T \to \gamma$). Therefore, $\pi_l \to 0$, so that nearly nobody is penalized by the difference between c_h (resp. c_l^T) and c_l. Then consumption levels for workers in skilled jobs and for tagged low-able individuals are equalized (it is the limit case of Proposition 3). Moreover, under the same conditions, the cut-off levels $\widetilde{\sigma}$ and $\widetilde{\delta}$ are equal:[13]

$$lim_{\pi_l \to 0}(c_h - c_l^T) = 0 \tag{41}$$

$$lim_{\pi_l \to 0}(\widetilde{\delta} - \widetilde{\sigma}) = 0 \tag{42}$$

Clearly, δ and σ capture different phenomena. The comparison between $\widetilde{\delta}$ and $\widetilde{\sigma}$ can however be made because δ and σ enter in a similar separable way in the utility function.

[13]The proof is straightforward. If $\pi_l \to 0$ at the optimum, then, $\pi_l^T \to \gamma$ and $\pi_h \to 1-\gamma$, (i.e. $G(\widetilde{\sigma}) \to 1$ and $F(\widetilde{\delta}) \to 1$,) in a equivalent way: $\widetilde{\sigma} \to +\infty$ and $\widetilde{\delta} \to +\infty$. As $\widetilde{\sigma} \to +\infty$, $g(\widetilde{\sigma}) \to 0$ and $\lambda_3 \to 0$ in (15). So, $\sigma \to 1$ in (23). Moreover, $\pi_l \to 0$ means also that $x = \frac{\pi_l}{\pi_l + \pi_h}$, the probability of occupying an unskilled job conditional on being untagged, tends to zero. Then, $\frac{\theta}{u'(c_l^T)} \to \frac{1}{u'(c_h)}$ in (25). As $\theta \to 1$, we can conclude that $c_h \to c_l^T$. Therefore, substracting (4) from (3) leads to $\widetilde{\delta} - \widetilde{\sigma} \to 0$.

Second, when $\widetilde{\sigma} = 0$, consumption is equalized for workers in skilled jobs and workers in unskilled jobs because a low differential in incomes, $c_h - c_l$, is sufficient to induce all high-ability workers to work in skilled jobs ($\pi_h \to 1 - \gamma$) (it is the limit case of Proposition 6). Actually, in this area where egalitarianism prevails, it does not matter whether tagging is used or not because both phenomena, stigmatization and substitution of the high–ability workers towards unskilled jobs, are negligible.

Finally, as r_δ becomes very large, $\forall\ r_\sigma$, the level of redistribution decreases up to a point where abilities are so dispersed among those who can perform skilled jobs that there is no redistribution any more ($\pi_h \to 0$ and $\pi_l \to 1$).[14]

IV.3 Sensitivity analysis

Subsection IV.2 emphasized the role of the distributions of σ and δ on the optimality of tagging. Let us now look at the effect of the other parameters. We consider in turn the curvature of the utility function, the wage differential and the proportion of low-ability individuals in the total population.

First, if the elasticity $k \equiv \frac{-u''(c)c}{u'(c)}$, i.e. the basis of the logarithmic function, increases, the area where tagging is optimal in $(r_\sigma,\ r_\delta)$ space is reduced (see Figure 5). Figure 5 displays how the area where tagging is optimal shrinks when k increases from 2 to 2.6. Intuitively, when tagging is optimal, it is used to reduce the inequality between $u(c_l^T)$ and $u(c_h)$. An increase in k increases the curvature of the utility function and the former inequality softens by itself. Tagging is less needed. So, for any pair $(r_\sigma,\ r_\delta)$ where tagging is optimal but c_l^T is close to c_l, tagging becomes suboptimal ($c_l^T = c_l$) when k increases.

Second, if the differential between the gross wage rates, $w_h - w_l$, decreases, tagging is again less needed. Actually, as in the case of an increase of k, the inequality in utility levels is reduced when the differential is reduced. Therefore, the area where tagging is optimal is reduced as illustrated Figure 5, yet with a scope of reduction depending on the parameter's variation.

