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Working Paper

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Kiel Working Papers, No. 702

Provided in cooperation with:
Institut für Weltwirtschaft (IfW)

Suggested citation: Stähler, Frank (1995) : Optimal transfer policies, Kiel Working Papers, No. 702, http://hdl.handle.net/10419/46761

Kieler Arbeitspapiere
Kiel Working Papers

Kiel Working Paper No. 702

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August 1995

Institut für Weltwirtschaft an der Universität Kiel

The Kiel Institute of World Economics

ISSN 0342 - 0787

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OPTIMAL TRANSFER POLICIES*

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Key words. In-kind transfers, monetary transfers, optimal policies.

JEL classification: D62, H40.

Abstract. This paper discusses the role of transfers in a non-cooperative environment. If reselling in-kind-transfers involves some retrading costs, in-kind transfers are supposed to realise at least some of the mutual bargaining gains which would be left unexploited by mere use of monetary payments. These retrading costs bias the recipient's consumption plans in favour of the donor. However, the paper shows that non-enforceability alone does not support the exclusive application of in-kind transfers in general because income effects can leave some scope for monetary transfers. The results of the model are discussed for some applications.

* I am indebted to Johannes Heister, Gernot Klepper and Jonathan Thomas for very useful discussion. The usual disclaimer applies.

1. Introduction

It is often a puzzling feature for economists that a lot of transfers are given in kind instead of cash. When two agents agree voluntarily upon a certain exchange which includes paying some transfers, both agent are at least weakly better off when the transfer is given cash instead of in kind because in-kind transfers are likely to incur some retrading costs since they do not qualify for a general currency. Hence, economic advisers are often puzzled by in-kind transfers because they apparently represent an inefficient compensation instrument. This inefficiency argument has stimulated the discussion about introducing a negative income tax which should substitute for the set of social services which are provided in kind.

However, these arguments rely on assuming enforceable agreements which determine transfer payments. Other papers have demonstrated for specific applications that in-kind transfers may qualify for an efficient instrument when agreements cannot be enforced. The papers of Garfinkel (1973) and Pollak (1988) explain in-kind transfers by paternalistic preferences. If goods which are given in kind cannot be resold (as it is guaranteed for public goods), a paternalistic agent is able to enforce the consumption of these goods by other agents. Bruce and Waldman (1991) have demonstrated that in-kind transfers can mitigate the commitment problem of an altruistic donor who faces a recipient who is able to influence future transfers. E.g., if parents will transfer the more to their children the lower their income is, children have an incentive to underinvest in their human capital in early periods. Hence, paying for the university is a better alternative for parents than paying cash. Both approaches assume a specific setting and in-kind transfers which cannot be resold. These papers are specific variants of this more general paper which will assume the mere existence of some non-zero retrading costs.

This paper will discuss the role of in-kind transfers in a general setting: a donor who is affected by the recipient's consumption plan pays some non-negative transfers to the

recipient. The donor is supposed to take the Stackelberg position such that transfers are specified in the first stage and the recipient decides on his consumption plan (which may want him to resell in-kind transfers) in the second stage. This general model will be presented in Section 2. Section 3 discusses the donor's optimal policies. Section 4 discusses applications some of which were not yet paid much attention to, and Section 5 concludes this paper. It is the aim of this paper to pronounce both the potential superiority of in-kind transfers and the beneficial role monetary transfers can still play in a non-cooperative setting.

This paper assumes complete information and does not address to information asymmetries. In another paper, Blackorby and Donaldson (1988) discuss the role of in-kind transfers for discriminating between real and pretended claims of recipients. They show that agents are more likely to refrain from pretending the need for support when support is given in kind. Their arguments for superior in-kind transfers could be easily applied on the model of this paper and emphasise the potential superiority of in-kind transfers which this paper clarifies in general.

2. The model

The model assumes two agents D (donor) and R (receiver) the utilities of both can be described by twicely differentiable utility functions. Both agents maximise their respective utilities but the donor moves first by specifying non-negative monetary and in-kind transfers which the recipient takes as given. Furthermore, the paper assumes that prices are given for both agents in order to rule out any transfer paradox (see Rao, 1992). Additionally, assuming a binding income constraint of the recipient ensures discussing a relevant problem in terms of scarce resources.

