Poverty reduction using self-interested intermediaries: Implications for the design of inter-governmental transfers

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Abstract

The paper studies the design of inter-governmental transfers when redistribution is e¤ected through the public provision of a private good (education) by local government agents. The central government does not necessarily have the same preferences as the local agents regarding the relative welfare of poor and non-poor individuals, but must rely on them to implement public spending decisions. This divergence of preferences induces an incentive role, which does not rely on the existence of externalities, for matching grants that take the form of two-part tari¤s. Numerical simulations are used to investigate the dependence of the matching grant on the relationship between central and local preferences, local poverty rates, and the use of poverty maps.

1 Introduction

Income redistribution has long been seen as the role of central rather than local governments, both due to the likely desirability of inter-regional transfers, and the potential for individuals to vote with their feet, that yields equilibrium uncoordinated within-region redistribution ine¤ective. In countries with sophisticated individual income tax systems, this allocation of responsibility seems appropriate. But in countries with less developed tax systems, and even in more advanced economies, redistribution often takes place via the public provision or …nancing of private goods.[1] Important examples of these are education and health services, but also include locally administered welfare programs (e.g., Galasso and Ravallion, 2000). Lately however, there has been a move towards

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[1] Atkinson and Stiglitz (1980), Blomquist and Christiansen (1999), Lommerud (1989), and Besley and Coate (1991) o¤er illustrations.

decentralized provision of these services in many countries. This paper thus examines the optimal design of intergovernmental transfers when expenditure policies with distributional e¤ects are delegated to self-interested agents at the local level.

When regions or localities (we shall use the terms interchangeably) di¤er in their incomes, there is a clear role of centrally implemented transfers between them. While the model we develop will admit analysis of such situations, our primary focus is on the role of central-local transfers as mechanisms for providing incentives to self-interested local bureaucrats or politicians. Thus we abstract, at least initially, from issues of inter-regional (sometimes called tax equalizing) transfers. For central-local budgetary policy to play a substantive role in generating incentives, two conditions must be satis…ed: …rst, the implementing agent must have di¤erent preferences to the central decision maker (the principal), and second, the actions or preferences of the agent must be private information. We focus in this paper on the case of adverse selection, in which the preferences of local agents are not known by the central authority.

All localities are populated by both poor and non-poor individuals. Each local agent allocates a …xed budget over two types of goods: a pure public good, and a private good, which we shall refer to as education. For simplicity there is no role for the private sector in the provision of either type of good. Importantly, the local agent can costlessly allocate di¤erent quantities of education to members of the two groups, but does not redistribute income between them directly. Allocations are made to maximize a weighted average of individual utilities.

The central government also cares about a weighted average of individual utilities, but this weight may di¤er from those used by the agents. Nonetheless, the center is constrained to use the local agents to make education allocation decisions. If all parties have the same preferences, and this is common knowledge, then the center's preferred allocation is easily attainable. We shall identify this as the …rst best. The second best outcome occurs when the preferences of the center and the localities can di¤er, but when the center can make (on average revenue neutral) lump-sum transfers, conditional on those local preferences. The third best, which is the primary focus of this paper, prevails when the center's preferences di¤er from those of the heterogeneous agents, but when the agents' preferences are private information. In this case, conditional lump-sum grants are infeasible, and other transfer mechanisms are needed.

In this paper, the particular …nancial transfer we shall examine is a uniform lump-sum transfer to all localities, plus a proportional share of the total education expenditures of each. Thus the center cannot subsidize or tax education spending for the poor or the non-poor separately within a locality. This assumption is motivated by recognizing the relative ease with which education expenditures on alternative groups can be relabelled.[2] This model allows us to rationalize the use of matching grants, even when there are no externalities associated with the activity upon which the grant is based. Thus it diverges

[2] This …nancing mechanism is isomorphic to the linear income tax (Sheshinski, 1972).

qualitatively from the fiscal federalism framework recently surveyed by Oates (1999).[3]

Our model is related to the literature on decentralized redistribution (Conning and Kevane, 1999, Ravallion, 1999, 1999, Galasso and Ravallion, 2000). The paper does not present a full model of the political process, in the sense that local authorities' preferences are not endogenized (as, for example, in Bardhan and Mookherjee, 1998, 1999, and 2000). However, it contributes to the literature on incentives and organizational design by formally modelling the effects of alternative central-local interactions within a normative model.

The next section presents the formal model in the tradition of the linear income tax model. Section 3 examines the second best policy, when the central government can observe the preferences of local agents, but still relies on them to implement policy choices. Section 4 presents a formal solution to the third best problem. As is typical of these kinds of models, the solution is implicit, so numerical simulations are performed to illustrate the nature of the optimal intergovernmental grants. In section 5 we allow regional poverty rates to vary, and perform a number of comparative statics exercises. This analysis permits an evaluation of so-called poverty targeting mechanisms, whereby localities with different poverty rates are treated differently. In additional, we investigate the effects of correlation between local poverty rates and local agents' preferences on optimal matching grants. Section 6 concludes by suggesting related applications of the model in the contexts of addressing the male-child bias and the allocation of international aid.

