The Economics of "Tagging" as Applied to the Optimal Income Tax, Welfare Programs, and Manpower Planning

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The advantages of a negative income tax are easy to describe. Such a tax typically gives positive work incentives to even the poorest persons. With some forms of the negative income tax there are no incentives for families to split apart to obtain greater welfare payments. Furthermore, individuals of similar income are treated in similar fashion, and therefore it is fair and also relatively cheap and easy to administer.

In contrast to these advantages of a negative income tax, the advantages of a system of welfare made up of a patchwork of different awards to help various needy groups are less easy to describe and also less well understood. Such a system uses various characteristics, such as age, employment status, female head of household, to identify (in my terminology to "tag") groups of persons who are on the average needy. These groups are then given special treatment, or, as the economist would view it, they are given a special tax schedule different from the rest of the populace. A system of tagging permits relatively high welfare payments with relatively low marginal rates of taxation, a proposition which will be explained presently and discussed at some length.

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It is the aim of this paper to explore the nature of the optimal negative income tax with tagging and to compare this tax with the optimal negative income tax in which all groups are treated alike. I should emphasize at the outset, however, that I do not wish to defend one type of welfare system versus another—rather, I feel that if welfare reform is to be successful, the merits of different systems must be understood, especially the merits of the system which is to be replaced. The evidence is fairly strong that the proponents of welfare reform have failed to understand (or to face) the costs involved in going from a system of welfare based on tagging (such as we now have in the United States) to one which treats all people uniformly.

The role of tagging in income redistribution can be seen most simply in a very simple formula and its modification. Consider a negative income tax of the form $T = -\alpha \overline{Y} + tY$, where α is the fraction of per capita income received by a person with zero gross income, t is the marginal rate of taxation, and $\overline{Y}$ is per capita income. Summing the left-hand side and the right-hand side of this formula over all individuals in the economy and dividing by total income yields a formula of the form:

$$(1) \qquad t = \alpha + g$$

where g is the ratio of net taxes collected to total income, and t and α come from the formula for the negative income tax.[1] For-

[1] Define g as: $\Sigma T_i / \Sigma Y_i$, where g is net tax collections relative to total income. Formula (1) can be derived as follows: $T_i = -\alpha \overline{Y} + tY_i$ is the taxes paid by individual i. Summing over all i individuals (assumed to be n in number),

$$\sum_{i=1}^{n} T_i = \sum_{i=1}^{n} -\alpha \overline{Y} + \sum_{i=1}^{n} tY_i$$

$$(a) \qquad \sum_{i=1}^{n} T_i = -\alpha n \overline{Y} + t \sum_{i=1}^{n} Y_i$$

Because $\overline{Y}$ is by definition, $(\Sigma Y_i)/n$, and because g is

mula (1) indicates the fundamental tradeoff involved in income redistribution by a linear negative income tax. Higher levels of support α can be given, but only at the cost of higher marginal rates of taxation. Thus, if α is 40 percent and g is 15 percent, numbers which are not unrealistic, marginal tax rates are 55 percent.

Suppose, however, that it is possible to identify (tag) a group which contains all the poor people and that this group contains only a fraction β of the total population. By giving this tagged group a minimum support, which is a fraction α of average income and a marginal tax rate t, and by giving untagged persons a zero support level and the same marginal tax rate t, similar to formula (1), we find:[2]

$$(2) \qquad\qquad t = \beta\alpha + g$$

Formula (2) shows that tagging makes the tradeoff between levels of support and marginal rates of taxation more favorable by eliminating the grant to taxpayers, and thus

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by definition, $\sum_{i=1}^{n} T_i / \sum_{i=1}^{n} Y_i$, a division of the left-hand and the right-hand sides of (a) by ΣY_i yields:

$$\frac{\Sigma T_i}{\Sigma Y_i} = -\alpha \frac{n\overline{Y}}{\Sigma Y_i} + t$$

whence: $g = -\alpha + t$, and $t = \alpha + g$.

[2] Formula (2) is derived in similar fashion to formula (1). Let n_p denote the number of poor people, with $n_p/n = \beta$. (Let poor people be numbered 1 to n_p.) Poor people pay a tax

$$T_i = (-\alpha\overline{Y} + tY_i) \qquad i = 1, \ldots, n_p$$

whereas other people pay a tax

$$T_i = tY_i \qquad i = n_p + 1, \ldots, n$$

Thus, total net revenues are:

$$\sum_{i=1}^{n} T_i = \sum_{i=1}^{n_p} (-\alpha\overline{Y} + tY_i) + \sum_{i=n_p+1}^{n} tY_i$$

and

$$\sum_{i=1}^{n} T_i = -n_p\alpha\overline{Y} + t\sum_{i=1}^{n} Y_i$$

or using the definition of β, $n_p = \beta n$

$$(b) \qquad \sum_{i=1}^{n} T_i = -\beta\alpha n\overline{Y} + t\sum_{i=1}^{n} Y_i$$

allows greater support for the poor with less distortion to the tax structure.

Table 1 is taken from the 1974 *Economic Report of the President* (p. 168). This table indicates the scope and magnitude, and also the importance, of tagging in federal redistribution programs. Such programs as aid to the aged, the blind, and the disabled, and also Medicare (including such aid administered by the Social Security system), are examples of tagging. Such programs as aid to families with dependent children are less clearcut—but it must be remembered that this program began as Aid to Dependent Children, and assistance was given to families with children without able-bodied fathers.

