forthcoming in ***The Quarterly Journal of Economics***

ALL SCHOOL FINANCE EQUALIZATIONS ARE NOT CREATED EQUAL*

Caroline M. Hoxby

School finance equalization has probably affected American schools more than any other reform of the last 30 years. Understanding it is a prerequisite for making optimal social investments in human capital. Yet, it is poorly understood. In this paper, I explain why: it differs from conventional redistribution because it is based on property values, which are *endogenous* to schools' productivity, taste for education, and the school finance system itself. I characterize equalization schemes and show why some "level down" and others "level up." Schemes that strongly level down have unintended consequences: even poor districts can end up worse off. I also show how school finance equalization affects property prices, private school attendance, and student achievement.

I. Introduction

School finance equalization (SFE) is probably the reform that has most affected American schools over the past 30 years. Unlike reforms such as school choice or merit pay, which are often debated but tiny in practice, SFE has affected every school in the nation–some of them dramatically. In some states, its effects on school spending, private schooling, and achievement have been felt for decades. SFE is, moreover, of great interest to economists because optimal social investment in human capital (on which economic growth depends) hinges on how school spending is distributed across students.[1] In short, SFE is an interesting and important policy that we should understand. Yet it is poorly understood in practice.

This is not to say that, when state courts and legislatures decide to equalize spending across school districts, they are confused about their goals or the legal issues. States are confused about how to *implement* their goals. This has not kept them from enacting SFE schemes, the key feature of which is redistribution from districts with high per-pupil property values to districts with low per-pupil property values. Since 1970, every American state has enacted at least one such scheme.[2] States frequently rely on lawyers rather than economists, so that the

---

* The author gratefully acknowledges comments from Gary Becker, David Cutler, Thomas Downes, Dennis Epple, William Evans, Martin Feldstein, William Fischel, Roger Gordon, James Heckman, Robert Inman, James Poterba, Robert Schwab, Jon Sonstelie, and seminar participants at Harvard University, University of Pennsylvania, Columbia University, the University of Michigan, Carnegie-Mellon University, the University of Chicago, the University of Wisconsin, the National Tax Association, and the National Bureau of Economic Research. Alan Durell provided very helpful research assistance.

[1] For examples of the literature on school finance, macroeconomic growth, and income inequality, see Benabou [1996] and articles referenced by him.

[2] See American Education Finance Association [1988, 1992, 1995] and United States Office of Education [1969, 1972, 1973, 1974, and 1975].

schemes are manifestations of the legal rhetoric of equalization rather than economic logic about taxation and redistribution. In practice, schemes often have effects that are smaller or different than what was intended. As a result, equalization debates and court cases recur, and states seem to have abandoned trying to understand school finance in favor of trial-and-error methods of finding suitable schemes.

This is a pity because there are a few general principles that could help states understand equalization. Also, empirical evidence–which states often dismiss because it seems inconsistent and irrelevant to their implementation decisions–can be made useful if school finance schemes are characterized by a few variables that summarize the income and price effects. In this paper, I attempt to establish general principles about SFE and provide useful empirical evidence.

SFE schemes have frequently replaced categorical aid schemes, which redistribute from high income households to districts that contain students who are poor or expensive to educate. Categorical aid is a conventional form of fiscal federalism and is therefore reasonably well understood by economists. SFE schemes have an unconventional feature that makes them much less understood: the *basis of redistribution* (property values) is *endogenous* to schools' productivity, local preferences for education, and the school finance system itself.

Because states do not fully appreciate conventional fiscal federalism and even more because they do not appreciate the consequences of basing redistribution on endogenous property values, SFE schemes sometimes produce unintended consequences. In particular, they can shrink the "pie" of total spending on schools even as they divide it more evenly. This phenomenon is known as *leveling down*: greater spending equality accompanied by lower average spending. If leveling down is sufficiently extreme, per-pupil spending can actually fall in districts that were intended beneficiaries of equalization.

The best-known SFE is California's, which was a response to the second Serrano decision in1976. It owes its fame to its stringency (it prohibited differences of more than 200 dollars in regular per-pupil spending) and to the unprecedented fall in spending that followed it.[3] Some commentators have argued that the fall in spending was not leveling down and was unrelated to the SFE. This argument has gained support from the experience of other states, where SFE has not been associated with leveling down.

In this paper, I first attempt to explain how SFE works and then provide evidence on its effects. The main results of the first section are that: (a) school finance schemes need not be mysterious black boxes–they can be

[3] Most researchers estimate that California's per-pupil spending fell by about 12-15 percent after the Serrano II SFE. The estimate varies depending on the specification used to control for other factors. See, for example, Silva and Sonstelie [1995].

characterized by a few variables that summarize their income and price effects, and (b) SFE schemes always level down compared to categorical aid schemes that are intended to achieve the same amount of redistribution. The latter result is just one of several peculiar consequences of having a scheme for redistribution among jurisdictions that is based on assets whose prices depend on how people value the jurisdictions The major result of the second section is that, if one uses the few key variables, one can reconcile apparently conflicting evidence on the effects of SFE. Moreover, the variables (such as the foundation property tax rate and the tax price of marginal local spending) appear in school finance formulas, so a state can design a formula that best meets its objectives.[4]

Specifically, I calculate the values of the school finance variables for every district in the United States in 1970, 1980, and 1990–thereby bringing all of the schemes into a common framework. I use regression analysis to estimate the effect of SFE on several outcomes: the level of per-pupil spending, inequality in per-pupil spending, property values, private school attendance, and student achievement. (In the last case, I estimate an education production function, using the high school drop-out rate as the measure of student achievement and SFE as a shock to districts' spending.) I account for the endogeneity of the observed values of the school finance variables by simulating the values each district would face if it were to have remained at its pre-SFE tax rates, spending, and property values.

