Optimal Pigovian Taxes under Altruism

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ABSTRACT. *This paper analyzes how different kinds of altruistic behavior would affect optimal externality-correcting taxes. Natural applications (not analyzed here) include the optimal road charge one should pay for increasing the accident risk of others, and optimal waste charges for households. The results turn out to depend crucially on the way altruism is modeled. It is shown that one cannot generally conclude that the optimal tax should be lower than the "standard" Pigovian tax level just because individuals decrease their consumption of externality-causing goods in altruistic response to others' externality-induced loss of utility.* (JEL D62, D64, H21)

Just as it is necessary to avoid the high-minded sentimentalism of assuming that all human beings ... try constantly to promote some selfless "social good," it is also important to escape what may be called the "low-minded sentimentalism" of assuming that everyone is constantly motivated entirely by personal self-interest.

A. K. Sen (1995, 15)

I. INTRODUCTION

Classical welfare economics since Pigou (1920) teaches that the government can internalize external costs by introducing a tax equal to the marginal damage on the externality-causing good, and then achieve an efficient allocation. The issue dealt with here is whether the size of such a tax depends on whether the individuals act altruistically or not. To be more specific, if the government observes that individuals impose externalities on others, should the tax then depend on whether the individuals are altruistic, and on their own partly adjust their behavior in response to others' decreased level of well-being? The result turns out to depend crucially on the exact way altruism is modeled.

As is well known, the principal idea behind Pigovian taxes is that individuals (and other economic agents) should be confronted with the full social costs of their actions, and not just their own private costs, for the society to be welfare-maximizing.[1] This fundamental result, as all welfare-theoretic results, is built on many strong assumptions. One of these is that all individuals are assumed to maximize their own individual utilities, or well-being, without taking into account the well-being of others in their action choice. Obviously, this is not a "correct" assumption, since we know that people, to various extents, do consider the well-being of others in their choice of actions.

However, all social theories naturally use strong simplifications of reality; one perhaps might even say that the essence of "positive" social science is to observe patterns and make systematic simplifications of reality. Without such simplifications, it would be impossible to draw any conclusions, since the "theory" would be infinitely complex. Thus, a theory should not be judged as inferior solely on the fact that another (more complex) theory might come closer to describing reality "as it is." Nevertheless, often it seems that many simplifying assumptions, such as neglecting altruism, are used without considering the magnitude of the simplification made.

Many recent studies on economics and altruism have been concerned with cost-benefit analysis in various forms; see, for example, Bergstrom (1982), Jones-Lee (1992), and Johansson (1992, 1993, 1994). Cost-benefit analysis is related to the optimal Pigovian charge, since the *social* maximization

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[1] Or at least (theoretically) to obtain an efficient allocation, in Hicks-Kaldor sense.

problems are identical (in the continuous case). Charity and private provision of public goods are considered by, among others, Sugden (1982, 1984), Andreoni (1989, 1990), Bergstrom, Blume, and Varian (1986), and Smith, Kehoe, and Cremer (1995). This literature is connected to the Pigovian tax case since the absence of negative consumption externalities can be interpreted as public goods.

Otherwise, altruism is mostly dealt with in a small-number framework, often within the family; see Becker (1974, 1976a), Bernheim and Stark (1988), Stark (1995), and Bergstrom (1989, 1995). Here, on the contrary, we will consider an individual's response to all others' utilities, that is, a large number case. Another relatively popular subdiscipline is economics and altruism in relation to sociobiology (Becker 1976b; Samuelson 1993; Simon 1993; Bergstrom and Stark 1993; Bergstrom 1995; Stark 1995). However, the analysis here will not consider *why* altruistic behavior may occur, but will merely treat the existence of different forms of altruism as given.

In environmental economics, which is the subdiscipline of economics which mostly deals with externalities, the emphasis has been on the relation between altruism and the controversial concepts of existence values or non-use values in cost-benefit analysis, introduced by Weisbrod (1964) and Krutilla (1967); see, for example, Randall (1991), Edwards (1992), Johansson (1993), Freeman (1993), Aldred (1994), and Cummings and Harrison (1995).

However, not much seems to have been done with respect to the influence of altruism on optimal consumption-taxes, and hence on externality-correcting taxes. Collard (1978) discussed problems related to poor people and the possibilities of subsidizing necessities, and the issue of redistributive income-taxation and altruism. The latter has also been analyzed by Arrow (1981) and more recently by Coate (1995).

