WWW.DAGLIANO.UNIMI.IT

CENTRO STUDI LUCA D'AGLIANO
DEVELOPMENT STUDIES WORKING PAPERS

N. 334

July 2012

Intervention Efficiency, Incentive Symmetry, and Information

*Earl L. Grinols**
*Peri Silva***

* Hankamer School of Business, Baylor University
** Kansas State University and Centro Studi Luca d'Agliano

Intervention Efficiency, Incentive Symmetry, and Information

Earl L. Grinols* and Peri Silva†

21 April 2012

Abstract

Assume that government maximizes the well being of its citizens subject to technological, political, and informational constraints. How should equilibrium be perturbed so that equilibrium post-perturbation quantities satisfy new exogenously-specified bounds? We prove an intervention principle and an incentive symmetry result that jointly describe the efficient intervention plus generate for it an equivalence class of interventions. If information is imperfect, asymmetric information may render some members of the equivalence class ineffective, but not others. This fact may be exploited in selected policy applications, meaning in cases where it is possible to increase the effectiveness of traditional entitlement programs, reduce their cost, or both.

JEL classification numbers: D61, D62

Keywords: welfare analysis, policy intervention, theory of policy

*Department of Economics, Hankamer School of Business, Baylor University, One Bear Place #98003, Waco, Texas 76798; Tel. (254) 710-7522

†Department of Economics, Kansas State University, and Centro Studi Luca d'Agliano. 325 Waters Hall, Manhattan, KS 66502; Tel. (785) 532-2195.

1 Introduction

The theory of policy studies ways to craft better and more efficient approaches to reach public policy objectives. Many governments, for example, sponsor relatively large entitlement programs that provide cash and in-kind goods to groups within a society, often related to education at various levels, health care, or old age benefits.[1] They regularly make and revise decisions on what kind and how much support should be provided to selected residents.

What ties together these circumstances is that the policies and periodic adjustments to them are attempts by a government interested in its citizens' well being to perturb an existing economic equilibrium, usually through taxes, subsidies, or in-kind provision of goods, to raise some measure of citizen welfare. New policies generally are not introduced *de novo*, but nearly always must be grafted into complex situations where government is already engaged in extensive activity and faces acknowledged constraints on its actions. A natural question, therefore, is what to do when it is not immediately feasible to adjust the existing policy, or it is only partly feasible.[2]

We prove two results, namely: the first is a general intervention principle or separation result and the second is an incentive symmetry or tax equivalency result. The first says that as long as government acts in the interests of its citizens, new policy should consist of taxes or subsidies directed narrowly to the object of interest and set at a level just sufficient to achieve the target quantity objective. This result can be characterized as a separation result because the described policy will be part of the efficient program independently of the constraints within which the rest of policy is conducted. It has been shown in first best cases (where there are no constraints beyond those determined by productive technology) and in situations where specific constraints have been described. For example, in the pioneering paper by Sandmo (1975) that examines how to lower the level of a harmful pollutant assuming that government engages in optimal taxation but does not have the capacity to use some forms of tax, the intervention that would apply in a first best world is "validated as part of a more comprehensive system of indirect taxation" (p. 97). This is just one

[1] For the vast majority of OECD economies, public provision of health care and education services reaches more than ten percent of their GDPs. Provision of old age benefits is also important in terms of the GDPs, such as the case of the social security system in the U.S. Currie and Gahvari (2008) provide a detailed discussion about the significance of entitlement programs in many economies.

[2] A significant literature exists to describe how pre-existing policies should be altered when a new policy is introduced. A classic example might be the question of how to change the optimal tax structure when correction of an environmental externality is added as an objective. A significant deal of literature examines a number of cases which depend on the description of the existing objectives and constraints. We offer comments on particular papers in this literature later in the paper. References include Bovenberg and van der Ploeg (1994), Cremer, Gahvari and Ladoux (2001), Kopczuk (2003), and Micheletto (2008) among others.

example of a more general result that deals with limitations on the ability to adjust pre-existing policy, the statement and proof of which is provided in Proposition 1.

Proposition 2 is a companion proposition that has antecedents in the Marshall-Lerner theorem of international trade and general equilibrium theory: in a perfect information world, tax structures are unique up to identifiable equivalence classes. We prove an inclusive form of this result and show that it can be used to raise policy effectiveness when information asymmetries render some policies ineffective. For example, assume that you want to raise the level of health care consumed by individuals in group A (the poor). The efficient policy would subsidize group A's purchase of health care at a level just sufficient to raise consumption to the target level. Since information identifying the members of group A is absent, however, many second-best programs give everyone free health care knowing that members of group A will be served. We show that selecting a different member of the equivalence class can cause group A to self-identify and restore the efficient outcome.

In summary, propositions 1 and 2 allow the description of efficient interventions in a wide range of circumstances. To the extent that entitlement programs have been instituted to provide in-kind goods (or cash constrained to be spent only on these goods) in consequence of information deficiencies or paternalism constraints, the internal objectives of these programs *on their own terms* can be met more efficiently. Propositions 1 and 2 also allow us to describe the form that the intervention should take over time.

The rest of the paper proceeds as follows. Section 2 describes the general equilibrium setting which includes government as provider of public goods and creator of tax policy. Sections 3 and 4 state and prove propositions 1 and 2. Section 5 applies the results to a stylized health care policy objective. Section 6 provides an evaluative discussion, and Section 7 concludes.

2 Model and Notation

Consider an economy of households, firms, and government. Households are indexed by $i = 1, ..., I$ and firms by $j = 1, ..., J$. Let K be the number of private goods, and let $x_i \, \epsilon \, \mathcal{R}^K$ ($\mathcal{R}^K$ is K-dimensional Euclidean space) be household i's vector of private good consumption. The kth component, x_{ik}, is the household's consumption of good k. The consumption of all households in the economy is $\sum_{i=1}^{I} x_i = x$. By convention, a positive element of x_i is a good consumed by the household, while a negative element (such as hours of labor supply) is a good or service that is supplied.

Production follows a similar nomenclature; $y_j \, \epsilon \, \mathcal{R}^K$ is the production of firm j, the kth component of which is y_{jk}. For production vectors, positive elements are outputs and negative elements are inputs; $\sum_{j=1}^{J} y_j = y$ is the vector of country production. Firms might face different prices for

buying and selling. To allow for firms to face prices $p_{j\oplus}$ when they sell, and prices $p_{j\ominus}$ when they buy means that we can distinguish policies that affect the firm in its role as a supplier of goods from those that affect it as a purchaser of inputs such as labor. Let $y_{j\oplus}$ denote the sales of firm j, and $y_{j\ominus}$ denote its purchases, where $y_j = y_{j\oplus} + y_{j\ominus}$. For example, if firm j is on both sides of the market for commodity k, buying 4 units and selling 7, then $y_{jk\ominus} = -4$, $y_{jk\oplus} = 7$ and $y_{jk} = 3$. If the firm is not on both sides of any market, it follows that $y_{j\oplus}$ equals the vector y_j with all negative elements replaced by zeroes and $y_{j\ominus}$ equals the vector y_j with all positive elements replaced by zeroes.

Government appears as a provider of public goods and services and in its capacity to tax and subsidize. For simplicity, we consider a single public good that can potentially enter directly into the utility of households and also into production as an input in the production sets of private firms. Thus, good g is a representative government-provided public good, which all consume in the same quantity. The vector $r \,\epsilon\, \mathcal{R}^K$ of nonnegative numbers in K-dimensional space denotes resources used by the government as inputs for the production of g. Since household utility depends on (x_i^g, x_i), larger r is associated with indirect utility cost to consumers. In conformity with the production conventions, vector $z \,\epsilon\, \mathcal{R}^K$ denotes the excess demands (international trade) of the economy. An element of z with a positive sign represents an imported good and a component with a negative sign is an exported good. Goods whose component happens to be zero are non-traded goods.