The results suggest that some spending equality can be achieved with leveling up or mild leveling down, but that near equality of per-pupil spending cannot be achieved without extremely strong incentives. In theory, either leveling-down or leveling-up SFEs could include extremely strong incentives, but, in practice, extremely strong incentives are included only in leveling-down SFEs because it is cheap to forbid high spending but expensive to bribe districts to spend more than they prefer to. Strikingly, there are actually poor districts in the United States that would probably have higher spending if their state attempted to achieve less complete equality.

My method differs from that of other researchers (Downes and Shah [1994], Manwaring and Sheffrin [1997], Card and Paine [1998], and Evans, Murray, and Schwab [1999]), who simply create a dummy variable for SFEs, lumping together schemes that changed school finance variables in *different* directions. My approach has some advantages: it produces economically interpretable estimates that are direct relevant for policy. In contrast, the dummy variable methodology produces estimates that are difficult to interpret, that do not illuminate the underlying economics, and that cannot provide policy-makers with useful information for designing SFEs. Put another way, my method is more likely to satisfy both economists, who want to understand the economics of equalization, and policy-makers, who know that they need to do some equalizing but want to understand the trade-offs they face. In addition, results produced by the dummy variable methodology are sensitive to the years and

[4] If these variables do not appear explicitly in a state's school finance formula, they can be backed out.

states investigated because it lumps heterogenous polices together into a single treatment. For evidence on this point, see Hoxby [1999].

II. School Finance Schemes

In this section, I describe prototypical school finance schemes. The prototypes illustrate general properties, but one must remember that every state's school finance program is different and that the prototypes are *extremely* simple compared to actual formulas.

A. Pure Local Property Tax Finance

Although no state's schools are currently financed through pure local property tax finance, it remains the core of most states' systems. Under it, districts spend all of their local property tax revenue (and only their local property tax revenue), and households divide their disposal income between property taxes, housing consumption, and other consumption. That is, a household's annual budget constraint is

$$y_{ij} = c_{ij} + (1+\tau_j)p_j^h h_{ij} \ , \tag{1}$$

and a district's annual, *per-pupil* budget constraint is

$$e_j = \tau_j v_j \equiv \tau_j \sum_{i=1}^{s_j} \frac{p_j^h h_{ij}}{s_j} \ , \tag{2}$$

where i indexes households in a district, j indexes districts, h_{ij} are the housing services consumed by household i in district j, p_j^h is the annualized price of a unit of housing services in district j, c_{ij} is household i's other consumption, e_j is spending per-pupil in district j, v_j is annualized property value per pupil in district j, τ_j is the tax rate on annualized property value in district j, and s_j is the number of students (households) in district j The variable y_{ij} is the income of household i that lives in district j, net of taxes that are unrelated to school finance. Purely for simplicity, each household is assumed to have one student. This assumption makes it easy to write equations in per-pupil terms. Note that all financial variables, including property values and the tax rate, are annualized.[5]

B. Categorical Aid

Before SFE schemes became popular in the early 1970s, categorical aid was the most common method

---

[5] A common method of annualizing property values is to multiply them by the current interest rate. The tax rate on annual property values would then be the statutory tax rate divided by the current interest rate. One should relax the assumption that each household has a single child if one is exploring the relationship between school finance and the household age distribution. Relaxing it would not prove particularly useful here. For now, is best to ignore differences in assessed and market values. Treat v_i as though it were annualized market value and treat τ_i as though it were the tax rate on annualized market value. Assessment is discussed in the section on data.

of redistributing among school districts. Categorical aid is still used by most states for limited purposes, but has been almost entirely displaced by SFE for major redistribution.

Categorical aid has two features that distinguish it from SFE. It is funded by state income or sales taxes–in fact, almost any state-level taxes except property taxes.[6] Second, categorical aid grants are based not on property values but on one or more characteristics of a school district, such as mean household income, the poverty rate, or the share of children from single-parent households. The logic of categorical aid is to give revenue to a school district if its residents are liquidity constrained and/or its children are unusually expensive to educate.

In the remainder of the paper, I sometimes discuss categorical aid schemes as though income were the only characteristic on which grants and taxes were based. I do this simply for convenience, although income is certainly most important in practice.

Under *flat grant categorical aid*, households' disposable income is reduced by a school-related tax on income. Each district receives a per-pupil grant that is a function of the income and demographics (***X***) of households. The appropriate household and per-pupil district annual budget constraints are:

$$y_{ij}(1-t_{FGCA}) = c_{ij} + (1+\tau_j)p_j^h h_{ij} \tag{3}$$

$$e_j = \tau_j v_j + FGCA(y_{1j}, \ldots, y_{Nj}, \boldsymbol{X}_{ij}, \ldots, \boldsymbol{X}_{Nj}) \quad , \tag{4}$$

where t_{FGCA} is the school-related tax rate on income, *FGCA()* is the flat grant, and ***X*** is a vector of demographics variables.