2 The model

There is a central government and a continuum of local authorities of mass one. Citizens of each jurisdiction consume three goods, education (s), a public good (g), and other consumption (c). Prices of consumption and education are normalized to one for everyone. Utility is a quasi-concave function $u(c; s; g)$ of these goods.

Citizens are either poor or non-poor. Poor people, who make up a share α of the local population, have fixed consumption c^p, and the non-poor have consumption $c^n > c^p$. The local government allocates education and the public good to individuals directly. It can tell who is who, and chooses s^p and s^n, and the single level g in accordance with its preferences and budget.

So as not to bias things in favor of larger jurisdictions, I will assume that all jurisdictions have the same number of individuals. Alternatively, we could interpret g not as a public good, but as a private good consumed at a uniform level by all individuals in the jurisdiction. Later, α will be permitted to vary across localities.

[3] Bordignon, Manasse, and Tabellini (1996) employ similar techniques to those used here, but within the context of a more traditional tax-equalization model.

2.1 Agents' preferences

Local government preferences are a weighted average of the utilities of the poor and non-poor. The weight ascribed to the well-being of the poor in the local authority's preference function is β, which is distributed across local authorities according to the distribution function F on domain $[0,1]$. Thus, s^p, s^n, and g, are chosen by the local authority to maximize

$$W(s^p, s^n, g) = \beta\alpha u(c^p, s^p, g) + (1-\beta)(1-\alpha)u(c^n, s^n, g). \tag{1}$$

A local authority's resources consist of own revenues R per capita, which we take as exogenous, and central government transfers. The latter come in the form of a grant that is a linear function of average per capita education spending, $\bar{s} = \alpha s^p + (1-\alpha)s^n$. That is, central transfers per capita are

$$T = a + b\bar{s}$$

so the local authority's per capita budget constraint is

$$g + (1-b)\bar{s} = a + R. \tag{2}$$

If the transfer is lump-sum, then $b = 0$. The local authority's problem is then to maximize (1) subject to (2). The first order conditions for s^p, s^n, and g, are

$$\begin{aligned} \frac{\beta u_s^p}{(1-b)} &= \lambda \\ \frac{(1-\beta)u_s^n}{(1-b)} &= \lambda \\ \beta\alpha u_g^p + (1-\beta)(1-\alpha)u_g^n &= \lambda \end{aligned}$$

where $u_x^q = \partial u(c^q, s^q, g)/\partial x$, $q = p$ or n. Optimal choices are denoted $s^{p*}(a + R, (1-b), \beta)$, $s^{n*}(a + R, (1-b), \beta)$, and $g^*(a + R, (1-b), \beta)$, respectively.

The local authority's "indirect welfare function" is then

$$\tilde{W}(a + R, (1-b), \beta) = \beta\alpha v^p(a + R, (1-b), \beta) + (1-\beta)(1-\alpha)v^n(a + R, (1-b), \beta)$$

where

$$v^q(a + R, (1-b), \beta) = u(c^q, s^{q*}(a + R, (1-b), \beta), g^*(a + R, (1-b), \beta)).$$

$v^q(.)$ is like the ordinary indirect utility function of a q person, except that his/her consumption of s and g are decided by the local authority. A version of Roy's identity holds in this situation, namely

$$\frac{\partial v^q}{\partial b} = \bar{s}\frac{\partial v^q}{\partial m}, \tag{3}$$

where m is the local authority's per capita lump-sum revenue, equal to $a + R$. Given (3), it follows that

$$\begin{aligned} \frac{\partial \hat{V}}{\partial b} &= \beta\alpha \frac{\partial v^p}{\partial b} + (1-\beta)(1-\alpha)\frac{\partial v^n}{\partial b} \qquad (4) \\ &= s\left[\beta\alpha \frac{\partial v^p}{\partial m} + (1-\beta)(1-\alpha)\frac{\partial v^n}{\partial m}\right] \\ &= s\frac{\partial \hat{V}}{\partial m}. \end{aligned}$$

Now, writing

$$\frac{\partial v^q}{\partial m} = \mu^q,$$

we know that

$$\beta\alpha\mu^p + (1-\beta)(1-\alpha)\mu^n = \lambda \qquad (5)$$

and indeed, since the local authority optimizes,

$$\beta\mu^p = (1-\beta)\mu^n.$$

Thus

$$\mu^p(\beta) = \frac{\lambda}{\beta} \qquad (6)$$

and

$$\mu^n(\beta) = \frac{\lambda}{(1-\beta)}. \qquad (7)$$

Note well that λ depends on β, and on $m = a + R$.