Third, if the proportion γ of low-ability individuals in the population increases, the area where tagging is optimal is also reduced. Let us see why by considering a point in the tagging area. If γ increases, the high-ability population receives a lower weight in the utilitarian criterion. In addition, keeping the allocation of resources unchanged is infeasible because of the growing share of low-ability persons. Simulations show that a utilitarian reacts partly through an increase in taxation, $w_h - c_h$, and partly through a decrease of c_l^T. Moreover, to prevent $\widetilde{\delta}$ from decreasing too much, c_l is reduced too but

[14]Such situations where there is no redistribution any more require, in our numerical example, $r_\delta > 10$ (if $r_\sigma = 0$). For such values, the probability that δ is higher than $u(w_h) - u(w_l)$ (2.31 in our example) is 99.99%. Such a situation does not appear to be realistic.

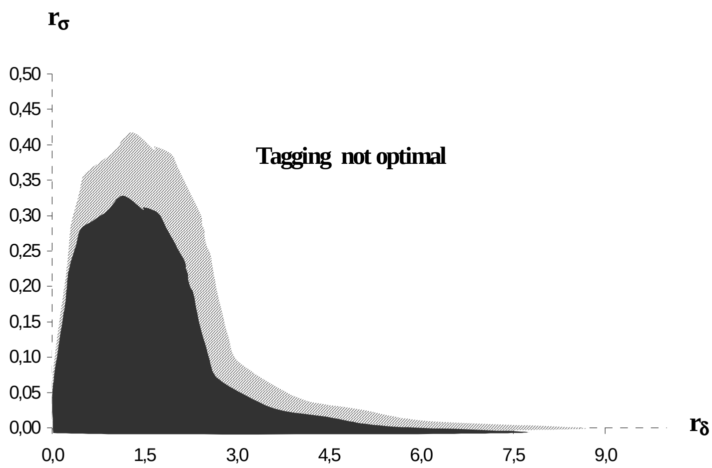

Figure 5: The reduction in the tagging area due to a reduction in the curvature of the utility function (k goes from 2 to 2.6).

to a lower extent than c_l^T. Therefore, close to the boundary of the tagging area where initially $c_l^T \sim c_l$, an increase in γ leads to $c_l^T - c_l \to 0$ (and $\widetilde{\sigma} \to 0$) .

V Conclusion

This paper has questioned the relevance of conditioning income transfers on personal characteristics of the potential recipients instead of basing them only on reported incomes. We have developed a simple framework with two main categories of (unobservable) abilities, in which individuals with low abilities decide whether to claim or not the targeted transfer and welfare authorities assess eligibility perfectly and costlessly. This assumption about welfare agencies is deliberately in favor of tagging. The socio-psychological literature motivates our assumption that being identified as having low abilities is demeaning. Both individuals with low abilities and high-able ones are assumed to have access to unskilled jobs. Since the effort level needed to perform a skilled job is dispersed among the high-ability workers, part of them prefers unskilled jobs. So, reporting low pretax earnings to the tax authority does not necessarily reveal low abilities. On the contrary, tagging requires enquiries and tests of a searching and detailed kind through which the demeaning characteristic of low-ability becomes visible. This is the reason why tagging is stigmatizing. The intensity of stigmatization is distributed among the population with low abilities. In our analysis, wage formation and the demand for labor have been kept exogenous.

The main conclusions are as follows. First, tagging is always suboptimal under a maximin social criterion. The intuition goes as follows. Let us start from a situation without tagging. The high-ability workers holding skilled jobs are taxed and the proceeds of taxation are distributed to people with low abilities. Introducing tagging allows an increase in the transfer given to the targeted individuals. Yet, to finance this increased generosity, more high-ability workers have to opt for a skilled job. For this reason, the consumption level associated with unskilled jobs has to decrease. This means a reduction of the well-being of the least well-off, namely of those who have low abilities but do not claim welfare benefits. This cannot be recommended in a Rawlsian perspective.

