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State government cash and in-kind benefits: Intergovernmental fiscal transfers and cross-program substitution

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Abstract

US states provide both cash and health insurance benefits for the poor, partially financed by fiscal transfers from the Federal government. The 1996 welfare reform drastically reduces Federal support for cash transfers *at the margin*, lowering the relative price to states of providing benefits to the poor through Medicaid. This paper analyzes the comparative-statics response of state governments to such changes in intergovernmental transfers, showing (in central cases) that they can contribute not only to *reductions* in state expenditures on cash benefits but to *increases* in expenditures on Medicaid, whether or not beneficiary populations are mobile among states.

JEL classification: H23; I18; I38

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1. Introduction

According to a longstanding tradition in the literature of federalism (dating at least to Stigler [16]), subnational governments cannot effectively execute redistributive policies. The openness of such jurisdictions implies that their ability to alter the distribution of (net) income is highly constrained, and attempts to do so will trigger inefficient reallocations of net beneficiaries and

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net contributors. Seen from this viewpoint, US experience, in which state and local governments persistently engage in programs of cash and in-kind redistribution, seems quite anomalous.[1] Notably, through the Medicaid and Temporary Assistance to Needy Families (TANF) programs (previously Aid to Families with Dependent Children, or AFDC), state governments have provided health and cash (welfare) benefits over a period of many decades.

The explanation for this apparent anomaly may lie in the structure of intergovernmental cost-sharing for state health and welfare expenditures, through which the Federal government has absorbed a large portion of state government outlays. On average, the Federal/state financing mix for these expenditures has remained fairly stable over time, with the Federal government paying for about 50–60% of expenditures for both programs during the past quarter century. Nevertheless, the state-Federal relationship has been far from static. Until the passage of the 1996 welfare reform (the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, or PRWORA), Federal assistance to the states took the form of matching grants, with matching rates that were inversely related to state per capita income but that insured that the Federal government would pay at least half and, in some cases, nearly 80%, of state outlays for AFDC and Medicaid benefits.[2] By lowering the relative price of supported activities, matching grants give rise to substitution effects (see, e.g., Wilde [21], Oates [11] for early presentations and discussion of this well-known result) that are expected to increase their amount. Since PRWORA, the Federal government has maintained approximately the same level of overall support for state cash welfare benefits through TANF,[3] but the *structure* of this support has changed: the earlier system of open-ended matching grants has been replaced by one in which grants are lump-sum in nature, so that state expenditures on cash benefits through TANF are no longer subsidized *at the margin*. Continued Federal support for state Medicaid expenditures, however, in the form of open-ended Federal matching grants, was not affected by PRWORA.

A number of analysts have drawn attention to this aspect of PRWORA and to its possible negative impact on welfare spending and caseloads. (See especially Chernick [6,7] and references therein.) An issue that has been relatively neglected in previous studies, however, is how matching grants (or their replacement by lump-sum grants) for *one* type of public expenditures (such as state spending on AFDC/TANF) may affect *other* types of recipient-government spending. AFDC/TANF and Medicaid are both means-tested programs with overlapping (though obviously not identical) beneficiary populations. How do states choose the *mix* of cash and in-kind benefits for their low-income residents, and how is this mix affected by changes in the level of Federal government support for each? Our goal, in the present paper, is to analyze how changes in the structure of intergovernmental transfers can affect the mix or composition of state government expenditures, using Medicaid and AFDC/TANF as our leading cases of grant-assisted programs

[1] There is a large literature (e.g., Ribar and Wilhelm [15] and references therein) that examines the determinants of subnational redistribution. Of course, almost all fiscal policies (e.g., education spending and tax policies (Bahl et al. [1])) have (re)distributional impacts, the subject of several other large branches of literature.

[2] The details of Federal support for and regulation of state health and welfare benefits have of course changed over time. The evolution of national and subnational government involvement in assistance to the poor has long historical antecedents, as discussed in Brown and Oates [3] and, more completely, in Lindert [9]. Modern US experience dates to the New Deal era, as discussed by Wallis [19], who notes (p. 147) that "[a]ll of the [New Deal] relief programs, except the CCC, ... required explicit or implicit matching of federal funds for state and local contributions." The provision of aid to state governments has inevitably come with "strings attached," including requirements as to eligibility and coverage, giving rise to continuous tension between national and state governments over program structure.

[3] There are, to be sure, some non-trivial variations in the levels of TANF funding relative to AFDC levels; see Powers [14].

and using the passage of PRWORA as a prime example of a policy change that substantially affects intergovernmental fiscal relations.

Specifically, in contrast to existing literature, we present a theoretical model in which lower-level governments offer both cash transfers and health-care benefits for poor households, and in which these expenditures are supported with grants from a higher-level government.[4] For Medicaid and AFDC/TANF beneficiaries, and presumably for the taxpaying populations that finance them, the benefits that they offer are partial but not perfect substitutes. Section 2 therefore presents a model in which a state's cash transfers augment the incomes of poor recipients while its in-kind health benefits provide partial protection against their health risks. In this model, a state's equilibrium policy mix depends on (a) the preferences of beneficiaries, (b) the preferences of taxpayers (or those who represent them in the political process), and (c) the level and form of financial aid provided to the state by the Federal government through its system of intergovernmental transfers in support of these two state programs.

Section 3 then undertakes a comparative-statics analysis that shows how a change in intergovernmental transfers—specifically, a reduction in the matching rate for Federal government assistance to a state's cash-transfer program—affects critical endogenous variables. In accordance with previous analyses of intergovernmental transfers, the analysis predicts that reduced Federal matching-grant support for cash transfers would reduce the generosity of state-determined cash benefits. More significantly, the analysis also shows that such a change in intergovernmental fiscal transfers would create incentives for *cross-program substitution*, resulting in *increased* generosity of health benefits, improved health for the poor, and *increased* levels of total state government expenditures for health benefits.

This analysis is undertaken first for the case where the beneficiaries of cash and in-kind transfers are unable to move from one state to another. However, interstate externalities arising from the mobility of the poor is frequently cited as one reason for Federal government grants in support of state-level transfer programs (Wildasin [20] and references therein). Section 4 therefore extends the analysis to the case where the poor are freely mobile among states, showing that the fundamental insights from the comparative-statics analysis in Section 3 continue to hold even when mobility of the poor is taken into account. Section 5 summarizes some main findings, avenues for further empirical analysis, and possible policy implications.