The recipient is assumed to realise a consumption bundle which embraces n goods. Consumption may be zero for some of these goods. The quasiconcave utility function of agent R which determines optimal consumption is given by

(1) $u^R = u^R(C), \qquad C = X + E - Y, \qquad Y \leq E.$

X denotes the [n×1]-row vector of goods which are bought by agent R, E denotes the [n×1]-endowment vector of in-kind transfers which are paid by agent D, and Y denotes the [n×1]-vector of in-kind transfers which are resold by agent R. $Y \leq E$ indicates that resold in-kind transfers cannot surmount received in-kind transfers. This constraint, however, will never bind because every rational consumer will never want to resale goods which he has bought on his own. Note that "≤" indicates that every column of Y does not exceed the corresponding column of E in quantity.

The budget constraint of agent R is given by

(2) $Y^R + MT + [p - c] \times Y - p \times X \leq 0.$

MT denotes the monetary transfers paid by agent D. p and c are the [1×n]-column vectors which denote prices and retrading costs, respectively. Consequently, [p-c] gives the [1×n]-vector which denotes the difference between prices and retrading costs. It is assumed that at least one good exists for which retrading costs are positive:

(3) $\forall i \in \{1,...,n\}: \qquad 0 \leq c_i \leq p_i,$

$\exists j \in \{1,...,n\}: \qquad c_j > 0.$

(3) assumes also that retrading costs do not exceed prices such that retrade incurred net costs. Note that public goods which are provided for several recipients imply a binding upper restriction, i.e. $c_i = p_i$, because public goods cannot be retraded by a single recipient. For this case, the model mirrors the policy options of a public institution which may support a set of recipients by providing a public good directly by an in-kind transfer.

Maximisation of (1) s.t. (2) gives the Kuhn-Tucker-conditions

$$(4)\quad X^* \geq 0, \qquad \frac{\partial u^R}{\partial C}[C^*] - \lambda p \leq 0',$$

$$X^* \times I' \times \left\{\frac{\partial u^R}{\partial C}[C^*] - \lambda p\right\}' = 0',$$

$$Y^* \geq 0, \qquad \frac{\partial u^R}{\partial C}[C^*] - \lambda[p - c] \geq 0',$$

$$Y^* \times I' \times \left\{\frac{\partial u^R}{\partial C}[C^*] - \lambda[p - c]\right\}' = 0',$$

$$\lambda > 0, \qquad Y^R + MT + [p - c] \times Y^* - p \times X^* = 0$$

$$C^* = X^* + E + Y^* \qquad \Rightarrow X^* \times I' \times Y^{*'} = 0'.$$

Sufficiency is guaranteed by the assumption of a quasiconcave utility function and a budget constraint which is linear in its arguments. λ denotes the shadow price of the budget constraint which (4) assumes to be positive in order to discuss a non-trivial problem. The optimal values are indicated by a star. Note that the second terms in the first and the third line of (4) are column vectors and $0'$ represents the transpose of the [n×1]-zero row vector. The slackness condition which is given in the second and the fourth column demands therefore introducing I' which is the transpose of the [n×1]-unity vector. For example, $X^* \times I'$ gives a [n×n]-matrix, which multiplied with a column vector gives the column vector which specifies slackness for all n goods.

(4) demonstrates that in-kind transfers drive a wedge between the marginal utility of selling a received good and the marginal utility of buying a good when retrading costs are strictly positive. Obviously, it is this wedge which optimal policies use to ensure a consumption structure not enforceable by pure income effects. (4) does also reveal that a certain goods will never be bought and retraded simultaneously by an agent. Therefore, the product of optimal demand for goods and of optimal supply of received goods is zero. From (4), general demand and supply functions can be derived:

(5) $X^* := X^*[MT,E],$

$Y^* := Y^*[MT,E].$

3. Optimal policies

(5) gives the optimal demand vector and the optimal supply vector as functions which depend on the monetary transfers and the endowment vector which are both specified by the donor. In a non-cooperative setting, these demand and supply functions give the recipient's response to transfer policies. Unless enforceability by binding contracts or credible punishment strategies is assumed, it is always a dominant strategy for the recipient to take the transfer and maximise his utility. Thus, (5) describes the scope of transfer policies in a purely non-cooperative environment.