Concerning Pigovian taxes and altruism, it is probably often reasonable to assume that people do not behave altruistically at all. Sometimes, however, this assumption can hardly be considered well motivated. One such example is the issue of designing optimal road charges with respect to the accident-risk a single road-user imposes on other road-users. It does indeed seem likely that drivers will adapt their behavior in order not to hurt or kill unprotected pedestrians. A similar case might apply to waste recycling for households. It is clear that altruistic motives are important for many recycling activities, since there is often a lack of traditional (non-altruistic) economic incentives. Should an optimal waste charge (if implemented) be adjusted because of these altruistic concerns? The latter example may be generalized to include practically all of the environment-related externalities caused by individuals. Therefore, it is clearly appropriate to investigate how the optimal Pigovian tax will change in response to different assumptions about altruism.

The paper is organized as follows: Section II describes the general model assumptions and Sections III–VI derive the optimal taxation based on these different ways of modeling altruism. Section VII summarizes and draws conclusions.

II. GENERAL MODEL ASSUMPTIONS

Assume a society consisting of n individuals, where n is a large number. For simplicity, it is assumed that all individuals are identical with respect to their sufficiently well-behaved utility functions and their exogenously given incomes.[2] Thus, there are no distributional considerations in the model. There are only two different goods in the market, x and z, where x is an untaxed clean good and z causes an externality (or diseconomy) Z, which consists of

[2] It is straightforward to generalize the model to include heterogenous individuals, as long as the marginal utility of income is unaffected, that is, as long as we neglect all distributional concerns. It would then be a second-best problem, since the government could hardly observe individual differences in taste with regard to altruism. A "well-behaved utility function" refers to the generation of a unique interior solution to the individual's maximization problem. Exogenous incomes imply that the supply side of the economy is fixed.

the total consumption (from all individuals) of good z. Producer prices are normalized to one (without loss of generality).

The government's objective is to maximize the utility of a representative individual by choosing the tax t on good z. It is assumed that this can be done without any transaction costs or possibilities to cheat. Hence, the word "utility" will be used in a *normative* sense, as a measure of individual well-being (in a broad sense), and not just as a tool to *describe* individual consumption behavior. That is, we use utility as a relevant measure of what the government should maximize, which is in accordance with the intentions of the nineteenth-century philosophers who created the concept; see, for example, Haslett (1990).[3] Furthermore, we will assume that there is no fiscal need in the society (i.e., we will assume the absence of public goods), and that it is possible for the government to redistribute tax revenues back to the consumers as lump-sum transfers.[4] Thus, we are dealing with a first-best solution in this respect.

We will discuss four different forms of altruistic behavior which will be defined subsequently: *Pure* altruism, *paternalistic* altruism, *impure* altruism, and *genuine* altruism. To simplify the analysis, we will only consider one type of altruism at a time, while in reality it seems reasonable that they occur together.

III. PURE ALTRUISM

An individual's utility level depends here on other people's utility (as well as on their own consumption, etc.), but not on any specific component of their utilities per se. This form of altruism is commonly used in economic theory; see, for example, Becker (1974, 1976a, 1981) or Johansson (1992). The utility function for an individual i under the assumptions of pure altruism may in the large number case be written as follows:

$$u^i = u(x^i, z^i, Z, U) \qquad [1]$$

where x^i and z^i are, respectively, the "clean" and "dirty" goods consumed by individual i; Z is an externality caused by the total consumption (from all individuals) of the "dirty" good z, that is, $Z = \Sigma_j z^j$; and U is the sum of all others' utilities, $U = \Sigma_k u^k$. The following conditions are assumed to hold: $\partial u/\partial x^i > 0$, $\partial u/\partial z^i > 0$, $\partial u/\partial Z < 0$, $\partial u/\partial U > 0$. Assume next that each individual's own contribution to the externality they experience themselves is small. Z can then be written without any individual index, since n is assumed to be large. Hence, each consumer's own contribution to these variables is considered negligible (compared to the variables).[5]

Furthermore, we will assume that the utility for an individual i derived *directly* from an additional unit of the good x is not small (negligible) compared to the utility derived *indirectly* through their altruistic preferences; that is, it is not small compared to the utility derived from the fact that every others' utility increases in response to i's increased consumption. This assumption seems rather natural but, as we will see, it is a crucial one; the implications will be discussed later. We will assume that individuals maximize their utility functions under the constraint of their individual budgets, where the exogenously given income must equal total consumption expenditures. The corresponding Lagrangean for an arbitrary individual i can then be written as:

$$\mathcal{L} = u(x^i, z^i, U(x^i, z^i, Z(z^i)) + \mu(y^i - x^i - (1 + t)z^i) \qquad [2]$$

[3] The reader who would prefer to use some other notion for this, such as individual welfare, personal welfare, well-being, a person's interest, felicity or capabilities, is of course free to do so.