To help provide a concrete motivation for the theoretical analysis, this section concludes with a brief review of some striking empirical trends. First, as can be seen from Table 1, total cash welfare benefits from AFDC-TANF constitute a diminishing share of combined AFDC-TANF/Medicaid expenditures. In the early 1970s until the early 1980s, total (combined Federal/state) Medicaid spending, initially slightly greater than AFDC expenditures, grew to about

[4] Several empirical studies have already drawn attention to some aspects of cross-program substitution. In particular, Moffitt [10] and Chernick [6,7] discuss the interactions between the Federal Food Stamp program and AFDC. Moffitt [10] also considers Medicaid substitution for AFDC benefits. He finds that between 1960 and 1984 the growth of the size of a "bundle" of social transfers (including AFDC, Food Stamps, and Medicaid) matched growth in income, but the composition of these transfers shifted away from AFDC benefits towards the others. Baicker [2] finds that federally mandated increases in Medicaid eligibility in the 1980s and 1990s led states to reduce welfare expenditures, substituting of one kind of means-tested benefit for another. This empirical finding is largely consistent with our theoretical analysis which, however, highlights the role of intergovernmental grants. (Grants provide an inducement for states to comply with mandates (the "strings" attached to fiscal assistance) and the effects of the two are thus not readily distinguishable. Both emerge from a political process in which the interests of donor and recipient governments are represented. The modeling of that process goes beyond the scope of the present analysis. Chernick [5] alludes to the difficulties that this may present for empirical analysis.)

Table 1
Annual Medicaid and AFDC/TANF nominal expenditures and expenditure shares

Fiscal year	Total Medicaid spending (in millions)	Total AFDC/TANF spending (in millions)	Total state government spending (in millions)	Medicaid spending divided by AFDC/TANF spending	Medicaid spending as a % of total state government spending	AFDC/TANF spending as a % of total state government spending
2001	228,038	24,543	1,186,108	9.29	19	2
2000	206,083	22,607	1,084,097	9.12	19	2
1999	189,874	21,728	998,365	8.74	19	2
1998	177,281	21,513	929,952	8.24	19	2
1997	165,945	23,179	894,132	7.16	19	3
1996	161,963	28,193	859,599	5.74	19	3
1995	156,395	30,091	837,082	5.20	19	4
1994	143,204	28,854	774,168	4.96	18	4
1993	131,775	27,037	743,262	4.87	18	4
1992	118,166	26,606	701,601	4.44	17	4
1991	91,519	24,133	628,836	3.79	15	4
1990	72,492	22,018	572,318	3.29	13	4
1989	61,246	19,657	525,077	3.12	12	4
1988	54,116	19,016	484,667	2.85	11	4
1987	49,344	18,456	455,700	2.67	11	4
1986	44,851	17,195	424,233	2.61	11	4
1985	40,917	16,359	390,742	2.50	10	4
1984	37,568	16,069	351,182	2.34	11	5
1983	34,956	15,437	333,669	2.26	10	5
1982	32,446	14,613	310,129	2.22	10	5
1981	30,377	14,493	291,527	2.10	10	5
1980	25,781	13,435	257,812	1.92	10	5
1979	21,755	12,129	224,657	1.79	10	5
1978	18,949	11,839	203,832	1.60	9	6
1977	17,103	11,565	191,225	1.48	9	6
1976	14,644	10,745		1.36		
1975	12,637	9494		1.33		
1974	10,229	8111		1.26		
1973	9111	7613		1.20		
1972	8434	7035		1.20		

Sources: • Medicaid data from 1972 to 1996 are from Gruber [8].
• Medicaid data from 1997 to 2001 are generated from CMS-37 data, URL: http://www.cms.hhs.gov/medicaid/mbes/sttotal.pdf.
• AFDC/TANF data from 1970 to 1989 are from the 1996 Green Book [17, Table 7.4].
• AFDC/TANF data from 1990 to 2001 are from the 2004 Green Book [18, Table 7.18].
• State government data comes from the Census Bureau.

twice their size. By the mid-1990s, total Medicaid spending was about 5 times larger than AFDC/TANF; since then, the relative sizes of these programs, measured in terms of expenditures, have changed even more dramatically: total Medicaid benefits are now almost ten times larger than cash benefits through TANF, the consequence of simultaneous increases in Medicaid spending and decreases in TANF spending. These changes in expenditures are associated with corresponding and even more pronounced changes in numbers of beneficiaries.

Medicaid has grown in size not only relative to AFDC/TANF but relative to all state government spending. As a proportion of total state government expenditures, Medicaid has approxi-

mately doubled during the quarter-century between 1977 and 2001, rising from 9 to 19%, while AFDC/TANF spending, which stood at 6% of state spending at the beginning of this period, is now only about 2%. The two together have thus increased from about 15 to about 21% as a share of total state government spending.

Thus, starting from a situation over 30 years ago where expenditures on Medicaid and AFDC were approximately equal in amount, Medicaid has become by far the dominant program of means-tested state government redistributive spending, now dwarfing TANF. This shift in relative size has been ongoing, but has become particularly pronounced since the mid-1990s. These two categories of means-tested spending have been major and increasing components of state government budgets, driven by rapid increases in Medicaid spending, especially since the mid-1990s. While the 1996 welfare reform did not reduce Federal fiscal assistance for state welfare spending, it changed the form of this assistance in a way that dramatically raised the cost of such spending to state governments relative to Medicaid spending. The theoretical analysis that follows suggests that such a restructuring of fiscal assistance may help to explain the observed recent shifts in state expenditures.

We hasten to note that there are many other factors that have contributed to the changes in state expenditures in these programs. These include both demand- and supply-side factors, including rising health care costs, changes in health care technology, changes in mandated program eligibility rules, changes in state administration of programs, demographic shifts, and changes in morbidity and mortality in the recipient population. These (and a host of other possible factors) are not explicitly modeled in the following discussion, although they would very plausibly be included (though difficult to disentangle) in any satisfactory empirical analysis. Our analysis is intended partly to instigate interest in, but not to answer, the empirical question of whether the several-fold reduction in the relative cost to states of in-kind transfers may be an important determinant of the growth of Medicaid spending. To our knowledge, no empirical analysis of the growth of Medicaid spending has taken into account the possibility of cross-program substitution induced by the 1996 welfare reform. The following analysis highlights this possibility in a stark manner by omitting many other potentially important determinants of Medicaid spending.