Endowments (nonproduced goods inherited from nature or the past) are denoted by $\omega \,\epsilon\, \mathcal{R}^K$. Endowments owned by firm j are ω_j. Firms, in turn, are owned by households. The share of firm j owned by household i is given by scalar θ_{ij}, where $\sum_i \theta_{ij} = 1$. Indirectly, therefore, the household owns $\theta_{ij}\omega_j$ of firm j's endowment and is entitled to θ_{ij} of firm j's profits and earnings from the sale of its endowments.

All prices relate to domestic prices p ($p \,\epsilon\, \mathcal{R}^K$) as follows:

$$
\begin{aligned}
p_w &= p - \delta && \text{(world prices } p_w\text{)} && (1)\\
p_i &= p + t_i && \text{(consumer prices } p_i\text{)} && (2)\\
p_{j\oplus} &= p - \tau_{j\oplus} && \text{(firm prices as a seller } p_{j\oplus}\text{)} && (3)\\
p_{j\ominus} &= p - \tau_{j\ominus} && \text{(firm prices as a buyer } p_{j\ominus}\text{)} && (4)
\end{aligned}
$$

where $\tau_{j\oplus} > 0$ for a tax and $\tau_{j\ominus} > 0$ for a subsidy. If firm selling prices and firm buying prices are the same, then

$$
\begin{aligned}
p_{j\oplus} = p_{j\ominus} &= p_j && (5)\\
&= p - \tau_j && (6)
\end{aligned}
$$

where $\tau_{j\oplus} = \tau_{j\ominus} = \tau_j$ and $(p, p_w, p_i, p_j, \delta, t_i, \tau_j)$ = (domestic prices, world prices, individual i prices, firm j prices, the vector of specific tariffs, consumer i taxes, firm j taxes). K is the number of goods, as noted, so each price vector or tax vector has K components. Here the term "tax" is used to mean either "tax" or "subsidy." If a levy collects positive revenues for the government it is a tax; if it collects negative revenues it is a subsidy.

Social accounting implies the following aggregate quantities,

$$x + r = y + \omega + z \tag{7}$$

$$x_i^g = \sum_j y_j^g = -y_j^G \tag{8}$$

Consumption of the public good by individual i is $x_i^g \varepsilon R^1$. Production is conducted by firms. Government may outsource production of the public good to firms $j = 1, ..., n$ as suggested by the economy supply $\sum_j y_j^g \varepsilon R^1$. With some adjustment in notation, government could also be assumed to produce the public good in its own facilities. For the purposes of this paper it would be immaterial which is done. The production choice of firm j is described by its list of inputs and outputs $(y_j, y_j^g, -y_j^G) \epsilon Y_j$ where y_j^g in 1-dimensional space is the quantity of public good produced by j and Y_j is the $(K + 2)$-dimensional set of feasible production choices. The production set satisfies standard assumptions such as being nonempty, closed, and convex. Use of the public good as an input by firm j is $y_j^G \varepsilon R^1$. Consumption of the public good and use of it as an input by firms each equal the available economy supply $\sum_j y_j^g \varepsilon R^1$ because of its public good characteristic. The capital letter G denotes the publicness of the public good; all firms can use the same public good input. The negative sign before y_j^G indicates that y_j^G is an input to the firm.

An *allocation* $\alpha = ((y_{j\oplus}), (y_{j\ominus}), (x_i), z) \epsilon R^{(2J+I+1)K}$ is defined as the list of all quantities of households, firms and international trade. When we compare discrete equilibria, we will reserve superscripts 0 and 1 to refer to the alternative periods or situations being compared. We denote the utility function of consumer i by $u_i = u_i[x_i^g, x_i]$ where x_i is the K-dimensional vector of private goods consumption previously defined. Market expenditure equal in value to $e_i[x_i^g, p_i, u_i]$ is the least that is capable of generating utility u_i to the consumer i when public good availability is x_i^g and prices are p_i. $e_i[x_i^g, p_i, u_i] = p_i \cdot x_i$ by construction of e_i. Since the expenditure function is monotonic in utility for fixed prices and public good provision, $e_i[x_i^g, p_i, u_i[x_i^g, x_i]]$ is a standard utility function measuring utility by the amount of money needed to attain the given level of well being. A natural choice for x_i^g and p_i involves the observed initial or final quantities x_i^{g0}, p_i^0 or x_i^{g1}, p_i^1.

Define the social welfare function as $W = \sum_i w_i W_i$ where $W_i = e_i[x_i^{g0}, p_i^0, u_i]$. Assume that we scale the weights so that $w_i > 0$ and $\sum_i w_i = I$.

We assume that government maximizes W. The limitations that determine the government's feasible set of choices could take various forms including technological, informational, or political

constraints, the consequence of which is that certain vectors α are not in the government's choice set. The government objective function is a weighted average of the utility of all members of the society, but possibly with unequal weights assigned. This suggests that certain members of the society may be more important than other members in the social welfare function. The vast literature on the role played by lobbying in setting public policy can be referred to as justification. For example, Grossman and Helpman (1994) assume that lobbies interact with the government to obtain advantageous trade policies for its members, where the government cares about the average voter's welfare level as well as political contributions. This way members of politically organized groups have greater weight than individuals not affiliated with them in the social welfare function.

The assumption that the government optimizes on behalf of households but faces political and other constraints is consistent with the efficient redistribution hypothesis treated by Gardner (1983) which "asserts that political competition will ensure the selection of policies which are efficient in the sense that there are no alternative policies that can achieve the same distributional goals at lower cost." As is true of most of this literature, we do not model why some policy instruments are available to the government and others are not.[3] We take the presence of constraints as a given and pursue the implications for policy intervention in the case of quantitative non-economic objectives. Changes in social welfare moving from situation 0 to situation 1 are described by $\Delta W = \sum_i w_i \Delta W_i = \sum_i w_i \left(e_i[x_i^{g0}, p_i^0, u_i^1] - e_i[x_i^{g0}, p_i^0, u_i^0] \right)$. If the policy adopted in situation 0 is efficient (maximizes social welfare subject to the choice available to government) then we should find that $\Delta W \leqslant 0$ for feasible changes where,

[3] Tests of the hypothesis are discussed in Bullock (1995) and Bullock, Jeong, and Garcia (1999). See also Coate, 2000, pp. 453. In one of the few papers that sheds light on this issue, Grossman and Helpman (1994) argue that lobbies may prefer the use of tariffs instead of production subsidies despite the fact that the latter instruments are more efficient. They suggest that production subsidies may lead to a greater degree of competition among lobbies than tariffs since the joint welfare of rival lobbies and the government can be greater when output subsidies can be employed by the government. Thus, lobbies prefer to tie the hands of government by not allowing the use of production subsidies.

$$\Delta W = -\sum_{j=1}^{J}\left((p^0_{j\oplus}\cdot(y^0_{j\oplus}+\omega_j)+p^0_{j\ominus}\cdot y^0_{j\ominus})-(p^0_{j\oplus}\cdot(y^1_{j\oplus}+\omega_j)+p^0_{j\ominus}\cdot y^1_{j\ominus})\right) \quad (9a)$$

$$-\sum_{i=1}^{I}\left(p^0_i\cdot x^1_i - e_i[x^{g1}_i,p^0_i,u^1_i]\right) \quad (9b)$$

$$-\left(\sum_{i=1}^{I}\left(e_i[x^{g1}_i,p^0_i,u^1_i]-e_i[x^{g0}_i,p^0_i,u^1_i]\right)-p^0\cdot(r^0-r^1)\right) \quad (9c)$$

$$+I\sum_{i=1}^{I}\frac{1}{I}(w_i-1)\Delta W_i \quad (9d)$$

$$-\sum_{j=1}^{J}\tau^0_{j\oplus}\cdot(y^0_{j\oplus}-y^1_{j\oplus})-\sum_{j=1}^{J}\tau^0_{j\ominus}\cdot(y^0_{j\ominus}-y^1_{j\ominus})-\sum_{i=1}^{I}t^0_i\cdot(x^0_i-x^1_i)-p^0\cdot(z^0-z^1) \quad (9e)$$

Components (9a)-(9e) display particular economic features. In component (9a), $\left(p^0_{j\oplus}\cdot(y^0_{j\oplus}+\omega_j)+p^0_{j\ominus}\cdot y^0_{j\ominus}\right)$ is the profit of firm j. Its maximization implies that the net social gain from producer optimization,

$$S_P \equiv \sum_{j=1}^{J}\left((p^0_{j\oplus}\cdot(y^0_{j\oplus}+\omega_j)+p^0_{j\ominus}\cdot y^0_{j\ominus})-(p^0_{j\oplus}\cdot(y^1_{j\oplus}+\omega_j)+p^0_{j\ominus}\cdot y^1_{j\ominus})\right)$$

is non-negative because $(y^0_{j\oplus}+\omega_j, y^0_{j\ominus})$ must be at least as profitable as rejected alternatives, including $(y^1_{j\oplus}+\omega_j, y^1_{j\ominus})$.