Matching grant categorical aid schemes match locally-raised spending, where the matching rate is a function of district demographics. Typically, the lower is household income, the higher is the matching rate. In addition, matching grant categorical aid schemes often include flat grants. The household and per-pupil district annual budget constraints are:

$$y_{ij}(1-t_{MGCA}) = c_{ij} + (1+\tau_j)p_j^h h_{ij} \tag{5}$$

$$e_j = \tau_j v_j [1 + mrca(y_{1j}, \ldots, y_{Nj}, \boldsymbol{X}_{ij}, \ldots, \boldsymbol{X}_{Nj})] + FGCA(y_{1j}, \ldots, y_{Nj}, \boldsymbol{X}_{ij}, \ldots, \boldsymbol{X}_{Nj}) \quad , \tag{6}$$

where *mrca()* is the matching rate and t_{MGCA} is the school-related tax on income that funds the matching and flat grants.

---

[6] Income and sales taxes are not attached to particular school districts. The property tax is based on assets that *are* attached to particular school districts. This is the key distinction.

C. Foundation Aid

Foundation Aid (FA) is the most common type of SFE scheme. FA is like flat grant categorical aid *except* that it redistributes among districts based on per-pupil property values, not on socio-demographic characteristics of households. Under a very simple FA scheme, the household annual budget constraint is given by equation 1 and the per-pupil district annual budget constraint is:

(7) $$e_j = \tau_j v_j + f - \tau^f v_j \quad ,$$

where f is the foundation level of spending guaranteed to each district, and τ^f is the state-wide foundation tax rate on property that supports the scheme. FA is often designed to be self-funding, so that total foundation taxes paid equal total foundation grants disbursed That is, τ^f is often set so that:

(8) $$f = \tau^f \left(\frac{\sum_{j=1}^{J} s_j v_j}{\sum_{j=1}^{J} s_j} \right) \quad ,$$

where J is the total number of districts.

The stringency of a FA program is greater in states where the foundation grant is higher relative to per-pupil spending. If the foundation grant is set at, say, the 75th percentile of per-pupil spending in the state, then only a minority of districts want to set their local property tax rate higher than the FA property tax rate (in order to spend more than the foundation level). It is possible to set τ^f and f so high that no district would want to spend more than the foundation level.

D. Power Equalization/Guaranteed Tax Revenue Schemes

Most states that attempt stringent equalization do so through guaranteed tax revenue (GTR) schemes or power equalization schemes. These two types of schemes are fundamentally similar, so hereafter I refer to them as GTR schemes.

GTR schemes attempt to make the same *tax rate* τ generate the same revenue for each school district in the state, regardless of the district's own property value per pupil. Many GTR schemes provide stronger redistribution among districts that have higher *tax rates*. For instance, the scheme might guarantee average per-pupil revenue in the state (this would be the first guarantee, or g_1) for the first τ^{g1} mils of districts' property tax rates, guarantee per-pupil revenue at the 65 percentile in the state (this would be the second guarantee, or g_2) for the next τ^{g2} mils of districts' property tax rates, and guarantee per-pupil revenue at the 85 percentile in the state (this would be the third guarantee, or g_3) for any remaining mils of the property tax rate. (Property taxes are typically expressed in mils or thousandths.) Thus, in order to get the maximum amount of aid, a district must have both low per-pupil valuation and high property tax rates. Under a very simple GTR scheme with two guarantees, the household annual budget constraint are given by equation 1 and the per-pupil district annual budget constraints is:

$$e_j = \min(\tau_j, \tau^{g_1}) \cdot g_1 + \min[\max(0, \tau_j - \tau^{g_1}), \tau^{g_2}] \cdot g_2 + \max(0, \tau_j - \tau^{g_1} - \tau^{g_2}) \cdot v_j \tag{9}$$

GTR schemes are sometimes self-funding, so that tax rates and guarantees are chosen to ensure that contributions from districts with high property value per pupil fully fund the aid to districts with low property value per pupil. For instance, if the above system were self funding, the following equation would hold:

$$\sum_j \min(\tau_j, \tau^{g_1}) \cdot v_j + \min[\max(0, \tau_j - \tau^{g_1}), \tau^{g_2}] \cdot v_j = \sum_j \min(\tau_j, \tau^{g_1}) \cdot g_1 + \min[\max(0, \tau_i - \tau^{g_1}), \tau^{g_2}] \cdot g_2 \ . \tag{10}$$

To prevent districts from opting out of GTR schemes (by providing negligible local public schools), states often impose a minimum local tax rate.

California has an extreme GTR scheme, under which each district gets the basic guarantee regardless of its local tax revenue and tax rate.[7] Because every district has an incentive to set its local property tax rate to zero and free ride on the tax revenues collected by other districts, the scheme includes a minimum tax rate (10 mils). When the scheme was enacted, Californians discovered that their local schools did not get any additional revenue if they let themselves be taxed at more than the minimum rate or if their property values rose. Thus, it is not surprising that, soon after, the majority of Californian voters supported Proposition 13, which made 10 mils the maximum tax rate as well as the minimum tax rate and banned reassessment of a house's value so long as the owner kept it. Fischel [1989, 1994] explains the political process by which the Serrano equalization led to Proposition 13.