2.2 The center's preferences

Like the local agents, the central government's preferences are defined over the well-being of the citizens of each locality. The only potential difference is that the weight the center places on the utility of the poor, $\hat{\beta}$, may not coincide with that used by a local agent. The central government's valuation of citizens' utilities is

$$V(s^p; s^n; g) = \hat{\beta}\alpha u^p + (1-\hat{\beta})(1-\alpha)u^n.$$

For given transfer parameters (which might vary with β, if this is observable), local agent behavior determines a net transfers $T(\beta)$ to an authority with preference parameter β. We assume that the central government has a total budget T that can be allocated across all localities, so the center's optimization problem is to

$$\max \int_{\beta} V(s^p(\beta); s^n(\beta); g(\beta))dF \quad \text{subject to} \quad \int_{\beta} T(\beta)dF(\beta) = T. \qquad (8)$$

3 The second-best

In the first-best, the central government directly redistributes income from the non-poor to the poor. This case is of limited interest to us here. The second-best occurs when the local authorities' preferences are observable by the central government, in which case inter-governmental transfers can be conditioned on those preferences directly. Assuming then that $b = 0$ and using (6) and (7), a marginal increase in per capita lump-sum income, m, of a jurisdiction ruled by officials with preference parameter β, yields an increase in central government welfare of

$$
\begin{aligned}
\nu(\beta; m) &\equiv \hat{\beta}\alpha\mu^{p} + (1-\hat{\beta})(1-\alpha)\mu^{n} \\
&= \left(\frac{\hat{\beta}\alpha}{\beta} + \frac{(1-\hat{\beta})(1-\alpha)}{(1-\beta)}\right)\lambda(\beta; m) \\
&\equiv \xi(\beta)\lambda(\beta; m)
\end{aligned}
$$

This expression says that the marginal welfare associated with an increase in a local authority's per capita grant, as measured by the central government, is a multiple $\xi(\beta)$ of the marginal welfare as measured by the local authority itself. The center's marginal welfare is larger than the local authority's if and only if its pro-poor preference is sufficiently different to the local authority's. In particular after a little manipulation, $\xi(\beta) > 1$ if and only if

$$
\alpha(\hat{\beta} - \beta) > \beta(\hat{\beta} - \beta).
$$

There are two cases to consider: $\hat{\beta} > \alpha$, and $\hat{\beta} < \alpha$. In the first case, as long as β is smaller than α or larger than $\hat{\beta}$, $\xi(\beta) > 1$. Similarly, in the second case, as long as β is smaller than $\hat{\beta}$ or larger than α, $\xi(\beta) > 1$. Thus in both circumstances, the center's marginal welfare gain is larger than the local authority's as long as β is either low or high. Only when β is between α and $\hat{\beta}$ is the local authority's marginal welfare gain higher than the center's.

To illustrate these relationships further, consider the case $\hat{\beta} > \alpha$. As long as $\beta > \hat{\beta}$ the center's marginal welfare is larger than the local authority's - this can be interpreted as arising because there are not enough poor people (α is low) to satisfy the relatively strong pro-poor preferences of the local authority. Similarly, if β is too low (less than α), even the small number of poor, whose utilities receive a low weight by the local government, contribute little to local welfare, and relatively more to the center's measure. Only when β is intermediary, between α and $\hat{\beta}$, does the center value additional per capita income less than the local authority. The same kind of story can be told for the second case, $\hat{\beta} < \alpha$. Note that when $\hat{\beta} = \alpha$, it can be simply shown that $\xi(\beta)$ achieves a minimum value of 1 over the entire range $[0, 1]$. Thus, except when the local government's preferences are identical to those of the center ($\beta = \alpha$), the marginal welfare of income as evaluated by the center is larger than that as measured by the local government. In general however, the center's evaluation of the marginal welfare of additional per capita income can be lower than that of the local authority.

Differentiation of $\xi(\beta)$ confirms that the function attains a unique minimum at $\hat{\beta}$, which satisfies the equation[4]

$$\frac{\beta}{1-\beta} = \sqrt{\frac{(1-\theta)(1-\alpha)}{\theta\alpha}}.$$

If $\xi(\hat{\beta}) < 1$, then for localities with β in a neighborhood of $\hat{\beta}$ the marginal utility of income as assessed by the local authority is greater than as assessed by the central government. This does not, of course, imply that the central government's optimal schedule of lump-sum grants will redistribute away from localities with β near $\hat{\beta}$. This depends on the behavior of the actual marginal utility of income as β varies. A weaker proposition is that, starting from a position in which per capita grant income is distributed across jurisdictions so as to equalize local marginal welfares, the central government will wish to redistribute income from jurisdictions with "intermediary" preferences to those with more extreme preferences. Thus, suppose $m^0(\beta)$ is such that

$$\begin{aligned} \int m^0(\beta)dF(\beta) &= \int RdF(\beta) + T \\ \lambda(\beta; m^0(\beta)) &= \bar{\lambda} \text{ for all } \beta \end{aligned}$$

for some constant $\bar{\lambda}$. Starting from this distribution of income, there exist values $\beta^- < \hat{\beta} < \beta^+$ such that the central government would wish to tax jurisdictions for which $\beta \in (\beta^-; \beta^+)$, and to use the proceeds to subsidize those with preference parameters outside this range.