[4] It would not be very difficult to generalize the model in this respect to more realistic and less strong assumptions, but the presentation would have to be considerably more "technically" complicated. Since little would be gained from such a generalization, regarding how the existence of altruism would affect the optimal tax, these strong assumptions will be kept throughout the paper.

[5] This is why we could write the externality which affects individual i as $Z = \Sigma_j z^j$, instead of $Z^i = \Sigma_{j \neq i} z^j$. Correspondingly we could write $U = \Sigma_k u^k$, instead of $U^i = \Sigma_{k \neq i} u^k$.

where y is the income received by the consumer (including lump-sum transfers), and where the Lagrange-multiplier μ can be interpreted as the marginal utility of income. The first-order conditions (f.o.c.) for an interior solution are as follows:

$$\frac{\partial u}{\partial x^i} + \frac{\partial u}{\partial U}\frac{\partial U}{\partial x^i} = \mu \qquad [3]$$

$$\frac{\partial u}{\partial z^i} + \frac{\partial u}{\partial U}\frac{\partial U}{\partial z^i} + \frac{\partial u}{\partial U}\frac{\partial U}{\partial Z} = \mu(1 + t). \qquad [4]$$

We have then used that $\partial Z/\partial z^i = 1$. Note that the partial derivatives of U are measures of the utility change for the rest of the society, including the indirect effects of the fact that the utilities are functions of each other. That is, if Al increases consumption of good x, he derives utility from the fact that all other individuals' utilities would increase (through their altruistic utility functions) in response to Al's increased utility level. But Al's utility would increase even more from the fact that Bob's utility would increase in response to Carl's increased utility, and so forth. One may interpret this as a network externality, and these effects may be expounded as follows: By definition we have that $\partial U/\partial x^i$ is the sum of all others' utility change from i's consumption increase of good x. They will derive utility both from i's direct utility increase and from all others' indirect utility increase, that is, $\partial U/\partial x^i = n(\partial u/\partial U)(\partial u/\partial x^i + \partial U/\partial x^i)$. Solving for $\partial U/\partial x^i$ from this expression implies:

$$\frac{\partial U}{\partial x^i} = \frac{n\dfrac{\partial u}{\partial U}}{1 - n\dfrac{\partial u}{\partial U}}\frac{\partial u}{\partial x^i}. \qquad [5]$$

A corresponding expression applies for $\partial U/\partial z^i$ (holding Z constant). The derivative with respect to the externality Z will be somewhat different, since each individual will now have a *direct* utility effect from Z, as well as an indirect effect through others' utilities, that is, $\partial U/\partial Z = n(\partial u/\partial Z + (\partial u/\partial U)(\partial U/\partial Z))$. This may be rewritten as:

$$\frac{\partial U}{\partial Z} = \frac{n}{1 - n\dfrac{\partial u}{\partial U}}\frac{\partial u}{\partial Z}. \qquad [6]$$

Substitution of [5] and [6] into [3] and [4] yields:

$$\Omega\frac{\partial u}{\partial x^i} = \mu \qquad [7]$$

$$\Omega\frac{\partial u}{\partial z^i} + \frac{n\dfrac{\partial u}{\partial U}}{1 - n\dfrac{\partial u}{\partial U}}\frac{\partial u}{\partial Z} = \mu(1 + t) \qquad [8]$$

where

$$\Omega = \frac{1 - n\dfrac{\partial u}{\partial U}\left(1 - \dfrac{\partial u}{\partial U}\right)}{1 - n\dfrac{\partial u}{\partial U}}. \qquad [9]$$