If California's scheme illustrates one extreme, New Jersey's recent GTR scheme illustrates another. A simplified version of it is as follows:

$$e_j = \tau_j v_j + \max\left(1 - \frac{v_j}{v^g}, 0.10\right) \min\left(\tau_j v_j, f^{NJ}\right) \ . \tag{11}$$

The parameter v^g was set at the 85[th] percentile of per-pupil valuation in the state, and f^{NJ} was set equal to mean spending in the state. Districts with per-pupil valuation that was at least 90 percent of v^g spent their locally raised revenue ($\tau_j v_j$) plus $0.10 \cdot f^{NJ}$. But a district with, say, per-pupil valuation equal to half of v^g spent one and a half times its locally raised revenue, up to a maximum of $\tau_i v_i + 0.5 \cdot f^{NJ}$. Since every district received at least some aid under the New Jersey formula, the scheme was not self-funding. It required revenues from state-wide income and sales taxes.

---

[7] Actually, California's scheme is not strictly self-funding and a few districts are exempted from the system because of a hold harmless clause.

A district's tax price is the amount of revenue it has to raise in order to spend an extra dollar. GTR schemes make each district's tax price a positive function of its per-pupil valuation. One can derive a district's tax price by differentiating its budget constraint with respect to its local tax rate. The GTR scheme given by equation 9, for instance, produces the following tax prices:

(12) $$\frac{v_i}{g_1} \;\; for \;\; \tau_i \leq \tau^{g_1} \quad , \frac{v_i}{g_2} \;\; for \;\; \tau^{g_1} < \tau_i \leq \tau^{g_2} \quad ,1 \;\; for \;\; \tau_i > \tau^{g_2} \;.$$

The tax prices actually produced by states' GTR formulas vary greatly. California's tax prices are nearly infinite and New Jersey's are mostly less than one.[8]

III. School Spending Under Various School Finance Schemes

In order to predict the effects of various school finance schemes, we need to combine the formulas from the previous section with Tiebout determination of school spending. In the Tiebout model, households maximize their utility by choosing among residences located in different districts and by voting on tax rates in the districts where they reside.

A. Tiebout Equilibria with Local Property Tax Finance

The Tiebout literature has focused on pure local property tax finance. This paper is not the place for a review of the literature, but it is useful to rehearse two properties of Tiebout equilibria.[9] First, households tend to live in districts with other households that prefer similar school spending.[10] Second, spending tends to be such that the benefits to local households of a marginal dollar of school spending are equal to the costs to local households.

---

[8] In California, the only way that a district can increase its local expenditure by raising more revenue is through the self-funding constraint. The typical district in California would see less than a 0.001 dollar increase in its per-pupil expenditure if it raised an extra dollar of revenue per pupil. Under the New Jersey formula, a district with per-pupil valuation above 90 percent of the 85th percentile in the state faced a tax price equal to one. A district with per-pupil valuation below this cut-off (and sufficiently low per-pupil spending) had a tax price given by:

$$\frac{\partial \tau_i \cdot v_i}{\partial \tau_i \cdot v_i \cdot \left(2 - \frac{v_i}{v^g}\right)} = \frac{1}{2 - \frac{v_i}{v^g}} \quad if \;\; \tau_i v_i < f^{NJ} \;.$$

Thus, a district with per-pupil valuation equal to 0.2 of per-pupil valuation at the 85th percentile faced a tax price of 0.56.

[9] Epple and Platt [1992] provide a good, formal exposition of Tiebout equilibrium with local property tax finance, median voter determination of local tax rates, and heterogeneous tastes.

[10] This does *not* mean that districts contain households with homogeneous income. A district might contain high income households that have a moderate taste for education and moderate income households that have a high taste for education if both types of households prefer the same level of local school spending.

B. Tiebout Equilibrium with Categorical Aid

The only thing that makes categorical aid different than more familiar forms of fiscal federalism (such as federal highway aid to states) is that households can react to the aid by changing their preferred district.

Before considering such reactions, consider the first order effects of categorical aid. Under flat grant categorical aid, a district receives a net revenue transfer that has income effects (local residents feel richer or poorer and want to buy more or fewer school inputs). There are, however, no price incentives for residents or school staff to change their behavior. That is, under flat grant categorical aid, a household pays a additional dollar in taxes to have its local schools spend an additional dollar.

Under matching grant categorical aid, the tax price that a district's residents face is a positive function of their income. Tax prices have income effects, and they also have substitution effects: richer residents have a price incentive to substitute away from purchases of public school inputs and towards purchases of other goods (including private schooling). Poorer residents have a price incentive to substitute towards public school inputs.

Households' preferred districts can change when categorical aid is introduced. For instance, high income households have less incentive to segregate themselves. Essentially, low income neighbors are accompanied by categorical aid, which partially eliminates the difference in preferred school spending that would otherwise deter low and high income households from living in the same district.

