NBER WORKING PAPERS SERIES

ROBIN-HOODING RENTS: EXPLOITING THE PECUNIARY EFFECTS OF IN-KIND PROGRAMS

Richard Zeckhauser

Steve Coate

Stephen Johnson

Working Paper No. 4125

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1992

NBER Working Paper #4125
July 1992

ROBIN-HOODING RENTS: EXPLOITING THE PECUNIARY EFFECTS OF IN-KIND PROGRAMS

ABSTRACT

The pecuniary effects of cash and in-kind programs differ. A program that builds housing for the poor, for example, is likely to result in a lower price of existing low-income housing than would an equally costly cash transfer program. Low-income renters in general would benefit; landlords would lose. The process we label Robin-Hooding rents employs in-kind programs to transfer rents from one group in society to another.

Direct taxation of "donor" groups may be infeasible because their incomes can't be monitored, they are engaged in illegal activities, they are foreign, or the government's administrative apparatus is ineffective. A general equilibrium analysis reveals that absent the ability to target taxation, Robin-Hooding may be a valuable second-best transfer instrument.

Robin-Hooding also has drawbacks. Its incentive effects are significant, for today's rents flow from yesterday's investment activities. Moreover, even when Robin-Hooding is undesirable, parochial government agencies may be tempted to employ it as a means to escape the scrutiny of the budget process.

The real world use of Robin-Hooding in both developed and developing nations is discussed.

Professor Richard Zeckhauser
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
and NBER

Professor Steve Coate
Department of Economics
University of Pennsylvania
3718 Locust Walk
Philadelphia, PA 19104

Stephen Johnson
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138

I. Introduction

What is the appropriate role for government in providing specific private goods? This question is central to public finance, if only to explain current practices: The governments of many nations devote considerable resources to secure private goods such as food, housing, health, and education, for their citizens. Existing public finance theory supports this practice only in special circumstances. The first major justification for providing citizens with goods rather than cash is paternalism, reflecting a belief that recipients would make the wrong consumption choices if given cash. The second is target efficiency: goods may attract the intended beneficiaries better than cash. The final justification is that of externalities: the rest of society benefits in some way from the recipients consumption of the good in question.[1]

An obvious difference between in–kind and cash programs lies in their pecuniary effects. A program that builds housing for the poor, for example, is likely to result in a lower price of existing low–income housing than would an equally costly cash transfer program. This implies benefits for all low–income renters, not just the ones in the new housing. We argue here that these different pecuniary effects can provide a previously unstudied rationale for the use of in–kind programs. Specifically, we show that in a world in which the government has limited ability to tax, the pecuniary effects of in–kind programs may be used to transfer rents from one group in society to another.

To provide a simple but compelling illustration, consider a developing country whose government would like to redistribute from rural farmers to urban dwellers. Suppose, however, that the government does not have the administrative infrastructure to

---

[1]Garfinkel (1973) develops the case in which donor taxpayers have special preferences about the consumption patterns of recipients. Nichols and Zeckhauser (1981), Blackorby and Donaldson (1988) and Besley and Coate (1991) provide various versions of the target efficiency argument. Bruce and Waldman (1991) provide a somewhat different argument for in–kind transfers based on the Samaritan's Dilemma. Thurow (1974) provides a good summary of many of the economic arguments for in–kind transfers. Rodgers (1973) makes a non–economic argument, claiming that farmers interested in raising the price of farm products in the late 1930's played a major role in creating the first Food Stamp Plan.

tax the rural population directly. One policy it may implement is to import food from the world market and distribute it, financing the deficit by a tax on urban dwellers. This will expand domestic supply, lower the price of food, and thereby shift rents from farmers to urban dwellers. The government can therefore effect redistribution even though it has no ability to tax the donor group. We refer to the process of using in–kind programs in this way as *Robin–Hooding rents*. The key idea is that, by expanding the supply of a good, an in–kind program lowers its price and transfers rents from suppliers to consumers.

Robin–Hooding rents creates distortions in the economy. By lowering the price of the publicly–provided good, it results in overconsumption relative to the efficient level. Therefore a system of lump–sum taxes and transfers could, if unconstrained, accomplish the same redistribution at lower social cost. In many practical situations, however, governments will not have available any such system of distortion–free taxation. Indeed, in some circumstances (such as the one described above), Robin–Hooding may be the only way of effecting transfers between the groups in question.

More commonly, the government will have alternative instruments for effecting transfers, but these instruments will themselves create distortions. Such instruments include statutory restrictions on trade (e.g., price controls), as well as distortionary taxes. We find that public provision will always be a useful supplement to price controls. It may also be desirable in the presence of distortionary taxes, if the government cannot directly tax the rents of the target donor group. For example, if the government wishes to transfer rents from foreign producers to domestic consumers but GATT rules or political sensitivities prevent the tax system from discriminating against foreign producers (say through a tariff), public provision of the good in question may be a useful supplement to an excise tax on all producers. Alternatively, if the government can tax labor earnings but cannot observe the income derived from renting out third–floor apartments, then public provision of housing may be part of a second–best efficient system of redistribution.

Although Robin–Hooding can serve normative purposes, it also has its drawbacks.

Expropriating rents in this fashion may have long–run incentive effects, for today's rents flow from yesterday's investment activities. If real estate rents or sales are taxed, buildings may be too few and too small, at least in the long run. So too if building rents are confiscated by the construction of public housing. Moreover, even when Robin–Hooding is undesirable in some second–best sense, governments may still be tempted to employ it. Since Robin–Hooding works through pecuniary effects rather than direct expenditures, it may largely escape the scrutiny of the budgetary process. This could be an attractive feature to a government agency seeking to make transfers that might not be welcomed by the general public.

The existing literature on cash versus in–kind transfers has largely ignored the implications of their quite different pecuniary effects.[2] One exception is Coate's (1989) paper on famine relief, which analyzes whether an agency concerned with minimizing mortality should give cash to famine victims or instead should ship in and distribute food. Coate observes that in some circumstances cash transfers to famine victims may have pecuniary effects that hurt the recipient group. Starving citizens will spend cash on food; the price of food will rise (assuming some supply inelasticity); and part of the cash grant will end up benefiting those who supply food rather than the intended famine victims. Thus in certain circumstances, shipping food into the famine region may be more effective than distributing cash.

The remainder of our paper is organized as follows. Section II outlines a framework for our analysis of Robin–Hooding. Section III shows how a government may use in–kind programs to transfer rents from a group that it cannot reach with taxes. Section IV examines the case for Robin–Hooding when the government has alternative instruments for effecting transfers from the target donor group. Section V identifies some of the likely

---

[2]Usher (1977), in his interesting analysis of why commodities are socialized, notes that a socialization program which decreases average consumption of a good (say medical care) "appropriates" rents from suppliers of the socialized commodity (doctors).

drawbacks with Robin–Hooding. Section VI discusses Robin–Hooding in practice, and section VII concludes.

II. The Model

We consider an economy with two goods and two groups of individuals. Good x serves as the numeraire; good z has price p. The groups are labelled A and B; group i ($i \in \{A,B\}$) has n_i individuals. A member of group A is endowed with an income of y_A units of the numeraire. The per capita income endowment for group B is y_B. Only group B members own good z; each possesses $\bar{z}$ units.

The members of group i have identical utility functions for the two goods, represented as $u_i(x,z)$. The two utility functions are assumed to be smooth, increasing in both arguments and strongly quasi–concave. In addition, for both groups, the two goods are normal and gross substitutes. The demand for z at price p of an individual in group i with wealth w is denoted by $z_i(p,w)$.[3] The associated indirect utility function by $v_i(p,w)$.

The economy can supplement its holdings of good z with new production. Specifically, the economy has a technology that transforms c units of the numeraire into 1 unit of z, where $c > 0$. This technology is not reversible; that is, good z cannot be turned back into units of the numeraire.[4] Producers are assumed to behave competitively which implies that the price of good z cannot exceed c in equilibrium. It may, however, fall below c if the demand for z from As is less than the (net) supply from Bs.

The laissez–faire equilibrium in this economy is simple to characterize. At price p, As will demand $n_A z_A(p,y_A)$ units of good z, as depicted in figure 1. Supply of z comes from two sources, Bs and new production. At price p, Bs supply $S_B(p) \equiv n_B[\bar{z}-z_B(p,y_B+p\bar{z})]$

---

[3]More formally, $z_i(p,w) = \text{argmax}\{u_i(w-pz_i,z_i)\}$.

[4]This assumption can be weakened somewhat. All we really require is that there exists some asymmetry such that 1 unit of z produces strictly less than c units of the numeraire.

units.[5] The supply curve of new production is horizontal at price c, as shown in figure 1. Thus the aggregate supply curve turns flat as new production is drawn into the market.