Likewise, the social gain from consumer choices in (9b), $S_C \equiv \sum_{i=1}^{I}\left(p^0_i\cdot x^1_i - e_i[x^{g1}_i,p^0_i,u^1_i]\right)$, is non-negative because the least costly way for the consumer to achieve utility u^1_i is no more expensive than rejected alternatives, including x^1_i.

Components (9c)-(9e) reflect the social contribution of government in its different roles. Equation (9c) relates to the supply of public goods. The net social gain from provision of x^{g1}_i units of public good compared to x^{g0}_i is

$$B_G \equiv \sum_{i=1}^{I}\left(e_i[x^{g1}_i,p^0_i,u^1_i]-e_i[x^{g0}_i,p^0_i,u^1_i]\right)-p^0\cdot(r^0-r^1)$$

where the cost of resources used public good production is captured in $p^0\cdot(r^0-r^1)$. For example, if the public good is beneficial to every consumer, more of it raises utility and $x^{g0}_i > x^{g1}_i$ implies that $e_i[x^{g1}_i,p^0_i,u^1_i] > e_i[x^{g0}_i,p^0_i,u^1_i]$. Thus, $B_G > 0$ says that the gain in utility from providing more of the public good exceeded the cost of it.

Equation (9d) measures distributional effects and has a statistical interpretation. Since there are I individuals, the probability of randomly selecting one would be $\frac{1}{I}$. Further, by this measure,

the "expected value" of the social weights w_i is 1 since we scale weights so that $\sum w_i = I$. Thus

$$\sum_{i=1^I}^{I} \frac{1}{I}(w_i - 1)\Delta W_i = Cov[w_i, \Delta W_i]$$

To the extent that the welfare gains across individuals are positively correlated with the social weights, there is additional value attached to the change. If a dollar of gains to one individual is treated as equally valuable as a dollar of gains to another, however, then the weights are uniform, and the term (9d) is identically zero.

Last, (9e) displays the effect of taxes on welfare, including deadweight loss. Taxes from producers' sales and purchases, taxes from consumers, and taxes on international trade appear, respectively. Term (9e) can be written as $\beta^0 \cdot (\alpha^0 - \alpha^1)$ where $\beta^0 = ((\tau^0_{j\oplus})_j, (\tau^0_{j\ominus})_j, (t^0_i)_i, p^0)$, $\alpha^0 = ((y^0_{j\oplus})_j, (y^0_{j\ominus})_j, (x^0_i)_i, z^0)$, and $\alpha^1 = ((y^1_{j\oplus})_j, (y^1_{j\ominus})_j, (x^1_i)_i, z^1)$.

Writing (9c)-(9e) as $B_G + ICov[w_i, \Delta W_i] + \beta^0(\alpha^0 - \alpha^1)$ is more concise and nearly where we would like to be. However, in what follows we want to focus on a single representative good to state our first proposition. To do this, let α_q with its associated tax or subsidy t_q represent the element of allocation α and tax β, respectively, that refers to the good q to be singled out. Let an over bar $\bar{(\cdot)}$ denote variables from an arbitrary initial equilibrium and write the q^{th} component of $\beta^0 \cdot (\alpha^0 - \alpha^1)$ as

$$t^0(\alpha^0_q - \alpha^1_q) = \bar{t}_q(\alpha^0_q - \alpha^1_q) + \Delta t_q(\alpha^0_q - \alpha^1_q)$$

where $\Delta t_q \equiv t^0_q - \bar{t}_q$. With the q^{th} term singled out, $\beta^0 \cdot (\alpha^0 - \alpha^1) = \Delta T + \Delta t_q(\alpha^0_q - \alpha^1_q)$ defines ΔT. Thus

$$S_G \equiv B_G + I\text{Cov}[w_i, \Delta W_i] + \Delta T$$

is the social contribution of government in all of its roles (9c)-(9e) when the tax on good q is fixed at the initial level $\bar{t}_q$.

Let $\mathcal{C}$ define the set of outcomes $c = (x^{g1}_i, \alpha^1)$ (quantity of the public good and allocation in situation 1) that are feasible to government in situation 0. Inequality $S_G \leq 0$ subject to $c \in \mathcal{C}$, therefore, says that government selects its policy (taxes and production of the public good) to maximize social welfare subject to the constraints that it faces.

3 Efficient Intervention

Assume that government wishes efficiently to move the economy from initial position $\bar{\alpha}$ to alternative α^0 that meets certain new social quantity objectives. In the health care example of section 5, for example, it wants individuals who do not purchase insurance in equilibrium $\bar{\alpha}$ to make those purchases in α^0. Government may be restricted in various ways but is assumed to

have available to it the use of a tax or subsidy directed to the variable involved in the new policy objective.[4]

There are three relevant equilibria. By assumption, the initial equilibrium, which we denote by barred variables, fails to achieve the social objective. The second equilibria, denoted by superscript 0 is the perturbed post-policy equilibrium wherein the social objective has been achieved. To prove that the intervention is efficient we compare equilibrium 0 to an alternative that also achieves the social objective, denoted by superscript 1. The proof is complete if welfare is lower in any such alternative.

Proposition 1: The Intervention Principle. Let an arbitrary initial equilibrium allocation $\bar{\alpha}$ with quantity of public good $\bar{x}_i^g$ and taxes $\bar{\beta}$ be given where $\bar{\alpha}_q$ is an element of $\bar{\alpha}$ for some good indexed by q, and $\bar{t}_q$ is the element of $\bar{\beta}$ representing the initial tax or subsidy (if any) applicable to good q. Assume that,

(i) Government selects taxes and production of the public good to maximize social welfare subject to the constraints that limit its choice set.

(ii) Without loss of generality, assume that $\bar{\alpha}_q < \theta$ and that the new social policy seeks to raise α_q so that $\alpha_q \geq \theta$. (For example, it is desired to raise consumption of good q, which is recorded as a positive number in α by convention.)

Then, intervention that achieves the new social policy by moving the economy to α^0 where $\alpha_q^0 = \theta$ and $t_q^0 = \bar{t}_q + \Delta t_q, \;\; \Delta t_q < 0, \;$ is efficient, i.e., in the efficient policy the consumer price of good q should be lowered (subsidy applied/pre-existing tax on q reduced).

Proof 1 *Starting from allocation α^0, consider moving to an alternative equilibrium 1 that meets the specified target. From (9a)-(9e)*

$$\begin{aligned} \Delta W &= -S_P - S_C - S_G - \Delta t_q \cdot (\alpha_q^0 - \alpha_q^1) \\ &= -S_P - S_C - S_G - \Delta t_q \cdot (\theta - \alpha_q^1) \end{aligned} \tag{10}$$

We have $-S_P - S_C \leq 0$ by the actions of households and firms; $-S_G \leq 0$ by assumption (i). Since $(\theta - \alpha_q^1) \leq 0$ because the target is met and $\Delta t_q < 0$ by assumption, $\Delta W \leq 0$. Thus welfare is lower in any alternative that similarly satisfies the objective. Equilibrium 0 is therefore efficient as was to be shown. □

[4] In the optimal taxation literature, researchers have considered situations where taxation directed to the variable of interest is not available. For instance, Micheletto (2008) shows that if externalities are not of the "atmospheric" type, and policy makers can not observe the individuals' characteristics, then taxation of non-polluting commodities may present an environmental adjustment. In this specific context then the policy recommendation would deviate from the intervention principle described in Proposition 1. We discuss in the next Section how to overcome informational obstacles to the employment of the intervention principle.