The government would like to maximize utility $u^i = u(x^i, z^i, Z, U)$ for an arbitrary individual i due to a social production constraint, that is, total consumption in the society should equal total production. This problem may be dealt with in various ways. One way is to solve the problem directly and explicitly, through a Lagrangean corresponding to this maximization problem. Another way hinges on the fact that the solution to this problem must be the same as the solution to the reduced problem, where no explicit altruistic concerns are part of the utility function. As Bergstrom (1982) has pointed out in the cost-benefit case, the fact that people are altruistic with respect to their relatives (or, of course, to other individuals) does not in general imply that the value of a statistical life used in social cost-benefit appraisals should exceed the value that can be derived *directly* from the individual willingness to pay for a decreased risk; see also Collard (1978, 183–84) and Johansson (1993). Intuitively, this is so because, if we are in a social optimum without considering the altruistic part (i.e., that everybody derives utility from everybody else's utilities), the same allocation of resources

must be optimal as if we moved to a situation where we also derive utility from each others' utilities. The only difference would be a scaling factor (Ω). This result holds if individuals are *purely* altruistic with respect to others' utilities per se, and not to any particular component of their utilities. We will then arrive at a well-known maximization problem (see, for instance, Sandmo 1975) with the following f.o.c. for an interior solution with respect to the consumption of goods x and z for an individual i.

$$\frac{\partial u}{\partial x^i} = \lambda \qquad [10]$$

$$\frac{\partial u}{\partial z^i} + n\frac{\partial u}{\partial Z} = \lambda. \qquad [11]$$

A combination of [7] and [10] gives directly that $\lambda = \mu/\Omega$. The optimal tax t is then given from [8] in [11]:

$$t = -\frac{n}{\mu}\frac{\partial u}{\partial Z}\left(1 - \frac{\partial u}{\partial U}\right). \qquad [12]$$

If $\partial u/\partial U = 0$, and hence the factor in brackets is equal to one, we are back to the "standard" Pigovian tax without altruism.

How large then is this second term in brackets? As mentioned, we assume that individual i's utility increase derived *directly* from consuming one additional unit of good x is not negligible compared to the utility increase derived *indirectly* from the fact that all others' utilities will increase. The ratio between this indirect effect and the direct effect may be written as:

$$\frac{\dfrac{\partial u}{\partial U}\dfrac{\partial U}{\partial x^i}}{\dfrac{\partial u}{\partial x^i}} = \frac{n\dfrac{\partial u}{\partial U}}{1 - n\dfrac{\partial u}{\partial U}}. \qquad [13]$$

For this to be finite and positive, it must be that $0 < \partial u/\partial U < 1/n$, and consequently that

$$\lim_{n\to\infty} t = -\frac{n}{\mu}\frac{\partial u}{\partial Z}. \qquad [14]$$

Perhaps surprisingly, we are then back to the "standard" Pigovian tax, that is, the tax is equal to the marginal damage, without considering altruism! Intuitively, this is so because the adaptation an individual makes because of altruistic concern is small compared to the consumption pattern without altruism. This, in turn, is so because of the "stability" assumption about the size of the altruistic preference. Thus, to arrive at an optimal tax level considerably lower than the "standard" Pigovian tax level, one would have to make rather counterintuitive assumptions about the proportions between what fraction of utility an individual derives directly from their own consumption and what fraction an individual derives from altruistic concern. Note that the result would be basically different if instead we were dealing with a "few-person economy." One might also conclude that this way of modeling altruism in a many-person economy is perhaps not very fruitful.

IV. PATERNALISTIC ALTRUISM

Following Archibald and Donaldson (1976), paternalistic altruism implies that specific elements of others' utilities are included in the individual utility functions, but that they are independent of others' utilities per se (in the extreme case in which we focus on). For example, the specific components valued positively by other individuals might be interpreted as safety, or health. In the case of air pollution; Al's utility will not depend *directly* on Bob's utility, but on the air quality experienced by Bob.[6] A utility function as described may be written as follows:

$$u^i = u\left(x^i, z^i, Z, Z_p\right) \qquad [15]$$

[6] Holmes (1990) uses this form of altruism (without externalities) in an empirical study of health-risk reduction and voting behavior. However, he does not use the notion *paternalistic altruism*, but simply says (p. 141) that the utility function is "representing an individual's egoistic and altruistic motivations."

where, again, Z is an externality caused by the total consumption of good z, and $Z_p = Z_p(Z)$ is a variable related to the paternalistic altruism. That is, we assume that an individual's utility depends negatively on other people's experienced levels of the externality. Each individual is assumed to take Z but not Z_p as given. The individual f.o.c. for an interior solution to the maximization of [15] subject to the individual budget can then be written:

$$\frac{\partial u}{\partial x^i} = \mu \qquad [16]$$

$$\frac{\partial u}{\partial z^i} + \frac{\partial u}{\partial Z_p}\frac{\partial Z_p}{\partial Z} = \mu(1 + t). \qquad [17]$$