If group A's demand exceeds group B's supply at price c, the equilibrium price of z will be c.[6] Group A individuals will consume $z_A^o \equiv z_A(c,y_A)$ units of z and obtain a utility level $v_A(c,y_A)$, while Bs will consume $z_B(c,y_B+c\bar{z})$ $(= \bar{z}-S_B(c)/n_B)$ units of z and enjoy a utility level $v_B(c,y_B+c\bar{z})$. New production will account for $\hat{z}$ units of the total consumption of z. Group B individuals will earn rents from their holdings of good z, shown as the shaded area in figure 1.[7]

This completes the description of the basic model. The reader may find it helpful to consider two examples that fit quite nicely into this framework. In the first, good z is taken to be housing. The Bs are landlords who own the existing stock of housing. The As have no housing and thus must rent it on the market. New housing may be built at a breakeven annual rental cost of c.

In the second example, good z represents food. The Bs are rural farmers who have stocks of food that they have grown. The As are urban dwellers endowed only with income. Food can be imported from abroad at price c; thus 1 unit of food can be obtained from c units of the numeraire. Farmers face significant transactions costs in exporting food and hence (at least for prices not substantially below c) will sell their food on the domestic market.[8]

---

[5]We will assume that group B individuals' holdings of good z are sufficiently large so that they are net suppliers over the relevant range of prices. The gross substitutes assumption implies that this supply is increasing in p.

[6]While we focus on the case where the laissez–faire equilibrium price is c, the same arguments for Robin Hooding would apply (with minor modifications) if the laissez–faire equilibrium involved no new production and a price less than c.

[7]If their $\bar{z}$ units are the fruits of a past investment project, the rents received by group B individuals are more properly interpreted as quasi–rents.

[8]This is similar to Coate's famine relief example. We may think of c as the world price of food plus the costs of transporting food in $(c = p_W+\tau)$. Assuming symmetric transport costs, farmers would not be induced to export until domestic price fell below $p_W-\tau = c-2\tau$.

With a few changes in labeling, the model captures situations in which foreign (or out of state) producers are earning rents from their ability to produce more efficiently than domestic producers. In this interpretation, group A can be thought of as "domestic" consumers and $S_B(p)$ represents the supply curve of foreign producers. Domestic producers have a technology that allows them to transform c units of the numeraire into 1 unit of z. Since $S_B(p)$ is positive for prices below c, foreign producers have a more efficient technology over some ranges of output; the source of their rents.

III. Robin–Hooding Rents

Suppose that the government of this economy would like to redistribute from group B to group A. The purpose could be conventional redistribution, if say As were the poor and Bs the rich, but this is only one possibility. As in our foreign trade interpretation, group A could be one's own citizens, with group B being foreigners. Or, in common parlance, Bs could be bad guys, say criminal elements making profits from black marketeering.[9] Finally, group B might be the politically disadvantaged, such as the rural farmers in our food example.

The simplest approach would be to tax the members of group B, but administrative or political constraints preclude such taxation. This section shows that, despite these constraints, the government can still effect redistribution by Robin–Hooding rents through public provision. We demonstrate that the government can redistribute from Bs to As by taxing the As and using the revenues to provide good z. We also show that Robin–Hooding through public provision is equivalent in its impact to what we call a

---

The assumption that τ is large seems germane to many developing countries with their inadequate distribution and marketing systems.

[9]Sometimes rents go to individuals who are willing to or have the capabilities to engage in illegal activities. Running the activity on a restricted basis under government supervision transfers rents from the illegal operators to consumers. Often the denial of rents to such parties is thought to be a benefit in itself. One argument in favor of government provision of heroin to identified addicts or of state lotteries is that they have the potential to create beneficial rent transfers.

"discriminating" subsidy.

A. The Simple Analytics of Robin–Hooding

Consider a public provision program of the following form: first, the government produces g units of good z. Thus, in the food example, it imports g units of food and, in the housing example, it builds g units of public housing. Then, this government production is granted equally to the As at no charge. Thus each A receives g/n_A units of z from the government. Finally, a head tax of cg/n_A is levied on each A to finance the cost of the program (cg). The Bs are only affected by this policy through the operation of the market.

The effect of this policy is shown in figure 2. Assuming that government rations are tradeable, each A's wealth will equal $y_A+(p-c)g/n_A$ at price p (i.e., income plus the value of the ration less taxes). The new (net) demand curve for z is therefore $n_A z_A(p,y_A+(p-c)g/n_A)-g$. This demand curve equals $n_A z_A^0-g$ at price $p = c$. Because of the effect of p on wealth, it has a steeper slope than the original curve.[10] The new equilibrium price of z is p(g), which is less than c. This price satisfies the market–clearing condition that group A's (net) demand equal group B's supply; that is,

$$(1) \qquad n_A z_A(p(g),y_A+(p(g)-c)g/n_A) - g = S_B(p(g)).$$

Provided that g exceeds $\hat{z}$, all new private production is crowded out by the policy. In response to the lower price of z, the As consume an additional Δz_A units of z. The Bs also consume more z, as the lower price leads them to supply less of their holdings to the market. The increase in their consumption is Δz_B.

Our interest lies in understanding the welfare effects of this policy. Figure 2 permits a simple analysis in terms of changes in consumer surplus.[11] Group B's rents are reduced

[10]The gross substitutes assumption implies the new demand curve is downward sloping.

[11]A parallel analysis based on the more reliable equivalent variation measure of welfare

by the area D+E+F. Some of these rents (shaded area D) are transferred to the As. The remainder (area E+F) are lost to the economy as a result of the distortion created by the policy. By reducing the price of z below its true social opportunity cost, public provision results in over–consumption of good z. Area E is the deadweight loss resulting from As consuming units of z which they value less than c. Area F is the deadweight loss resulting from excessive consumption of z by the Bs.

Straightforward intuition explains why this policy must benefit the As. In the laissez–faire equilibrium each A consumes z_A^o units of z at price c. The public provision program essentially buys each A g/n_A units of z at price c, and allows them to purchase additional units at a price (p(g)) which is less than c. Provided that g is less than $n_A z_A^o$, this expands the As' opportunities. They could continue consuming z_A^o units of z and increase their consumption of x. This would obviously make them better off. In fact, as shown in figure 2, they will choose to take advantage of the lower price and increase their consumption of z.[12]

It is important to note that Robin–Hooding does not require the government to *give* its production to the As. The government could equally well *sell* its production in the market, financing any deficit by a head tax on the As.[13] Under this policy, an A would have wealth $y_A-(c-p)g/n_A$ at price p. The term $(c-p)g/n_A$ is his share of the government deficit which results from selling the g units at price p. It follows that the demand for z would be $n_A z_A(p,y_A-(c-p)g/n_A)$. The supply of z at price p would be $S_B(p)+g$. From (1)

---

change is developed in Appendix A.

[12]If the laissez–faire equilibrium price were below c, public provision would not necessarily improve the welfare of the As. This is because the As would have to pay a higher price for the g units provided by the government. This extra cost would have to be offset against the benefits of the lower price for the additional units. A sufficient condition for a small amount of public provision to improve the welfare of the As is that $p^o/(c-p^o) > \epsilon_S(p^o)$ where p^o is the initial price and $\epsilon_S(p)$ is the elasticity of the B's supply at price p.

[13]In reality, the selling policy is likely to be less costly administratively, since it avoids setting up a mechanism for distributing government supplies.

it is clear that the same price and allocation would result.

The redistributive power of the policy stems from the government production. By expanding the supply of the good, this forces down the market price of z. This serves to shift rents from the producers (or owners) of z to consumers. It does so at the cost of creating inefficiency in the economy.[14] If total consumption of good z exceeds the economy's endowment (i.e., $n_A z_A + n_B z_B > n_B \bar{z}$), then efficiency is lost if consumers do not face the true social cost of z, namely c. By forcing the price of z below its true opportunity cost, Robin–Hooding results in overconsumption of good z relative to the efficient level. Nonetheless, redistribution is effected without explicit taxation of the donor group.

B. Robin–Hooding and Discriminating Subsidies

Additional insight into the effects of public provision, may be obtained by considering its relationship to a "discriminating" subsidy. The government with an interest in Robin–Hooding rents need not produce the good itself. It can expand production of z, thereby reducing its price, by subsidizing private supply. If such subsidies went to all suppliers, including the members of group B who already own good z, group A members would clearly be worse off. However, if subsidies were discriminating in the sense of going only to new producers, rents would be transferred from group B members.