Second, a utilitarian criterion (that makes room for stigmatization) cannot justify tagging in a wide range of situations. Our analysis has shown that tax/transfer systems with and without tagging can solve the first-order optimality conditions. These are not necessarily sufficient however. Therefore, we have developed a numerical analysis that suggests that tagging can only be recommended if the distribution of the intensity of stigmatization is highly concentrated around low values. "Low" is here a relative notion. It is measured in comparison with the level of earnings in unskilled jobs. However, this is only a necessary condition. The dispersion of effort among those who can perform a skilled job ('the high-ability people') also plays a crucial role. Even when the intensity of stigmatization can be considered as a minor phenomenon, tagging is not optimal if the dispersion of abilities among the 'high-ability people' is too large or too narrow. Finally, increasing the curvature of the utility function, decreasing the wage differential or increasing the proportion of low-ability individuals in the total population is unfavorable to tagging.

To sum up, stigmatization which has often been neglected in the economic literature questions the robustness of previous normative conclusions about the advantages of tagging. Moreover, the ethical foundation of normative criteria matters a lot.

References

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

[2] Arneson, R.J. (1990) "Liberalism, Distributive Subjectivism, and Equal Opportunity for Welfare" *Philosophy and Public Affairs* **19**(2), 158-194.

[3] Ashenfelter, O. (1983) "Determining participation in income-tested social programs" *Journal of The American Statistical Association* **78**, 517-525.

[4] Bagnoli, M. and Bergström, T., (1989) "Log-concave probability and its applications" *CREST WP*, University of Michigan, 8923.

[5] Bernheim, B.D. (1994), "A theory of conformity" *Journal of Public Economics* **102**, 841-877.

[6] Besley, T. (1990) "Means Testing Versus Universal Provision in Poverty Alleviation Programmes" *Economica* **57**, 119-129.

[7] Besley, T. and Coate, S. (1992) "Understanding welfare stigma: Taxpayer resentment and statistical discrimination" *Journal of Public Economics* **48**, 165-83.

[8] Blank, R.M. and Ruggles, P. (1996) "When Do Women Use Aid to Families with Dependent Children and Food Stamps? The Dynamics of Eligibility versus Participation" Journal of Human Resources **31**, 57-89.

[9] Blundell, R., Fry, V. and Walker, I. (1988) "Modelling the take-up of means-tested benefits : the case of housing benefits in the United Kingdom" *The Economic Journal* **98** (supplement), 58-74.

[10] Boadway, R. and Keen, M. (2000) "Redistribution", in Atkinson, A.B. and Bourguignon, F. (eds.), *Handbook of Income Distribution*, Amsterdam: Elsevier, vol.1, chap.12, 677-789.

[11] Boadway, R., Marceau, N. and Sato, M. (1999) "Agency and the design of welfare systems" *Journal of Public Economics* **73,** 1-30.

[12] Chandar, P. and Wilde, L.L. (1998) "A general Characterization of Optimal Income Tax Enforcement", *Review of Economic Studies* **65**, 165-83.

[13] Cournot, A. (1838) *Recherches sur les principes mathématiques de la théorie des richesses* Librairie Hachette, Paris. (new edition Paris: Marcel Riviere, 1938).

[14] Cremer, H. and Gahvari, F. (1996) "Tax Evasion and Optimal General Income Tax" *Journal of Public Economics* **60**, 235-49.

[15] Crocker, J., Major, B. and Steele, C. (1998) "Social stigma" in Gilbert, D.T., Fiske, S.T. and Lindzey, G. (eds.), *Handbook of social psychology*, 4th ed.,vol. 2, Boston: McGraw-Hill, 504-553.