According to proposition 1, policies that apply a tax or subsidy narrowly to the good or service of interest at the least level needed to satisfy the objective are efficient, though they need not be unique. This result, which we call the intervention principle, presumes that government acts to the best of its abilities in the interest of its citizens. If it does a poor job, it is because it is constrained in some way. The alternative—a government that seeks its citizens' wellbeing and is *not* limited in any way from choosing what is best—is at variance with real-world observations, but also would be covered by Proposition 1.

The usefulness of Proposition 1 can be seen as follows. Consider two hypothetical extremes. In extreme case 1, Government I (the initial or pre-policy government apparatus) has *no* ability to adjust any current policy instrument (there is complete political gridlock). Then, subject to the inability to adjust any policy tool (except t_q, of course), the optimal intervention (the *only* intervention in this extreme case) is to assign t_q to achieve the new intervention target. Government I (trivially) maximizes social welfare subject to the constraints that it faces, and Government II (the post-policy new government division tasked with the new objective) sets $\Delta t_q < 0$ to meet the target $\alpha_q^0 = \theta$. The described outcome is efficient with respect to the constraints that apply.

Now consider the opposite extreme in case 2 where Government I has the ability to adjust *all* other policies (all taxes and public good production levels) simultaneously to Government II setting the tax on good q. The intervention principle says that the same intervention with respect to good q is efficient (i.e. remains part of the overall efficient plan).

There are intermediate cases as well. In a hypothetical situation where Government I could adjust some, but not all, policies, the intervention described by Proposition 1 would be part of the efficient intervention.

If instead of raising α_q, the objective were to *lower* it so that target $\alpha_q \leq \theta$, the subsidy would become a tax and the intervention principle would continue to apply. Extensions involving targets that are sums of variables in $\bar{\alpha}$ (for example aggregate employment for a group of firms) and linear combinations of variables are also possible.[5]

In line with the original work of Lipsey and Lancaster (1956), if constraints prevent the economy from achieving a first best allocation where marginal rates of substitution equal marginal rates of transformation, it might be beneficial from the point of view of social welfare to distort other markets if government tools permit it, as is evident from the presence of the term S_G. This does not change the conclusion that the introduction of a new quantitative objective $\alpha_q \leq \theta$ involves the application of taxation at the margin of interest in order to achieve the new policy objective. As we have characterized the mathematics, "new policy" can be thought of as being pursued by Government II through the intervention principle and "old policy," subject to the constraints that apply, is implemented by Government I. This is true regardless of the constraints that apply to

[5] See Dixit (1985) for a related discussion.

Government I.

4 Incentive symmetry

Section 3 described interventions where the government faces difficult and possibly complex pre-existent constraints, but maintained that the government was able to direct taxation narrowly to the variables of interest. In many circumstances, however, information asymmetries preclude the use of a particular tax instrument to achieve a policy objective. It may be impossible, for example, to direct subsidies only to those who would not buy insurance on their own if we have no way to identify who is in the target group. Fortunately, price and tax incentives that support a given equilibrium in a full information world are not unique. Some members of a tax-equivalent class may be less sensitive to information asymmetries than others. In this section, we characterize tax-equivalent policies in an incentive symmetry result. The next section applies both propositions 1 and 2 to show that one tax approach might succeed in eliciting the needed information to support an efficient intervention, where another might not, even though both structures would be equivalent in a full information world.

It is not difficult to find examples of incentive symmetry. In international trade theory, for example, the Marshall-Lerner theorem states that a nation that imports good y and exports good x can achieve the same equilibrium by imposing a t percent tariff on good y imports or by imposing a t percent export tax on good x. The import duty and the export tax are members of a tax incentive equivalence class.

The existence of incentive symmetry provides policy makers with flexibility. Seeking to increase more of A is often equivalent to seeking to reduce "*not-A*."For example, A and B might be two cola drinks. If we want individuals to increase their purchase of A, we could lower the price of A by subsidizing it. But we could also raise the price of B by taxing it, again making purchases of A relatively more attractive.

The following is the most general version of incentive symmetry of which we are aware.

Proposition 2: Incentive Symmetry

(i) Let equilibrium quantities be $((y^0_{j\oplus})_j, (y^0_{j\ominus})_j, (x^0_i)_i, z^0)$ at prices $((p^0_i)_i, (p^0_{j\oplus})_j, (p^0_{j\ominus})_j, p^0, p_w)$.

(ii) Assume that government use of resources is r^0, production of public good is $x^{g,0}_i$, and markets clear $r^0 + \sum_{i=1}^{I} x^0_i = \sum_{j=1}^{J}(y^0_j + \omega_j) + z^0$.

(iii) Then, equilibrium quantities are unchanged when prices take the alternative form $((\lambda_i p^0_i)_i, (\lambda_j p^0_{j\oplus})_j, (\lambda_j p^0_{j\ominus})_j, \lambda p^0, p_w))$ where $((\lambda_i)_i, (\lambda_j)_j, \lambda) \epsilon R^{(I+J+1)K}$ are positive scalars and appropriate income adjustments are applied.

Proof 2 *Write consumer demands as* $x^0_i = x_i[p^0_i, I^0_i]$ *and producer choices as* $y_j = y[p^0_{j\oplus}, p^0_{j\ominus}]$

where household i's budget constraint is

$$p_i^0 x_i^0 = I_i^0 = \sum_{j=1}^{J} \theta_{ij}(p_{j\oplus}^0 \cdot (y_{j\oplus}^0 + \omega_j) + p_{j\ominus}^0 \cdot y_{j\ominus}^0) + T_i^0$$

Transfers, if any, from government to individual i are T_i^0, and the government budget is,

$$p^0 r^0 + \sum_i T_i^0 = \sum_i t_i x_i^0 + \sum_j \left(\tau_{j\oplus}^0 (y_{j\oplus}^0 + \omega_j) + \tau_{j\ominus}^0 y_{j\ominus}^0\right) + p^0 z^0.$$

Now consider the alternative $\{\lambda_i p_i^0, \lambda_j (p_{j\oplus}^0)_j, \lambda_j (p_{j\ominus}^0)_j, \lambda p^0, p_w^0\}$ where $\lambda_i, \lambda_j, \lambda$ are positive scalars and $T_i^1 = \lambda_i p_i^0 x_i^0 - \sum_j \theta_{ij}\lambda_j (p_{j\oplus}^0 \cdot (y_{j\oplus}^0 + \omega_j) + p_{j\ominus}^0 \cdot y_{j\ominus}^0)$. Let $\delta^1 = \lambda p^0 - p_w^0$, $t_i^1 = \lambda_i p_i^0 - \lambda p^0$, $\tau_{j\oplus}^1 = \lambda p^0 - \lambda_j p_{j\oplus}^0$, $\tau_{j\ominus}^1 = \lambda p^0 - \lambda_j p_{j\ominus}^0$, and

$$\begin{aligned} \lambda_j p_{j\oplus}^0 + \tau_{j\oplus}^1 &= \lambda p^0 \\ \lambda_j p_{j\ominus}^0 + \tau_{j\ominus}^1 &= \lambda p^0 \\ \lambda_i p_i^0 - t_i^1 &= \lambda p^0 \end{aligned}$$

We now show that

$$\{(x_i^1)_i, (y_{j\oplus}^1)_j, (y_{j\ominus}^1)_j, r^1, z^1\} = \{(x_i^0)_i, (y_{j\oplus}^0)_j, (y_{j\ominus}^0)_j, r^0, z^0\}$$

and the government budget constraint is met, proving that the two systems are equivalent.

Consider producers first. Since producer choices are homogeneous of degree zero in prices $y_{j\oplus}^1 = y_{j\oplus}[p_{j\oplus}^1] = y_{j\oplus}[\lambda_j p_{j\oplus}^0] = y_{j\oplus}[p_{j\oplus}^0] = y_{j\oplus}^0$. Likewise, $y_{j\ominus}^1 = y_{j\ominus}^0$.