More generally, the central government's second-best problem is to specify the distribution of per capita income, $m^*(\beta) = a^*(\beta) + R$, that is feasible and that equalizes marginal central government welfare across jurisdictions:

$$\begin{aligned} \int m^*(\beta)dF(\beta) &= \int RdF(\beta) + T \\ \mu(\beta; m^*(\beta)) &= \bar{\mu} \text{ for all } \beta \end{aligned}$$

We do not solve this control problem here, mainly because our primary interest is in the third-best. However, it is instructive to report some descriptive results of numerical simulations. The specifications of these simulations will be discussed later, in section 5. Figure 1 shows the behavior of the local and central marginal welfares of income as functions of β when all local authorities have the same lump-sum grant (i.e., before any centrally mandated redistribution).

The marginal welfare of income as measured by local preferences, λ, increases with β. However, as measured by central preferences (in this case, $\theta = 0.5$), the marginal welfare of local income, μ, is U-shaped, slightly skewed to the

[4] The right hand side is always positive, and the left hand side ranges from 0 to ∞, so a unique solution always exists.

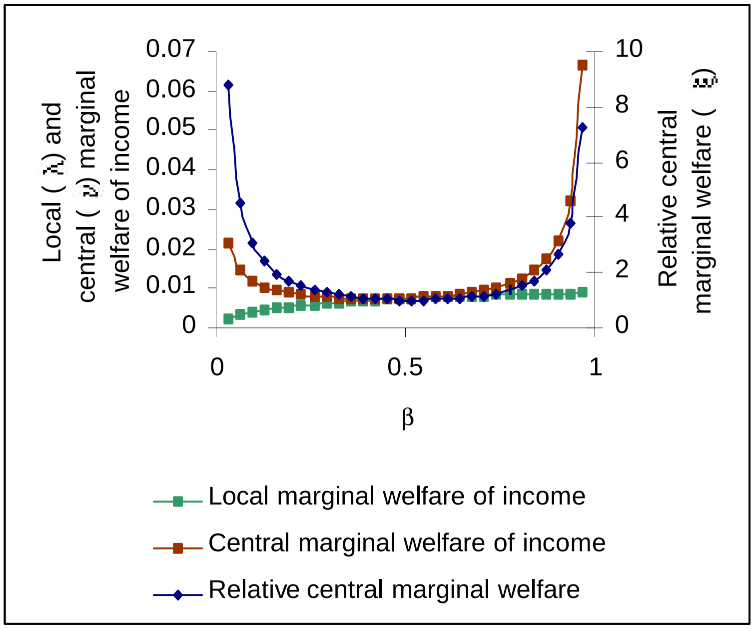

Figure 1: Local and central marginal welfare of local budget income

right relative to »(¯) due to the fact that ¸ is increasing. The optimal schedule of lump-sum grants would in general be such as to equalize º(¯) across ¯, and would be characterized by redistribution from the central range to both extremes.

4 The third best

When the central government cannot distinguish between jurisdictions on the basis of ¯, it is constrained to pay the same head grant, a, and to match education spending at the same rate, b, for all local authorities (random allocations are not considered). These parameters determine the allocation of utilities, given the local authority's preferences, ¯, which can be written

$$\hat{v}(a + R; (1 ¡ b); ¯) = b®v^p(a + R; (1 ¡ b); ¯) + (1 ¡ b)(1 ¡ ®)v^n(a + R; (1 ¡ b); ¯)$$

The optimization problem (8) then becomes

$$\max_{a;b} \int_{¯} \hat{v}(a + R; (1 ¡ b); ¯)dF \text{ s.t. } a + bE_{¯}[\bar{s}] = T \qquad (9)$$

where $\bar{s} = \bar{s}(a + R; (1 ¡ b); ¯)$.