The donor's concave utility function is given by

(6) $u^D = u^D[T,C^*], \quad T = MT + p \times E, \quad C^* = X^*[MT,E] + E + Y^*[MT,E],$

$$\frac{\partial u^D}{\partial T} < 0, \quad \frac{\partial^2 u^D}{\partial T^2} \leq 0,$$

$$\exists i \in \{1,\ldots,n\}: \quad \frac{\partial u^D}{\partial C_i}[0,C^*] \neq 0,$$

$$\forall j \in \{1,\ldots,n\} \wedge \frac{\partial u^D}{\partial C_j}[\cdot,C^*] \neq 0: \ \frac{\partial u^D}{\partial C_j}[\cdot,C^*]\frac{\partial^2 u^D}{\partial C_j^2}[\cdot,C^*] \leq 0.$$

The donor decreases his utility by paying transfers which consist of monetary transfers and the expenses for endowing the recipient with in-kind transfers. The impact of the recipient's consumption may increase, decrease or leave the utility of the donor untouched. (6) assumes that at least the consumption of one good touches the potential donor's utility if no transfers are paid. Thus, the recipient's consumption produces an externality which could be dealt with in a Coasian framework if contracts were perfectly enforceable. Additionally, (6) assumes that any damaging impact on the

donor's utility is marginally increasing with consumption, and that any benefiting impact on the donor's utility is marginally decreasing with consumption.

As the donor takes the Stackelberg position, he determines endowments and monetary transfers in order to maximise his utility. The necessary conditions for a maximum are given by (7a) and (7b):

(7a) $MT^* \geq 0,$

$$\frac{\partial u^D}{\partial T}\left[MT^* + pE^*\right] + \frac{\partial u^D}{\partial X^*}\left[MT^* + pE^*\right] \times \left[\frac{\partial X^*}{\partial MT}\left[MT^*, E^*\right] - \frac{\partial Y^*}{\partial MT}\left[MT^*, E^*\right]\right] \leq 0,$$

$$MT^* \left\{\frac{\partial u^D}{\partial T}\left[MT^* + pE^*\right] + \frac{\partial u^D}{\partial X^*}\left[MT^* + pE^*\right] \times \left[\frac{\partial X^*}{\partial MT}\left[MT^*, E^*\right] - \frac{\partial Y^*}{\partial MT}\left[MT^*, E^*\right]\right]\right\} = 0$$

(7b) $E^* \geq 0$

$$\frac{\partial u^D}{\partial T}\left[MT^* + pE^*\right]p + \frac{\partial u^D}{\partial X^*}\left[MT^* + pE^*\right] \times \left[\frac{\partial X^*}{\partial E}\left[MT^*, E^*\right] - \frac{\partial Y^*}{\partial E}\left[MT^*, E^*\right]\right] \leq 0'$$

$$E^* \times I' \times$$

$$\left\{\frac{\partial u^D}{\partial T}\left[MT^* + pE^*\right]p + \frac{\partial u^D}{\partial X^*}\left[MT^* + pE^*\right] \times \left[\frac{\partial X^*}{\partial E}\left[MT^*, E^*\right] - \frac{\partial Y^*}{\partial E}\left[MT^*, E^*\right]\right]\right\}' = 0'$$

It is assumed that the Hessian of this function is negative definite for the optimal policies in order to ensure sufficiency. Note that the zero terms in (7a) are zero scalars whereas the zero terms in (7b) give the transpose of the [n×1]-zero row vector. The partial derivatives of the utility functions with respect to consumption produce a column vector, the derivatives of the demand and supply functions with respect to monetary transfers produce a row vector, and the derivatives of the demand and supply functions with respect to consumption produce an [n×n]-matrix.

(7a) and (7b) do not imply that both monetary and in-kind transfers will be made use of by the donor: Either all instruments are introduced, or only one instrument is

introduced, or no instrument is introduced. The latter case is given if the marginal losses of introducing transfers surmount the marginal gains of a changed consumption plan already for the zero transfer level. (7a) and (7b) can be made more precise by using Proposition 1.