Such discriminating subsidies are commonplace in the public arena. We frequently subsidize the production of new Ph.D.'s, new housing and new investment, but not the existing stock. To operate a discriminating subsidy in the food example, the government would subsidize only the import of food. Group B individuals, domestic producers who hold the existing stock, would receive no subsidy. In the foreign trade interpretation, the government would subsidize domestic production of the good in question. Indeed, such

---

[14]Appendix A develops a measure of the inefficiencies created by the policy. Not surprisingly, it is goods for which the substitution effect is large that result in large deadweight loss from Robin–Hooding.

production subsidies are discussed in the trade literature (see Bhagwati and Srinivasan (1983)).

We compare direct government provision with a discriminating subsidy, assuming that in both cases government expenditure is financed by a tax on As. The key finding is that, under our assumptions, the two policies are equivalent. Thus for any given public provision policy there exists a discriminating subsidy policy which achieves the same allocation and visa versa. A discriminating subsidy policy with subsidy c–p(g) achieves precisely the same allocation as a public provision policy that provides an amount g ($> \hat{z}$). Under the discriminating subsidy policy, the equilibrium price of z must be p(g) as under public provision. Moreover, the total production of good z must equal g which means that As will have a tax bill of $g(c-p(g))/n_A$ as under public provision (assuming the good is sold, rather than given away).

To see the converse, consider a subsidy policy under which the government offers a subsidy $s > 0$ to producers of good z. Let z_s denote production under this policy. Note that z_s will be positive and hence the price of z will be c–s. Now consider a public provision policy under which the government provides z_s units of good z. It is straightforward to verify that $p(z_s) = c-s$, which means that each A will have a tax bill of sz_s. Since this is the same as under the subsidy policy, the same allocation will result.

It may be argued that since the government can always achieve the rent transfer by using a discriminating subsidy, public provision is redundant. Notice, however, that the informational requirements for operating a discriminating subsidy are much greater. In particular, it must be possible to distinguish new producers from group B members. This may be difficult in practice. In the food case, for example, the government would have to be sure that the food brought in by importers was really from abroad rather than simply purchased from the rural farmers. By importing the food itself, the government avoids this problem.

IV. Robin–Hooding versus Alternative Instruments

The previous section showed how the government could shift rents from one group in society to another by using public provision or government subsidized private production, with all costs financed by a head tax on the recipient group. The pecuniary effects of public provision are thus harnessed to achieve redistributional goals in environments where the government has limited abilities to tax the donor group. This finding has widespread applicability in the context of developing countries, where governments typically have extremely limited administrative infrastructures.[15] Frequently, however, governments are likely to have other instruments available for effecting transfers from the target donor group. The question then becomes whether the existence of these instruments make public provision redundant as a tool for redistribution. This section addresses this issue.

A. Robin–Hooding versus Price Controls

The first alternative instruments we consider are price controls. These are widely used by governments, particularly in the markets to which our model applies. Food price controls are popular in developing countries, and rent controls are common even in developed economies like the US. Like public provision, price controls have the merit that they may be implemented without a sophisticated system of tax collection. In contrast to public provision, however, the government must be able to monitor transactions in the market closely to ensure that controls are adhered to. This requirement severely hampers the effectiveness of price controls in practice. Moreover, price controls create rent–seeking behavior which may dissipate the gains to beneficiaries of the lower prices.

In what follows we ignore the issues of enforcement and rent–seeking. Our focus will be to demonstrate that public provision will be a useful supplement to even an

---

[15]As we will see in section VI, Robin–Hooding appears to be a popular strategy for transferring from the rural to the urban sector in many developing countries.

idealized price control. It will then follow that public provision has a role to play in more realistic circumstances. Suppose then that the government imposes a ceiling $\bar{p} < c$, on the price of z. The resulting supply of good z from Bs is $S_B(\bar{p})$. Assuming that this supply is divided equally among those who demand it, each A will consume $S_B(\bar{p})/n_A$ units of good z and $y_A - \bar{p}S_B(\bar{p})/n_A$ units of x. Such a policy could make the As better off than in the status quo, if the benefits of the lower price of z outweigh its reduced availability.

A standard supply and demand analysis of this policy, as in figure 3, identifies area D as the rent transfer from Bs to As and area E+F as the deadweight loss. Area E is the deadweight loss resulting from Bs consuming units of z they value less than the social opportunity cost c. Shaded area F is the deadweight loss resulting from the As not consuming units of z even though their willingness to pay exceeds c.

Now suppose that, in addition to imposing the price control, the government produces g units of good z, divides them equally among the As and finances the resulting deficit by a head tax on As. It should be clear from figure 3 that such a policy can improve the welfare of the As. Effectively, the government is buying good z for the As at price c. For small amounts of g (say, less than $n_A z_A^o - S_B(\bar{p})$), this must improve the welfare of the As since their willingness to pay for good z exceeds c at the price control equilibrium. By publicly providing z, the government can reduce or eliminate the deadweight loss area F. Since the Bs are not negatively effected, we conclude that introducing public provision can result in a pareto improvement over a pure price control policy.

Given the price control $\bar{p}$, the efficient level of public provision solves the problem:

$$\text{(2)} \qquad \max_g \; v_A(\bar{p},g),$$

where $v_A(\bar{p},g) \equiv u_A(y_A - \bar{p}S_B(\bar{p})/n_A - cg/n_A, S_B(\bar{p})/n_A + g/n_A)$. The first order condition for this problem reveals, not surprisingly, that the efficient level, $g^*(\bar{p})$, is such that the As' marginal rate of substitution between the two goods is just equal to c. It follows that the

price ceiling $\bar{p}$ will still be binding at this level of public provision; that is $S(\bar{p}) < n_A z_A(\bar{p}, y_A + (\bar{p}-c)g^*(\bar{p})/n_A)$. Thus it is not generally optimal to publicly provide an amount such that the price ceiling is redundant. The pareto efficient policy involves the use of both instruments.[16] This conclusion might change if account were taken of the rent–seeking likely to be associated with a binding price ceiling.

Finally, note that the allocation which is achieved with a price control $\bar{p}$ and public provision of $g^*(\bar{p})$ is exactly the allocation which would be achieved if the government were to simply use a "discriminating" price control; that is, a control which applied only to the units of z supplied by Bs. Interestingly, discriminating rent controls are commonplace in housing markets. New apartment buildings are not subject to rent controls in many U.S. cities. Again, the choice between a discriminating price control and public provision is likely to depend on the administrative feasibility of distinguishing the two types of supply. In the housing market this would appear straightforward, in the food case, less so.

B. Robin–Hooding versus Distortionary Taxation

Obviously, if it is feasible to impose lump sum taxes on Bs, then there is no case for Robin–Hooding rents through public provision. One does not, however, need to make the extreme assumption of the availability of lump sum taxation to rule out Robin–Hooding. It is enough to suppose that the government can tax the sales of good z by Bs. As we saw in the previous section, the effect of public provision on Bs is to reduce the price they can get for selling their holdings of good z. Exactly the same effect can be achieved by levying

[16]The above analysis tells us the efficient level of public provision for any given price ceiling. If the government cares solely about the well–being of the As, it would choose a price ceiling $\bar{p}$ to maximize $v_A(\bar{p}, g^*(\bar{p}))$. It is straightforward to verify that the optimal ceiling satisfies the condition $\bar{p} = c/[1+1/\epsilon_S(\bar{p})]$. Thus the optimal price control maximizes the rent transfer D. This makes good intuitive sense. Public provision allows the government to eliminate the deadweight loss to group A — area F. Therefore, if it is concerned solely with the well–being of the As, the price control should be chosen to maximize the rent transfer.

an excise tax of c–p(g) on the units of good z sold by Bs, or by imposing a proportional tax at the rate of 1–p(g)/c on the income they derive from sales of good z. The government can then transfer the revenues raised by such taxes to As in the form of a cash transfer. As a consequence, in contrast to public provision, deadweight loss on the recipient side of the market (area E in figure 2) is eliminated. In effect, then, public provision is a more clumsy method of transferring rents from Bs than would be an excise or income tax.[17]

It follows that, if there is to be a case for public provision then it must be in an environment where a tax on the sales of good z by Bs is not feasible. One possibility is that the government is unable to distinguish or discriminate between different sellers of good z. This is plausible in the third interpretation of our model, where the rent earners are foreign suppliers. International agreements, such as GATT, may prevent a government from imposing taxes that discriminate against foreign suppliers. Alternatively, constitutional provisions may prevent discriminatory taxes against specific classes of individuals. A second possibility is that the government is simply unable to observe sales of good z. In the housing case, for example, it may be that the government's infrastructure is not sufficiently developed to monitor and record transactions in the housing market. More generally, this would certainly be the case if Bs were black–market sellers of good z. We will discuss the case for Robin–Hooding rents through public provision in both these cases.