It is worth writing the constraint in (9) as $a = T - b\bar{s}$, where $\bar{s} \equiv E_\beta[s]$, to indicate that a is an implicit function of b, $a(b)$, with derivative $a'(b) = -\bar{s} - b(d\bar{s}/db)$ (which should be negative, but it is hard to say in general). Thus, maximizing (9) over b only, the central government's first order condition is

$$\begin{aligned}
\frac{dV^E}{db} &= \int_\beta \left\{ \phi\alpha\left(\frac{\partial v^p}{\partial b} + a'(b)\frac{\partial v^p}{\partial m}\right) + (1-\phi)(1-\alpha)\left(\frac{\partial v^n}{\partial b} + a'(b)\frac{\partial v^n}{\partial m}\right)\right\} f(\beta)d\beta \\
&= \int_\beta \left[\phi\alpha\,(s + a'(b))\,\mu^p + (1-\phi)(1-\alpha)\,(s + a'(b))\,\mu^n\right] f(\beta)d\beta \\
&= \int_\beta \left[\phi\alpha\left(s - \bar{s} - b(d\bar{s}/db)\right)\mu^p + (1-\phi)(1-\alpha)\left(s - \bar{s} - b(d\bar{s}/db)\right)\mu^n\right] f(\beta)d\beta \\
&= \phi\alpha\left(\operatorname{cov}(s;\mu^p) - b(d\bar{s}/db)E_\beta[\mu^p]\right) + (1-\phi)(1-\alpha)\left(\operatorname{cov}(s;\mu^n) - b(d\bar{s}/db)E_\beta[\mu^n]\right) \\
&= 0
\end{aligned}$$

or

$$\phi\alpha\operatorname{cov}(s;\mu^p) + (1-\phi)(1-\alpha)\operatorname{cov}(s;\mu^n) = b(d\bar{s}/db)\left(\phi\alpha E_\beta[\mu^p] + (1-\phi)(1-\alpha)E_\beta[\mu^n]\right).$$

Using (6) and (7) and writing $\bar{\mu}^q = E_\beta[\mu^q]$ as the average marginal utility of income of a q-person as β varies, we arrive at an expression for the optimal sharing parameter

$$b^* = \frac{1}{d\bar{s}/db}\frac{\left[\phi\operatorname{cov}(s;\alpha\mu^p) + (1-\phi)\operatorname{cov}(s;(1-\alpha)\mu^n)\right]}{\phi\alpha\bar{\mu}^p + (1-\phi)(1-\alpha)\bar{\mu}^n}.$$

The denominator of this expression is the social marginal value of income, as measured by the central authority (with weight ϕ) aggregated across individuals, under the constraint that resources are allocated according to the local authority's preferences. This is positive. Each term in the numerator measures the covariance in average education spending across values of β with the total marginal utility of income of each group (weighted by the number of people in the group). The term out the front is likely to be positive, but due to the high degree of implicitness this is not obvious.

5 Numerical simulations

To examine the determinants of optimal inter-governmental grants, we resort to numerical simulations of the central government's optimization problem. Let us suppose that individuals have separable utility functions given by

$$u^q(c;s;g) = \omega(c)v^q(s;g)$$

where $v^q(s;g)$ is the sub-utility derived from education and the public good by a q-person, with $q = p$ or n. We assume the subutility of other consumption is a simple power function, $\omega(c) = c^h$. v^q takes on the constant elasticity of substitution form

$$v^q(s; g) = \frac{1}{1-\gamma}(\delta^q s^\rho + (1-\delta^q)g^\rho)^{(1-\gamma)/\rho}$$

where γ is the coefficient of risk aversion. The marginal rate of substitution between education and the public good for a q person is

$$\left.\frac{dg}{ds}\right|_q = -\left(\frac{\delta^q}{1-\delta^q}\right)\left(\frac{g}{s}\right)^{1-\rho}.$$

We assume that $\delta^p > \delta^n$, so for $\rho < 1$ a poor person's demand would be relatively skewed towards education ahead of the public good, compared to that of a non-poor person.[5] This feature of demand makes education an attractive basis for redistribution.

5.1 Optimal inter-governmental transfers

Our first set of simulations describes the relationship between the parameters of the optimal transfer mechanism and the relative preferences of the central and local governments. We assume that the local authorities' preference parameters are distributed uniformly on $[0; 1]$, that is $F(\beta) = \beta$, and examine how the optimal transfer parameters change with $\hat{\beta}$. All localities have the same income distributions, with half of their residents in poverty, $\alpha = 0.5$. The central transfers must be self-financing, i.e., $T = 0$. The results are presented in Figure 2, for specific paramterizations of the utility functions as indicated.

Note that even for what might be regarded as a "neutral" central government with $\hat{\beta} = 0.5$, it is optimal to provide a subsidy at the margin to education spending, $b^* > 0$.[6] Only when the central government becomes relatively anti-poor, i.e., $\hat{\beta} \approx 0.25$, is it optimal to have no subsidy at the margin (and hence no lump-sum financing tax). In the cases where central preferences are significantly anti-poor compared with the distribution of local preferences ($\hat{\beta} < 0.25$), it is optimal for the center to tax education spending at the margin. Conversely, as the preferences of the central government for the poor come to dominate most of those of the local authorities, i.e., as $\hat{\beta} \to 1$, the optimal marginal education subsidy increases, but with these parameters at least, does not rise above 40 percent.