2. The model

In order to assess how Federal assistance to state governments affects their policy choices, it is necessary to develop a model in which their policies are endogenously determined. Ultimately, this necessitates a model of political economy. We present a very simple and stylized model in which state policy choices reflect the interests of just two types of households, those who are the beneficiaries of state cash and health insurance programs (the "poor") and those whose taxes pay for these benefits (the "rich"). To simplify the analysis, this section abstracts from the potential interstate mobility of either rich or poor households and thus focuses on a single state, considered in isolation from all other states.[5] Let $\bar{N}$ denote the number of poor households; the number of rich households is normalized at 1.

[5] Note that the determination of "programmatic mix" is an issue at the national level as well as at the state level. In the US (and in other advanced economies), fixing the balance between cash (Social Security) and health (Medicare) benefits for the elderly has (and will increasingly have) major fiscal consequences. The basic model of state-level benefit determination presented here could similarly be applied, at the national level, to the analysis of this issue. In that context, however, the role of intergovernmental transfers, a focus of the present paper, is not so important.

Households of each type are endowed with labor and possibly other resources, all of which are assumed to be inelastically supplied, so that the incomes of each poor and rich household, denoted by w_P and w_R, respectively, are exogenously determined.

2.1. Poor households

The income of a poor household may be augmented by a cash transfer of b. This income is used to purchase an all-purpose good, taken as numéraire, and health care, the (fixed) relative price of which is p_m. The state government pays for a fraction $1 - c$ of the health care costs of the poor, where the policy parameter c lies between 0 and 1. Letting x_P and m denote the consumption of all-purpose good and of health care, the budget constraint for a poor household can be written as

$$x_P + cp_m m = w_p + b \equiv y, \tag{1}$$

where y is income inclusive of cash transfers.

Two comments about this specification are in order. First, public health insurance programs like Medicaid alter the prices that beneficiaries face for health care services. In the above specification, the policy parameter c is like a "coinsurance rate" for the poor. It should be viewed as an average, across many types of health care, of the fraction of costs that beneficiaries must pay. The value of c for some types of care might be 0 (the cost of services is covered completely) while for others c might be 1 (the service is not covered at all). The introduction of Medicaid, or a change in its coverage, affects the prices that recipients pay for specific types of medical services, to which recipients respond by altering the bundle of medical services that they consume, and their expenditures on medical services (and other goods) as a whole.[6] Second, to justify the assumption that poor households do not purchase private health insurance, we may appeal to the possibility of adverse selection; furthermore, government health benefits would in any case completely crowd out actuarially-fair private health insurance in this model (as discussed further in an earlier version of the paper, available on request) so that, in equilibrium, poor households would depend only on government-provided insurance, as in (1).

The utility of a poor household $u(x_P, h)$ depends on its consumption of the all-purpose good (assumed throughout to be normal) and on its health status, h. With probability π a household suffers poor health; otherwise, it is healthy. Let $\bar{h}$ denote good health, and let ℓ denote the loss in health due to illness. Assume that health care has no effect on the health status of a healthy household, for whom $h = \bar{h}$, but that each unit of health care raises the health of a sick household by one unit, for whom $h = \bar{h} - \ell + m$. (In other words, health status is measured in units commensurate with units of health care.) Health care is purchased subsequent to the realization of health status, so that a healthy household simply sets $m = 0$ and spends its entire income on consumption of all-purpose good; its realized level of utility is thus $W(y) \equiv u_P(y, \bar{h})$. A household in poor health chooses (x_P, m) to maximize $u_P(x_P, \bar{h} - \ell + m)$ subject to (1).[7] Let $(x_P[y, cp_m], m[y, cp_m])$ denote the demand functions for the all-purpose good and for health care for a household in poor

[6] This method of modeling health insurance is a simplification of the method used in Phelps [13] to model private health insurance. Technically, if all health care services were consumed in fixed proportions, the treatment of health care as a composite commodity is harmless. In general, however, such an aggregation ignores substitution effects and related policy questions about the optimal structure of prices for different types of health care.

[7] Normality of x_P implies that consumer will never fully replace the health lost due to illness, i.e., $m < \ell$ and $h < \bar{h}$ for sick households.

health and let $V(y, cp_m)$ denote its realized level of (indirect) utility. The expected utility of a poor household is thus given by

$$EU_P(b, c) \equiv \pi V(y, cp_m) + (1 - \pi)W(y). \tag{2}$$

As is clear from (2), a state's cash (b) and health care benefits (which depend inversely on c) affect the utility of poor households through their effects on the incomes of the poor (y) and on the net price of health care (cp_m).

In the following analysis, the preference structures of the poor households are assumed to be either risk averse ($u_P(x_P, h)$ is strictly concave) or, in some cases, to have preferences that are quasi-linear in the all-purpose good ($u_P = x_P + \rho(h)$, with $\rho' > 0 > \rho''$), which implies both risk-neutrality and a zero income elasticity of demand for health status. The choice of health care consumption by a poor household is discussed further in Section 3, after completing the description of the model.

2.2. Rich households

The (representative) rich household is assumed always to enjoy good health and it thus consumes only the all-purpose private good. State-financed cash and health benefits for the poor are financed by state taxation of this household. The rich household also pays taxes to the Federal government. Its budget constraint therefore takes the form

$$x_R = w_R - T_S - T_F. \tag{3}$$

The utility of the rich household depends not only on its consumption of the private good, but upon the welfare of the poor and, separately, upon the health of the poor. Quite generally, the utility function of a rich household takes the form $U_R(x_R, EU_P, h)$, where we allow, as special cases, the possibilities that the first derivatives are zero for either the second term, the third term, or both. (In the latter case, for example, the utility function effectively reduces simply to $U_R(x_R)$.) A possible rationale for the second term in this utility function is that the rich are "general altruists" toward the poor, in the sense that they care, non-paternalistically, about the welfare of the poor, as measured by their expected utility. One possible rationale for the third term in the utility function of the rich is that they separately care about the health of the poor, either because they are "specific altruists" who attach special significance to the health of the poor, perhaps because of a paternalistic concern that does not respect the preferences of the poor themselves (i.e., because they may attach more weight to the health of the poor, relative to consumption of other goods, than do the poor households). Externalities related to public health (contagion, etc.) provide another possible rationale for the inclusion of the health status of the poor in the utility function of the rich. Our general specification allows for any combination of these considerations. In any case, the utility of the rich household depends indirectly on the state's policy parameters (b, c, T_S) since these determine, indirectly, its own consumption of the private good, the expected utility of the poor, and their health status.