Consider first an environment in which the government is unable to discriminate between suppliers. In this situation the government may still be able to impose a tax on the sales of good z and distribute the proceeds in the form of a cash transfer to As. It cannot, however, target the tax solely to Bs.

Suppose that the government were to levy an excise tax t^o on good z. The resulting

---

[17]This corresponds to the result in the trade literature that in an undistorted economy, a subsidy to domestic producers is dominated by a tariff on foreign producers (see Bhagwati and Srinivasan (1983)).

equilibrium is depicted in figure 4. Here, p^o denotes the post–tax equilibrium price. Group B supplies $S^o \equiv S_B(p^o - t^o)$ units of good z. Government tax revenue is $t^o \cdot S^o$ and each A receives a cash transfer of $t^o \cdot S^o/n_A$. Shaded area D (which equals $[c-(p^o-t^o)]S^o$) represents the rents transferred from Bs. Notice that p^o must be less than $c+t^o$ if the policy is to transfer rents successfully. This implies that the tax will crowd out all new production. Area E represents the deadweight loss from the Bs consuming too much z, and shaded area F the deadweight loss from the As consuming too little z.

Now consider replacing this excise tax policy with a policy under which the government imposes an excise tax of $\tau \equiv c-(p^o-t^o)$ on good z, produces an amount $g = n_A z_A(c, y_A + \tau S^o/n_A) - S^o$, and sells its production in the market. It is easy to see that c is the equilibrium price of good z under this policy. In this equilibrium, the net of tax price of good z is $c-\tau = p^o-t^o$. As a consequence, Bs continue to supply S^o units of good z. Tax revenues are $\tau \cdot S^o$ and each A receives a transfer of $\tau \cdot S^o/n_A$. Public provision generates no net deficit since the price of good z equals its production cost.

The Bs are made no worse off by the new policy, since they face the same net–of–tax price of good z. But the As are better off.[18] The same amount of rent is transferred from Bs. However, the deadweight loss area F is now eliminated. We may therefore conclude that introducing this mixed policy of excise tax and public provision results in a pareto improvement over the pure excise tax policy. Thus in an environment where the government is unable to discriminate between suppliers of good z, there may still be a role for public provision.

Consider next an environment in which the government is unable to observe sales of good z. This means that the government is unable to get directly at the income Bs get

---

[18]This intuition may be verified formally as follows: let $v_A^o \equiv v_A(p^o, y_A + t^o S^o/n_A)$ denote an A's utility under the pure excise tax policy and define Δ from the equation $v_A(c, y_A + \tau S^o/n_A - \Delta) = v_A^o$. Solving for Δ using the expenditure function reveals that Δ is positive which implies that the As are better off.

from z by taxation. Thus it may wish to employ the more clumsy device of Robin–Hooding. The desirability of Robin–Hooding will, however, depend on what other tax instruments the government has available. For example, it may be that Bs have another source of income which is taxable. Alternatively, the government may be able to tax certain commodities which the Bs consume. The question then becomes one of understanding how Robin–Hooding compares with these alternative distortionary taxes.

Obviously, the answer to this question will depend on the particular circumstances and the alternative taxes that are available. One way of extending the model to get more precise results is to model the incomes y_A and y_B as being generated by labor supply decisions and allow the government to operate a (non–linear) tax on labor income. This we do in Appendix B. There we assume that each individual in group i has wage rate (or income–generating ability) a_i. We suppose that $a_A < a_B$, so that Bs have higher wage rates as well as owning stocks of good z. The government is presumed to know the number of individuals in each group, but cannot observe any individual's wage rate; hence group membership is unclear. Individuals now have preferences over labor ℓ as well as the two goods x and z.

In the context of this framework, if individuals have identical preferences which are weakly separable between labor and the twc consumption goods, we show that, under relatively weak conditions, government provision of good z will enhance the efficiency of the redistributive process. We do this by establishing the desirability of a discriminating subsidy and appealing to the equivalence between such subsidies and public provision noted in section III. Intuitively, it should be clear that (at the very least) a small discriminating subsidy will be desirable. There will be no loss of efficiency from a very small reduction of price below c, since all deadweight loss terms are of second order. But, on the other hand, a small reduction of price will have a first order distributional effect.

This result should be contrasted with those of Atkinson and Stiglitz (1976) and Stiglitz (1982). These authors are concerned with the role that commodity taxes and

subsidies should play, when the government can impose non–linear income taxes. Their major result is that when individuals' preferences are weakly separable between labor and consumption goods, there should be no commodity taxes or subsidies. Thus we are not simply picking up the fact that subsidies are in general efficiency enhancing in the presence of non–linear income taxation. Rather, it is because reducing the price of z plays a rent–shifting role in our model that it enhances efficiency. When $\bar{z} = 0$, the model collapses to a special case of the standard optimal tax model and we get the usual no subsidy result.

V. Cautions

The previous two sections focused on the normative role for public provision. In section III we demonstrated that a government unable to tax a particular group may nonetheless be able to "Robin–Hood" rents from that group through public provision. In section IV we expanded the range of possible instruments that government could use and showed that public provision might still play a useful role in enhancing the efficiency of the transfer process. A basic message emerges: Robin–Hooding through public provision is a tool that governments can employ to the net benefit of society. The purpose of this section, however, is to offer some cautions about the use of this instrument.

The first caution concerns the potential effect of Robin–Hooding on investment. To the extent that it transfers quasi–rents, Robin–Hooding will damage agents' incentives to stay in a market.[19] In the food case, for example, farmers may reduce their production of food or even migrate to the urban area in the face of persistent Robin–Hooding. In the housing case, potential landlords might seek alternative outlets for their capital if they anticipate that public housing will be built. By taking the source of rents ($\bar{z}$) as exogenous,

[19]There is nothing particularly special about Robin–Hooding in this respect. Most taxes are taxes on quasi–rents and hence negatively affect investment. Income taxes, for example, affect human capital investments as well as labor supply decisions.

our model abstracts from these effects. They would, however, both reduce the redistributive power of Robin–Hooding and increase the distortions it creates.

Robin–Hooding's effect on investment incentives raises commitment problems similar to those discussed in the literature on the taxation of capital income (see, for example, Chari and Kehoe (1990)). Society might be better off if government could commit to limit its Robin–Hooding activities. This would prevent investors from abandoning markets vulnerable to Robin–Hooding. However, such commitments would not be credible, since administrations can not bind their successors. Whatever commitments were made, once a new generation of investors got locked in, the then administration would choose to Robin–Hood unreservedly. The government appears to have few mechanisms by which to make binding commitments, and the usual means — promises by leaders, constitutional amendents, or other kinds of legislation — might be difficult to use for this purpose.[20] Building a reputation not to expropriate may, however, be helpful, discouraging lesser temptations for Robin–Hooding, and providing reassurance to investors.[21]

The second caution concerns the incentive effects of the potential for Robin–Hooding on government officials. Public provision proves beneficial precisely where it enables society to compensate for inherent limitations in the sophistication of the policy–making process, or to overcome limits on observability and jurisdiction. This ability to slip bonds, however, may prove undesirable if society has imposed constraints it would wish to have honored. The word "exploiting" in our title purposefully has multiple meanings. Robin–Hooding offers many enticements to government officials. They may wish to employ it even if it is undesirable in some second–best sense.

In particular, to an agency trying to advance its parochial interests, Robin–Hooding

---

[20]See Rodrik and Zeckhauser (1988) for a discussion of this "dilemma of government responsiveness".

[21]Kreps (1990, pp. 531–35) provides a clear introduction to the role of reputations.

might be an inviting means of getting more personal bang for its buck (i.e., for the dollars it has been allocated) even if it happens to be socially wasteful. Consider an agency with a budget of $10 million that cares only about helping the elderly. Giving the elderly cash yields them $10 million of benefits. Spending the same amount on the construction of retirement homes lowers housing prices enough to reduce the living expenses of the elderly by $12 million. However, the reduction in the market price of existing retirement units causes a windfall loss of $5 million to private landlords. The parochial agency would choose the construction program -- a highly wasteful way to provide the extra $2 million in benefits.[22]

The final caution concerns the "fairness" of Robin–Hooding. This method of redistribution would seem to violate the principle of horizontal equity. By Robin–Hooding rents, the government *sticks the stuck*, or, in the waggish language of Sherwood Forest, it "takes from the rigid and gives to the poor". Thus two individuals in similar positions but with differing degrees of flexibility, would end up differentially effected by a Robin–Hooding policy.