Female-headed households have a particularly high incidence of poverty, and this criterion (despite its perverse incentive to families to split up) was therefore one of the most efficient techniques of tagging. Other programs, such as Medicaid and housing subsidies, represent a form of tagging most common in underdeveloped and Communist countries. Since poor people spend a greater fraction of their income on some items than others, the subsidization of items of inferior but utilitarian quality constitutes one method of income "redistribution." It is also an example of tagging. In sum, Table 1 shows, to a fairly good degree of accuracy, that *U.S.* federal redistribution schemes are, with some exceptions, based on tagging.

Furthermore, the record of the debate on welfare reform reveals that the central issues involve the tradeoffs between α, t, and β reflected in formulas (1) and (2). Recall that, in August 1969, President Nixon proposed the Family Assistance Plan. By this

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Dividing the left-hand and right-hand sides of (b) by ΣY_i yields:

$$\frac{\sum_{i=1}^{n} T_i}{\sum_{i=1}^{n} Y_i} = -\beta\alpha \frac{n\overline{Y}}{\sum_{i=1}^{n} Y_i} + t$$

or $g = -\beta\alpha + t$.

TABLE 1—FEDERAL GOVERNMENT TRANSFER PROGRAMS, FISCAL YEAR 1973

Program	Total Expenditure (millions of dollars)	Number of Recipients (thousands)	Monthly Benefits per Recipient[a]	Percent of Recipients in Poverty[b]
Social Security				
Old age and survivors insurance	42,170	25,205	$139	16
Disability insurance	5,162	3,272	132	24
Public Assistance				
Aid of families with dependent children	3,617	10,980	c	76
Blind	56	78	c	62
Disabled	766	1,164	c	73
Aged	1,051	1,917	c	60
Other Cash Programs				
Veterans' compensation and benefits	1,401	7,203	74	(4)
Unemployment insurance benefits	4,404	5,409	68	(4)
In Kind				
Medicare	9,039	10,600	71	17
Medicaid	4,402	23,537	c	70
Food stamps	2,136	12,639	14	92
Public housing	1,408	3,319	c	d
Rent supplements	106	373	24	d
Homeownership assistance (section 235)	282	1,647	14	d
Rental housing assistance (section 236)	170	513	28	d

[a]The number of recipients is for individuals, not families.

[b]Poverty is defined relative to money income and the size of the recipient's family. Money income includes money transfer payments but excludes income received in kind. All percents are estimated.

[c]Programs with federal-state sharing of expenses.

[d]Not available.

plan a typical welfare family would receive $1,600 per year if it earned no income at all (*New York Times,* Aug. 9, 1969). There would be no decrease in benefits for the first $720 earned, but thereafter a 50¢ decline in benefits for every dollar earned up to an income of $3,920. The debate on this proposal in Congress was long and discussed many peripheral questions, but one central issue stands out. On the one side were those, with Senator Abraham Ribicoff as the leading protagonist, who considered the benefits too "meager" (Ribicoff's phrase, *New York Times,* Apr. 21, 1970); on the other side was the administration, with a succession of secretaries of Health, Education, and Welfare as leading protagonists, who viewed any increase in these benefits as too "costly" (Elliott Richardson's phrase, *New York Times,* July 22, 1971). By this it was meant that with such an increase the marginal tax rate t would have to be too great. No compromise was reached, and in

March 1972 the bill was withdrawn by the administration. In the background, of course, was the current welfare system, whose tagging programs allow a better tradeoff between α and t—even though other incentives such as incentives to work and to maintain a family may be perverse.

Thus, formula (1) and its modification with tagging are instructive and pertain to real issues. These formulas are generally useful in showing the two-way tradeoff between welfare support and marginal rates of taxation, and the three-way tradeoff between these two variables and tagging. It is fairly intuitive by consumer's surplus arguments that the cost of a tax is the "deadweight loss" due to the gap created between private and social marginal products, which in this case is the marginal rate of taxation itself; ideally, however, the welfare cost of a tax is endogenous and should be derived from basic principles of utility maximization and general equilibrium analysis.

Ray Fair and James Mirrlees have developed the theory of the negative income tax uniformly applied. Their approach is reviewed in the next section, because, with added complication, the tradeoffs may be applied to a model of the optimal negative income tax with tagging. Section III illustrates the proposition that tagging of poor people typically results in greater support levels to the poor. Section IV gives a complicated and generalized model of optimal income redistribution with tagging, of which Section III presented a simple but illustrative example. Section V discusses the relation between tagging and the estimation of costs and benefits of manpower programs. Section VI gives conclusions.