[16] De Donder, P. and Hindriks, J. (1998) "The Political Economy of Targeting" *Public choice* **95**, 177-200.

[17] Diamond, P. and Sheshinski, E. (1995), "Economic Aspects of Optimal Disability Benefits", *Journal of Public Economics* **57**, 1-23.

[18] Duclos, J.-Y. (1995) "Modelling the Take-up of State Support" *Journal of Public Economics* **58**(3), 391-415.

[19] Duclos, J.-Y. (1997) "Estimating and testing a model of welfare participation: the case of supplementary benefits in Britain" *Economica* **64,** 81-100.

[20] Fleurbaey, M. and Maniquet, F. (1999) "Compensation and responsibility", mimeo.

[21] Friedman, M. (1962) *Capitalism and freedom,* Chicago: University of Chicago Press.

[22] Gelbach, J.B. and Pritchett, L.H. (1996) "Does more for the poor means less for the poor?" *PRE Working Paper,* World Bank, 1523.

[23] Goffman, E. (1963) *Stigma: Notes on the management of Spoiled Identities*, Englewood Cliffs: Prentice-Hall.

[24] Hancock, R.M. and Barker, G. (2003) "The Quality of Social Security Benefit Data in the British Family Resources Survey: Implications for Investigating Income Support Take-up by Pensioners", *forthcoming in Journal of the Royal Statistical Society.*

[25] Hancock, R.M., Pudney, S. Barker, G., Hernandez, M. and Suntherland, H. (2003) "The Take-up of Multiple Means-tested Benefits by British Pensioners: Evidence from the Family Resources Survey" mimeo, University of Leicester.

[26] Ireland, N.J. (2000) "Optimal income tax in the presence of status effects" *Journal of Public Economics* **81**, 193-212.

[27] Marhuenda, F. and Ortuño-Ortin, I. (1997) "Tax Enforcement Problems" *Scandinavian Journal of Economics* **99**, 61-72.

[28] Mirrlees, J.A. (1971) “An Exploration in the Theory of Optimum Income Taxation” *Review of Economic Studies* **38**, 175-208.

[29] Moffitt, R. (1983) “An Economic Model of welfare Stigma” *American Economic Review* **73**(5), 1023-35.

[30] Okun, A.M. (1975) *Equality and Efficiency*, in Washington D.C.: The Brookings Institution, *The Big Tradeoff.*

[31] Parsons, D.O. (1996) “Imperfect ’Tagging’ in Social Insurance Programs” *Journal of Public Economics* **62**, 187-207.

[32] Pudney, S. Hernandez, M. and Hancock, R. (2002) “The Welfare Cost of Means-testing: Pensioner Participation in Income Support”, *Discussion Papers in Economics* 03/2, University of Leicester.

[33] Rainwater, L. (1982) “Stigma in income-tested programs”, in Garfinkeld I. (ed.), *Income-tested programs: The case for and against*, New York: Academic Press, chap.2, 19-65.

[34] Sen, A.K. (1995) “The political economy of targeting”, in van De Walle, D. and Nead, K. (eds.), *Public Spending and the Poor*, Baltimore: J. Hopkins University Press, 11-24.

[35] Stiglitz, J.E. (1987) “Pareto Efficient and Optimal Taxation and the New New Welfare Economics”, in Auerbach, A.J. and Feldstein, M.S. (eds.). *Handbook of Public Economics,* Amsterdam: Elsevier, vol.2, chap.15, 991-1006.

[36] Sutherland, H. (2003) “The Take-up of Income Support and Passported Benefits for Pensioners in the UK: Some Issues”, mimeo, University of Leicester.

[37] Terracol, A. (2002) “Analyzing the take-up of means-tested benefits in France”, mimeo, Université Paris 1.

[38] Tobin, J. (1966) “The Case for an Income Guarantee” *The Public Interest* **4**, 31-41.