Robin–Hooding would also seem to violate Hochman's (1974) notion of *transitional equity*. "Transitional equity ... [is concerned] with entitlements to certainty that pre–existing rights and endowments sanctioned by a social contract will continue undiminished. The basic issue is the fairness of windfall declines in the absolute wealth of some individuals that occur when the community–at–large, in its quest for a preferable long–run allocative or distributional income, alters its rules and institutions" (p. 330). While Robin–Hooding may impose less arbitrary, more intentional, changes in welfare than do rule changes or institutional reforms, it may be no less offensive to people's sense of entitlement to security in their property.

---

[22]Producer groups that would receive discriminatory subsidies, such as the builders of low–income housing, would be expected to lobby for that type of program.

VI. Robin–Hooding in Practice

As we noted at the outset, a substantial amount of government redistributive activity is directed to in–kind transfers. In some instances this represents Robin–Hooding in practice. Salient examples include a range of efforts from the production of low–income housing to expansion of the capacity of the health–care sector. In the 1960s and 1970s, for example, the U.S. substantially increased the ranks of medical students and added substantially to hospital capacity, in the expectation that adding to supply — whatever the level of demand — would lower medical prices.[23]

One of the arguments for building new low–income housing has long been that it would lower demand pressure, and therefore price, for units competing in the same market.[24] There is no doubt that it has often had this effect. In the 1960s, for example: "The development of Co–Op City in the Northeast Bronx induced many Italians and Jews to vacate their older lower–quality walk ups in the South Bronx. Landlords faced with a tremendous drop in demand for these units lowered their prices, and poor blacks and Hispanics moved in. Landlords suffered a wealth loss." (Hughes and Vandoren (1990), p. 104)

Developing nations have frequently responded to the political pressures of urban citizens to redistribute to them and away from the rural population, which is usually both

---

[23]Interestingly, the justification for increasing the supply of physicians was usually expressed as overcoming a shortage, rather than containing prices: "The Commission believes that there is currently a shortage of physicians and that this shortage will worsen in relation to growing demand.....The production of physicians should be increased beyond presently planned levels by a substantial expansion in the capacity of existing medical schools and by continued development of new schhols." (Report of the National Advisory Commission on Health Manpower (1967) pp. 18–19) In retrospect, it seems clear that, from a cost–containment standpoint the most salient effect of additional physicians was to expand the total amount of medical care delivered.

[24]Supply expansion has not always been the goal, witness the unusual "legal requirement, present in the first low–rent public housing legislation of 1937, for 'equivalent elimination'. That requirement, later somewhat modified, made it impossible for the national government to fund or subsidize low–rent public housing unless each project was accompanied by the removal from the market of an equal number of existing units." (Starr (1985) pp. 85–86)

poorer and less capable of exerting political pressures. Robin–Hooding is a popular strategy for effecting such redistribution. For example, in his book on government intervention in Tropical Africa, Bates (1981) notes that: "In seeking to maintain low consumer prices, the (state) marketing agencies attempt to increase urban food supplies. They do so by importing food from abroad and distributing it in the urban market. Government–sponsored food imports have become a regular feature of the agricultural cycle in Africa: as the planting season begins and domestic stocks dwindle, African governments enter the world market in search of food. And by importing food, the marketing agencies in effect compete with the local farmers in supplying the urban market, thereby lowering the price of the farmers' product." (p. 39)

Importing food is not the only way in which African governments have sought to transfer rents. Bates reports that "Many directly engage in agricultural production, using the public treasury to offset production costs and thereby providing cheap food for the urban market. In effect, they enter the market for food and set themselves up as rivals to the peasant producers." (p. 46)

Developed nations employ Robin–Hooding to change terms of trade, extracting rents from foreigners to the benefit of their citizens. Tariffs would be handy instruments to this end, but GATT rules and international norms tend to constrain or preclude their use. The subsidy of domestic competition, however, may be a mechanism for Robin–Hooding that skates by the rules. Thus, the Airbus, subsidized by France and England made the commercial aircraft market more competitive. Rents that had gone to Boeing or Lockheed got transferred to air travelers and airlines.

VII. Conclusion

This paper has explored a previously unstudied rationale for in–kind programs; namely, that they allow the government to transfer rents from one group in society to another. The practice works through pecuniary effects. By expanding the supply of a

good, an in–kind program lowers its price and thereby transfers rents from suppliers to consumers. Using in–kind programs in this way may be desirable in environments where certain groups are difficult or impossible to tax directly. This rationale appears to be behind the use of many such programs in practice.

This paper has focused on government programs that provide goods directly, or subsidize their production by others. The same type of analysis could usefully be undertaken for other types of government programs, such as taxation and public expenditure measures.[25] As an example of this more general type of Robin–Hooding, consider a tax on a commodity used for different purposes by the poor and the well–to–do. (A particular wood might be used for housing for the former, furniture for the latter.) A tax on the "affluent" use would be a redistributional measure, which should be evaluated alongside other such measures.

Some Robin–Hooding practices work by changing factor prices. Ravallion (1990), for example, shows that rural public works projects in developing countries increase the demand for labor and bid up rural wages, transferring rents from landlords to workers. More generally, government subsidies to labor–intensive industries may also raise wages, shifting rents from owners of capital to workers. Given the difficulties of taxing and spending in many contexts, these may sometimes be efficient redistributional measures.

A general lesson emerges from our analysis: The pecuniary effects of government programs, including in–kind programs, can sometimes be harnessed to enhance the efficiency of redistributional efforts.

---

[25]We are grateful to Lawrence Summers for raising this point.

References

Atkinson, A., and J. Stiglitz, 1976, The Design of Tax Structure: Direct versus Indirect Taxation, *Journal of Public Economics* 6, 55–75.

Bates, R., 1981, *Markets and States in Tropical Africa*, Berkeley, University of California Press.

Besley, T., and S. Coate, 1991, Public Provision of Private Goods and the Redistribution of Income, *American Economic Review* 81, 979–984.

Bhagwati, J., and T. N. Srinivasan, 1983, *Lectures on International Trade*, Cambridge, MA, MIT Press.

Blackorby, C., and D. Donaldson, 1988, Cash versus Kind, Self Selection, and Efficient Transfers, *American Economic Review* 78, 691–700.

Bruce, N., and M. Waldman, 1991, Transfers in Kind: Why they can be Efficient and Non–Paternalistic, *American Economic Review* 81, 1345–1351.

Chari, V., and P. Kehoe, 1990, Sustainable Plans, *Journal of Political Economy* 98, 783–802.

Coate, S., 1989, Cash versus Direct Food Relief, *Journal of Development Economics* 30, 199–224.

Garfinkel, I., 1973, Is In–kind Redistribution Efficient? *Quarterly Journal of Economics* 87, 320–330.

Hochman, H., 1974, Rule Change and Transitional Equity in *Redistribution Through Public Choice*, Hochman and Peterson, eds., 1974.

Hughes, M., and P. Vandoren, 1990, Social Policy through Land Reform: New Jersey's Mount Laurel Controversy, *Political Science Quarterly* 105, 97–112.

Kreps, D., 1990, *A Course in Microeconomic Theory*, Princeton, Princeton University Press.

Lowry, I., 1983, *Experimenting with Housing Allowances: The Final Report of the Housing Assistance Supply Experiment*, Cambridge, MA, Oegeschlager, Gunn & Hain.

Nichols, A., and R. Zeckhauser, 1981, Targeting Transfers Through Restrictions on Recipients, *American Economic Review* 72, 372–377.

Ravallion, M., 1990, Market Responses to Anti–Hunger Policies: Effects on Wages, Prices and Employment in J. Dreze and A. Sen (eds) *Hunger, Economics and Policy*, Oxford, Oxford University Press.

Report of the National Advisory Commission on Health Manpower Volume 2, 1967, Washington D.C., Government Printing Office.

Rodgers, J., 1973, Distributional Externalities and the Optimal Form of Income Transfers, *Public Finance Quarterly* 1, 266–299.

Rodrik, D., and R. Zeckhauser, 1988, The Dilemma of Government Responsiveness, *Journal of Policy Analysis and Management* 7, 601–620.

Starr, R., 1985, Twenty Years of Housing Programs, *The Public Interest* 81, 82–93.

Stiglitz, J., 1982, Self–selection and Pareto Efficient Taxation, *Journal of Public Economics* 6, 213–240.

Thurow, L., 1974, Cash versus In–kind Transfers, *American Economic Review* 64, 190–196.

Usher, D., 1977, The Welfare Economics of the Socialization of Commodities, *Journal of Public Economics* 8, 151–68.

Appendix A

The purpose of this Appendix is to present a parallel analysis of the welfare effects of public provision based on the equivalent variation measure of welfare change. To simplify notation, let $z_A(g)$ and $z_B(g)$ denote the demands of group A and B individuals respectively, when the government provides g units; that is, $z_A(g) \equiv z_A(p(g),y_A+(p(g)-c)g/n_A)$ and $z_B(g) \equiv z_B(p(g),y_B+p(g)\bar{z})$. In addition, let $v_A(g)$ and $v_B(g)$ denote the utility levels of individuals in the two groups.