2.3. State and Federal fiscal policies

The state government chooses the generosity of its cash and health benefits for the poor, represented by the policy parameters (b, c). It incurs expenditures for both of these programs which may be partially compensated by transfers from the Federal government; its expenditures net of such transfers must be financed from taxes on the rich household. (The model allows for

the poor also to pay taxes; the policy parameter b should be interpreted as cash benefits to the poor, net of any taxes that they pay.) Let L denote any lump-sum transfers from the Federal to the state government in support of either program, and let μ_b and μ_m represent the proportions of state cash and health benefit outlays paid by the Federal government through matching grants. The state government budget constraint can then be written as[8]

$$(1-\mu_b)\bar{N}b + (1-\mu_m)\pi\bar{N}(1-c)p_m m(b,c) = T_S + L. \tag{4}$$

The Federal government finances its transfers to states (as well as any other expenditures, held fixed for the purposes of the analysis) through taxes collected from the rich. Budget balance for the Federal government would require that an "average" state's residents pay as much in Federal taxes as the state government receives in transfers. It is not necessary for our purposes to specify in detail how these taxes are distributed, however, or to limit the analysis to the case of an average state.

A state government's policies must satisfy (4). Subject to this constraint, how are these policies chosen? We consider two equivalent hypotheses.

The first is that the state policies are selected so as to maximize the utility of the rich household, for example because taxpayers (represented by our single rich household) are more numerous and are decisive in electoral competitions. That is, the state government chooses (b, c, T_S) to maximize $U_R(x_R, EU_P, h)$. Substituting from the state government budget constraint into the budget constraint of the rich household, this means that the state government solves the problem

$$\text{(P)} \quad \max_{\langle b,c\rangle} U_R\big(x_R, EU_P[b,c], \bar{h} - \ell + m[b,c]\big)$$

subject to

$$x_R = w_R - T_F + L - (1-\mu_b)\bar{N}b - (1-\mu_m)\pi\bar{N}(1-c)p_m m(b,c).$$

As an alternative, we could postulate that the public policies chosen by a state reflect the interests of different groups, including the poor as well as the rich. The rich may exhibit no general altruism toward the poor at all, caring only about their own private good consumption (x_R) as well as any public-health externalities associated with the health status of the poor (h), while the interests of the poor are represented by their expected utility (EU_P). Any model of the political process that produces policies that maximize a function that depends positively on the variables (x_R, EU_P, h)—for instance, many probabilistic voting models in which contending politicians maximize their probability of election, or their expected plurality (see, e.g., Persson and Tabellini [12] for a survey)—would be formally isomorphic to one in which policies are chosen to maximize the welfare of a rich household with general and specific altruism toward the poor and their health, so that equilibrium policies can be characterized as solutions to the constrained optimization problem (P). To economize on words, the discussion to follow does not explicitly refer to this second interpretation but statements about the preferences of the rich household could be rephrased in terms of the "as if" preferences of politicians, induced by a probabilistic voting model.

Before turning to the formal analysis, it is important to note that if the rich household only cares about the welfare of the poor and not (separately) about their health, there will be no special

[8] The model can easily accommodate any other state government expenditures for purposes other than benefits for the poor; one need only interpret the term T_S to represent state taxes collected from the rich, net of any other exogenously-given state expenditures.

benefit attached to the provision of health-care benefits, whereas the converse is true if the rich household does not care at all about the welfare of the poor. Under either of these specifications, only one type of transfer program (cash or health) would exist in equilibrium, and the model cannot be used to analyze an economy in which both types of programs exist.

3. Comparative statics analysis

There are two levels of comparative statics analysis that we must consider. The first concerns the response of poor households to changes in state-level cash and health benefits policies. These impacts must be analyzed because they enter into the determination of state-level policies, as described by problem (P) above. The second level of comparative statics concerns the response of state policies—the choices of the policy parameters (b, c)—to changes in intergovernmental fiscal transfers on the part of the Federal government. The details of the comparative statics analysis are largely relegated to Appendix A; the main results are summarized here. In order to focus on the role of relative price changes facing consumers and state policymakers, some of the main results below are derived under the assumption that households have quasi-linear preferences, so that perverse income effects can be ruled out.

3.1. The effect of state policies on poor households

The state policy parameter b affects all poor households, both those that are healthy and those that are sick, because cash transfers are not conditioned on health status. On the other hand, the generosity of state health benefits, represented (inversely) by the parameter c, only affects those households who have poor health, since $m = 0$ for healthy households. The following results, which follow from standard consumer theory, are used in the sequel.

Proposition 1. *If the all-purpose good and health status are non-inferior goods, then*:

(a) *An increase in cash benefits* (*weakly*) *increases consumption of the all-purpose good by all poor households and of health care by the sick, and increases the expected utility of the poor.*
(b) *An increase in c* (*reduced generosity of health benefits*) *reduces consumption of health care by sick households and the expected utility of all poor households.*

Part (b) follows because the policy parameter c determines the relative price of health care for the poor.

Since sick households are worse off than healthy ones, poor households face risk. In particular, subsidized health care for the poor not only increases their consumption of health care by lowering its relative price, it also transfers resources to the poor households who are least well-off and, in this way, it serves an important insurance function. In order to clarify the intuition of the results to follow, it is sometimes helpful to focus on a limiting case:

(A) The preferences of poor households are quasi-linear in consumption of the all-purpose good, i.e, $u_P(x_P, h) = x_P + \rho(h)$, where ρ is strictly increasing and concave (i.e., $\rho' > 0 > \rho''$).

When this assumption is imposed, poor households are risk-neutral rather than risk-averse and the income elasticity of demand for health status is zero. The results obtained in this limiting

case also hold, approximately, when preferences are nearly quasi-linear, i.e., when households are not "too" risk averse and have a "small" income elasticity of demand for health status.

3.2. Equilibrium state policy choices

The solution to problem (P) is characterized by the first-order conditions with respect to b and c, derived in Appendix A, which are the basis of the comparative statics analysis of state policy. These conditions take a particularly simple form under assumption (A), yielding, respectively,

$$MRS_U = (1-\mu_b)\bar{N} \tag{5}$$

and

$$\pi\big(MRS_U - (1-\mu_m)\bar{N}\big)m = s\big(MRS_h - (1-\mu_m)\bar{N}\pi(1-c)p_m\big); \tag{6}$$

here, $MRS_U \equiv (\partial U_R/\partial EU_P)(\partial U_R/\partial x_R)^{-1}$ denotes the rich household's marginal rate of substitution between the expected utility of the poor and the all-purpose good and MRS_h similarly denotes its marginal rate of substitution between health care for the poor and the all-purpose good. In addition, $s < 0$ is the Slutsky substitution term for the own-price derivative of demand for health care. These conditions are readily interpretable.