As previously, we will assume that the government will maximize utility of a representative individual subject to a social budget constraint that total consumption should equal total production. The social f.o.c. for consumption by an individual i are then:

$$\frac{\partial u}{\partial x^i} = \lambda \qquad [18]$$

$$\frac{\partial u}{\partial z^i} + n\frac{\partial u}{\partial Z_p}\frac{\partial Z_p}{\partial Z} + n\frac{\partial u}{\partial Z} = \lambda. \qquad [19]$$

In response to Bergstrom (1982), Jones-Lee (1992) showed that if individuals are partly altruistic in a paternalistic way, so that they value the safety-component of others' utility more than other components, then the social value of increased safety exceeds the individuals' willingness to pay.[7] This corresponds here to the second term of [19], which implies that the consumption of good z should be relatively under-provided compared to the standard case without altruism. However, as we will see, the optimal tax-response to such preferences is somewhat surprising. A combination of the private and social conditions [16, 18] gives directly that $\mu = \lambda$ (which is a result of the fact that we do not have to use any distortionary taxes). This together with [17] and [19] gives that

$$t = -\frac{n}{\mu}\frac{\partial u}{\partial Z} - \frac{n-1}{\mu}\frac{\partial u}{\partial Z_p}\frac{\partial Z_p}{\partial Z}$$

$$\approx -\frac{n}{\mu}\left(\frac{\partial u}{\partial Z} + \frac{\partial u}{\partial Z_p}\frac{\partial Z_p}{\partial Z}\right) \qquad [20]$$

where the last step holds with equality as n goes to infinity. Note that this tax is actually higher than the "standard" Pigovian tax! The result may seem confusing, since, because of altruism, the consumers have already to some extent adapted their consumption of the externality-causing good z. The reason is that the social optimum has changed too, as a result of this kind of altruism. At a social level it will now be optimal to consume less of good z than without any altruistic concern, and since each individual only considers their own changed utility from the fact that Z_p has decreased, and not everybody else's utility changes, one tax-component is added compared to the case with no altruism. This can be illustrated as follows (see Figure 1): PMC_A and PMC are the private marginal cost with and without altruism, and SMC_A and SMC are the corresponding social marginal costs. Hence, although consumption in the absence of taxation will be reduced from z_0 to z_{A0} as a result of the altruistic preferences, the optimal tax t will be higher than the standard Pigovian tax t_{Pigou}. This is because the social optimum has changed from consuming z^* in the absence of altruism to z_A^* with paternalistic altruism, and $SMC_A - PMC_A > SMC - PMC$. This is so, in turn, since an individual Al will not "internalize" the fact that Bob's safety decrease (for example) affects Carl's utility.

A natural question then is whether this deviation from the "standard" Pigovian tax is large or not, and specifically whether this deviation will be negligible when n becomes large, as in the case of pure altruism. The first term in brackets in [10] equals the

[7] Except, of course, for the so-called "cold-blooded costs" of medical care, etc.