Now define $\Delta_A(g)$ to be a group A individual's *equivalent variation* associated with public provision; that is, the amount of the numeraire an A would have to be given to make him as well off in the original situation as he would be with public provision of g. Formally, it is defined by the equation $v_A(c,y_A+\Delta_A(g)) = v_A(g)$. Similarly, define $\Delta_B(g)$ to be a B's equivalent variation associated with public provision of an amount g. This is defined by the equation $v_B(c,y_B+c\bar{z}-\Delta_B(g)) = v_B(g)$.

By using the consumer's expenditure function and Shephard's Lemma, the reader may easily verify that:

$$\Delta_A(g) = \int_{p(g)}^{c} [z_A^h(p,v_A(g)) - g/n_A]dp, \tag{A.1}$$

where $z_A^h(p,v_A)$ is a group A individual's *Hicksian* (or *compensated*) demand function for z. This is the analogue to area D in figure 2, except the integrand is the Hicksian demand curve rather than the Marshallian. Similarly, it can be shown that:

$$\Delta_B(g) = \int_{p(g)}^{c} [\bar{z} - z_B^h(p,v_B(g))]dp, \tag{A.2}$$

where $z_B^h(p,v_B)$ is a group B individual's Hicksian demand function for z. This is the

analogue to area D+E+F in figure 2.

The obvious measure of the inefficiencies created by the policy is the amount by which the loss of the Bs exceeds the gain of the As. Using (A.1) and (A.2), we obtain:

$$(A.3)\quad n_B\Delta_B(g)-n_A\Delta_A(g) = \int_{p(g)}^{c}[z_A(g)-z_A^h(p,v_A(g))]dp + \int_{p(g)}^{c}[z_B(g)-z_B^h(p,v_B(g))]dp.$$

The first term on the right hand side of (A.3) is the analogue to area E in figure 2, and the second the analogue to area F. This expression reveals, not surprisingly, that it is goods for which the substitution effect is large that result in large deadweight loss from Robin–Hooding. In particular, notice that if individuals consume goods z and x in fixed proportions, Robin–Hooding imposes no deadweight loss.

Appendix B

The purpose of this appendix is to investigate the role for public provision in a world in which individuals' incomes are generated by labor supply decisions and the government can tax labor income. Assume that each individual in group i has wage rate (or income–generating ability) a_i. Suppose that $a_A < a_B$, so that Bs have higher wage rates as well as owning stocks of good z. The government knows the number of individuals in each group, but cannot observe any individual's wage rate; hence group membership is unclear. Individuals now have preferences over labor ℓ as well as the two goods x and z. We assume that all individuals have identical preferences represented by the utility function $u(x,z,\ell)$. The utility function is assumed to be smooth, strongly quasi–concave, increasing in x and z and decreasing in ℓ. Furthermore, we assume that it is weakly separable between labor and the two consumption goods. Formally, this means that there exist functions $h(x,z)$ and $U(h,\ell)$ such that $u(x,z,\ell) = U(h(x,z),\ell)$. This assumption will not only make it much simpler to investigate efficient redistributive policies, but will also permit a clear distinction between our results and those in the optimal taxation literature. We retain the assumptions that the two consumption goods are normal and gross substitutes.

Analytically, the main virtue of the separability assumption is to allow the decomposition of an individual's choice problem into two parts. First, for any given level of wealth w, the individual chooses that combination of x and z that maximizes $h(x,z)$ subject to the constraint that $x + pz = w$. Let $z^*(p,w)$ be the optimal amount of z and let $h^*(p,w)$ be the value function. Second, the individual decides how much he will work and hence how much wealth he will have to spend. With no taxation and the price of good z equal to p, group A individuals would choose to earn an amount y_A, where y_A maximizes $U(h^*(p,y),y/a_A)$. Group B individuals would choose the amount y_B that maximizes $U(h^*(p,y+p\bar{z}),y/a_B)$.

Following standard practice in the optimal income tax literature, we view the

income tax problem as choosing a pair of bundles relating the gross earnings of a group i individual, y_i, with his after tax earnings, χ_i. A tax system is therefore described by a pair of bundles $\{\chi_i,y_i\}$ for i = A,B. At price p with this tax system, an A obtains utility $U(h^*(p,\chi_A),y_A/a_A)$, while a B gets utility $U(h^*(p,\chi_B+p\bar{z}),y_B/a_B)$. The difference $y_i-\chi_i$ represents the tax paid by group i individuals. In choosing the tax schedule the government must respect the requirement of incentive compatability, which requires that individuals in each group prefer the package intended for them to the one offered to the other group. The incentive compatability constraints are given by:

$$U(h^*(p,\chi_B+p\bar{z}),y_B/a_B) \geq U(h^*(p,\chi_A+p\bar{z}),y_A/a_B), \tag{B.1}$$

and

$$U(h^*(p,\chi_A),y_A/a_A) \geq U(h^*(p,\chi_B),y_B/a_A). \tag{B.2}$$

This way of formalizing an income tax system is sufficiently general to allow for non–linear taxes.

Rather than allow directly for the possibility of public provision, it will be more convenient to view the government as choosing a discriminating subsidy or, equivalently, the price difference c–p. In section III.B we established that discriminating subsidies and public provision are equivalent policies under our assumptions. Thus, if we can establish that a discriminating subsidy is desirable (i.e., that c > p and that new production takes place), it will follow that there is a case for public provision. In choosing the subsidy the government must obey the constraint that group A's demand exceeds group B's supply; that is,

$$n_A z^*(p,\chi_A) \geq n_B[\bar{z}-z^*(p,\chi_B+p\bar{z})]. \tag{B.3}$$

New production will equal this excess demand, and the cost of the subsidy policy to the government will equal $(c-p)\cdot\{n_A z^*(\cdot)-n_B[\bar{z}-z^*(\cdot)]\}$. The government's budget constraint is therefore:

$$(B.4) \qquad n_A(y_A-\chi_A)+n_B(y_B-\chi_B) \geq (c-p)\cdot\{n_A z^*(p,\chi_A)-n_B[\bar{z}-z^*(p,\chi_B+p\bar{z})]\}.$$

Pareto efficient redistribution programs can be characterized by solving the problem:

$$(B.5) \qquad \underset{\{(\chi_i, y_i)_{i=A,B},p\}}{\text{Max}} U(h^*(p,\chi_B+p\bar{z}),y_B/a_B)$$

$$\text{s.t. } U(h^*(p,\chi_A),y_A/a_A) \geq \bar{u}_A, \text{ (B.1), (B.2), (B.3), \& (B.4).}$$

There will be a case for a discriminating subsidy (and hence Robin Hooding rents through public provision) if solutions to this problem are such that $c > p$ and new production occurs.

Before we can solve problem (B.5).we need to make three technical assumptions.

Assumption 1: For all $p \in [0,c]$ and $(\chi,y) \in \mathbb{R}^2_+$

$$-U_\ell(h^*(p,\chi),y/a_A)/[a_A U_h(h^*(p,\chi),y/a_A)h_w^*] >$$
$$-U_\ell(h^*(p,\chi+p\bar{z}),y/a_B)/[a_B U_h(h^*(p,\chi+p\bar{z}),y/a_B)h_w^*].$$

This assumption says that As have steeper indifference curves in (χ,y) space or, equivalently, the increase in χ required to compensate As for a given increase in y is greater than that for Bs. This is not an unreasonable assumption since, because of their lower wage rate, As have to work harder to earn any given increase in y.

Assumption 2: Let $\{(\chi_i^o, y_i^o)_{i=A,B}, p^o\}$ solve problem (B.5) without the incentive compatability constraints (B.1) and (B.2). Then

$$U(h(p^o, \chi_B^o + p\bar{z}), y_B^o/a_B) < U(h(p^o, \chi_A^o + p\bar{z}), y_A^o/a_B).$$

This assumption says that the target level of utility for As ($\bar{u}_A$) must be sufficiently high that ignoring the incentive constraints would result in Bs choosing to masquerade as As.

Assumption 3: Let $\{(\chi_i^o, y_i^o)_{i=A,B}\}$ solve problem (B.5) with p constrained to equal c. Then

$$n_A z^*(c, \chi_A) > n_B[\bar{z} - z^*(c, \chi_B + c\bar{z})].$$

The final assumption says that in the solution to problem (B.5) when discriminating subsidies are not feasible, new production of z must be positive or, equivalently, the equilibrium price of z will be c. This requires that the demand for z from group A is large relative to the supply from group B.