The first, which is like the Samuelson condition for efficient provision of a public good, states that the optimal state policy balances the marginal benefit of cash transfers to the poor against the marginal cost to state taxpayers, which is reduced by whatever matching grant assistance the state receives from the Federal government.

The left-hand side of (6) is the marginal benefit to the rich from the welfare gain enjoyed by the poor when the cost of health care to them is reduced ($\pi m MRS_U$) minus the marginal cost of this small reduction in price ($\pi m(1-\mu_m)\bar{N}$), reflecting whatever assistance the state receives from the Federal government in the form of matching grants for Medicaid. The right-hand side reflects the relative-price effects of a small reduction in the cost of health care for the poor, the magnitude of which depends on the size of the substitution term s. An increase in health care for the poor benefits the rich directly because it generates a positive consumption externality (MRS_h); for this reason, the poor would "underconsume" health care if they paid its full price. This price, in the absence of matching grants, is p_m adjusted for the size of the consuming group ($\pi\bar{N}$); when the Federal government provides a matching grant for health benefits, the price to the state falls by the proportion $(1-\mu_m)$. The health-consumption externality to the rich would be precisely internalized by reducing the price of health care to the poor by a proportion $(1-c)$ that reduces the right-hand side of (6) to zero.

Combining the two first-order conditions above, we obtain an especially transparent characterization of the equilibrium state policy:

Proposition 2. *Under assumption* (A)*, the state government chooses a mix of cash and health benefits satisfying the condition*

$$\pi(\mu_m - \mu_b)\bar{N} = \frac{\epsilon_m}{cp_m}\big(MRS_h - (1-\mu_m)\bar{N}\pi(1-c)p_m\big) \tag{7}$$

where ϵ_m $(\equiv cp_m s/m)$ *is the compensated price elasticity of demand for health care by poor consumers.*

This result takes an especially simple form when, as was true prior to PRWORA, the following condition holds:

(B) The Federal matching grants rates for cash and health assistance are (initially) equal, i.e., $\mu_b = \mu_m$.

Since the left-hand side of (7) is zero when $\mu_b = \mu_m$, we have:

Corollary to Proposition 2. *Under assumptions* (A) *and* (B)*, the state chooses its health benefits solely in order to internalize the consumption externality associated with the health status of the poor.*

The special assumptions (A) and (B) reveal some of the basic intuition of the model especially clearly. From the Corollary to Proposition 2, it is clear that state health benefits disappear entirely unless the rich derive some special benefit from improved health for the poor. (If the rich do not care at all about the health of the poor, then satisfaction of (7) requires $c = 1$ (no public health coverage).) When both types of benefits are equally supported by the Federal government, there is no special incentive on that account to provide one type of benefit rather than the other, and, to whatever extent the rich care simply about the welfare of the poor and not specifically their health, they would favor the use of cash rather than health benefits because this allows the poor to use the resources provided by the rich in a manner that maximizes their expected utility.[9] "General altruism," in other words, favors "general egalitarianism" in this model, and "specific egalitarianism," in the form of state health benefits, requires "specific altruism" or, in less lofty terms, perhaps simply a fear of epidemic.

Let us note, finally, that the basic intuition presented above remains fundamentally valid if we relax assumptions (A) and (B). The first-order conditions naturally become more complex, however, reflecting the role of risk aversion and income effects on the demand for health care by the poor, as spelled out in Appendix A. Since a main objective of our analysis is to highlight the impact of changes in Federal government grant policies, we continue to focus on the case where (A) and (B) hold, since this reveals those impacts most clearly.

3.3. The effects of Federal grants on state policies: comparative statics

We are now in a position to see how a change in Federal government grant policies, corresponding to those brought about through PRWORA, affect equilibrium state policies. In terms of our notation, PRWORA resulted in a decrease in the Federal matching rate for cash benefits, μ_b, starting from an initial situation where $\mu_b = \mu_m$, i.e., a situation corresponding to assumption (B). We can also investigate the effect of a similar change in Federal matching grant support for Medicaid, that is, a change in μ_m; recent policy debates have raised this as a possible reform.

In order to obtain simple and clear-cut results, we make two further assumptions:

(C) The compensated price elasticity of demand for health care by poor households ϵ_m is (locally) constant.

[9] Under assumption (A), in fact, cash transfers would lead only to increased consumption of the all-purpose good, since the income elasticity of demand for health care is zero in this case.

(D) The preferences of the rich household are quasi-linear in consumption of the all-purpose good, i.e, $U_R(x_R, EU_p, h) = x_R + \phi(EU_P) + \psi(h)$ where ϕ and ψ are strictly increasing and concave.

The first of these is a purely technical assumption used to streamline the analysis. The second assumption rules out income effects arising from the preferences of the rich households. All of the following results continue to hold without either of these assumptions, provided that the compensated elasticity for health care does not vary too much, and that income effects in the preferences of rich households are not too large, both evaluated locally, i.e., in the neighborhood of an initial equilibrium.[10]

To begin with, we examine the effects of changes in matching grants on the state policy parameters (b, c):

Proposition 3. *Under assumptions* (A)–(D)*, a reduction in the Federal matching rate for cash transfers, μ_b, reduces the equilibrium level of cash benefits b and increases the generosity of state health benefits by reducing c, the portion of health care costs paid by the poor. A reduction in the Federal matching rate for health benefits, μ_m, has the opposite of these effects. Formally,*

$$\frac{\partial b}{\partial \mu_b} > 0 < \frac{\partial c}{\partial \mu_b} \quad \textit{and} \quad \frac{\partial b}{\partial \mu_m} < 0 > \frac{\partial c}{\partial \mu_m}.$$

The proof of this proposition is sketched in Appendix A. Its main implication is that the relative price effects of changes in Federal government matching grants alter the incentives for states to offer cash or health benefits for the poor. The own-effect of these changes in grants (that is, the effect of μ_b on b and of μ_m on c) are exactly as expected from standard analyses of matching grants. Proposition 3 also signs the *cross effects* of a change in matching grant support for one type of program on a recipient government's policy choices regarding a different program. In this respect, Proposition 3 goes beyond previous theoretical analyses, few (if any) of which study the cross-program effects of intergovernmental transfers. These cross effects are of critical importance if we seek to understand how PRWORA may have affected state government Medicaid policies. As an obvious implication of these results, note:

Corollary to Proposition 3. *The health care consumption of the poor, and thus their health status, depends positively on the matching grant rate for health benefits and negatively on the matching grant rate for cash benefits.*

Since it operates on the relative price of health care for the poor, the "coinsurance rate" c is a critical parameter in our model. It does not, however, correspond directly to observed budget items such as state expenditures on health benefits or the other fiscal outcomes shown in Table 1. In the model, total state government spending for health benefits is represented by $M \equiv$

[10] The Federal government budget constraint plays no important role in the model because of the quasi-linearity of the preferences of the rich households. A change in matching grant rates must be financed either by a change in Federal taxes paid by the rich T_F, by a change in lump-sum grants to states, L, or by any combination of the two. With quasi-linear preferences, neither matching grants nor lump-sum taxes and grants give rise to any income effects, unlike with more general preferences. However, the substitution effects of changes in grant structure would still "normally" dominate in the general case because the income effects of changes in matching grants would be offset, to a first approximation, by the changes in lump-sum taxes or transfers needed to balance the Federal budget. As discussed further in the conclusion, PRWORA exemplifies just this kind of policy combination.