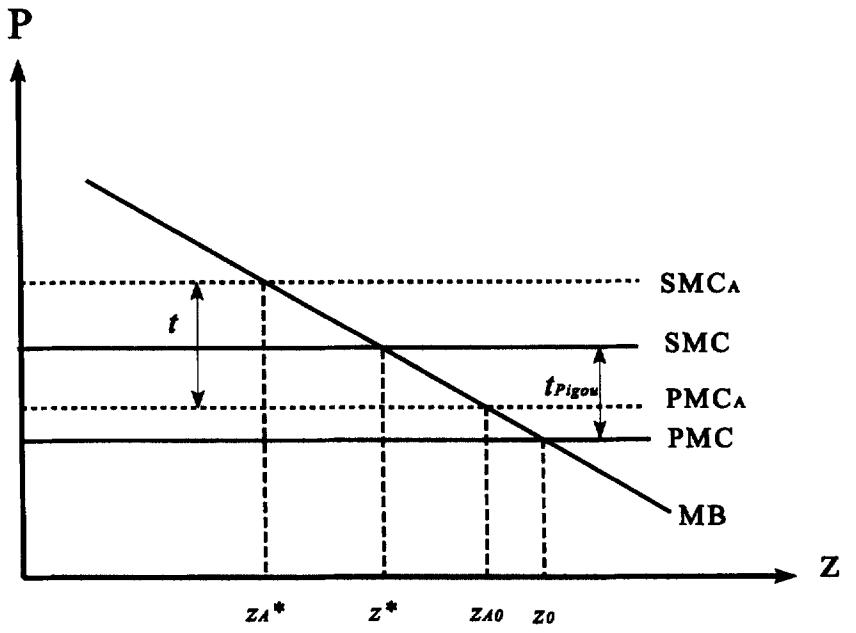

FIGURE 1
OPTIMAL EXTERNALITY CORRECTING TAXES WITH AND WITHOUT REGARD TO PATERNALISTIC ALTRUISM

direct utility effect of a marginal change of the externality-generating good, while the second term equals the corresponding indirect effect through the altruistic preferences. If these are of the same order of magnitude, then the influence through the altruistic mechanism will not be negligible. For example, if the indirect effect of the increased externality affects your utility by 10 percent of the direct effect, then the optimal tax should be 10 percent higher.[8]

V. IMPURE ALTRUISM

Impure altruism, as it has been known in the literature, implies that individuals "get some private goods benefit from their gift per se, like a warm glow" (Andreoni 1989, 1448–49); see also Andreoni (1990) and Roberts (1987). Here we will assume that the only "altruistic utility" individuals get is from their own actions. This form of altruism is an extremely egocentric kind, since all that individuals consider is their own impact on the externality component (such as safety or health) for others.[9] An individual Al is then completely indifferent to whether or not Bob decreases the utility of Carl. This case is analytically very similar to the case of paternalistic altruism and the individual utility function for an individual i may be written as:

$$u^i = u(x^i, z^i, Z, Z^i) \qquad [21]$$

where z^i is i's consumption of good z; Z is the externality caused by the total consumption of good z (as before); and $Z^i = Z^i(z^i)$ is a measure of i's contribution to that externality (e.g., the number of accidents, or cancers from air pollution, because of i's consumption of good z). Thus, consumption of good z enters the utility function for

[8] However, one might argue, here too, that this way of modeling altruism is perhaps not very reasonable in the large number case, which in itself might be an important conclusion.

[9] Johansson (1993) denotes a person who is characterized by this extreme impure altruism a *pure egoist*.

individual i both directly, as an ordinary good, and indirectly, through i's impure altruistic concern.

The first-order conditions for the clean good will be the same as in the case of paternalistic altruism, and consequently $\mu = \lambda$. The individual utility maximization with regard to good z is given by:

$$\frac{\partial u}{\partial z^i} + \frac{\partial u}{\partial Z^i}\frac{\partial Z^i}{\partial z^i} = \mu(1 + t). \qquad [22]$$

The corresponding social maximization may be written:

$$\frac{\partial u}{\partial z^i} + n\frac{\partial u}{\partial Z} + \frac{\partial u}{\partial Z^i}\frac{\partial Z^i}{\partial z^i} = \mu. \qquad [23]$$

The third term of [23] implies that consumption of good z should be relatively underprovided compared to the case without altruism. A combination of [22] and [23] implies that

$$t = -\frac{n}{\mu}\frac{\partial u}{\partial Z}. \qquad [24]$$

With this form of altruism we have thus found that the tax should *exactly* equal the "standard" Pigovian tax level. As in the case of paternalistic altruism, the socially optimal consumption level of good z is lower compared to the case without altruism. However, here this change corresponds exactly to the change an individual would spontaneously choose, since there is no externality of the altruistic component itself. This can be illustrated in a similar way as in the case of paternalistic altruism. (See Figure 2.)

Here the tax will not be affected by the impure altruism, since the change in social optimum corresponds to the change in private optimum and $SMC_A - PMC_A = SMC - PMC$. Hence, $t = t_{Pigou}$.

VI. GENUINE ALTRUISM

By genuine altruism, adopted after Kennett (1980),[10] we simply mean that individuals care for other individuals, through their behavior, without deriving any utility from it. This is perhaps the most controversial way of modeling altruistic behavior, since it relaxes one of the most fundamental assumptions in mainstream economics, that individuals always maximize their own utility. However, as has been noted by several authors including Sen (1977, 1979, 1987), Sugden (1982), Etzioni (1988), Slote (1989), and Edwards (1992), the characterization of individual behavior as purely utility-maximizing might be too narrow a perspective. The often stated counter-argument, in the neoclassical tradition, is that we do not need to bother about the character and the nature of utility, we can merely see utility as a measure of preferences and choice. Then individuals can be utility maximizers *by definition*. As Harrison (1992, 150) puts it: "I call my utility 'jolly'. What you call your utility is (...) your business." But with such a definition of utility it is hard to see, from any ethical rules, why society should try to maximize individual utilities. Or to speak with Sen (1987, 14–15): "Calling that binary relation the person's 'utility function' does not tell us that it is his or her utility in any independently defined sense (such as happiness or desire-fulfillment) that the person is in fact trying to maximize."