II. A Simple Example and Explanation of Mirrlees-Fair

Following the example of Mirrlees and Fair, there is a population with a distribution of abilities a, according to the distribution function $f(a)$. Members of this population receive income dependent on their marginal products of the form $w(a)L(a)$, where $w(a)$ is the wage of a worker of ability of index a, and $L(a)$ is the labor input of such a worker. After-tax income is $w(a)L(a) - t(w(a)L(a))$, where $t(y)$ is the tax paid on gross income y. Members of this population have utility positively dependent on after-tax income and negatively dependent on labor input. Thus, utility of a person of ability a is

(3) $\quad u(a) = u[w(a)L(a)$

$\qquad\qquad - t(w(a)L(a)), L(a)]$

The optimal tax is defined as maximizing the expected value of the utility of the population, denoted U,

(4) $\quad U = \int u[w(a)L(a)$

$\qquad\qquad - t(w(a)L(a)), L(a)] f(a) da$

subject to the constraint that taxes equal transfers, or,

(5) $\qquad \int t(w(a)L(a)) f(a) da = 0$

and also subject to the constraint that each individual chooses his labor input to maximize his utility, given the wage rate paid to persons of his ability, his utility function u, and the tax schedule $t(y)$, yielding the first-order condition:

$$\frac{\partial}{\partial L(a)} \{u[w(a)L(a)$$

$$- t(w(a)L(a)), L(a)]\} = 0$$

However complicated the equations or the mathematics, the basic tradeoff made in the choice of an optimal Mirrlees-Fair style income tax can be explained as follows. As taxes are raised and incomes are redistributed, there is a gain in welfare, because income is distributed to those who have greater need of it (higher marginal utility). But this gain must be balanced against a loss: as tax rates rise in relatively productive jobs and as subsidies rise in relatively unproductive jobs, workers are less willing to take the productive (and more willing to take the unproductive) jobs. Such switching, per se, results in a loss in U because each worker is choosing the amount of work, or the kind of job, which maximizes his private utility rather than the amount of work or kind of job which maximizes social utility. In general, the redistributive gains versus the losses caused by tax/transfer-induced switching is the major tradeoff in the theory of optimal income taxes and welfare payments—both with and without tagging.

III. A Simple Example of Optimal Taxes and Subsidies with Tagging

Section I gave formula (2) which indicated that tagging improved the relation between the marginal tax rate and the minimum subsidy to *tagged* poor people. Loosely, it could be said that tagging will in consequence reduce the cost of income redistribution (since, with lower marginal tax rates, there is a smaller gap between social and private returns from work and therefore less loss of consumer's surplus due to redistribution-caused job switching). As a result, it is only natural that tagging increases the optimal transfers to poor people.

A. *The Rudimentary Mirrlees-Fair Model*

As implied by Mirrlees, there are no interesting easily solved algebraic examples of the optimal income tax with a continuum of abilities. There is no question that tagging, since it adds an additional degree of freedom, makes the problem still harder. Therefore, the example presented here is a much simplified version of the Mirrlees-Fair general case.

The example here is the most rudimentary model in which the optimal tax structure, both with and without tagging, is dictated by the tradeoffs between the deadweight loss due to taxes and subsidies and the gains of redistribution from rich to poor. Instead of a continuum of workers (as in Mirrlees), there are just two types: skilled and unskilled; instead of a continuum of output dependent upon labor input, there are just two types of jobs: difficult jobs (denoted by subscript D) and easy jobs (denoted by subscript E). Instead of a marginal condition describing the optimal tax reflecting continua of both labor input and worker types and the corresponding use of the calculus of variations, the optimum tax is characterized by a binding inequality constraint, which results from the discrete calculus corresponding to the discrete number of job types and worker types.

It is assumed that there are an equal number of skilled and unskilled workers. Skilled workers may work in either difficult or easy jobs, but unskilled workers may work only in easy jobs.[3] The output of a skilled worker in a difficult job is q_D, which is a constant independent of the number of workers in such jobs. Similarly, the output of both skilled and unskilled workers in easy jobs is q_E, which is also a constant independent of the number of workers in such jobs. These data are summarized in Table 2, which gives the technology of the model. Of course, output in difficult jobs exceeds output in easy jobs, so that $q_D > q_E$.

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[3]The model works out equivalently if unskilled workers can work in different jobs but have great distaste for the extra effort required.

TABLE 2—OUTPUT OF WORKER BY TYPE OF WORKER BY TYPE OF JOB

Type of Worker (Percent of Workforce)	Type of Job	
	Difficult	Easy
Skilled (50%)	q_D	q_E
Unskilled (50%)	Not applicable	q_E

Note: $q_D > q_E$

The economy is competitive, so that pretax, pretransfer pay in each job is the worker's marginal product in that job. The utility of each worker depends upon after-tax, after-transfer income and upon the nonpecuniary returns of his job. The utility functions can be written as a separable function of the pecuniary and the nonpecuniary returns. Let t_D denote the taxes paid by workers in difficult jobs (with income q_D), and let t_E denote transfers to workers in easy jobs (with income q_E). After-tax income in difficult jobs is $q_D - t_D$; after-transfer income in easy jobs is $q_E + t_E$. The utility of skilled workers in difficult jobs is $u(q_D - t_D) - \delta$, and the utility of both skilled and unskilled workers in easy jobs is $u(q_E + t_E)$. The parameter δ reflects the nonpecuniary distaste of workers for difficult jobs due to the greater effort necessary. Of course, $u' > 0$, $u'' < 0$. It is further assumed that $u(q_D) - \delta > u(q_E)$; otherwise, easy jobs dominate difficult jobs, so that, at the optimum, all workers (trivially) work in easy jobs without paying taxes or receiving transfers. The preceding data are summarized in Table 3.