Figure 3 illustrates the dependence of the optimal transfer parameters on local poverty rates (assumed uniform across localities). The center's preferences

[5] A more elaborate specification would make the marginal rate of substitution between education and the public good an explicit function of an individual's other income. Since there are only two types of individual in our model, this binary specification is sufficient.

[6] Note that because individuals have declining marginal utilities of income, neutrality (i.e., utilitarianism) does not imply indifference to the distribution of income.

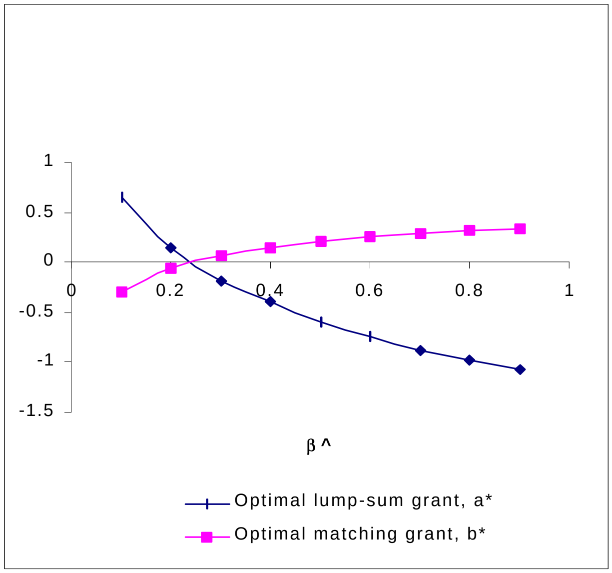

Figure 2: Optimal transfer parameters as **b** varies. [° = 2, ´^{n} = 0:3, ´^{p} = 0:8, ½ = 0:5, ® = 0:5]

are assumed to be neutral (**b** = 0:5), and the localities to be distributed uniformly over [0; 1]. An increase in the poverty rate from 45 percent to 55 percent reduces the matching component of the intergovernmental grant from about 25 percent to less than 15 percent, with an o¤setting reduction in the lump-sum tax.

5.2 Poverty targeting

There is a growing trend towards the use of so-called poverty maps to help central governments better target redistributive transfers. The simple idea is that if information about the geographic distribution of poverty can be obtained, then central transfers can be used with greater e¢cacy. In this sub-section we investigate optimal transfer parameters when poverty rates di¤er across localities, and when the central government can observe these di¤erences.

We assume there are just two di¤erent types of locality, ones with a high poverty rate (®$_H$) and ones with a low poverty rate (®$_L$). The center's problem is to make separate lump-sum transfers and matching grants to the two di¤erent types of locality, while maintaining overall budget balance. We can think of this as a two stage process, wherein the center chooses a lump-sum per capita transfer from non-poor to poor localities, and then solves the optimization problem (9) for each type of locality separately. The overall optimum is determined by varying the inter-regional transfer so as to maximize aggregate welfare, as

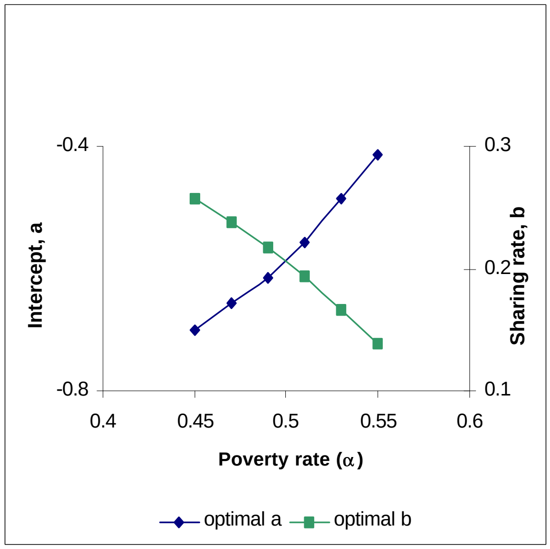

Figure 3: Effects of poverty rates on optimal transfers

measured by the center.

We maintain the assumption that all localities have the same local budget resources, so there continues to be no explicit need for fiscal equalization across regions.[7] Figure 4 illustrates the case in which the distribution of local preferences is uniform over $[0; 1]$ for both high and low poverty rate localities. Thus there is no correlation between localities' poverty rates and the redistributive preferences of the agents. Aggregate social welfare attains a maximum when approximately 3 percent of the (common) local budget is redistributed from localities with low poverty rates to those with high poverty rates. At the optimum, the optimal matching rate for low poverty localities is $b^*_L = 26$ percent, and that for high poverty rate regions is $b^*_H = 14$ percent.[8]

Although we have not modeled the formation of agents' preferences in a political economic framework, it might be expected that poverty rates and pro-poor tendencies of local officials should be correlated. A natural assumption to make is that otherwise similar localities with higher poverty rates would be controlled by agents with less interest in the well-being of the poor. On the other hand, one could argue (as Galasso and Ravallion (1999) do) that as the share of the poor in a local population rises, they become more powerful, and

[7] The regions tax bases are the same, but the number of poor people can differ. Since the incomes of the poor and non-poor are the same in the different types of regions, this assumption of equal tax bases can be questioned. It has no substantive impact on the comparative statics to come however, and is useful in sterilizing the effect of fiscal inequality on the nature of inter-governmental grants.