Theory cannot predict whether categorical aid levels up or down compared to local property tax finance. The direction of change depends how preferences for education differ between high and low income households. If high and low income households have identical preferences and there are decreasing marginal benefits of school spending, then even flat grant categorical aid levels up because it takes from households that want to spend a small share of their marginal income on education and gives to households that want to spend a large share of their marginal income on education. On the other hand, if high income households have much greater taste for education than low income households, even matching grant categorical aid schemes can level down. The possibility exists because, even if low income households face subsidized prices for education spending, they can still choose to spend less on education than high income households would have spent. A formal exposition of Tiebout equilibria with categorical aid is presented by Fernandez and Rogerson [1999], who show that a range of possibilities exist.[11] Furthermore, there is a well-known empirical phenomenon, known as the "flypaper effect," that suggests that districts spend a larger amount out of income from grants than one would predict based on their

[11] The paper is confusing because they claim to analyze SFE schemes, but they actually analyze categorical aid schemes. Moreover, they make local *income* taxes support public schools. Local public schools are not supported by local income taxes anywhere in the United States, and households' location and voting decisions would not be similar under local income and local property taxes (see Nechyba [1997a]).

elasticities of spending with respect to (normal) income. There are also studies that suggest that districts overreact to being penalized for their spending.[12] In short, even a calibration based on normal income elasticities is unlikely to tell us whether categorical aid levels up or down.

C. Tiebout Equilibria with School Finance Equalization - Part 1

Here, I go beyond the existing literature to consider Tiebout equilibria with SFE. In order to do this, it is necessary to review a few more results from the Tiebout literature.

First, productivity differences between school districts are capitalized in house prices. If a district uses its money more efficiently than neighboring districts, households will be willing to pay more for houses in the district because the tax burden will be smaller for any given level of school quality.

Second, districts that have assets that convey positive fiscal externalities tend to attract households with high taste for education, so that entire districts can be filled with residents who have a high taste for education relative to their incomes and whose house prices contain a relatively large amount of capitalization. Consider a district that contains vacation property. Vacation property tends to convey positive fiscal externalities because its owners pay property taxes out of proportion to their consumption of local services. (The location of desirable vacation property is also relatively inelastic.) Non-vacationer households should be willing to more for a house in the district because their tax burden is small for any given level of local spending. This is capitalization. More importantly, the district attracts households whose taste for education is high relative to their incomes because the absolute size of the fiscal externality is increasing in the tax rate. As a result, districts that contain households whose *taste for education is high* systemically have capitalization forming *a large share of house prices*.[13]

So far, I have been describing the asset that conveys the fiscal externality as tangible property, but the asset could be something intangible, like a district's good reputation with colleges and employers, a district's spending each tax dollar more productively, or some feature (a college, cultural institution, employer, *et cetera*) that makes the district attractive to families whose children are good peers. *Anything* that affects how a dollar of tax revenue in a district translates into perceived output can be capitalized. Put another way, there is some part of a house's price that can be explained purely by the house's physical characteristics, the physical characteristics of the land attached to it, and its local property tax rate; the remaining part of a house's price is sensitive to its association with a particular district and that district's productivity, reputation, fiscal externalities, attractiveness to peers, *et cetera*. Both statistical evidence and anecdotal evidence from real estate professionals suggest that

---

[12] Hines and Thaler [1995] survey the flypaper effect literature.

0. Households are heterogeneous in both income and tastes: this is a statement about taste for education, for any given level of income.

the latter part of the price can be substantial in districts with good tangible and intangible assets.[14] Of course, it is not easy to observe the division of each property price into the part that is payment for housing and land services and the part that reflects the district's tangible and intangible assets. Nevertheless, the variable v_i means different things in different districts. As a reminder, it is useful to write v_i as the sum $v_i = v_i^{*} + v_i^{**}$, where v_i^{*} is the price of housing and land services and v_i^{**} is the part of the price that depends on the association of the land with the particular school district i.

Just as with a fiscal externality, not only can a district's tangible and intangible assets get capitalized, but districts with such assets attract households whose taste for education is high relative to their incomes. That is, there will be a positive correlation between v_i^{**} and taste for education (for a given income). From now on, I assume that some districts do have tangible or intangible assets, so that v_i^{**} and taste for education are positively correlated. (Of course, if one is hesitant about this assumption and believes that house prices might be fully explained by their physical characteristics, the physical characteristics of attached land, and local property tax rates; then one believes that v^{**} might be zero everywhere. In such a case, there could be no correlation between tastes and v_i^{**}, and one should modify the strong inequalities ("less than") of the next section to be weak inequalities ("less than or equal to").)

D. Tiebout Equilibria with School Finance Equalization - Part 2

What makes categorical aid and SFE schemes similar is that they tax districts on some indicator of ability-to-pay. These taxes cause the usual distortions. Income taxes distort income-related decisions like labor supply. Property taxes distort decisions about purchases of housing and land services. What makes SFE schemes *peculiar* is they do not just tax indicators of ability-to-pay. They also tax v^{**}.

It is useful to compare FA and categorical aid schemes that have the same flat/foundation grant because such a comparison holds the redistributive goals constant. Although theory delivers ambiguous predictions about whether flat grant categorical aid levels up or down relative to local property tax finance, theory is unambiguous about the difference between flat grant categorical aid and FA.