These three assumptions allow us to simplify problem (B.5). Assumption 1 implies that if (B.1) is satisfied with equality and if $y_B \geq y_A$, then (B.2) must be satisfied. Assumption 2 implies that at the optimum (B.1) will be satisfied with equality. Thus, we can replace constraint (B.2) with the much simpler monotonicity constraint $y_B \geq y_A$. Assumption 3 guarantees that group A's demand will exceed group B's supply at the optimum. Thus constraint (B.3) will not be binding. It follows that problem (B.5) is equivalent to the following simpler problem:

$$\underset{\{(\chi_i, y_i)_{i=A,B}, p\}}{\text{Max}} \; U(h^*(p, \chi_B + p\bar{z}), y_B/a_B)$$

(B.6)

$$\text{s.t. } U(h^*(p, \chi_A), y_A/a_A) \geq \bar{u}_A, \; y_B \geq y_A, \; (B.1) \; \& \; (B.4).$$

The Lagrangian for problem (B.6) is:

$$
\begin{aligned}
L \equiv\ & U(h^*(p,\chi_B+p\bar{z}),y_B/a_B) + \lambda_1[U(h^*(p,\chi_A),y_A/a_A) - \bar{u}_A] + \lambda_2[y_B - y_A] \\
& + \lambda_3[U(h^*(p,\chi_B+p\bar{z}),y_B/a_B) - U(h^*(p,\chi_A+p\bar{z}),y_A/a_B)] \\
& + \lambda_4[n_A(y_A-\chi_A)+n_B(y_B-\chi_B) - (c-p)\cdot\{n_A z^*(p,\chi_A)-n_B[\bar{z}-z^*(p,\chi_B+p\bar{z})]\}].
\end{aligned} \tag{B.7}
$$

The first order conditions for the problem are therefore:

$$U_\ell(A)\lambda_1/a_A - \lambda_2 - U_\ell(B:A)\lambda_3/a_B + n_A\lambda_4 = 0 \tag{B.8}$$

$$U_\ell(B)/a_B + \lambda_2 + U_\ell(B)\lambda_3/a_B + n_B\lambda_4 = 0 \tag{B.9}$$

$$U_h(A)h_w^*(A)\lambda_1 - \lambda_3 U_h(B:A)h_w^*(B:A) - \lambda_4[n_A(1+(c-p)z_w^*(A))] = 0 \tag{B.10}$$

$$U_h(B)h_w^*(B) - \lambda_3 U_h(B)h_w^*(B) - \lambda_4[n_B(1+(c-p)z_w^*(B))] = 0 \tag{B.11}$$

$$
\begin{aligned}
& U_h(B)[h_p^*(B)+h_w^*(B)\bar{z}] + \lambda_1 U_h(A)h_p^*(A) + \lambda_3[U_h(B)(h_p^*(B)+h_w^*(B)\bar{z}) - \\
& U_h(B:A)(h_p^*(B:A)+h_w^*(B:A)\bar{z})] + \lambda_4[n_A z^*(A)-n_B(\bar{z}-z^*(B)) - \\
& (c-p)(n_A z_p^*(A)+n_B(z_p^*(B)+z_w^*(B)\bar{z})] = 0.
\end{aligned} \tag{B.12}
$$

The notation $U_\ell(A)$ denotes $U_\ell(h^*(p,\chi_A),y_A/a_A)$, $U_\ell(B:A)$ denotes $U_\ell(h^*(p,\chi_A+p\bar{z}),y_A/a_B)$, $U_\ell(B)$ denotes $U_\ell(h^*(p,\chi_B+p\bar{z}),y_B/a_B)$, etc.

Using these conditions, we may now establish:

Proposition: Let $\{(\chi_i^o,y_i^o)_{i=A,B},p^o\}$ solve problem (B.6). Then $p^o < c$.

Proof: If $\{(\chi_i^o,y_i^o)_{i=A,B},p^o\}$ solves problem (B.6) then there exist multipliers such that the

first order conditions (B.8) – (B.12) are satisfied. The proof uses these conditions to show that $c-p^o > 0$.

By Roy's Identity, $h^*_p(p,w) = -h^*_w(p,w)z^*(p,w)$. Thus we may rewrite (B.12) as follows:

$$\begin{aligned}(B.13)\quad &(1+\lambda_3)U_h(B)h^*_w(B)(\bar{z}-z^*(B)) - \lambda_1 U_h(A)h^*_w(A)z^*(A)\\ &- \lambda_3 U_h(B{:}A)h^*_w(B{:}A)(\bar{z}-z^*(B{:}A)) + \lambda_4[n_A z^*(A)-n_B(\bar{z}-z^*(B))]\\ &= \lambda_4(c-p^o)[n_A z^*_p(A)+n_B(z^*_p(B)+z^*_w(B)\bar{z})]\end{aligned}$$

In addition, (B.10) and (B.11) imply that:

$$(B.14)\qquad U_h(A)h^*_w(A)\lambda_1 = \lambda_3 U_h(B{:}A)h^*_w(B{:}A) + \lambda_4[n_A(1+(c-p)z^*_w(A))]$$

and

$$(B.15)\qquad (1+\lambda_3)U_h(B)h^*_w(B) = \lambda_4[n_B(1+(c-p)z^*_w(B))].$$

Substituting (B.14) and (B.15) into (B.13) yields:

$$\begin{aligned}(B.16)\quad &(c-p^o)\lambda_4[n_A(z^*_p(A)+z^*_w(A)z^*(A)) + n_B(z^*_p(B)+z^*_w(B)z^*(B))]\\ &= -\lambda_3 U_h(B{:}A)h^*_w(B{:}A)[\bar{z}+z^*(A)-z^*(B{:}A)].\end{aligned}$$

Under our assumption that the two consumption goods are gross substitutes, the term multiplying $(c-p^o)$ on the left hand side of (B.16) is negative. Furthermore, since both consumption goods are normal, $\bar{z}+z^*(A) > z^*(B{:}A)$, which implies the term on the right hand side is negative. It follows that $c > p^o$. □

This proposition establishes that efficient redistribution will involve the use of a discriminating subsidy or, equivalently, public provision. Notice that this depends on $\bar{z}$

being positive. When $\bar{z} = 0$, $z^*(A) = z^*(B{:}A)$ and hence (B.16) implies that $p^o = c$. Our model therefore collapses to a special case of the standard optimal tax model and we get the usual no–subsidy result.