In the absence of tagging, the Mirrlees-

TABLE 3—UTILITY OF WORKERS BY TYPE OF WORKER BY TYPE OF JOB, WITH TAXES t_D ON PERSONS WITH PRETAX INCOME q_D, AND TRANSFERS t_E TO PERSONS WITH PRETAX INCOME q_E

Type of Worker (Percent of Workforce)	Type of Job	
	Difficult	Easy
Skilled (50%)	$u(q_D - t_D) - \delta$	$u(q_E + t_E)$
Unskilled (50%)	Not applicable	$u(q_E + t_E)$

Note: $u(q_D) - \delta > u(q_E)$

Fair optimal income tax, as applied to this model, is obtained by choosing a tax on income in difficult jobs t_D and a transfer to income in easy jobs t_E, subject to the constraint that qualified workers will choose skilled or unskilled jobs depending upon which one yields greater utility (after taxes), and also subject to the constraint that taxes equal transfers. In mathematical form this becomes the maximization problem to choose t_D and t_E to maximize U,

$$(6) \quad U = \frac{1}{2} \max \{ u(q_D - t_D) - \delta,$$

$$u(q_E + t_E) \} + \frac{1}{2} u(q_E + t_E)$$

subject to

(7a)

$$t_D = t_E \quad \text{if} \quad u(q_D - t_D) - \delta \geq u(q_E + t_E)$$

(7b)

$$t_E = 0 \quad \text{if} \quad u(q_D - t_D) - \delta < u(q_E + t_E)$$

It is convenient to denote optimal values with an asterisk. Thus the optimal value of U is U^*, of t is t^*, and of t_E is t_E^*.

The maximand (6) consists of the sum of the utilities of skilled and unskilled workers weighted by their respective fractions of the population. The utility of a skilled worker is $\max \{ u(q_D - t_D) - \delta, u(q_E + t_E) \}$ since skilled workers are assumed to work in difficult jobs if $u(q_D - t_D) - \delta \geq u(q_E + t_E)$, and in easy jobs otherwise. Equations (7a) and (7b) jointly reflect the balanced budget constraint. If skilled workers work in difficult jobs, the tax collection per skilled worker is t_D. If tax collections equal transfers, $t_D = t_E$ (which is (7a)). However, if skilled workers work in easy jobs, they must receive the same transfer as unskilled workers. As a result, the condition that taxes equal transfers implies that $t_E = 0$, which is (7b).

Tagging does not occur in this maximization, since skilled and unskilled workers alike receive the same transfer t_E if they work in easy jobs.

Two equations, (8) and (9), characterize the optimal tax-*cum*-transfer rates t_D^* and

t_E^* which maximize U:

$$(8) \qquad\qquad t_D^* = t_E^*$$

$$(9) \quad u(q_D - t_D^*) - \delta = u(q_E + t_E^*)$$

Of course, (8) is the tax-equal-transfer balanced budget constraint. Equation (9) expresses the additional condition that, at the optimum, as much is redistributed from skilled to unskilled workers as possible, subject to the constraint that any greater redistribution would cause skilled workers to switch from difficult to easy jobs. (Any increase in t_D above t_D^*, or in t_E above t_E^*, results in a shift of all skilled workers into easy jobs.) As a result of this threatened shift, the deadweight loss due to a marginal increase in taxes or in transfers exceeds the returns from any redistributive gain.[4] Thus, our model, although rudimentary, has an optimal tax-*cum*-transfer schedule which reflects the tradeoffs of Mirrlees-Fair: the optimal tax/transfer policy being determined both by the gains from redistribution and the losses due to labor-supply shifts in response to changes in taxes and transfers.

B. Tagging Introduced into Rudimentary Mirrlees-Fair Model

Now consider how tagging will alter the Mirrlees-Fair maximization and its solution. Suppose that a portion β of the unskilled workers can be identified (i.e., tagged) as unskilled and given a tax/transfer schedule different from that of other workers. In the altered model with tagging, let T_D denote the taxes paid by untagged workers in difficult jobs; let T_E denote transfers (perhaps negative) paid to untagged workers in easy jobs; and let τ denote the transfer to tagged workers (all of whom work in easy jobs). Table 4 compares the tax/transfer schedule of the earlier

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[4]It also happens in this maximization that any further increase in taxes or in transfers at the margin causes such a large and discontinuous shift in the number of workers earning high incomes in difficult jobs that such an increase also decreases the revenues available for redistribution to unskilled workers.

TABLE 4—TAXES ON DIFFICULT JOBS AND
TRANSFERS TO EASY JOBS IN MODELS WITH
AND WITHOUT TAGGING

	Model without Tagging	Model with Tagging
Tax on Difficult Job	t_D	T_D
Transfer to Easy Job (workers untagged)	t_E	T_E
Transfer to Easy Job (workers tagged)	Not Applicable	τ

model without tagging and the tax schedule of the current model with tagging.

Using Table 4, it is easy to construct Table 5, which gives the utility of workers by type of job after taxes and after transfers. Table 5 differs from Table 3 by addition of the bottom row, which represents the utility of tagged workers in easy jobs who receive the transfer τ.

Using the data in Table 5, it is easy to see that, with tagging, the optimum tax-*cum*-transfer policy is to choose the values (T_D, T_E, τ) that maximize U^{Tag}, where:

(10) $U^{Tag} =$

$$\frac{1}{2} \max\{u(q_D - T_D) - \delta, u(q_E + T_E)\}$$

$$+ \frac{1}{2}(1 - \beta)u(q_E + T_E) + \frac{1}{2}\beta u(q_E + \tau)$$

subject to the balanced budget constraints (11a) and (11b):

(11a) $T_D = (1 - \beta)T_E + \beta\tau$

     if $u(q_D - T_D) - \delta \geq u(q_E + T_E)$

(11b) $(2 - \beta)T_E + \beta\tau = 0$

     if $u(q_D - T_D) - \delta < u(q_E + T_E)$

Again, denote the optimum values with an asterisk: T_D^*, T_E^*, τ^*, and U^{Tag*}.