Genuine altruism can be modeled in different ways. It seems convenient to assume that individuals instead of solely maximizing their own utility, maximize a sum consisting of their own utility and a function of the sum of all others' utilities. Hence, they will maximize $u + \Phi(U)$, where $u^i = u(x^i, z^i, Z)$ is the individual utility function. Thus, the utility function per se, will not reflect any

[10] It is not perfectly clear, however, whether this specific meaning was what Kennett had in mind. He writes (p. 183): "Genuine altruism must be action taken without expectation of reward or coercion and it is not to be found in models of concealed requirement or in forcible redistribution." Edwards (1992) cites Kennett and uses the term in this specific meaning, that is, when the altruistic concern is working outside the own utility function. Alternative names for similar definitions are: *commitment*, after Sen (1977), *rule-utilitarian altruism*, after Sugden (1982), or *semi-Kantian altruism*, after Bergstrom (1995).

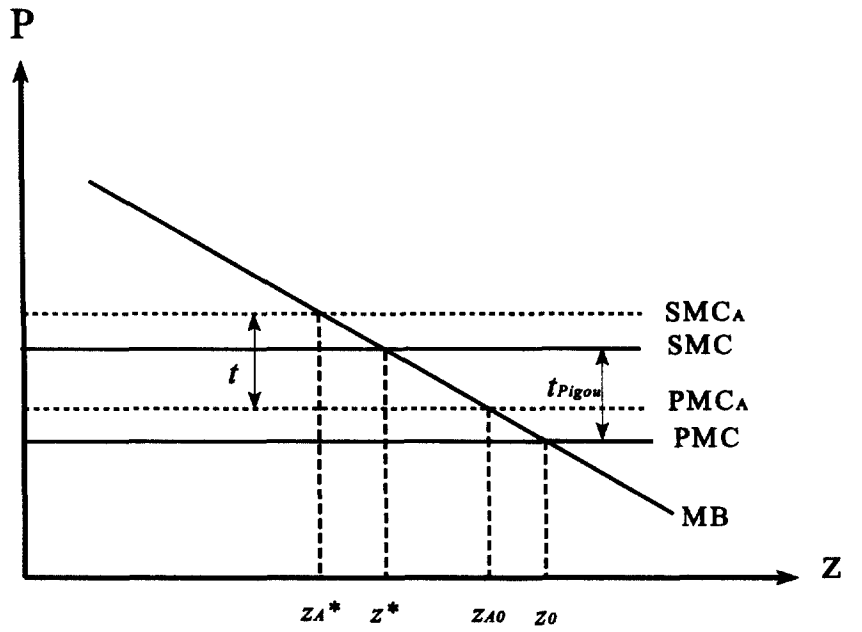

FIGURE 2
OPTIMAL EXTERNALITY CORRECTING TAXES WITH AND WITHOUT REGARD TO IMPURE ALTRUISM

altruistic concern.[11] The individual behavioral condition with respect to consumption of good z is then given by:

$$\frac{\partial u}{\partial z} + n\frac{\partial \Phi}{\partial U}\frac{\partial u}{\partial Z} = \mu(1 + t). \qquad [25]$$

The social maximization problem is trivially the same as without altruism, since individual utility is not affected by any altruistic concern. The private behavioral condition in the social maximization condition implies that the optimal tax on good z is given by:

$$t = -\frac{n}{\mu}\frac{\partial u}{\partial Z}\left(1 - \frac{\partial \Phi}{\partial U}\right). \qquad [26]$$

Thus, the tax on good z will here be lower than a "standard" Pigovian tax. This expression looks similar to that in the pure altruism case. However, here there are no a priori reasons why the second term in parentheses needs to be small. This is because the utilities are not interdependent here. Then Al's utility would not increase from the fact that others' utility would increase indirectly due to Al's increases consumption, etc., as in the pure altruism case. This case may be illustrated as follows: Here the optimal tax t will be lower than a Pigovian tax t_{Pigou} since the social optimum will not change from z^* due to the altruism. The private utility optimum is z_0, but, due to the genuine altruism, the individual will demand the lower quantity z_{A0}. In the (unrealistic) extreme case where individuals care equally much about others' utilities as

[11] Bergstrom (1995) discusses a utility function of this kind, which he calls a semi-Kantian utility function, in a two-person economy. Arrow (1981), Margolis (1982), and Stark (1995) discuss altruism in a similar way when they divide a person's overall utility so it depends both on a specific self-interest utility function (or felicity) and on a group-interest or altruistic utility function. It is not clear, however, whether they consider the second part to be included in the individual's overall "well-being" or not.