Which districts could receive more money under FA then they would have received under categorical aid? The answer is: districts in which households prefer to spend an unusually small share of their incomes on schools. The reverse is true as well. Thus, average school spending under a FA scheme will be lower than average school spending under categorical aid with the same flat grant. Because FA generates income effects that are *systemically*

[14] Black [1999] provides particularly nice evidence that a house's price–controlling for its physical characteristics, land, and tax rate–depends on the school with which it is associated. Vigdor [1999] reviews a variety of other empirical evidence that confirms that households with unusually high demand for school spending relative to their incomes live in districts that have property prices that are unusually high.

related to households' tastes, it creates leveling-down compared to categorical aid.

Figure I illustrates this point. Consider two districts, A and B, that are of the same size and that contain households with identical income but different tastes for education. School spending is on the horizontal axis and consumption of non-housing goods is on the vertical axis. Residents of districts A and B are on the same budget constraint because they have the same income, but residents of district A have less taste for education (the indifference curves for district A are flatter than those for district B). Suppose that, under flat grant categorical aid, the districts are at points A^0 and B^0 and spend amounts e_A^0 and e_B^0. Average education spending is $\bar{e}^0$ (midway between e_A^0 and e_B^0).

As discussed above, there is a positive correlation between taste for education and v^{**}, so $v^{**}_A < v^{**}_B$. A FA formula transfers income from residents of district B to residents of district A. Under FA, the districts face

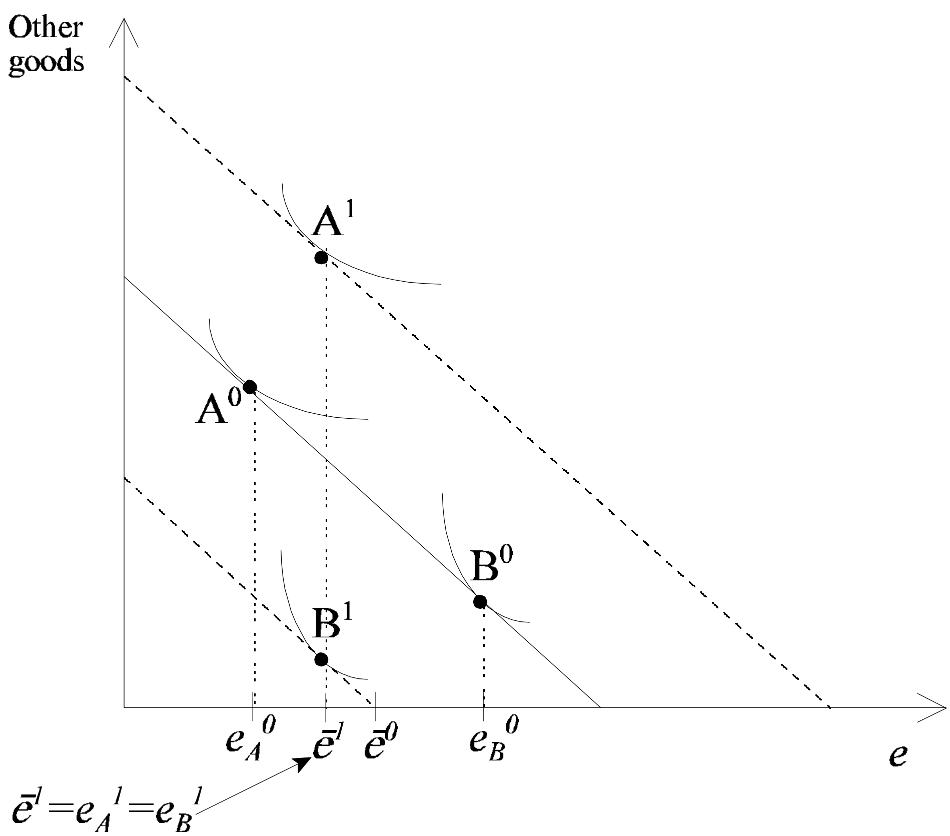

Figure I
School Spending under Categorical Aid and Foundation Aid

the budget constraints given by the dotted lines spend at points A^1 and B^1.[15] FA has induced the districts to spend amounts that are more equal (in fact, they happen to spend exactly the same amount in the figure). However, average education spending also falls from $\bar{e}^0$ to $\bar{e}^1$. Thus, relative to a flat grant categorical aid scheme that attempts to achieve the same redistribution, FA levels down.

It is useful to compare GTR schemes to matching grant categorical aid schemes that attempt to achieve a similar amount of redistribution. In general, if a district receives a larger net transfer from the state and has a lower tax price under a GTR scheme than under a matching grant categorical aid scheme, then it is a district in which households prefer to spend an unusually small share of their incomes on schools. The reverse holds too. Compared to matching grant categorical aid schemes that attempt to achieve a similar degree of redistribution and are similarly self-funding, GTR schemes level down.

Figure II illustrates this point. Consider districts A and B again. Under a matching grant categorical aid scheme, residents of districts A and B are at points A^2 and B^2 on the same budget constraint. They spend amounts e_A^2 and e_B^2. Average education spending is $\bar{e}^2$ (midway between e_A^2 and e_B^2).