The maximand U^{Tag} is the sum of the utility of all three types of workers—skilled, untagged unskilled, and tagged unskilled—weighted by their respective fractions of the population. The utility of skilled workers is $u(q_D - T_D) - \delta$ or $u(q_E + T_E)$, dependent upon whether they choose difficult or easy jobs. Equations (11a) and (11b) are the tax-equal-transfer, balanced-budget constraints.

TABLE 5—UTILITY OF WORKER BY TYPE
OF WORKER BY TYPE OF JOB WITH TAGGING;
UNTAGGED WORKERS PAY TAXES T_D IN DIFFICULT
JOBS AND RECEIVE TRANSFERS T_E IN UNSKILLED
JOBS; TAGGED WORKERS RECEIVE A TRANSFER τ
IN UNSKILLED JOBS

Type of Worker (Fraction of Workforce)	Type of Job	
	Difficult	Easy
Skilled (Untagged) (1/2)	$u(q_D - T_D) - \delta$	$u(q_E + T_E)$
Unskilled (Untagged) $((1 - \beta)/2)$	Not Applicable	$u(q_E + T_E)$
Unskilled (Tagged) $(\beta/2)$	Not Applicable	$u(q_E + \tau)$

The respective equation applies accordingly as skilled workers are in difficult or in easy jobs.

In the Appendix, it is shown that with $u(q_D) - \delta > u(q_E)$, for $0 < \beta \leq 1$, the optimal transfer to tagged workers τ^* exceeds the optimal transfer to untagged unskilled workers t_E^* in the model without tagging. With $\beta = 1$, complete equality of income is attained at the optimum. In this precise sense, tagging increases the optimum transfers to those who are identified as poor and given special tax treatment.

The difference between the tagging and the nontagging optimization is clear: with tagging, for a given increased subsidy to tagged people, there is a smaller decline in the income differential between difficult and easy work, since T_E need not shift, and there is therefore a smaller tendency for workers to shift from difficult to easy jobs with a given redistribution of income. As a result, optimal transfers to tagged workers are greater with tagging than in its absence.

An outline of the proof, which is given in the Appendix, illustrates the application of this logic more particularly. The proof shows that, at the optimum, the rate of taxation of workers in difficult jobs and the rate of transfer to untagged workers in easy jobs is taken up to the point that any further increase in either of those two rates will

induce skilled workers to shift into easy jobs. This is reflected by the optimization condition (12), which is exactly analogous to the similar optimization condition (9) in the untagged case:

$$(12) \quad u(q_D - T_D^*) - \delta = u(q_E + T_E^*)$$

It is then shown by contradiction that τ^* (the optimal transfer to tagged workers) exceeds T_E^* (the optimal transfer to unskilled untagged workers). Suppose the contrary (i.e., $\tau^* \leq T_E^*$). In that case, a marginal decrease in T_E and a marginal increase in equal dollar amount in τ can cause no decrease in utility, while it allows some additional redistribution to be made from skilled workers in difficult jobs to other workers without inducing any skilled workers to switch from difficult into easy jobs. Since total utility U^{Tag} is sure to be increased by at least one of these two changes and not decreased by the other, the optimality of τ^* and T_E^* is contradicted. At the optimum, therefore, τ^* must be greater than T_E^*.

Knowing that $\tau^* > T_E^*$, as has been shown, knowing that T_D^* and T_E^* satisfy (12), and knowing that t_D^* and t_E^* satisfy the similar condition (9), $u(q_D - t_D^*) - \delta = u(q_E + t_E^*)$, the budget constraints can be used to show that $\tau^* > t_E^*$.

IV. Generalized Problem

In the example in the last section, there was no opportunity for people to change the characteristics by which they were tagged. Age, race, and sex are real life examples of such characteristics. However, there are also redistribution programs in which people, by some effort or with some loss of utility, may alter their characteristics, thereby becoming members of a tagged group. The most commonly cited example of this concerns families who allegedly have separated in order to obtain payments under the Aid to Dependent Children program (see Daniel Moynihan).

To consider the case more generally, in which group membership is endogenous, this section presents a general model. It

then becomes an empirical (rather than a theoretical) question to determine what amount of tagging (and quite possibly the answer is none) will maximize aggregate utility U. There is no major theorem in general, unless it is the falsity of the proposition to which the previous section gave a counterexample, that a uniform negative income tax is always superior to a welfare system that gives special aid to people with special problems or characteristics.

In general, we may assume the goal is to choose functions $t_\gamma(y_\gamma)$ to maximize

$$(13) \quad U = \int u_x f(x)dx$$

where $f(x)$ denotes the distribution of people of type x, and where the utility of such a person depends on his after-tax income, his characteristics, and the group to which he belongs γ, or

$$(14) \quad u_x = u(y - t, x, \gamma)$$

In the real world, of course, tagging is not costless, one of the major complaints against the current welfare system being its cost of administration. Let Γ be the grouping of people into various subgroups of the population, and let $c(\Gamma)$ be the administrative cost of such tagging.