Consider consumers next. Since demand is homogeneous of degree zero in prices and income $x_i^1 = x_i[p_i^1, I_i^1] = x_i[p_i^1, \sum_j \theta_{ij}(p_{j\oplus}^1 \cdot (y_{j\oplus}^1 + \omega_j) + p_{j\ominus}^1 \cdot y_{j\ominus}^1) + T_i^1] = x_i[\lambda_i p_i^0, \sum_j \theta_{ij}(p_{j\oplus}^1 \cdot (y_{j\oplus}^0 + \omega_j) + p_{j\ominus}^1 \cdot y_{j\ominus}^0) + T_i^1] = x_i[\lambda_i p_i^0, p_i^1 \cdot x_i^0] = x_i[\lambda_i p_i^0, \lambda_i p_i^0 \cdot x_i^0] = x_i[\lambda_i p_i^0, \lambda_i I_i^0] = x_i[p_i^0, I_i^0] = x_i^0$.

Since trade is unchanged by assumption, domestic demands and supplies are unchanged ($x^1 = x^0, y^1 = y^0, z^1 = z^0$), and material balance applies ($r + x = y + \omega + z$), we have $r^1 = r^0$.

Last, T_i^1 are feasible and satisfy the government's budget constraint. To see this, let GE be

government expenditures and GTR be government tax revenues:

$$
\begin{aligned}
GE &= p^1 r^1 + \sum_i T_i^1 \\
&= \lambda p^0 r^0 + \sum_i \lambda_i p_i^0 x_i^0 - \sum_i \sum_j \theta_{ij} \lambda_j p_{j\oplus}^0 (y_{j\oplus}^0 + \omega_j) - \sum_i \sum_j \theta_{ij} \lambda_j p_{j\ominus}^0 y_{j\ominus}^0 \\
&\qquad - \sum_j \tau_{j\oplus}^1 (y_{j\oplus}^1 + \omega_j) - \sum_j \tau_{j\ominus}^1 y_{j\ominus}^1 \\
&\qquad - \sum_i t_i^1 x_i^1 - p^1 z^1 + GTR \\
&= \lambda p^0 r^0 + \sum_i (\lambda_i p_i^0 - t_i^1) x_i^0 - \sum_j (\lambda_j p_{j\oplus}^0 + \tau_{j\oplus}^1)(y_{j\oplus}^0 + \omega_j) - \sum_j (\lambda_j p_{j\ominus}^0 + \tau_{j\ominus}^1) y_{j\ominus}^0 \\
&\qquad - p^1 z^1 + GTR \\
&= \lambda p^0 r^0 + \lambda p^0 x^0 - \lambda p^0 (y_\oplus^0 + \omega) - \lambda p^0 y_\ominus^0 - \lambda p^0 z^0 + GTR \\
&= \lambda p^0 (r^0 + x^0 - y^0 - \omega - z^0) + GTR \\
&= GTR \ \square
\end{aligned}
$$

5 An Example

The example in this section is inspired by policy objectives connected to American health care. For insured individuals with the ability to pay, care in the United States is among the best in the world. The existence of uninsured individuals, however, suggests that efficient interventions might exist that could move equilibrium to one in which everyone is able to choose and does choose coverage. The odd phrasing "is able to choose and does choose" is relevant for the following reason. In hearings before the House Budget Committee at the Capitol in Washington, D.C. Chief Medicare Actuary Richard Foster testified to the following,

> We find many other people, and this is a bit surprising, where they might be eligible for Medicaid or they might be eligible for their employer plan, and they have actually fairly high health care costs and yet they still don't sign up even though it would be in their best interest financially. But something is preventing them from doing it, lack of understanding or maybe they can't afford their share of premiums. So there is a lot of variation out there in people's insured status.[6]

This is consistent with earlier findings that nearly one of every three uninsured people in the United States is eligible for a government program, generally Medicaid or a state children's health insurance

[6] Rick Foster, Chief Medicare Actuary, Hearing of the House Budget Committee, Capitol, Washington, D.C., 26 January 2011.

plan.[7]

Since health care insurance is available for purchase in the private market, the choice not to buy must be because some cannot "afford" it and others do not want it at existing prices. The objective in this section is to raise the quantity purchased of a selected good, good y, by a group of consumers who initially purchase below the targeted level. We show both that the intervention principle can be applied in a circumstance that previously may have been thought infeasible, and that a strong incentive can be created to overcome the inertia that prevents the taking up of coverage even when it is affordable and in some cases free.

5.1 An Analogy

Before taking up the issue of how such individuals might be made part of an efficient intervention, consider a similar situation that has already been solved. It shows how incentives can be altered to identify and efficiently target a specific group in a way that might initially seem impossible .

Presume that we want those who use bottles and cans to dispose of them properly. In a full information world, the intervention principle says that we should subsidize the act of proper disposal for those who would otherwise litter. That is, those who previously littered and who now place bottles or cans in trash receptacles will receive a subsidy payment for each such act. There are three problems: First, this requires a government expenditure. Second, if a reward is issued for placing bottles or cans in trash receptacles it will affect more than those who would have littered in the absence of the reward. (We therefore violate the intervention principle, which says the intervention should be targeted just to those who litter.) Third, we face an information problem requiring us to know each incident of proper disposal. Lack of information appears to thwart efficient intervention.

However, instead of making proper disposal more attractive by subsidizing it, consider making the alternative *less* attractive. Many states impose a deposit requirement on bottles and cans. The deposit is returned when they are returned. All three problems are solved: No government expenditure is required. Only those who litter are affected by the deposit system (pay any tax), and those who dispose properly *self-identify* when they appear to collect their deposits. The previous non-litterers (who continue not to litter) pay neither more nor less than before. Conclusion: the direct form of intervention encounters an information asymmetry that prevents effective intervention. The alternative form does not. Our goal in health care is to effectively make people post a deposit and self-identify so that we can match the intervention is targeted and efficient.

[7] According to BlueCross BlueShield (2006), "Nearly one-third of the uninsured are reachable through existing public programs. Of the 44.7 million non-elderly uninsured individuals identified in the 2004 Census Current Population Survey (CPS) data, nearly one-third–almost 14 million–were reachable through existing government health programs such as Medicaid and the State Children's Health Insurance Program (SCHIP) under current rules."

5.2 The Example

1in4in2.5inSubsidy-vs-Tax-I.wmf

Figure 1: The household budget constraint for members of the target group. 1a) $C_x \geq 3/2$ is the consumption set. 1b) $C_x \geq 3/2, C_y \geq 1$ is the policy-target consumption set.

Assume that the economy consists of two types of individuals, one of which under-consumes good y. Figure 1 shows a hypothetical individual in Group A (this will be the under-consuming target group) who consumes leisure and two goods at levels C_x and C_y. The individual has lump sum income $I = 1$ and an endowment of time that allows leisure to be selected at levels $L_e \epsilon [0, 1]$. Labor supplied is therefore the quantity $L = 1 - L_e$. The budget constraint shown is

$$I + w = wL_e + p_x C_x + p_y C_y$$

where $(w, p_x, p_y) = (1, 1, 1)$. Were all time taken in leisure, for example, the consumer's budget choices would be limited to points on the triangle *a, b, c* in the foreground of the three dimensional budget constraint. We suppose that good x is a necessity (food) that must be consumed at level $3/2$ or greater. Given this requirement, the individual's feasible choices are shown in $1a$ as points in the relatively small pyramid-like region lying to the right of $3/2$ on the C_x axis that has corners *d, e, f, g.* The left edge of this region is shaded.

To this description, we now add the social constraint that the individual must consume good y at quantity 1 or greater. The effective consumption set is the box-like region shown in Figure 1b, the corner of which is point $h = (C_x, C_y) = (3/2, 1)$. Since no point in the individual's budget constraint intersects this set, individuals in Group A have no ability to consume good y at the required level $C_y \geq 1$ and meet the food requirement $C_x \geq 3/2$.