As discussed above, v^{**} is positive correlated with taste for education, so a GTR scheme sets a higher tax price for residents of district B than for residents of district A.. Under GTR, the districts face budget constraints given by the dotted lines labeled "$B.C._A$" and "$B.C._B$," and are at A^3 and B^3. They spend amounts e_A^3 and e_B^3, and average education spending is $\bar{e}^3$ (midway between e_A^3 and e_B^3). In short, the amounts they spend are more equal, but average spending falls. Relative to a matching grant categorical aid scheme that attempts to achieve the same redistribution, a GTR scheme levels down.

E. Summary

In summary, both categorical aid and SFE can reduce the dispersion of spending (relative to local finance). However, theory does not tell us whether categorical aid and SFE raise or lower mean spending.[16] SFE levels down compared to similar categorical aid, but it is a purely empirical question whether categorical aid levels up or down compared to local finance.

I have used only four variables to describe the constraints imposed by school finance schemes: (1) the

---

[15] The old budget constraint is midway between the two new budget constraints because the FA scheme has the same flat/foundation grant as the categorical aid scheme. That is, the two districts, A and B, are making the same transfers to districts whose residents have incomes *different* than those of A and B residents.

[16] To proceed in closed form, one would substitute the SFE budget constraints into a general equilibrium problem à la Epple and Platt [1992]. This procedure would be impossible to carry out because revenue transfers and tax prices depend on preferences. It might be feasible to proceed à la Nechyba [1997b] and simulate the effects of various schemes with computable general equilibrium techniques applied to a toy metropolitan area, whose initial characteristics were calibrated to those of some real U.S. metropolitan area.

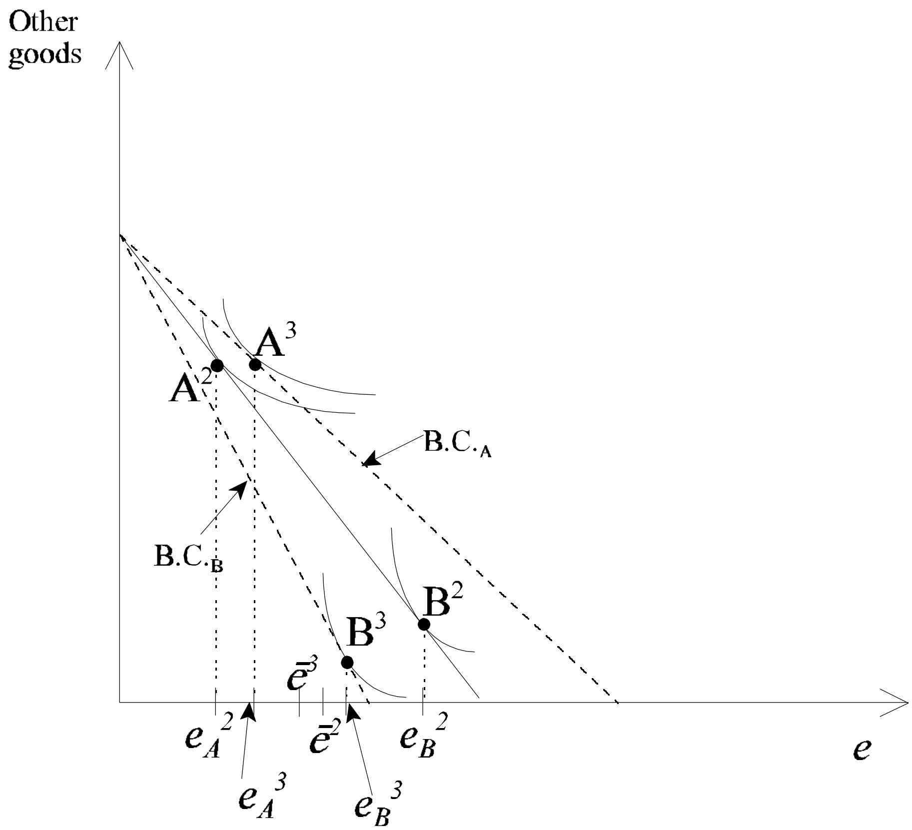

Figure II
School Spending under Matching Grant Aid and Guaranteed Tax Revenue Aid

foundation tax rate, (2) the school finance-related income or sales tax rate, (3) the flat/foundation grant, and (4) the tax price. Values for these variables can found in each school finance formula (see below). It is worth keeping in mind that, although tax prices can be affected by either GTR or matching grant categorical aid, nearly all actual variation in tax prices is generated by GTR schemes. Also, I invert the tax price before doing empirical analysis. (The inverted tax price is the dollars that a district gets to spend if it raises one dollar in local revenue.) Because some SFE schemes have nearly infinite tax prices, it is easier to work with inverted tax prices.

V. Beyond the Direct Effects of Equalization on Spending

Thus far, I have focused on the direct effects of SFEs on spending, but SFEs have other consequences.

First, the consequences of an SFE can be capitalized. Because households choose among residences within the state, the price of housing will fall in districts that pay more into the scheme than they get out of it, and *vice versa*. Since net aid is a negative function of property values, capitalization of an SFE will partially un-do it. Put another way, the basis of redistribution is *endogenous* to the consequences of the redistribution scheme.