U is maximized subject to two constraints, the first being that taxes equal transfers plus administrative costs, or

$$(15) \quad \int_x t_\gamma(y(x), \gamma(x))f(x)dx + c(\Gamma) = 0$$

where $\gamma(x)$ is the group to which an individual of type x belongs, and the second being that an individual of type x chooses his labor input and the group to which he belongs to maximize

$$(16) \quad u[w(x, \gamma)L(x, \gamma) \\ \qquad - t_\gamma(w(x, \gamma)L(x, \gamma)), x, \gamma]$$

where $w(x, \gamma)$ is the wage of a person of characteristic x belonging to group γ, and $L(x, \gamma)$ is the labor input.

In sum, this is the generalization of Mirrlees' (and Fair's) problem to taxation with tagging. I have taken the trouble to

specify this general problem since it is important to note the potential endogeneity of the tagged characteristics and of administrative costs.

V. Cost-Benefit Evaluation of Manpower Programs and Tagging

Another type of program in which tagging is important is manpower training programs. Typically, such programs in the United States have aimed at improving the skills of the disadvantaged and the temporarily unemployed. Because of formal eligibility requirements, and also because of the self-selectivity of the trainees, people in special need are identified (or tagged) by such programs.

There has been an intensive effort in the United States to evaluate the benefits and costs of such programs, so much so that there have been extensive "reviews of the reviews" (see David O'Neill). The studies have typically (but with some exceptions) found that the benefits of manpower training programs, as conventionally accounted, have been less than the costs. But because of the value of tagging done by such programs, a benefit-cost ratio of less than unity is not sufficient reason for their curtailment.

This last point can be made formally in terms of the tagging models in Sections III and IV. A manpower program could be introduced into the model in Section III by assuming that, at a given cost per worker, an unskilled worker who is previously untagged can be made into a skilled worker. The costs of such a program, as usually accounted, are its costs of operation plus the wages foregone by workers while engaged in training. The cost of operation becomes an additional term in the balanced budget constraint (analogous to the term $c(\Gamma)$ in (15)). The benefits from the program are the increase in the pretax, pretransfer wages of the worker subsequent to training. It is easy to construct an example in which the benefits (thus accounted) are less than the costs (thus accounted), yet U^{Tag} is greater with the program than in its absence, because the program tags unskilled workers and makes income redistribution possible with relatively little distortion to the incentive structure.

An unrigorous calculation using consumer's surplus logic shows that the tagging benefits of manpower programs may be substantial. Consider two subgroups of the population, both of which are young and both of which have low current incomes. One group is skilled but has low current income because it is building up human capital; the other group is unskilled and has low current income for that reason; it also has low permanent income.

Let there be a manpower training program. At a cost of c dollars, the permanent income of a young unskilled worker can be raised by $1. The costs of this program (as usually accounted) are c dollars, and its benefits are $1. Considering consumer's surplus and assuming that there is a deadweight loss of λ per dollar due to taxes to pay for the program, the cost of the program, inclusive of deadweight loss is $c(1 + \lambda)$.

Now compare the advantages of this training program to a negative income tax that gives lump sum transfers to all young workers, whether skilled or unskilled. Let unskilled workers be a fraction θ of the total population. To redistribute $1 to an unskilled young worker, a total of $1/\theta$ dollars must be redistributed to all young people.

Which scheme—the manpower training program or the negative income tax—is the cheaper way of redistributing $1 to unskilled workers? The cost, inclusive of deadweight loss of the manpower program, is $c(1 + \lambda)$. The cost, inclusive of deadweight loss of the negative income tax, is the deadweight loss on $1/\theta$ dollars, plus the $1 redistributed, or $\lambda/\theta + 1$. Which scheme is cheaper depends upon whether $c(1 + \lambda)$ is greater or less than $(\lambda/\theta + 1)$.

Let λ be .05 and let θ be .1, numbers which are not unrepresentative of reasonable parameters for deadweight loss due to income taxation and the fraction of the population eligible for a typical manpower training program such as the Job Corps. If the benefit-cost ratio of the manpower program $(1/c)$ is less than .7, the negative income tax is the cheaper method of redis-

tribution; if the benefit-cost ratio is greater than .7, the manpower program is preferable.

VI. Summary and Conclusions

This paper has identified the important tradeoffs in the design of institutions to re-distribute income. Some types of programs, either by their eligibility requirements or by the self-selection of the beneficiaries, iden-tify (tag) people who are in special need. With tagging, taxpayers (as opposed to beneficiaries) are denied the benefit of the transfer, so that in effect a *lump sum* trans-fer is made to tagged people.

In contrast, with a negative income tax, a grant is made to all taxpayers and this grant must be recovered to achieve the same net revenue. This recovery results in high mar-ginal tax rates, whose disincentive effects are the major disadvantage of a negative in-come tax. This disadvantage, however, must be weighed against the disadvantages of tagging, which are the perverse incentives to people to be identified as needy (to be tagged), the inequity of such a system, and its cost of administration.

The problem of the optimal redistribu-tional system, both with and without tag-ging, has been set up in the framework of the Mirrlees-Fair optimal income tax. It was shown in a special example that if a portion of the poor population could be identified (costlessly, in this example), total welfare U could be raised by giving in-creased subsidies to the tagged poor.