Figure 2 shows group B. These individuals have the same preferences and budget constraint as individuals in Group A, except that their wage is $w = 2$. Their budget set contains the budget set of Group A, which is shown in dashed lines. Individuals in Group B maximize their utility by choosing to consume at point $j = (2, 1)$. No intervention is needed for members of Group B since they meet the good-y target.

The socially efficient intervention is to subsidize the purchase of good y by Group A members just enough to induce them to meet the target. Figure 3 shows the effect of a subsidy on the purchase of good y for members of this group. Prices are now $(w, p_x, p_y) = (1, 1, 1/s)$ where $s > 1$. The heavy lines show the consumer's expanded budget set. With a subsidy the price of good y can always be made low enough that the consumer would be more than able to afford good y in the socially constrained amount. In the hypothetical case shown, $s = 3$ ($p_y = 1/3$) and point

2in2in2inSubsidy-vs-Tax-II.wmf

Figure 2: The household budget constraint for members of the non-target group.

$k = (3/2, 3/2)$ exceeds the good y constraint. Greater subsidies would expand the choices of the consumer even more. Subsidy $s = 2$ where $(w, p_x, p_y) = (1, 1, 1/2)$, supports point h, which exactly meets the constraint and is just affordable. An incentive-equivalent intervention would involve higher prices for goods other than y, $(w, p_x, p_y) = (2, 2, 1)$, coupled with an income transfer of 1 to members of Group A.

With full information either intervention achieves the same outcome. If individuals in Group A cannot be distinguished from members of Group B, however, the first of the two interventions cannot be applied since it is not known who needs the subsidy and who does not. Without better options, the response might be to legislate an entitlement program that grants *all* consumers subsidized purchase of good y. The target for good y purchases would be met, but at a higher social cost since members of Group B are also subsidized.

Instead of lowering the price of good y by half, consider the effect of doubling the price of good x and rebating the tax if the individual purchases quantity $C_y = 1$ or greater. If good y represents insurance, coverage could be verified in several ways, such as by swiping a card at the point of purchase. Another alternative might be for rebates to be applied for periodically, as is done now for sales tax credits when federal taxes are filed. For members of Group B prices have not changed and their choices are unaffected. For members of Group A, however, the higher price of good x creates a strong incentive to buy good y. Figure 4(a) shows an individual of Group A with the intervention applied in the alternative format $(p_x, p_y) = (s, 1) = (2, 1)$. The new budget constraint is bounded by the heavier lines. The consumer cannot afford to purchase $C_x = 3/2$ let alone the bundle $(C_x, C_y) = (3/2, 1)$. If the original consumption set described in Figure 1 represents a survival constraint, this forms a very strong incentive indeed. If a government window is available to which Group A members can go, they have an incentive to self-reveal and receive income aid. With income transfers to members of Group A, the effective budget constraint is shown by the heavy lines in Figure 4b. If the consumer buys good y in the required amount the budget set is the set shown for quantities of y greater than 1. Otherwise, the lower portion of the budget set reflects the set in 4a for quantities C_y below 1.

A comparison shows that the subsidy equilibrium for members of Group A is characterized by $(p_x, p_y, w, I) = (1, 1/2, 1, 1)$ while the incentive-symmetric alternative just described is characterized

1.75in2in2inSubsidy-vs-Tax-III.wmf

Figure 3: The household budget constraint with subsidy applied to the purchase of good y.

.25in4in2inSubsidy-vs-Tax-IV.wmf

Figure 4: The household budget with the alternative intervention applied.

by $(p_x, p_y, w, I) = (2, 1, 2, 2)$. Moreover, the incentive-symmetric form of the intervention is supported when the direct intervention is not, due to members of Group A self identifying and receiving income transfers. Members of Group B, on the other hand, are unaffected by the intervention and continue to buy insurance.

Incentive symmetry and the intervention principle have been jointly used to support an efficient, targeted intervention that induces everyone to buy good y. In essence, consumers have been made to place a "deposit" on having purchased good y that they are rebated when the purchase has been made. What was not possible using one form of intervention was possible using the alternative.

6 Evaluation and Discussion

The evidence of the twentieth century is that even when efficient intervention using prices and income might be possible (as in the example of section 5), governments have tended to pursue public objectives by creating entitlement programs that guarantee recipients selected in-kind benefits (e.g. health care, education, housing, old age consumption) through direct provision of those goods or by giving money that is restricted to their purchase. Public provision of health care and education represents the norm across most countries, for example. Instead of providing income throughout life that can be saved for old age or used immediately if that is more valuable to the recipient, the Social Security system enforces old-age consumption by giving cash only to those who are old, an easily observed and verified feature.[8]

The reliance on public provision of private goods through in-kind programs has been something of a puzzle and an object of interest to economists. Currie and Gahvari (2008) review the evidence on public expenditures and in-kind programs and provide an excellent survey of what is by now an extensive literature. They analyze various welfare implications and discuss explanations of why such programs are pursued. In this section we consider the main ideas as they relate to the intervention principle and its implications. In some respects, the situation is reminiscent of the

[8] It is known that quantity adjustments in second best situations "are likely to prove an invaluable aid in promoting a socially desirable state of affairs" (Guesnerie and Roberts, 1984). Incentive symmetry and the intervention principle describe efficient interventions to effect quantity changes in the presence of different pre-existent constraints. Policy makers should direct taxes or subsidies to the variables of interest dictated by new public policy objectives, regardless of pre-existing constraints using income transfers and incentive symmetry to craft the efficient form of the intervention. In theory, efficiently achieved quantity changes through price interventions could also be imposed directly and vice versa since "in compensated terms, the effect of quantity controls acting on a consumer are directly equivalent to price changes of the goods being controlled" (Guesnerie and Roberts, p. 69).

story used to discuss efficient markets: Two economists see a $100 bill lying on the sidewalk, upon which the first says to the other, "Pay it no attention. If that really were a $100 bill, it would have been picked up by now." In the case at hand, we (the observers) believe that governments want to do what is good for their citizens, but observe them engaging in in-kind programs ($100 is lying on the sidewalk). Should we believe that they are optimizing on citizens behalf or that perhaps they have overlooked something? Economists have taken both sides. We suggest that because most entitlements were created before the intervention principle was widely known, it was not applied. It should therefore be possible to improve entitlement approaches with ones based on the intervention principle. Efficiency gains can be used either to accomplish a fixed set of objectives taken within their own context in a less costly way, or to enhance the provision of desired benefits at the same cost.

Although entitlementation and in-kind provision do not guarantee that the programs operating under this philosophy will be ineffective, in practice entitlement programs tend to violate efficiency principles in two ways. First, they fail to target their benefits and thus violate the intervention principle. In Curie and Gahvari's words, "Universal programs will evidently cover all needy persons, but at a cost of covering those who are not needy as well. This cost may be considerable" (p. 341). Second, not uncommonly they are directly inefficient. The second problem has to do with incentives: "I will accept the health care provided to me that I value at $15, even if it costs $100 to provide, because I get nothing if I do otherwise." Both types of inefficiency are reported in the literature.

According to research by Gruber and Simon (2007), 60 percent of publicly provided health insurance was "crowded out" from the private sector, i.e. went to individuals who were not uninsured. Such a program is 250 percent of the size of a program that targeted just the uninsured. In their study of government housing, Sinai and Waldfogel (2002) find that two units of privately constructed housing were crowded out for every three that were government-provided, numbers that indicate 300 percent more expenditure. They suggest that subsidies (an approach consistent with the intervention principle identified here) may be more effective than government construction. Englehardt and Gruber (2010) find an even larger impact of Medicare Part D (Medicare Modernization Act of 2003 dealing with prescription drugs). Eighty percent of spending displaced private spending implying that the program was 500 percent the size of a targeted program. Goodman and Saving (2010) (the latter is former trustee of the Social Security and Medicare Trust Funds) cite evidence that seniors on Medicare use 50 percent more care than comparable non-Medicare recipients on private insurance. Jacoby (1997) examines government-provided lunch supplements. Households valued the supplements at about $158 per year, yet they cost $400 per year to provide.