[8] These matching rates are not shown in the figure.

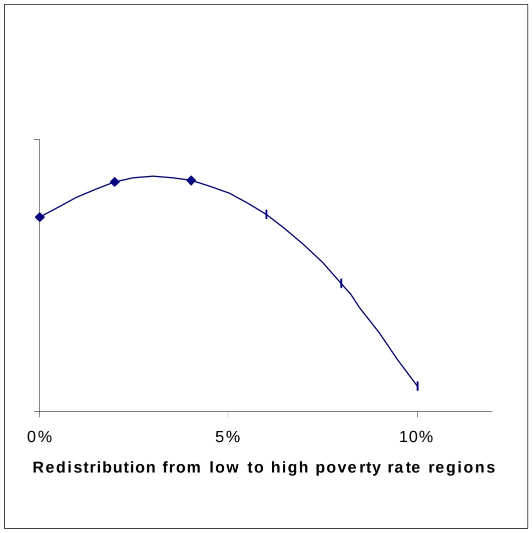

Figure 4: E¤ect of redistribution on welfare when there is no correlation between poverty rates and preferences

hence can increase the total (although not necessarily per capita) allocation of public funds to their advantage.

One approach to examining the e¤ects of correlation is to specify a one-parameter group of joint distribution functions of the form F (®; ¯ : ½), where ½ is the correlation coe¢cient, and to allow ½ to vary. However, as there is little to guide the choice of functional form, it is su¢cient at this stage to illustrate the e¤ects with some simple speci…cations. Thus Figure ?? shows the dependence of (normalized) social welfare on the size of the inter-regional redistributive transfer for three cases: zero, low, and high correlation between regions' poverty rates and the preferences of the local agents. The bottom curve (zero correlation) is just that of …gure 4 reproduced. The curve representing the case of low correlation (middle curve) corresponds to a situation in which the preference parameters of agents in low poverty rate localities are distributed uniformly over the interval [0:1; 1], while those of high poverty rate areas are distributed uniformly over [0; 0:9]. Thus agents in low poverty rate areas have, on average, greater preference for the poor than those in high poverty rate areas. The case of high correlation is also shown (top curve). In this case preference parameters are distributed uniformly over [0; 0:5] in high poverty areas, and over [0:5; 1] in low poverty areas.

In this example the higher is the (negative) correlation between a region's poverty rate and the preferences of the agent, the higher the inter-regional redistributive transfer from low poverty regions to high poverty regions. This is at …rst puzzling, since the redistribution appears to favor agents who are less pro-poor than others.

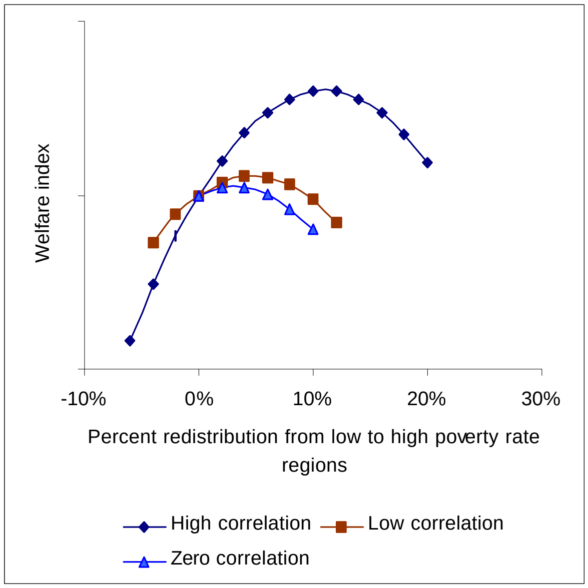

Figure 5: Optimal regional redistribution with di¤erent correlations between poverty rates and preferences

At least two features of these comparative statics results are important in understanding this result. First, since the distributions of agents' preferences are symmetrically displaced from the center's preference parameter, we need to be careful in identifying low poverty rate regions as having preferences that are closer to those of the center. Second, agents' preferences, while correlated with poverty rates are, in this model, exogenous, so invoking the language of incentives and rewards with respect to the e¤ects of inter-regional transfers is misplaced.

Both of these features are of comparatively little importance however when we consider not just the size and direction of the inter-regional transfer, but the response of the optimal transfer parameters to the changes in correlation between poverty rates and preferences. Figure 6 shows, schematically, the relationship between the matching grant rates for the low and high poverty regions (b^{*}_{L} and b^{*}_{H}) as the degree of correlation changes from zero, to low, to high.