Finally, the consequences of tagging for manpower programs were discussed. Since tagging is a benefit of most manpower pro-grams, benefit-cost ratios need not exceed unity to justify their existence. In fact, an example showed that benefit/cost ratios could be significantly less than one (.7 in the example), and a manpower program might still be preferable to a negative income tax as a method of income redistribution.

APPENDIX

THEOREM 1: *Using the definitions of τ^* and t_E^* in Section III, and also the models in*

that section, if $u(q_D) - \delta > u(q_E)$ *and* $0 < \beta \leq 1, \tau^* > t_E^*$.

PROOF:

The proof proceeds by five propositions. Propositions 1 and 2 make variational argu-ments which show that at the maximum as much must be redistributed from skilled workers as possible without inducing them to switch into easy jobs. This yields the con-dition:

$$(A1) \quad u(q_D - T_D^*) - \delta = u(q_E + T_E^*)$$

It is similarly true without tagging that

$$(A2) \quad u(q_D - t_D^*) - \delta = u(q_E + t_E^*)$$

From (A1) and (A2) it can be easily shown (Proposition 3) that if $T_D^* > t_D^*$, $T_E^* < t_E^*$ (and vice versa).

Proposition 4 then shows that $\tau^* \geq t_E^*$. There are two cases. In one case, $T_D^* < t_D^*$. If $T_D^* < t_D^*$, by Proposition 3, $T_E^* > t_E^*$. Suppose $t_E^* \geq \tau^*$. A variational argument shows that this cannot be a maximum, for a decrease in T_E^* and an increase in τ^* can increase U^{Tag}. In the other case, $T_D^* \geq t_D^*$. But if $T_D^* \geq t_D^*$, by Proposition 3, $T_E^* \leq t_E^*$. It follows from the balanced budget con-straints that if T_E^* is smaller than t_E^*, but also, T_D^* is larger than t_D^*, that τ^* must be larger than t_E^*. As a result, in both Case I and Case II, $\tau^* \geq t_E^*$. Proposition 5 shows that the inequality is strict.

PROPOSITION 1: $u(q_D - T_D^*) - \delta \geq u(q_E + T_E^*)$

PROOF:

Suppose otherwise. Then,

$$(A3) \quad U^{Tag^*} = \frac{1}{2} \{(2 - \beta)u(q_E + T_E^*)$$
$$+ \beta u(q_E + \tau^*)\} \leq u(q_E)$$

by the concavity of u and the constraint (11b) that $(2 - \beta)T_E^* = -\beta\tau^*$. Since $u(q_D) - \delta > u(q_E)$ by assumption,

$$(A4) \quad u(q_E) < \frac{1}{2} \{u(q_D) - \delta + u(q_E)\}$$

Since $T_D = T_E = \tau = 0$ is a feasible tax/transfer vector (satisfying budget constraint

(11)), and with

(A5) $U^{Tag} = \dfrac{1}{2} \{ u(q_D) - \delta + u(q_E) \}$

the optimality of U^{Tag^*} is contradicted by (A3), (A4), and (A5). By this contradiction,

(A6) $u(q_D - T_D^*) - \delta \geq u(q_E + T_E^*)$

PROPOSITION 2:

(A7) $u(q_D - T_D^*) - \delta = u(q_E + T_E^*)$

PROOF:

Suppose that $u(q_D - T_D^*) - \delta > u(q_E + T_E^*)$. A variational argument shows that (T_D^*, T_E^*, τ^*) is not optimal.

Let $T_D' = T_D^* + \epsilon$

$\qquad T_E' = T_E^* + \epsilon/(1 - \beta)$

(A8) $U^{Tag}(T_D', T_E', \tau^*) = U^{Tag}(T_D^*, T_E^*, \tau^*)$
$\qquad\qquad + \epsilon/2[-u'(q_D - T_D^*)$
$\qquad\qquad\qquad + u'(q_E + T_E^*)] + \sigma^2(\epsilon)$

where $o^2(\epsilon)$ is an expression with $\lim_{\epsilon \to 0} o^2(\epsilon)/\epsilon = 0$. But since $u(q_D - T_D^*) - \delta > u(q_E + T_E^*)$ by assumption,

(A9) $u'(q_D - T_D^*) < u'(q_E + T_E^*)$

by the concavity of u.

Therefore, by (A8), $U^{Tag}(T_D', T_E', \tau^*) > U^{Tag}(T_D^*, T_E^*, \tau^*)$ for ϵ sufficiently small, which contradicts the optimality of (T_D^*, T_E^*, τ^*). Therefore, $u(q_D - T_D^*) - \delta \leq u(q_E + T_E^*)$.