Since the existence of individuals with too little income is not a health care problem, any more than it is a housing problem, a food problem, a clothing problem, or any other "private-good' problem, it is not clear why the response to too little income should be the creation of a government

system of health care provision, or other in-kind provision. Explanations of why governments engage in entitlement programs have therefore examined rationales including paternalism (this includes interdependent preferences where the quantity of your consumption of a given good is part of my preferences), information deficiencies and self-targeting, distortionary taxes coupled with redistribution objectives, and other selected political and externality arguments.

Paternalism. Curie and Gahvari (2008), whose review of the literature we respect, reject most explanations and focus on paternalism and its special case of interdependent preferences[9] recognizing that "It is plain that this approach can rationalize in-kind redistribution of any good that the society considers as essential at any desired level."[10] In addition to relying on an external rationale that explains too much, justifying social interventions on grounds of paternalism contradicts the doctrine of consumer sovereignty and individualistic welfare which traditionally underlie economic reasoning (Besley,1988).

Information Deficiencies. Public provision of private goods could be a response to the inability of the government to observe and respond to major economic signals such as income. If this is the case, some commodity might be used to "seek out" the intended group of beneficiaries and/or to be superior in avoiding the non-intended group. This is the idea behind self-targeting, where the government tries to overcome some information deficiency. Besley and Coate (1991) provides an example of self-targeting. An economy of poor and rich individuals incorporates a numeraire good z and a good that can be consumed or not at different quality levels, q. It may be possible to redistribute in a way that disproportionately benefits the poor if there are many quality levels available where the rich opt out. The fact that the resulting in-kind transfers differ from their efficient level results from the second best nature of the mechanism. Marchand and Schroyen (2005) investigate public provision of health care when the government influences participation in the in-kind program by using waiting lists in the public health sector to discourage non-intended beneficiaries from participating.

In an interesting addition, Gavahri and Mattos (2007) discuss an extension of Besley and Coate (1991) to include conditional cash transfers t, received only by the recipients (the poor)of the publicly provided good. If the social objective is to induce recipients to consume a selected good, this satisfies the intervention principle by subsidizing the desired activity and targeting the desired group. It is true in many developing countries that governments award cash transfers if the recipients consume a certain level of the publicly provided good. In Brazil, the program Bolsa Familia provides conditional cash transfers to more than 13 million families (http://www.mds.gov.br/).

[9] "The evidence suggests that paternalism and interdependent preferences are leading overall explanations for the existence of in-kind transfer programs" (p. 338).

[10] For example, with respect to labor supply they write, "Another large literature explains in-kind transfers as a way to reduce the labor-supply distortions of the tax system. However, this argument is contradicted by the observation that the bulk of such transfers are made to individuals who do not supply labor" (p. 377) .

According to the ministry of social development and fight against hunger (MSD, in Portuguese), "through the direct cash transfer programs, such as Bolsa Família, MSD provides citizenship and social inclusion to the beneficiaries, which are committed to health and education activities." In Colombia, the plan Familias en Accion awards conditional cash transfers to more than 1.7 million families. Similar programs exist in other Latin American countries. School attendance and periodic health checkups are regularly part of the criteria for awarding the conditional cash to recipients. The use of cash transfers is welfare enhancing relative to the original Besley and Coate strategy.

Apart from simple paternalism, the leading reason for in-kind transfers is this argument. However, observations of in-kind transfer programs reveals that the government often does have the ability to observe incomes and individual-specific information. For instance, U.S. entitlement programs usually grant cash as well as in-kind goods (food stamps, medicaid, housing assistance and etc.) after determining eligibility, which strongly suggests that the government makes use of observed data.

Distortionary Taxes. Income taxation usually involves distortions characteristic of a second best environment as described by the literature on optimal taxation (Stiglitz,1982, 1987). A different strand of reasoning for implementing in-kind transfers investigated by the literature, therefore, is the possibility of improving the efficiency of the tax system. Examples in this literature include Munro (1992), Gahvari (1995), Cremer and Gahvari (1997), Blomquist and Christiansen (1998, 1999). Under certain conditions the incentive compatibility constraints for public programs that apply to high-ability individuals can be weakened by in-kind transfers, more redistribution achieved, and a Pareto superior allocation implemented. While this explanation for in-kind programs may be at work, casual observation reveals that governments usually do observe incomes. In the example of section 5 the targeted set of individuals had an incentive to reveal the necessary information.

A variant of this argument focuses on in-kind transfers and labor supply. However, it is dubious whether programs that distribute in-kind have the expected effects on labor supply as discussed by this branch of the literature. In particular, many entitlement programs that provide in-kind may not affect labor supply or even reduce it. For example, the large U.S. federal entitlement program Medicare provides health services to seniors and people with disabilities. Eligibility for this program is unlikely to have any effect on labor supply. On the other hand, housing assistance may even reduce labor supply by creating disincentives to work unless residential location matters in determining job opportunities. Curie and Gahvari concluded, "it is unlikely that this is the main motivation for most of the programs we consider" (p. 334).

Other. Other approaches have looked to voting mechanisms to explain public in-kind provision (Epple and Romano 1996), human capital externalities (De Fraja 2008), and revenue collection technology based on the fact that rich countries rely predominantly on cash transfers in their redistribution policies, while in poor countries there is a greater share of transfers in-kind ("governments

in rich countries have access to better revenue collection technologies and exhibit less corruption and/or less tax evasion than governments in poor countries," Bearse-Glomm-Janeba 2000).

Redistribution itself must also be questioned as the rationale for public provision of most private goods. Education and health care, in particular, seem more responsive to notions of equal opportunity and ensuring that everyone is equipped (functionally able) to earn a living. In the early days of the food stamp program, it was seen as a way to deal with agricultural surpluses, which has nothing to do with redistribution. Food stamps also appear to be given in-kind on the wish to prevent the aid from being used in other ways. When redistribution *is* the operable motive, as appears to be the case with the Earned Income Tax Credit (EITC), the government provides cash as theory predicts, not publicly-provided private goods. Even the EITC, however, can be viewed as a program to encourage labor force participation by individuals with low productivity. No statement can be final, but we conclude that arguments that in-kind transfers are based on redistributive concerns have tenuous support when examined closely in real-world facts and in the economic literature.

Often arguments for in-kind programs are made on externality grounds ("We all benefit when everybody is educated" or "We all benefit when everybody has health care.") Undoubtedly, most would feel some direct personal increase in satisfaction if they knew that their neighbors were happy, educated, and prosperous, such arguments are nevertheless debatable since they apply without change to my neighbor's clothing, to shelter, to newer production facilities for Ford Motor Company or Apple Computer, to better shopping malls, and to any number of economic activities that relate to the consumption or investment by others of goods known to be private goods. When my neighbor needs and gets an appendectomy the operation benefits my neighbor and is consumed solely by him. Presuming that he has health insurance and can pay for his consumption, there is no reason, other than personal charity, for me to participate in paying for his operation. A similar argument would apply to education beyond some minimal level (we want everyone to be able to read street signs, to understand and support the American system of government, to be capable of serving in the military if called upon, etc.) which becomes a personal investment good (higher income of the educated person accrues to the one educated, not to you or me) with personal consumption aspects ("My college years were some of the best years of my life," etc.) If government has the ability to observe incomes, can gather personal information, can make cash transfers, and charity is not its motivation, then the rationale for in-kind provision of health care, education, and other services does not apply. If charity *is* the motivation, transfers of cash are available. To reiterate, the fact that in many economies health care, education, food, and other goods are given in-kind, seems not to follow from redistributive social goals, but from paternalisitic views about the level of consumption of the selected commodities (Curie and Gahvari, *op cit.* p. 338).

Let us return to the economists and the $100 bill: If we presume that government is optimizing

and wants to do what it wants to do because of paternalism or because it is using quantity changes to improve a second best equilibrium, then it should use an efficient intervention. On the other hand, if government has *not* optimized, perhaps because it did not know the intervention principle when entitlement programs were created (this would be our preferred explanation), it again should turn to efficient interventions to replace inefficient ones. The conclusion is the same. Inefficiencies generally associated with entitlement programs merely add weight to the logic.