As the correlation between poverty rates and preferences grows, regions with high poverty rates are ruled by o¢ cials who place lower weight on the well-being of the poor. Other things equal, this kind of misalignment of preferences between the center and the localities calls for a higher rate of matching grant (see Figure 2). In order to …nance this higher matching rate, the lump-sum tax levied on these localities would be increased, the e¤ects of which are partially o¤set with a larger inter-regional transfer.

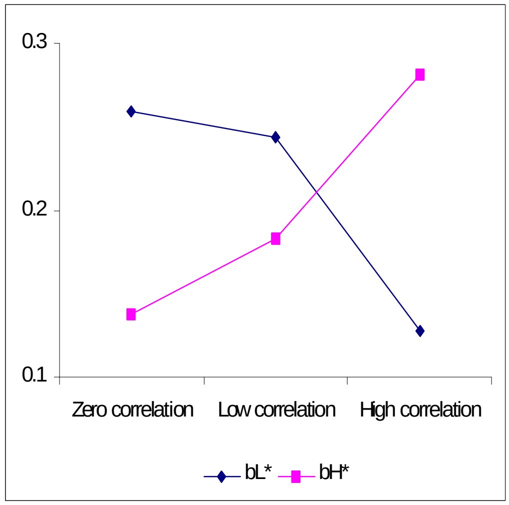

Figure 6: Optimal sharing rates as a function of the correlation between poverty and preferences

6 Other applications and conclusions

This paper has examined the way …nancial relationships between a central government and local authorities should be designed when local agents' distributional objectives di¤er from those of the center. Using the particular example of education spending, we were able to investigate the extent to which local education expenditures should be matched by central transfers, and how these parameters might vary with local poverty rates.

The model has wide applicability to other environments in which the distribution of well-being amongst individuals is of concern, and when local agents have control over the distribution of particular resources. Here we conclude by examining a number of cases where the same kinds of issues might arise.

6.1 School attendance and the male child bias

A number of studies (e.g., Elson, 1991, Garg and Morduch, 1998, and Sudha and Rajan, 1999) have documented the apparent favoritism a¤orded boys in many contexts. In particular, poor families are sometimes inclined to keep girls at home to help with household chores and income generation, while sending boys to school. One form of public intervention to address this bias is to require all children to attend school, but the chances of implementing such a policy (especially adjusting for quality of education) are low. What kind of …nancial transfer should a government design to assist in o¤setting the apparent male child preference of parents?

Within the context of our model, a pair of parents is seen as the implementing agent. It allocates a private good (schooling) across members of the family, using an implicit weight β on the well-being of girls. The financial transfer to the family takes the form of a per capita grant, plus a subsidy to the amount the family spends on education (on both boys and girls). Depending of the wealth of the family (corresponding to the local budget above), the number of girls (corresponding to the poverty rate above), and preferences, an optimal mix between these two components of the transfer can be determined. A high marginal subsidy rate would argue for basically free education for all, while a low subsidy would suggest that direct financial transfers to families, independent of educational choices, are preferred as a means of addressing gender bias. Obviously there are other aspects of intra-household allocation (e.g., access of boys and girls to health care, including immunization, etc.) that would be susceptible to similar analysis.

6.2 Allocating international aid

International donors and financial institutions often make it clear that they have specific preferences over the intended distributional effects of their policies. On the other hand, national sovereignty means that these outside interventions must usually be implemented by the national government, or at least with its acquiescence, and methods for generating incentives for "appropriate" behavior at the country level have received increasing attention recently (e.g., Collier, 1999).

The model of this paper can be used to understand the degree to which donor policies should be conditional on endogenous choices of national governments. Roughly speaking, little conditionality translates into little or no marginal subsidy (or tax), with the assistance taking the form of a more or less lump-sum grant. Higher conditionality would make the size of the financial transfer a function of performance, akin to designing a transfer with a significant matching grant component. This might sometimes take the form of a cost-sharing agreement.

A specific example of this is the recently formed Global Alliance for Vaccines and Immunizations (GAVI), a well-funded coalition of international agencies, bilateral donors, and pharmaceutical associations, that has been tasked with increasing vaccination rates of children in the developing world.[9] The large but nonetheless fixed budget of this body is to be allocated to countries as implementing agents. The model of this paper can be used to shed light on the extent to which different countries (ones with larger "local budgets", or different "local poverty rates", in the language of our model) might be required to contribute their own funds to the purchase of vaccines. Indeed, the general rules, while still under development, consist of a lump-sum payment to certain countries, plus a certain matching grant/cost sharing component. Clearly there is a high degree of heterogeneity across countries in relevant dimensions not

[9] For information on the alliance, see the web site www.vaccinealliance.org.

considered here, but an underlying, if implicit, rationale for the cost-sharing component is one of incentives.

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