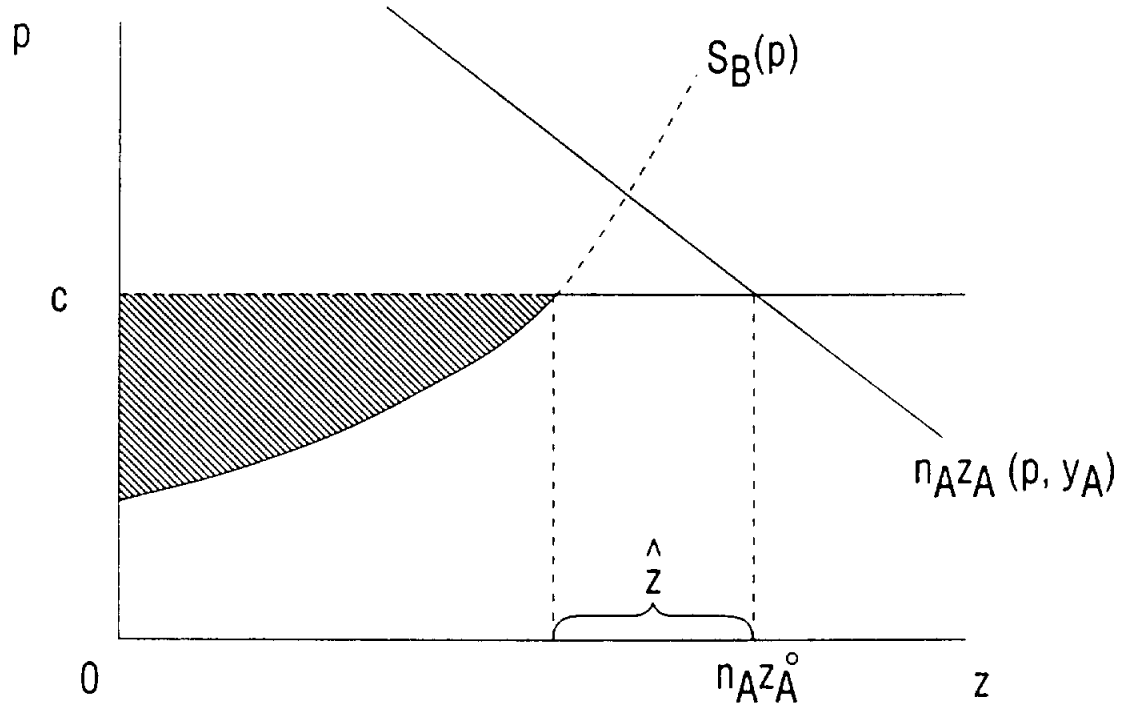

Figure 1

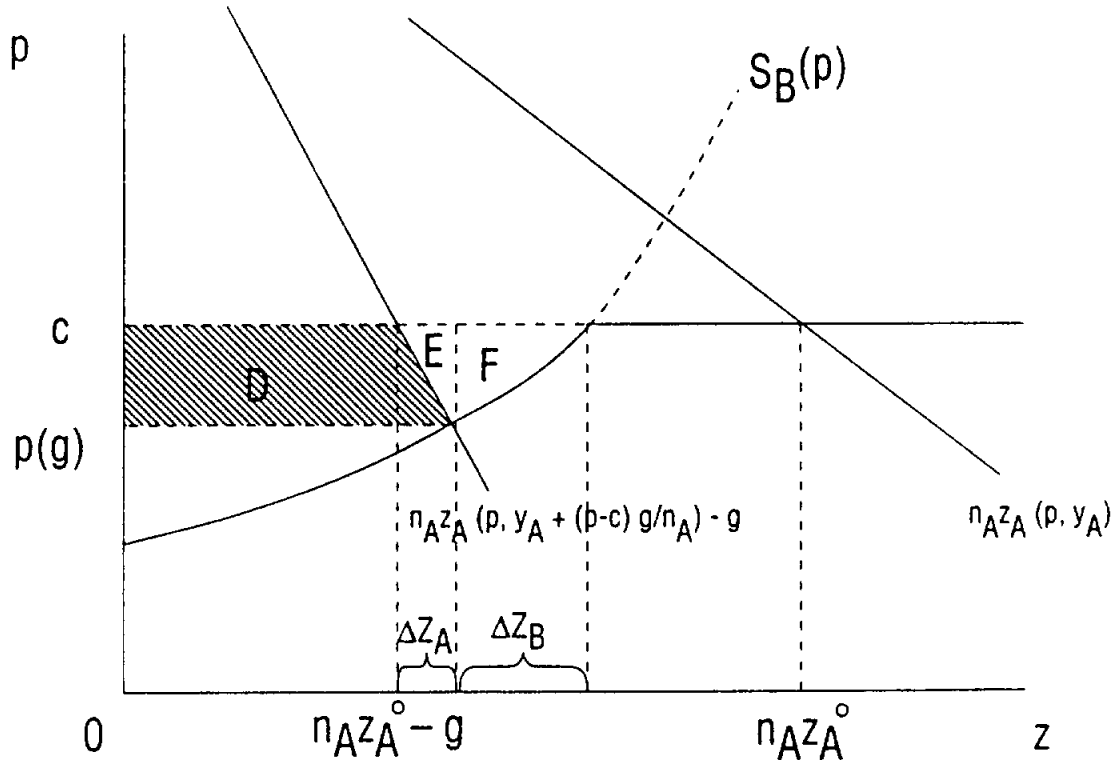
p
$S_B(p)$
c
D
E
F
p(g)
$n_A z_A(p, y_A + (p-c)\, g/n_A) - g$
$n_A z_A(p, y_A)$
Δz_A
Δz_B
0
$n_A z_A^\circ - g$
$n_A z_A^\circ$
z

Figure 2

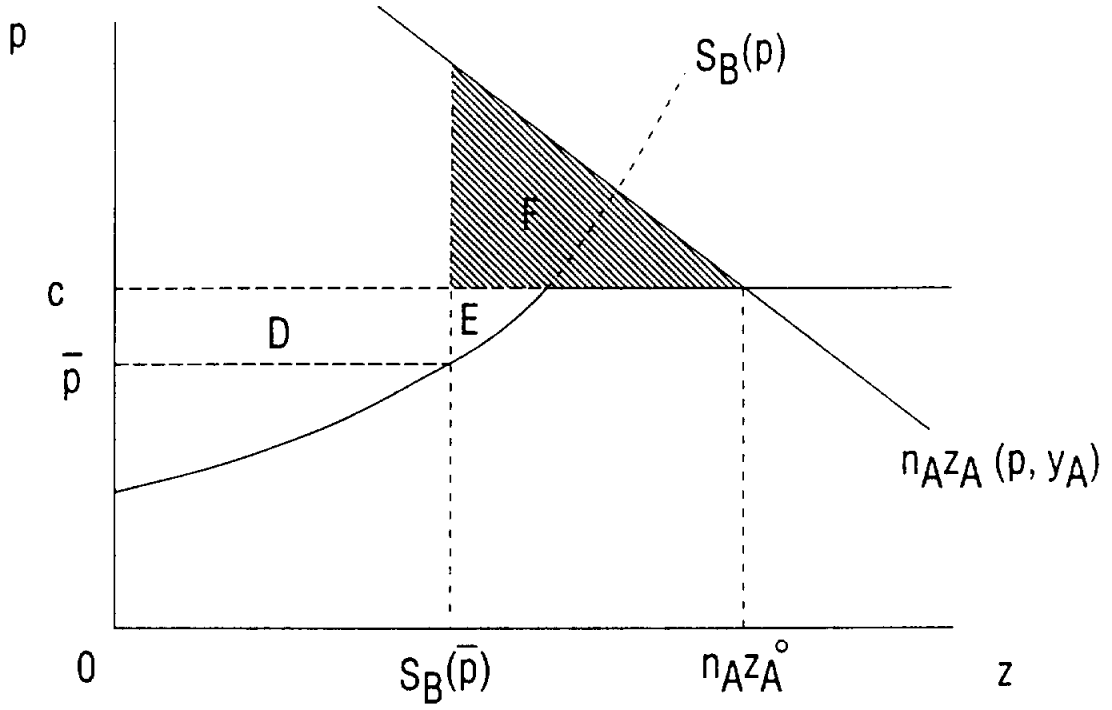

Figure 3

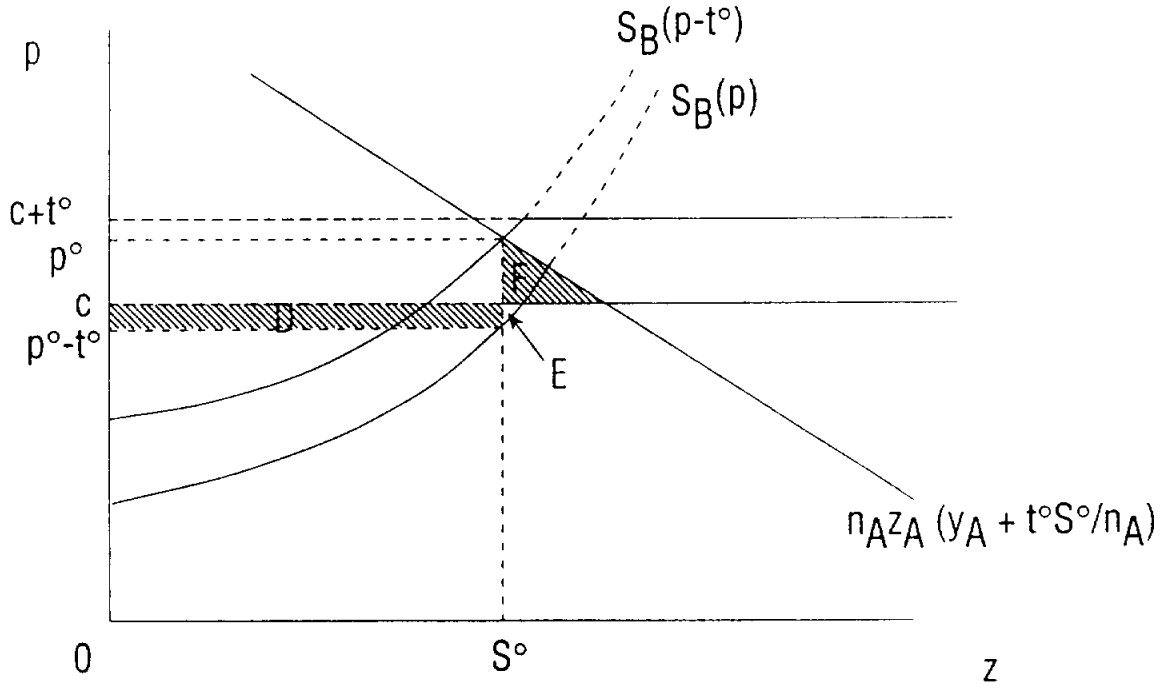

Figure 4