[39] Tobin, J. (1968) “Raising the Incomes of the Poor”, in Kermit G. (ed.), *Agenda for the Nation*, Washington D.C.: The Brooking Institution, 77-116.

VI Appendices

Appendix 1. A welfare criterion only based on income levels

This appendix is devoted to the analysis of a welfare criterion which is only based on income levels (neglecting the consequences of stigmatization and of the differences in abilities, i.e. δ and ρ). The social welfare function could then use any strictly increasing and concave function of consumption. For simplicity, we here use the utility function. In a welfarist perspective, therefore, this social welfare criterion can be written as:

$$\begin{array}{c} V \equiv \gamma \left\{ u(c_l^T)G(\widetilde{\sigma}) + u(c_l)(1-G(\widetilde{\sigma}))\right\} \\ +(1-\gamma)\left\{ u(c_h)F(\widetilde{\delta}) + u(c_l)(1-F(\widetilde{\delta}))\right\} \end{array} \tag{43}$$

Totally differentiating the social welfare objective (43), the budget constraint and the two conditions defining the cut-off levels, (3) and (4), and rearranging allow to write the change in V as:

$$\begin{aligned} dV &= u'(c_l^T)dc_l^T + \left[\gamma g(\widetilde{\sigma})\left(u(c_l^T) - u(c_l)\right) - (\pi_l + \pi_h)\right] d\widetilde{\sigma} \\ &\quad + \left[(1-\gamma)f(\widetilde{\delta})\left(u(c_h) - u(c_l)\right) + \pi_h\right] d\widetilde{\delta}, \end{aligned} \tag{44}$$

subject to the following balanced budget constraint:

$$\begin{array}{c} u'(c_l^T)\left[\frac{\pi_l^T}{u'(c_l^T)} + \frac{\pi_l}{u'(c_l)} + \frac{\pi_h}{u'(c_h)}\right] dc_l^T = \\ \left[\frac{\pi_l}{u'(c_l)} + \frac{\pi_h}{u'(c_h)} - \gamma g(\widetilde{\sigma})\left(c_l^T - c_l\right)\right] d\widetilde{\sigma} \\ + \left[(1-\gamma)f(\tilde{\delta})\left(w_h - c_h - (w_l - c_l)\right) - \frac{\pi_h}{u'(c_h)}\right] d\tilde{\delta} \end{array} \tag{45}$$

$$\begin{array}{c} u'(c_l^T)\left[\dfrac{\pi_l^T}{u'(c_l^T)} + \dfrac{\pi_l}{u'(c_l)} + \dfrac{\pi_h}{u'(c_h)}\right] dc_l^T = \\ \left[\dfrac{\pi_l}{u'(c_l)} + \dfrac{\pi_h}{u'(c_h)} - \gamma g(\widetilde{\sigma})\left(c_l^T - c_l\right)\right] d\widetilde{\sigma} \\ + \left[(1-\gamma)f(\tilde{\delta})\left(w_h - c_h - (w_l - c_l)\right) - \dfrac{\pi_h}{u'(c_h)}\right] d\tilde{\delta} \end{array} \tag{46}$$

With the utilitarian criterion, the balanced budget constraint is obviously the same. The change in the utilitarian criterion (5), dW, is different and can be written as:

$$dW = u'(c_l^T)dc_l^T - (\pi_l + \pi_h)d\widetilde{\sigma} + \pi_h d\tilde{\delta} \tag{47}$$

Equations (44) and (47) are now employed for comparison. As in the utilitarian case (see Subsection III.1), it is still true that $\frac{\partial V}{\partial \widetilde{\sigma}} = 0$ in $\widetilde{\sigma} = 0$. However, it is obvious that an additional positive term pushes $\widetilde{\sigma}$ upwards as soon as $\widetilde{\sigma} > 0$, namely $\gamma g(\widetilde{\sigma})\left(u(c_l^T) - u(c_l)\right)$. Expression $(1-\gamma)f(\widetilde{\delta})\left(u(c_h) - u(c_l)\right)$ plays a similar role for $\tilde{\delta}$. Both terms express that an increase in $\widetilde{\sigma}$ (respectively, $\widetilde{\delta}$) has a favorable effect on Criterion V via the impact on marginal individuals who are actually indifferent. So, it is not surprising that unreported numerical simulations indicate that the global optimum is characterized by tagging as soon as stigmatization is neglected in the normative criterion.