Proposition 1: *Any optimal policy will never imply retrade of received in-kind transfers.*

The proof can be given easily by contradiction: Suppose that optimal polices imply retrade and define $\Delta MT := [p - c]Y^*$ and $\Delta E := (-1)Y^*$. ΔMT is the increase of monetary transfers which equalises the income realised by retrading in-kind transfers, ΔE is the vector of decreased endowments which equalises the retraded in-kind transfers. If the donor increases the recipient's income by ΔMT and decreases the endowment by ΔE, the recipient's utility and consumption plans are not changed but his utility is increased:

$$(8) \quad \Delta MT := [p - c]Y^*,\ \Delta E := (-1)Y^*$$

$$\Rightarrow X^*, C^* = const., \qquad \Delta T := \Delta MT - p \times Y^* < 0.$$

ΔT denotes the change of the donor's total transfers. (8) shows that the donor's utility is increased as the transfer level necessary for a constant utility of the recipient is decreased. Thus, any policy implying retrade cannot be optimal. Q.e.d.

Proposition 1 implies that $Y^*[MT^*, E^*] = 0$ must hold for all utility functions satisfying (1) and (6). If optimal policies exclude retrade, the total differential at $[MT^*, E^*]$ must be zero as well:

$$(9) \quad dY^*[MT^*, E^*] = \frac{\partial Y^*[MT^*, E^*]}{\partial MT} dMT + \left\{ \frac{\partial Y^*[MT^*, E^*]}{\partial E} \right\}' \times dE = 0$$

$$\Rightarrow \frac{\partial Y^*[MT^*, E^*]}{\partial MT} = 0, \left\{ \frac{\partial Y^*[MT^*, E^*]}{\partial E} \right\}' = 0'.$$

(9) demonstrates that all derivatives must be zero as well: only zero derivatives guarantee that the total differential is zero because $[MT^*, E^*]$ is determined to maximise the donor's utility and not to satisfy the upper line of (9) in general. Proposition 1 and (9) imply revised optimality conditions:

$$(4)' \quad X^* \geq 0, \qquad \frac{\partial u^R}{\partial C}[C^*] - \lambda p \leq 0',$$

$$X^* \times I' \times \left\{ \frac{\partial u^R}{\partial C}[C^*] - \lambda p \right\}' = 0',$$

$$Y^* = 0, \qquad \lambda > 0, \qquad Y^R + MT^* - p \times X^* = 0, \qquad C^* = X^* + E^*.$$

$$(7a)' \quad MT^* \geq 0,$$

$$\frac{\partial u^D}{\partial T}[MT^* + pE^*] + \frac{\partial u^D}{\partial X^*}[MT^* + pE^*] \times \frac{\partial X^*}{\partial MT}[MT^*, E^*] \leq 0,$$

$$MT^* \left\{ \frac{\partial u^D}{\partial T}[MT^* + pE^*] + \frac{\partial u^D}{\partial X^*}[MT^* + pE^*] \times \frac{\partial X^*}{\partial T^M}[MT^*, E^*] \right\} = 0$$

$$(7b)' \quad E^* \geq 0$$

$$\frac{\partial u^D}{\partial T}[MT^* + pE^*]p + \frac{\partial u^D}{\partial X^*}[MT^* + pE^*] \times \frac{\partial X^*}{\partial E}[MT^*, E^*] \leq 0'$$

$$E^* \times I' \times \left\{ \frac{\partial u^D}{\partial T}[MT^* + pE^*]p + \frac{\partial u^D}{\partial X^*}[MT^* + pE^*] \times \frac{\partial X^*}{\partial E}[MT^*, E^*] \right\}' = 0'$$

Note that (4)' gives the reaction of the recipient to the optimal policy of the donor, and not as in (4) the reaction to any transfer policy. (7a)' and (7b)' are the result of maximising the donor's utility subject to a zero retrade vector the constraint of which will never bind due to Proposition 1.

Proposition 2 addresses substitution of monetary transfers by in-kind transfers.