By Proposition 1, $u(q_D - T_D^*) - \delta \geq u(q_E + T_E^*)$. Therefore,

(A10) $u(q_D - T_D^*) - \delta = u(q_E + T_E^*)$

PROPOSITION 3: $T_D^* > t_D^*$ *if and only if* $T_E^* < t_E^*$

PROOF:

Suppose $T_D^* > t_D^*$. By Proposition 2

(A11) $u(q_D - T_D^*) - \delta = u(q_E + T_E^*)$

By similar logic,

(A12) $u(q_D - t_D^*) - \delta = u(q_E + t_E^*)$

If $T_D^* > t_D^*$, then

(A13) $u(q_D - T_D^*) < u(q_D - t_D^*)$

whence

(A14) $u(q_E + T_E^*)$
$\qquad = u(q_D - T_D^*) - \delta < u(q_D - t_D^*) - \delta$
$\qquad = u(q_E + t_E^*)$

(A15) $T_E^* < t_E^*$

Similarly, if $T_D^* < t_D^*$, $T_E^* > t_E^*$

PROPOSITION 4: $\tau^* \geq t_E^*$

PROOF:

Suppose

(A16) $\tau^* < t_E^*$

It will be shown that the optimality of τ^* or of t_E^* is contradicted. Two cases will be analyzed:

Case I: $T_D^* < t_D^*$
Case II: $T_D^* \geq t_D^*$

Case I: By Proposition 3, if $T_D^* < t_D^*$,

(A17) $T_E^* > t_E^*$

But then

(A18) $U^{Tag}(T_D^*, T_E^* - \epsilon, \tau^* + (1 - \beta)/\beta \epsilon)$
$\qquad = U^{Tag}(T_D^*, T_E^*, \tau^*)$
$\qquad\quad - (1 - \beta)\epsilon/2u'(q_E + T_E^*)$
$\qquad\quad + \beta \dfrac{1 - \beta}{\beta} \epsilon/2u'(q_E + \tau^*) + o^2(\epsilon)$

which last equation (A18) for sufficiently small ϵ

(A19) $> U^{Tag}(T_D^*, T_E^*, \tau^*)$

since $u'(q_E + T_E^*) < u'(q_E + t_E^*) < u'(q_E + \tau^*)$ by the concavity of u and by both the inequality (A17), $(T_E^* > t_E^*)$, and the supposition (A16), $(t_E^* > \tau^*)$. The inequality (A19) contradicts the optimality of (T_D^*, T_E^*, τ^*). Therefore, if $T_D^* < t_D^*$, $\tau^* \geq t_E^*$.

Case II: $T_D^* \geq t_D^*$.

Suppose again

(A20) $\tau^* < t_E^*$

We will show a contradiction. By Proposition 3, if $T_D^* \geq t_D^*$,

(A21) $T_E^* \leq t_E^*$

By inequality (A21), $(T_E^* \leq t_E^*)$, the budget constraint (7a), $(t_D^* = t_E^*)$, and inequality (A20), $(\tau^* < t_E^*)$,

(A22) $T_D^* \geq t_D^* = t_E^* > (1 - \beta) T_E^* + \beta \tau^*$

which contradicts the budget constraint (11a), which states:

(A23) $T_D^* = (1 - \beta) T_E^* + \beta \tau^*$

Hence, if $T_D^* \geq t_D^*, \tau^* \geq t_E^*$.

Combining Cases I and II, it has been shown that $\tau^* \geq t_E^*$.

PROPOSITION 5: $\tau^* > t_E^*$

PROOF:

It remains to show that $\tau^* \neq t_E^*$. Suppose the contrary, that $\tau^* = t_E^*$. A contradiction will be demonstrated. By Proposition 3 at the optimum

(A24) $u(q_D - T_D^*) - \delta = u(q_E + T_E^*)$

and similarly,

(A25) $u(q_D - t_D^*) - \delta = u(q_E + t_E^*)$

The optimum (T_D^*, T_E^*, τ^*) and (t_D^*, t_E^*) must also satisfy the budget constraints (7a) and (11a):

(A26) $T_D^* = (1 - \beta) T_E^* + \beta \tau^*$

(A27) $t_D^* = t_E^*$

Add to the system (A24) to (A27) the assumption (A28):

(A28) $\tau^* = t_E^*$

An optimum with $\tau^* = t_E^*$ must satisfy the five relations (A24) to (A28). These five equations constitute a system of five equations in the five variables $(T_D^*, T_E^*, \tau^*, t_D^*, t_E^*)$, with unique solution with the property

$$T_D^* = T_E^* = \tau^* = t_D^* = t_E^*$$

Let

(A29) $T_D' = T_D^* + 2\epsilon_1$

(A30) $T_E' = T_E^* - 2\epsilon_2$

(A31) $\tau' = \tau^* + \dfrac{1 - \beta}{\beta} 2\epsilon_2 + \dfrac{1}{\beta} 2\epsilon_1$

with

(A32) $\epsilon_1 < \dfrac{u'(q_D - T_D^*)}{u'(q_E + T_E^*)} \epsilon_2$

Then,

(A33) $U^{Tag}(T_D', T_E', \tau') = U^{Tag}(T_D^*, T_E^*, \tau^*)$

$- \epsilon_1 u'(q_D - T_D^*) - (1 - \beta)\epsilon_2 u'(q_E + T_E^*)$

$+ \beta \dfrac{\epsilon_1}{\beta} u'(q_E + \tau^*)$

$+ \beta \dfrac{1 - \beta}{\beta} \epsilon_2 u'(q_E + \tau^*)$

$+ o^2(\epsilon_1) + o^2(\epsilon_2)$

Since $\tau^* = T_E^*$, for (ϵ_1, ϵ_2) sufficiently small $U^{Tag}(T_D', T_E', \tau') > U^{Tag}(T_D^*, T_E^*, \tau^*)$, which contradicts the optimality of (T_D^*, T_E^*, τ^*). Hence, $\tau^* \neq t_E^*$. And, using Proposition 4, $\tau^* > t_E^*$.

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