Appendix 2. The maximin welfare criterion

This appendix allows to show that the maximin optimum requires $\widetilde{\sigma} = 0$. Totally differentiating (4) yields:

$$dc_l = \frac{u'(c_l^T)dc_l^T - d\widetilde{\sigma}}{u'(c_l)} \tag{48}$$

Substituting (46) into (48), it is easily seen that

$$\frac{\partial c_l}{\partial \widetilde{\sigma}} = \frac{1}{u'(c_l)} \left[\frac{\frac{\pi_l}{u'(c_l)} + \frac{\pi_h}{u'(c_h)} - \gamma g(\widetilde{\sigma}) \left(c_l^T - c_l\right)}{\frac{\pi_l^T}{u'(c_l^T)} + \frac{\pi_l}{u'(c_l)} + \frac{\pi_h}{u'(c_h)}} - 1 \right] \tag{49}$$

This expression is used in Section III.2 to show that the Rawlsian optimum definitely requires $\widetilde{\sigma} = 0$.

Appendix 3. No tagging optimal with an utilitarian criterion and under asymmetric information, a sufficient condition

This appendix shows the existence of a solution to the first-order conditions characterized by $\widetilde{\sigma} = 0$ and $\widetilde{\delta} > 0$. This proof is produced for logarithmic utility functions, $u(.) \equiv log_k(.)$ with $k > 1$. The cut-off definitions (3) and (4) can then respectively be written as:

$$c_h = c_l k^{\widetilde{\delta}} \tag{50}$$

$$c_l^T = c_l k^{\widetilde{\sigma}}, \tag{51}$$

and the budget constraint becomes:

$$c_l = \frac{w_l + \pi_h(w_h - w_l)}{\pi_l^T k^{\widetilde{\sigma}} + \pi_l + \pi_h k^{\widetilde{\delta}}} \tag{52}$$

Substituting (50), (51) and (52) into (5), one gets an objective function of $\widetilde{\sigma}$ and $\widetilde{\delta}$. Maximizing this objective, the first-order conditions are:

$$\phi_{\widetilde{\sigma}}(\widetilde{\sigma}, \widetilde{\delta}) \equiv \pi_l^T u'(c_l^T) \frac{dc_l^T}{d\widetilde{\sigma}} + \pi_l u'(c_l) \frac{dc_l}{d\widetilde{\sigma}} + \pi_h u'(c_h) \frac{dc_h}{d\widetilde{\sigma}} = 0 \tag{53}$$

$$\phi_{\widetilde{\delta}}(\widetilde{\sigma}, \widetilde{\delta}) \equiv \pi_l^T u'(c_l^T) \frac{dc_l^T}{d\widetilde{\delta}} + \pi_l u'(c_l) \frac{dc_l}{d\widetilde{\delta}} + \pi_h u'(c_h) \frac{dc_h}{d\widetilde{\delta}} = 0 \tag{54}$$

where the various derivatives can be computed from (50) to (52).