$\pi \bar{N}(1-c)p_m m$, of which the proportion $(1-\mu_m)$ is financed from *own-source* revenues. Since the state policy parameter c depends on the Federal matching grant rates, state expenditures depend both directly and indirectly on these rates in a rather complex way: a change in grant policy directly affects transfers to the state, it alters equilibrium state policies, and this alters health care consumption by the poor. All of these impacts affect state government finances. The combined impact is as follows (see Appendix A for the proof):

Proposition 4. *Under assumptions* (A)–(D)*, a reduction in the Federal matching rate for cash transfers, μ_b, increases the total amount of state expenditures on health benefits and reduces state expenditures on cash transfers. A reduction in the Federal matching rate for health benefits, μ_m, has the opposite of these effects. Formally,*

$$\frac{\partial \bar{N} b}{\partial \mu_b} > 0 > \frac{\partial M}{\partial \mu_b}; \qquad \frac{\partial \bar{N} b}{\partial \mu_m} < 0 < \frac{\partial M}{\partial \mu_m}.$$

This proposition, then, suggests that PRWORA would have a positive cross-effect on state government expenditures on health benefits, as the states substitute away from cash benefits and toward greater generosity in their Medicaid policies. As an obvious implication of this finding, we note:

Corollary to Proposition 4. *A reduction in the Federal matching rate for cash benefits results in an increase in the equilibrium level of Federal transfers to the states for health benefits.*

4. Mobility of beneficiaries

The model so far has assumed that the beneficiaries of cash and health benefits are completely immobile. The actual or potential mobility of poor households and its importance for anti-poverty policy has been the subject of extensive analysis (see Brueckner [4] for a review of and citations to relevant literature). Indeed, the possibility of such mobility is sometimes cited as a reason for Federal government support for programs such as AFDC/TANF and Medicaid, since the interstate movement of beneficiaries could mean that state-level redistributive transfers produce positive interstate fiscal externalities. These considerations justify some attention to the case where poor households are mobile among states. The present section sketches the extension of the analysis of Sections 2 and 3 to this case. Assumptions (A)–(D) are maintained throughout.

First, suppose that poor households are costlessly mobile among states, and that they move to locations that maximize their expected utility. This means that the equilibrium level of expected utility for the poor must be the same in all states where they reside. Assume further that each state takes this equilibrium level of expected utility, $\widehat{EU}_P$, as parametrically-given when it formulates its redistributive policies.[11] Under these assumptions, the problem solved by an individual state government differs from (P) in two ways. First, the number of poor residents in a state N is endogenously determined and, second, the level of expected utility for the poor is treated as exogenously fixed.

To determine the equilibrium number of poor in a state, assume that total state output (measured in units of numéraire) is given by a strictly-concave and increasing function $F(N)$, that

[11] That is, states are "small" and "open." We do not attempt to study the intermediate cases where households are partially but not freely mobile and where there are several but not many states, focusing just on what amounts to the polar opposite case of the "closed" economy analyzed in previous sections.

factor markets are perfectly competitive, and that rich residents receive all income produced within a state other than the earnings of the poor.[12] Under these assumptions,

$$w_P = F'(N) \quad \text{and} \quad w_R = F(N) - NF'(N). \tag{8}$$

Conditional on any choice of state policies (b, c), the expected utility of the poor households depends positively on their wages w_P which, in turn, depends negatively on N (since $\mathrm{d}w_P/\mathrm{d}N = F''(N)$ by (8)). Hence, one can solve the equilibrium migration condition

$$EU_P = \widehat{EU_P}$$

implicitly for N as a function of (b, c); given assumption (A), this implicit function satisfies

$$\frac{\partial N}{\partial b} = \frac{-1}{F''(N)} > 0 \quad \text{and} \quad \frac{\partial N}{\partial c} = \frac{\pi p_m m}{F''(N)} < 0. \tag{9}$$

The problem of maximizing the utility of a rich household, taking the expected utility of the poor as given and noting the dependence of N on state policies, can be written as

$$(\mathrm{P}') \quad \max_{\langle b,c\rangle} U_R\big(x_R, \widehat{EU_P}, \bar{h} - \ell + m[b, c]\big)$$

subject to

$$\begin{aligned} x_R = {} & F\big(N[b, c]\big) - N(b, c)F'\big(N[b, c]\big) - T_F + L \\ & - (1 - \mu_b)N(b, c)b - (1 - \mu_m)\pi N(b, c)(1 - c)p_m m(p_m c). \end{aligned}$$

The characterization of the solution to (P') differs from that for (P) primarily with respect to the choice of the cash benefits, b, which must satisfy

$$\big((1 - \mu_b)b + (1 - \mu_m)\pi(1 - c)p_m m(p_m c)\big) = -\mu_b N(b, c)F''. \tag{10}$$

In particular, if there is no matching grant support for cash benefits, the right-hand side reduces to zero, showing that b is negative (if $c < 1$); in this case, the "cash benefit" to the poor becomes a tax that is equal to the value of whatever health benefits are financed by taxes on the rich.[13]

The first-order condition for the choice of c is derived similarly. When combined with (10), it yields precisely the same condition (7) as obtained previously, with the exception that the fixed population of poor $\bar{N}$ is now replaced by the equilibrium population of poor $N(b, c)$. Proposition 2 and its corollary thus continues to hold in the model with freely-mobile beneficiaries.

To carry out the comparative-statics analysis of the effects of changes in intergovernmental grants, it is essential to distinguish between changes that affect the grants received by only one state or changes that affect the entire system of all states. A policy reform like PRWORA, for example, altered the form of grants for all states simultaneously, not just for one small state in isolation. The formal analysis of the two cases differs in that a policy change affecting only one small state would have only a small effect on the equilibrium of the entire system of states,

[12] This means that, aside from their own earnings, rich households are the recipients of any income derived from capital and natural resources (including land). The literature on fiscal competition (see, e.g., Wilson [22] and Wilson and Wildasin [23] for recent surveys and many additional references) has discussed the treatment of rents to fixed factors and other related issues which, however, are not of central importance for present purposes.