7 Conclusion

Governments usually face constraints on their choices that prevent them from implementing first best equilibria. These constraints can be technical, political, institutional, informational, or all of the above. This paper considers interventions to achieve policy objectives under the assumption that government chooses among its feasible actions to optimize on behalf of its citizens. Two results were proved. The first, the intervention principle, says that government should direct taxes or subsidies to the variable or variables of interest at the minimum level needed to accomplish its quantity objectives. The second, incentive symmetry, proved the non-uniqueness of tax interventions for a given policy outcome. When informational constraints prevent a member of the policy equivalence class from being used, another member of the equivalence class may still be available.

An implication of our results is that subsidies directed to the purchase of a given good (e.g. health care, education, food, clothing, shelter or others) or its incentive-symmetric equivalent is the most efficient means to achieve a quantitative objective. Other policies such as direct public provision of private goods may also achieve the objective, but at a greater social cost. When information is imperfect, for example, the problem may be that the individuals who should be the recipients of aid are not distinguishable, and so more than the targeted group is provided goods. We provided an example that shows there are situations where applying the incentive symmetric form of the efficient intervention resolves the information limitations, and restores the ability of government to implement efficient interventions that satisfy the intervention principle.

We closed with a philosophical discussion that began by asking why entitlement programs (public provision of private goods) are observed. In practice it may be difficult to distinguish a government that acts badly or irrationally from one that is rational but subject to significant political and other constraints. In either case, however, use of a proper intervention principle is implied once it is known.

References

[1] Aidt, Toke (1998) "Political Internalization of Economic Externalities and Environmental Policy", *Journal of Public Economics*, vol. 69, pp. 1-16.

[2] Besley, Timothy and Stephen Coate (1991) "Public Provision of Private Goods and the Redistribution of Income", *American Economic Review*, vol. 81, pp. 979-984.

[3] Blomquist, Sören and Vidar Christiansen (1998) "Topping up or Opting out? The Optimal Design of Public Provision Schemes", *International Economic Review*, vol. 39, pp. 399-411.

[4] Blomquist, Sören and Vidar Christiansen (1999) "The Political Economy of Publicly Provided Private Goods", *Journal of Public Economics*, vol. 73, pp.31-54.

[5] BlueCross BlueShield Association (2006) "The Uninsured in America," Chicago: BlueCross BlueShield Association, January.

[6] Bovenberg, Ary Lans and Frederick van der Ploeg (1994) "Environmental Policy, Public Finance and the Labour Market in a Second-Best World", *Journal of Public Economics*, vol. 55, pp. 349-390.

[7] Bullock, David (1995) "Are Government Transfers Efficient? An Alternative Test of the Efficient Redistribution Hypothesis", *Journal of Political Economy*, vol. 103, pp. 1236-1274.

[8] Bullock, David, Kyeong-Soo Jeong, and Philip Garcia (1999) "Testing the Efficient Redistribution Hypothesis: An Application to Japanese Beef Policy", *American Journal of Agricultural Economics*, vol. 81, pp. 408-423.

[9] Coate, Stephen and Stephen Morris (1995) "On the Form of Transfers to Special Interests", *Journal of Political Economy*, vol. 103, pp. 1210-1235.

[10] Coate, Stephen (2000) "An Efficient Approach to the Evaluation of Policy Changes", *Economic Journal*, vol. 110, pp. 437-455.

[11] Cremer, Helmuth and Firouz Gahvari (1997) "In-kind Transfers, Self-selection and Optimal Tax Policy", *European Economic Review*, vol. 41, pp. 97-114.

[12] Cremer, Helmuth, Firouz Gahvari and Norbert Ladoux (2001) "Second-best Polluting Taxes and the Structure of Preferences", *Southern Economic Journal*, vol. 68, pp. 258-280.

[13] Currie, Janet and Firouz Gahvari (2008) "Transfers in Cash and in Kind: Theory Meets the Data", *Journal of Economic Literature*, vol. 46, pp. 333-383.

[14] De Fraja, Gianni (2008) "Market and Public in the Presence of Human Capital Externalities", *Journal of Public Economics*, vol. 92, pp. 962-985.

[15] Dixit, Avinash (1985) "Tax Policy in Open Economies", *Handbook of Public Economics*, vol. 1, pp. 313-373.

[16] Engelhardt, Gary V. and Jonathan Gruber (2010) "Medicare Part D and the Financial Protection of the Elderly," National Bureau of Economic Research, Working Paper 16155, http://www/nber.org/papers/w16155, July.

[17] Epple, Dennis and Richard Romano (1996) "Public Provision of Private Goods", *Journal of Political Economy*, vol. 104, pp. 57-84.

[18] Gahvari, Firouz (1995) "In-kind versus Cash Transfers in the Presence of Distortionary Taxes", *Economic Inquiry*, vol. 33, pp. 45-53.

[19] Gahvari, Firouz and Enlinson Mattos (2007) "Conditional Cash Transfers, Public Provision of Private Goods, and Income Redistribution", *American Economic Review*, vol. 97, pp. 491-502.

[20] Gardner, Bruce (1983) "Causes of U.S. Farm Commodity Programs", *Journal of Political Economy*, vol. 95, pp. 290-310.

[21] Goodman, John and Thomas Saving (2011) "Is Medicare More Efficient Than Private Insurance?" HealthAffairs Blog, http://healthaffairs.org/blog/2011/08/09/ is-medicare-more-efficient-than-private-insurance/, 9 August.

[22] Grossman, Gene and Elhanan Helpman (1994) "Protection for Sale", *American Economic Review*, vol. 84, pp. 833-850.

[23] Grinols, Earl (2006) "The Intervention Principle", *Review of International Economics*, vol. 14, pp. 226-247.

[24] Gruber, Jonathan and Kosali Simon, 2007, "Crowd-Out Ten Years Later: Have Recent Public Insurance Expansions Crowded Out Private Health Insurance?," NBER Working Paper No. 12858, January.

[25] Guesnerie, Roger and Kevin Roberts (1984) "Effective Policy Tools and Quantity Controls", *Econometrica*, vol. 52, 1, pp. 59-86.

[26] Jacoby, Hanan (1997), "Self-selection and theRedistributive Impact of In-kind Transfers, an Econometric Analysis", *Journal of Human Resources*, vol. 32, pp. 233-249.

[27] Kopczuk, Wojciech (2003) "A Note on Optimal Taxation in the Presence of Externalities", *Economics Letters*, vol. 80, pp. 81-86.

[28] Lipsey, Richard and Kelvin Lancaster (1956) "The General Theory of Second Best", *Review of Economic Studies*, vol. 25, pp. 11-32.

[29] Marchand, Maurice and Fred Schroyen (2005) "Can a Mixed Health Care System be Desirable on Equity Grounds?", *Scandinavian Journal of Economics*, vol. 107, pp. 1-23.

[30] Micheletto, Luca (2008) "Redistribution and Optimal Mixed Taxation in the Presence of Consumption Externalities", *Journal of Public Economics*, vol. 92, pp. 2262-2274.

[31] Moffitt, Robert (1989) "Estimating the Value of an In-Kind Transfer: The Case of Food Stamps," *Econometrica*, vol. 57, pp. 385-409.

[32] Munro, Alistair (1992) "Self-Selection and Optimal In-Kind Transfers", *Economic Journal*, vol. 102, pp. 1184-1196.

[33] Panagariya, Arvind and Pravin Krishna (2000) "A Unification of Second Best Results in International Trade", *Journal of International Economics*, vol. 52, pp. 235-257.

[34] Sandmo, Agnar (1975) "Optimal Taxation in the Presence of Externalities", *Swedish Journal of Economics*, vol. 77, pp. 86-98.

[35] Sinai, Todd, and Joel Waldfogel. 2002. "Do Low- Income Housing Subsidies Increase Housing Consumption?" National Bureau of Economic Research Working Paper 8709.

[36] Stiglitz, Joseph E. (1982) "Self-Selection and Pareto Efficient Taxation", *Journal of Public Economics*, vol. 17, pp. 213-240.