$\forall\ \widetilde{\delta}$, we know $\phi_{\widetilde{\sigma}}(\widetilde{\sigma}=0,\widetilde{\delta})=0$ (see Subsection III.1.1). Therefore, what follows is devoted to finding a sufficient condition for $\phi_{\widetilde{\delta}}(\widetilde{\sigma}=0,\widetilde{\delta})=0$. If $\widetilde{\sigma}=0$ and $\widetilde{\delta}=0$, $\phi_{\widetilde{\delta}}(\widetilde{\sigma}=0,\widetilde{\delta}=0)=u'(c_l)\frac{dc_l}{d\widetilde{\delta}}>0$. Hence, it suffices to show that $\exists\ \widetilde{\delta}_1>0$ such that $\phi_{\widetilde{\delta}}(\widetilde{\sigma}=0,\widetilde{\delta}_1)<0$ where $\phi_{\widetilde{\delta}}(\widetilde{\sigma}=0,\widetilde{\delta}_1)=(1-\pi_h(\widetilde{\delta}_1))u'(c_l)\frac{\partial c_l}{\partial\widetilde{\delta}}+\pi_h(\widetilde{\delta}_1)u'(c_h)\frac{\partial c_h}{\partial\widetilde{\delta}}$, with $\frac{\partial c_l}{\partial\widetilde{\delta}}\gtrless 0$ and $\frac{\partial c_h}{\partial\widetilde{\delta}}=\frac{\partial c_l}{\partial\widetilde{\delta}}k^{\widetilde{\delta}}+c_lk^{\widetilde{\delta}}\ln(k)$.

From (50) either $\frac{\partial c_h}{\partial\widetilde{\delta}}>0$ and $\frac{\partial c_l}{\partial\widetilde{\delta}}<0$ or $\frac{\partial c_h}{\partial\widetilde{\delta}}<0$, $\frac{\partial c_l}{\partial\widetilde{\delta}}<0$. In $\widetilde{\sigma}=0$, the latter case cannot occur when $\widetilde{\delta}$ grows up because it would violate the budget constraint. Hence two necessary conditions for the existence of $\widetilde{\delta}_1>0$ such that $\phi_{\widetilde{\delta}}(\widetilde{\sigma}=0,\widetilde{\delta}_1)<0$ are:

$$\frac{\partial c_l}{\partial\widetilde{\delta}}<0 \tag{55}$$

$$\frac{\partial c_h}{\partial\widetilde{\delta}}>0,\text{ or }\frac{\partial c_l}{\partial\widetilde{\delta}}>-c_l\ln(k) \tag{56}$$

With (52), the last inequality can be rewritten as

$$(1-\gamma)f(\widetilde{\delta}_1)(w_h-k^{\widetilde{\delta}_1}w_l)>-\pi_l(w_l+\pi_h(w_h-w_l))\ln(k) \tag{57}$$

The right-hand side is negative. Since $w_h>c_h$ and $w_l<c_l$, Equality (50) implies $w_h>k^{\widetilde{\delta}_1}w_l$. So, the left-hand side of (57) is positive.

Differentiating (52) and rearranging allows to rewrite (55) as

$$\frac{f(\widetilde{\delta}_1)}{F(\widetilde{\delta}_1)}<\frac{w_l+\pi_h(w_h-w_l)}{w_h-k^{\widetilde{\delta}_1}w_l}k^{\widetilde{\delta}_1}\ln(k) \tag{58}$$

The right-hand side is positive. So, log-concavity of $F(.)$ is sufficient to guarantee (58).

Finally, $\phi_{\widetilde{\delta}}(\widetilde{\sigma}=0,\widetilde{\delta}_1)<0$ and the derivative of (52) with respect to $\widetilde{\delta}$ can be combined to yield:

$$\frac{f(\widetilde{\delta}_1)}{F(\widetilde{\delta}_1)}<\frac{(u'(c_l)-u'(c_h))k^{\widetilde{\delta}_1}\ln(k)}{\pi_hu'(c_h)k^{\widetilde{\delta}_1}+\pi_lu'(c_l)}\frac{\pi_l(w_l+\pi_h(w_h-w_l))}{w_h-k^{\widetilde{\delta}_1}w_l}$$

The right-hand side of this inequality being positive, log-concavity of $F(.)$ is a sufficient condition to guarantee the existence of an optimum characterized by $\widetilde{\sigma}=0$ and $\widetilde{\delta}>0$.