[13] Recall from Section 2 that b is interpreted as the value of cash transfers to the poor, net of any taxes that they may pay. Thus, in practice, a negative value of b would correspond to a situation where taxes paid by the poor (on their earnings, consumption, property, etc.) exceed cash benefits financed from own-source revenues by the state.

whereas this is not true for a system-wide reform. Since we are primarily interested in the latter, the following discussion focuses on the case where grant policies are altered for all states simultaneously.

The simplest case to consider is one in which all states are initially identical in all respects. In this case, under any uniform system-wide program of intergovernmental transfers, all states will choose identical cash benefits, health benefits, and taxes, and, in equilibrium, all will contain identical numbers of poor residents. Notationally, this means that there is no need to introduce specific subscripts to identify variables pertaining to an individual state since any one state is representative of all.

An immediate consequence of this symmetry assumption is that a change in system-wide grant policies will have no effect on the equilibrium population of any state: each will have identical numbers of poor residents before a policy change as well as after a policy change. On the other hand, the induced policy changes of state governments certainly will affect equilibrium outcomes for rich and poor, the magnitudes of state budgets, and other endogenous variables in the system. Formally, however, the comparative-static analysis of a change in grant policy on state benefit levels (b, c) is no different from that for the case where poor households are completely immobile by virtue of the fact that no state faces a migration response to its own policy changes because all other states are adjusting their policies simultaneously and in an identical fashion. For this reason, the comparative-statics results of Propositions 3 and 4, and their corollaries, apply exactly in the present case.

The extension of Propositions 2–4 to the case where poor households are mobile is only exact in the case where states are identical. In practice, of course, this is not true, and there will be some variations among states in policy responses, in the equilibrium distribution of poor households among states, and in other respects. A thorough analysis of the case of asymmetric jurisdictions would necessitate a specification that identifies the way(s) in which states differ, and the type and magnitude of the asymmetries would dictate the extent to which the results of Propositions 2–4 would need to be amended. Since those are qualitative results, we know that they continue to hold if the asymmetries among states are "small."

In summary, allowing for the free mobility of poor households does not fundamentally alter the incentives for states to substitute between cash transfers (or taxes) and in-kind health benefits when the Federal government changes the structure of intergovernmental transfers. In particular, the elimination of matching grants for cash transfers associated with PRWORA would still be predicted to lead to a shift toward more generous and costly health-care benefits and a reduction in cash transfers.

5. Conclusion

Let us recall some of the empirical trends mentioned at the outset. State governments have shifted the composition of their cash and in-kind benefits for low-income households to such a degree that expenditures on AFDC/TANF are now dwarfed by Medicaid spending. Given that Medicaid and cash transfers through AFDC/TANF are both targeted, broadly, at low-income households, what explains the changes in the relative sizes of these programs? This is of course highly complex issue, with far-reaching implications for policy, and there are undoubtedly many factors that have played important roles in the evolution of these programs and their financing over time, the full explanation of which lies beyond the scope of the present study. Our more modest objective has been to develop a theoretical model that highlights just one potentially important aspect of large policy shifts like those that we have observed, namely, how the structure

of *intergovernmental transfers* can influence the programmatic mix of expenditures undertaken by states, as well as the total magnitude of these expenditures.

In this model, state-provided cash and health benefits perform distinct functions: cash transfers raise the welfare of the poor by increasing their incomes, while in-kind benefits for health care also create differential incentives for them to alter their consumption in the direction of higher levels of medical and health services. Grant support from the Federal government affects the cost to state governments, and ultimately to their taxpayers, of providing these benefits. In particular, matching grants lower the relative price of state government spending on these programs.

The analysis highlights the fact that changes in the level of matching grant support for *either* of these programs affects the generosity of benefits for *both*. The major welfare reform of 1996, PRWORA, eliminated matching subsidies for cash transfers (AFDC/TANF) while preserving existing high rates of matching subsidies for Medicaid, raising the relative price of cash compared to Medicaid expenditures by a minimum of 100% and, for some states, by a factor of 5. The model predicts not only that such a reform would reduce the level of cash welfare benefits, but that it would give rise to cross-program substitution that would *increase* the level of health benefits. These results are established first within the setting of a model where poor households are completely immobile, but they extend with no essential changes to the case where they are freely mobile among the states.

The analysis depends on a number of simplifying assumptions, including assumptions that limit the magnitude of income effects in the preference structures of poor and rich households, thus emphasizing substitution and relative-price effects. In practice, income effects, as well as other simplifications in the model, would affect the quantitative magnitudes of behavioral responses. However, with specific reference to US experience before and after PRWORA, it is noteworthy that the *average* Federal share in the financing for both cash (AFDC/TANF) and in-kind (Medicaid) transfers has remained approximately constant, while changes in matching rates have caused very large changes in the relative levels of *marginal* Federal support for these programs. In this instance, at least, it is to be expected that relative price and substitution effects would swamp income effects, which would be of second-order importance.

The continued rapid growth of Medicaid relative to TANF benefits and expenditures raises serious policy issues, both from the viewpoint of anti-poverty policy and from the viewpoint of overall fiscal policy. What balance should be struck between cash and in-kind benefits in anti-poverty policy? Should state-supported cash benefits dwindle to some comparatively negligible magnitude or perhaps disappear entirely? What portion of state government spending should be directed toward health care for the poor? Should state governments be relieved entirely from responsibility for anti-poverty policy or for health care, with one or perhaps both of these functions shifted entirely to the Federal level? More modestly, should Federal support for states be shifted back toward more balanced matching-grant support for both cash and in-kind transfers, perhaps at some uniform but intermediate level across programs? Or, in the interest of more fundamental reform, should the continued high level of Federal matching support for Medicaid be replaced by lump-sum grants with no Federal match at all?

Empirical analysis of state government response to changes in the structure of Federal grant support can help to provide an improved basis for the evaluation of these or other types of major reforms. Our analysis has provided a theoretical foundation that demonstrates the importance of taking *cross-program substitution* into account when estimating the impact of policy reforms, such as PRWORA, that alter the structure of intergovernmental fiscal relations. The analysis provides a strong theoretical presumption that the impacts of such reforms are not limited only to the programs to which they are directly addressed: their effects may spill over to other areas

of recipient-government policymaking. The recent experience of US welfare reform affords an excellent opportunity for empirical research to help determine the magnitude of such policy interactions.