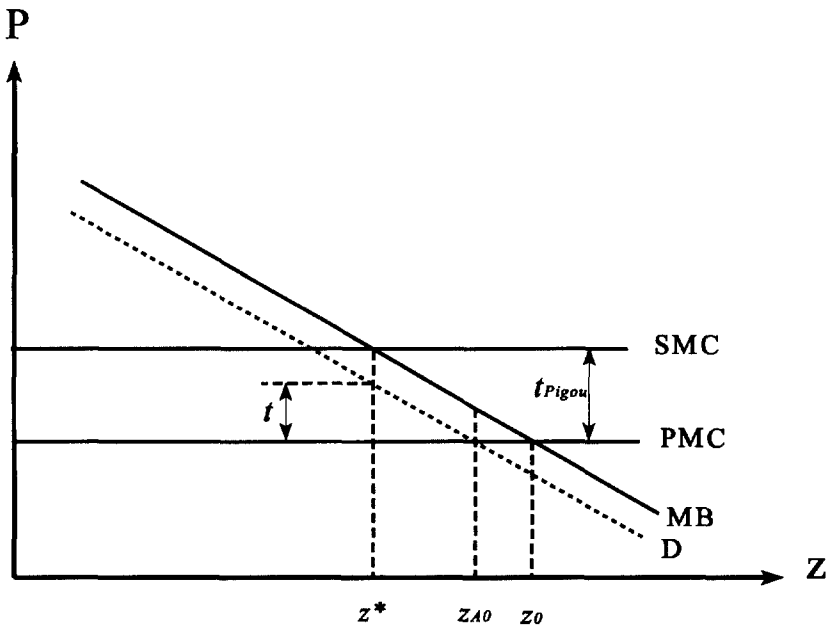

FIGURE 3
OPTIMAL EXTERNALITY CORRECTING TAXES WITH AND WITHOUT REGARD TO GENUINE ALTRUISM

their own, the tax is zero. Society would then automatically, without any external policy instrument, obtain a socially optimal consumption level of the externality-generating good.

VII. CONCLUSION

We have seen that altruistic concern may affect the size of optimal externality correcting taxes. However, one cannot generally say in what direction the change will be, or whether the change is negligible or not, without specifying more exactly the nature of the altruistic concern. This is because of the fact that the social optimum may change too, due to utility derived from altruistic concern. In general, it seems reasonable that different kinds of altruism would be present simultaneously, in different proportions in different cases. Unfortunately, these proportions are probably often difficult to quantify in the specific case.

In order to sum up our findings, let us examine a short illustration of transport safety and optimal traffic charges. The fact that individuals adapt their behavior because they think it would be unpleasant to hurt or kill another road-user (impure altruism) is not a valid argument for reducing the tax below the Pigovian level (the tax level in the absence of any form of altruism). The same will typically hold in a many-person economy where each individual utility is positively dependent on the others' utilities (pure altruism). In the (perhaps unrealistic) case where individuals (through their utility functions) bother about others' safety, but not about others' utilities per se (paternalistic altruism), the optimal traffic-charge with respect to safety is actually higher than the "standard" Pigovian tax level. However, if individuals, through their actions, care about others' safety without deriving any utility from it (genuine altruism), the optimal traffic-charge will to a corresponding degree be lower than the "standard" Pigovian tax level. Similar arguments could be applied to most externalities, such as individual contributions to air pollution.

However, these theoretical results are based on extremely stylized models, and one should therefore not use them for policy purposes without careful reflection. If one can draw any general conclusions from the results, they might be:

1. It is important in normative analysis to discuss whether observed revealed preferences are a good measure of what the government would like to maximize.
2. If, in any particular problem (not necessarily dealing with externalities), it seems reasonable that altruistic behavior (as we intuitively think about it) plays a significant role, it is important to carefully consider different possible types of altruism and ways of modeling them, and not to reject some alternatives for "dogmatic" reasons.

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