Proposition 2: *If all goods of the recipient's consumption bundle are superior goods, any allocation which does not involve resale and which is attainable by both in-kind and monetary transfers is also attainable by in-kind-transfers alone.*

The proof can be developed by using the comparative statics of the equalised demand conditions:

(9) $\forall i,j \in \{1,...,n\} \wedge \forall x_i^*[MT,E], x_j^*[MT,E] > 0$:

$$\sum_j \frac{\partial u^R / \partial C_i}{\partial C_j} dC_j - p_i d\lambda = 0, \qquad p \times dX + dMT = 0$$

$$dMT = (-1)p \times dE = (-1)pdX \leq 0$$

$$\Rightarrow dC_i^* = dX_i^* + dE_i^* = 0 \Rightarrow d\lambda = 0.$$

The second line of (9) gives the comparative statics for those goods which have a strictly positive demand. If every marginal decrease dMT is exactly compensated by a respective increase of endowments which equalises the marginal decrease of goods (see second line), total consumption and the shadow price are not changed. As this result holds for marginal changes away from every MT, it holds also for $\int_0^{MT} dMT = MT$.Q.e.d. Note that this result does only hold for superior goods for which a decrease of MT is reacted to by a decrease of demand.

Proposition 2 proves the weak superiority of in-kind transfers for strict superiority of all goods. As all allocations including the best one can be obtained by an exclusive introduction of in-kind transfers, monetary transfers can be neglected in this case. However, monetary transfers may still play their role if the consumption bundle of the recipient includes inferior goods. The intuitive reasoning behind this result is simple: In a non-cooperative setting, any policy can never seize a part of an agent's consumption bundle but only change the consumption plans. As every optimal policy will avoid retrade, in-kind transfers will always add to the consumption. Monetary

transfers, however, may imply a decrease in consumption of certain goods. Thus, monetary transfers may improve on the utility of the donor if they reduce the consumption of goods which harm the donor.

Proposition 3 clarifies the scope for strict dominance of in-kind transfers.

Proposition 3: *If all goods which benefit the donor are superior and all goods which harm the donor are inferior for all transfer levels, in-kind transfers Pareto-dominate monetary transfers.*

According to (7a)', MT should be set zero in any case if

$$(10)\quad \frac{\partial u^D}{\partial T}\left[MT + pE^*\right] + \frac{\partial u^D}{\partial X^*}\left[MT + pE^*\right]\frac{\partial X^*}{\partial MT}\left[MT, E^*\right] < 0$$

holds for every non-negative MT. The second term decides on the sign of (10) while the first term is unambiguously negative. For superior goods which harm the donor, $\partial u^D/\partial X^* < 0$, $\partial X^*/\partial MT > 0$ holds, for inferior goods which benefit the donor, $\partial u^D/\partial X^* > 0$, $\partial X^*/\partial MT < 0$ holds, such that the product of the column vector indicating the marginal utility and the row vector indicating the sign of the income elasticity second term is negative. Q.e.d. However, this is the only case which excludes monetary transfers in a purely theoretical setting.

This section has demonstrated the effects of in-kind and monetary transfers for utility functions like (1) and (6). The results do also apply on multilateral relationships which are governed by multilateral externalities because increasing the set of donors, recipients and externalities does not add to the basic features the model has outlined. Additionally, quasiconcavity is a very general assumption which allows for various reformulations and interpretations. For example, (1) can also mirror a production function which produces some positive and some negative spill-overs. In this case, (1) mirrors a production function which is maximised subject to a certain production cost level. In-kind transfers dominated monetary transfers unambiguously, if and only if factor demand were superior. This example reveals that the model can be easily

reformulated to discuss other relationships which are not governed by enforceable agreements. The following section will deal with appropriate reformulations and will discuss applications of in-kind transfers.

4. Applications

The merits of in-kind transfers are actually exploited in a lot of relationships which cannot rely on enforceable contracts. Enforcement problems arise most obviously in *international relations* because the sovereignty of independent states enables every country to repudiate any claim which is due to a contract it has signed before. Hence, countries cannot credibly commit to fulfil an agreement when they are better off by breaching it. But in-kind transfers are able to mitigate this institutional deficiency. Especially international environmental agreements are often based on tied compensations for projects which have proved their environment-friendliness. E.g., an emitting country can hardly be prevented to continue investing in pollution-intensive industries after it has just received financial compensations to restrict pollution. But erecting a modern power plant can serve as an efficient in-kind transfer to overcome this deficiency because this plant can guarantee to reduce transboundary pollution significantly (for a three-country-model with in-kind transfers, see Stähler, 1996). Transfer policies may also be restricted on a partial application of in-kind transfers when the use of pollution-intensive industries shows up as an inferior good.