To our knowledge, there is as yet no empirical analysis of state-level transfers to the poor that addresses this question, which is to say that a zero cross-program substitution effect is a maintained hypothesis of existing research. A direct examination of this hypothesis should reveal much about the nature of state government decisionmaking and about the substitutability or lack thereof between cash and health benefits for the poor. To reiterate our introductory remarks, however, it should be emphasized in conclusion that many factors have affected the evolution of state Medicaid and AFDC/TANF expenditures over time, and the structure of intergovernmental transfers is only one among a number of potentially important determinants of these expenditures.

Appendix A

This appendix presents some details of the comparative statics analysis summarized in Section 3.

A.1. Comparative statics analysis of poor households

Recall that there are two distinct types of poor households, the healthy and the sick. The former spend their entire incomes on the all-purpose commodity; an increase in benefits obviously raises their welfare and their consumption of this good. The sick poor households solve the problem

$$\max_{\langle x_P, m\rangle} u_P(x_P, \bar{h} - \ell + m)$$

subject to (1). This is a standard consumer choice problem in which changes in b result in one-for-one changes in income and where changes in c change the relative price of good m. Proposition 1 follows immediately.

A.2. Equilibrium state policy choices

State policies (b, c) are chosen so as to solve problem (P) in the text. The first-order conditions are

$$\frac{\partial U_R/\partial EU_P}{\partial U_R/\partial x_R}\left(\pi\frac{\partial V_P}{\partial y} + (1-\pi)\frac{\partial W_P}{\partial y}\right) - (1-\mu_b)\bar{N} + \frac{\partial m}{\partial y}\left(\frac{\partial U_R/\partial h}{\partial U_R/\partial x_R} - (1-\mu_m)\bar{N}\pi(1-c)p_m\right) = 0.$$

and

$$\frac{\partial U_R/\partial EU_P}{\partial U_R/\partial X_R}\left(\pi\frac{\partial V_P}{\partial y}\right) - (1-\mu_m)\bar{N}\pi + \frac{\partial m}{\partial y}\left(\frac{\partial U_R/\partial h}{\partial U_R/\partial x_R} - (1-\mu_m)\bar{N}\pi(1-c)p_m\right) = \frac{s}{m}\left(\frac{\partial U_R/\partial h}{\partial U_R/\partial x_R} - (1-\mu_m)\bar{N}\pi(1-c)p_m\right).$$

Under assumption (A), $\partial m/\partial y = 0$ so that the last terms on the left-hand side of both conditions vanish, while the marginal utility of income for the poor (both healthy and sick) is just one, yielding (5) and (6) in the text, from which Proposition 2 follows.

Combining the above two equations yields

$$(1-\mu_b)\bar{N} - \frac{\partial U_R/\partial EU_P}{\partial U_R/\partial x_R}\left((1-\pi)\frac{\partial W_P}{\partial y}\right) = \frac{s}{m}\left(\frac{\partial U_R/\partial h}{\partial U_R/\partial x_R} - (1-\mu_m)\bar{N}\pi(1-c)p_m\right) + (1-\mu_m)\bar{N}\pi.$$

A.3. The effect of Federal grants on state policies

We specialize the analysis henceforth by imposing assumptions (A)–(D). In particular, (D) implies that $MRS_h \equiv \psi'(h)$, so that (7) can be used to solve implicitly for c in terms of the grant parameters (μ_b, μ_m).[14] Writing this condition as

$$\Gamma(c,\mu_b,\mu_m) \equiv \frac{\epsilon_m}{cp_m}\left[\psi'\big(h(cp_m)\big) - (1-\mu_m)\bar{N}\pi(1-c)p_m\right] - \pi(\mu_m-\mu_b)\bar{N} = 0,$$

note that

$$\frac{\partial\Gamma}{\partial c} = -\frac{\epsilon_m}{c}\left(\psi''s + (1-\mu_m)\bar{N}\pi\right) > 0,$$

$$\frac{\partial\Gamma}{\partial\mu_b} = \pi\bar{N} > 0,$$

$$\frac{\partial\Gamma}{\partial\mu_m} = \frac{\epsilon_m}{cp_m}\bar{N}\pi(1-c)p_m - \pi\bar{N} < 0.$$

By the implicit function theorem,

$$\frac{\partial c}{\partial\mu_i} = -\frac{\partial\Gamma/\partial\mu_i}{\partial\Gamma/\partial c}$$

for $i = b, m$, establishing the right-hand side terms in Proposition 3.

Next, using the fact (just established) that c is implicitly determined as a function of (μ_b, μ_m), note that (5) can be written as

$$\Lambda\big(b, c[\mu_b,\mu_m], \mu_b, \mu_m\big) \equiv \phi'\big(EU_P\big[b, c[\mu_b,\mu_m]\big]\big) - (1-\mu_b)\bar{N} = 0$$

with partial derivatives

$$\frac{\partial\Lambda}{\partial b} = \phi'' < 0$$

(since $\partial EU_P/\partial b = 1$, by (A)),

$$\frac{\partial\Lambda}{\partial\mu_b} = \phi''\frac{\partial EU_P}{\partial c}\frac{\partial c}{\partial\mu_b} + \bar{N} > 0,$$

and

$$\frac{\partial\Lambda}{\partial\mu_m} = \phi''\frac{\partial EU_P}{\partial c}\frac{\partial c}{\partial\mu_m} < 0.$$

[14] Note that the policy variable b does not enter this condition, permitting the analysis to proceed recursively, focusing first on comparative statics with respect to c alone.

By the implicit function theorem,

$$\frac{\partial b}{\partial \mu_i} = -\frac{\partial \Lambda/\partial \mu_i}{\partial \Lambda/\partial b}$$

for $i = b, m$, establishing the left-hand side terms in Proposition 3.

The impacts of changes in grant policy on total state welfare spending $\bar{N}b$ are easily ascertained once the signs of $\partial b/\partial \mu_i$ are determined since $\bar{N}$ is a constant. To see what happens to M, total state spending on health care benefits, consider first how changes in the policy parameter c affects expenditures:

$$\frac{\partial M}{\partial c} = \pi \bar{N} p_m\big((1-c)sp_m - m\big) < 0.$$

Combining this result with the comparative-statics results from Proposition 3 yields

$$\frac{\partial M}{\partial c}\frac{\partial c}{\partial \mu_b} < 0;$$

the impact of μ_m on M is determined similarly.

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