Generally, in-kind transfers among sovereign nations are able to stabilise agreements which would not come into force if they should be based solely on monetary payments. Another field of relationship between sovereign states is development aid. Donors often suspect that governments which receive monetary development aid are likely to allocate financial aid inappropriately. Thus, the support concentrates on technical assistance, direct investments and financial aid for projects which are controlled by the donor. Hence, it is not surprising that the international aid for

restructuring the economy and cleaning-up the environment of the former socialist countries is nearly exclusively concentrated on tied aid.

But compliance problems are also existent in a national framework, especially with respect to *social services*. The physical provision of a collective good defines an extreme in-kind transfer because retrading a collective good is impossible. In addition to free-rider effects, serious problems can arise if the recipient is a principal who decides on behalf of an agent for which the social service is provided. E.g., in most countries at least elementary school services are provided free of charge instead of paying the parents for sending their children to school. This policy may suspect that low-income parents would prefer to spend the money for their individual consumption instead of school services for their children. Because poor people have nearly nothing to lose and thereby threatening them by non-compliance sanctions is incredible, free school services can enforce a certain degree of education.

This discussion sets the stage to reconsider the approaches of Garfinkel (1973) and Pollak (1988). Paternalistic preferences can be mirrored by the utility function (6) which specifies the donor's preference what the recipient *should consume*. If the recipient's preferences are different, the enforcement problem is obvious. However, it should be carefully noticed that in-kind transfers lose their strict superiority if it is the purpose of agent D to increase R's utility. Merit goods, however, drive a wedge between the assessment of R's utility *by R* and an assessment of R's utility *by D*. This is the reason why the poor are supported by coupons for clothing, food, etc. which avoid or at least render their retrade in alcohol, drugs, etc. more difficult.

Another interpretation of the model can demonstrate that in-kind transfers are even able to mitigate the conflicts of an agent who has "two souls". The first soul defines a long-run utility which maximises welfare in the long run and the second one defines a short-run utility according to (1) which maximises the instantaneous utility. E.g., imagine a potential sportsman who knows that jogging in the morning would increase his long-run utility but every morning he has to decide he accepts that staying in bed

for another hour increases his short-run utility. Strotz (1956) demonstrated that the consistent dynamic consumption plans which are defined by the short-run decisions may fail to meet the efficient ones because the agents cannot stick to an optimal consumption plan when they do not discount future utilities exponentially. This inconsistency results in a permanent change of plans and individual welfare losses.

Because such "weak" agents are fully aware of their inefficient behaviour, they sign long-term contracts with institutions which "sell" commitment by providing in-kind transfers (for a discussion of these contracts, see Bolle, 1990). The contract specifies that the agent transfers some money to an institution or to a firm which will provide in-kind transfers to maximise the long-run utility of the agent. The weak agent takes the opportunity because retrading is impossible. Therefore, the potential sportsman joins a fitness club and pays an annual membership fee in advance. This fitness club provides sporting facilities free of charge for its members who have sunk the annual membership fee. Another example are agents who regret that they watch too much television and would appreciate to enjoy the intellectual merits of modern literature. They join a book club and thereby commit themselves to buy some books periodically.

5. Concluding remarks

This paper has shown that in-kind transfers may provide for a superior transfer instrument when agreements are not enforceable. However, in-kind transfers were often misinterpreted as incurring welfare losses because the recipient is likely to sacrifice a significant share of the transfer for transaction costs when he wants to retrade some goods. In a cooperative environment or when an agent is aiming at improving on the other agent's utility, all these arguments are well-founded. However, there is a rationale for in-kind transfers if transfers want to change the other agent's plan in a non-cooperative environment. Retrading costs may allow to realise at least some of the mutual bargaining gains which would be left unexploited by mere use of monetary payments.

The paper has also demonstrated that the general setting of the model could not support the exclusive application of in-kind transfers. Only under certain restrictions, in-kind transfers dominate monetary transfers. Income effects which affect the demand for an inferior good can leave some scope for monetary transfers. Therefore, in-kind transfers alone cannot always do a better job and need at least to be supplemented by monetary transfers when donors aim at exploiting beneficial income effects. This feature may explain why transfer policies comprise a variety of monetary and in-kind transfers.

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