(The basis of redistribution under categorical aid is not similarly endogenous.) Since house prices are asset prices, one might expect that SFEs would be capitalized as soon their provisions were known. In practice, however, schemes may be capitalized as districts begin to recognize their consequences through a few budget cycles.

Second, a number of SFE schemes have built-in feedback loops that exaggerate the initial tendency towards leveling up or down. This usually occurs when parameters in the scheme (such as f, g_1, or g_2) are *functions* of school spending in the state. In the New Jersey formula, for example, f^{NJ} was mean per-pupil spending in the state. If low valuation districts spent more under the New Jersey formula and high valuation districts spent about the same amount (a likely consequence of setting tax prices less than or equal to one in every district), the target level of spending rose. As a consequence, there were further reductions in districts' tax prices, which encouraged yet further spending.

Third, as Silva and Sonstelie [1995] point out, an SFE may start out with mean state spending as its target, but the target will drift towards the *median* level of preferred spending in the state. The distribution of preferred spending is likely to be right-skewed (because the income distribution is right-skewed), so shifting the targets from mean to median preferred spending will generate leveling down. This argument depends on the idea that, in Tiebout equilibrium with local finance, every household has preferences similar to the decisive voter in its district so that the state's mean spending reflects mean preferred spending.

Fourth, households who find it hard to attain their desired schools after an SFE may shift towards private schooling, either by sending their children to private schools or by creating local educational foundations that effectively privatize parts of local schooling (such as athletics, advanced courses, or building projects). The most privatization should occur in districts that have high preferred spending because SFEs most constrain these districts. Indeed, in California after its SFE, the share of students attending private schools rose about 50 percent (Downes and Schoeman [1998]) and educational foundations grew tremendously (Brunner and Sonstelie [1996]). Privatization grew disproportionately in districts that were constrained by the SFE formula to spend less than they traditionally had. The abandonment of the public school sector by such districts is important because their voters (so long as they remain public school parents) are core supporters of ambitious state goals in education.[17]

Fifth, SFE may affect student achievement through changes in schools' resources and changes in schoolmates. (Schoolmates may change if households respond to an SFE by moving or sending their children to private schools.) Regardless of the channel by which SFE affects achievement, achievement is likely to rise more among students who are otherwise low-performing than among students who are otherwise high-performing. Low-

---

[17] See Nechyba [1996], Epple and Romano [1996], and Glomm and Ravikumar [1998] for theoretical studies of the effect on public school spending of making private school alternatives relatively more attractive.

performing students disproportionately attend schools that gain money when an SFE is enacted and that become more attractive to parents who have a taste for education. If one wants to discover a positive effect of SFE on achievement, one should focus on measures of achievement that reflect the outcomes of low-performing students.

Finally, even an equalization that initially levels up can level down as it ages if voters respond to the SFE by constraining the state so that future adjustments in the formula cannot *further* exploit their property wealth. The most obvious such constraints are property tax limitations and targets that are strictly tied to inflation. Eventually, changed circumstances may make voters want to impose more generous constraints, but they may not trust that the state will not exploit the opportunity to re-adjust the formula.

V. Data

Estimating the effects of SFEs requires school district data on expenditure, enrollment, property values, property tax rates, and socio-demographic characteristics of the population like income. I also need information about each state's school finance laws. I derive data from several sources.

A. Census of Governments Data

The Census of Governments, which is conducted every five years, records administrative data on school spending for every district in the United States. I use the 1972, 1982, and 1992 censuses because I need to match the Governments data to Census of Population data, which are available for decennial years.[18]

B. Census of Population and Housing Data

For data on enrollment and demographics, I use the Census of Population and Housing, summarized at the school district level. There are published district summaries of census data for 1980 and 1990, but I created the district summaries for 1970.[19] For 1970, districts were mapped to Census data in one of two ways. All dependent districts, all county-wide independent districts, and any independent district that is aligned with a general purpose jurisdiction (such as a municipality or town) were mapped to Census data through summary files prepared for the Office of Revenue Sharing.[20] For the remaining independent school districts, I aggregated block

[18] See United States Department of Commerce [1974, 1984, and 1999]. Most school districts are independent jurisdictions and have their own entry in the 1972 and 1982 Census of Governments. School districts that are dependent jurisdictions are included in the entry for the municipality or county on which they depend. Regardless of whether the district is dependent or independent, school spending is recorded as expenditure on local education. In the 1992 Census of Governments, each district has its own entry, regardless of whether it is independent or dependent.

[19] For 1980, the summary is *Summary Tape File 3F* [United States Department of Commerce, 1998]. For 1990, the summary is the School District Data Book [United States Department of Education, 1994].

[20] See *Office of Revenue Sharing, Fifth Count File, 1970* [United States Department of Commerce, 1974].

group/enumeration district data up to the district level.[21]

C. Consolidated Districts and Special Districts

Districts that consolidate are kept in the sample if the component districts can be successfully identified in previous censuses and "pre-consolidated." A regular district is dropped only if it cannot be matched from year to year or it is impossible to determine the value of school finance variables for the “pre-consolidated” district. I dropped special districts that are not based on geography but instead serve populations of students like the blind. Such special districts are not regulated by states’ normal school finance laws.

D. Property Values

In order to calculate taxable property value in each district, I used several sources. Some states report districts’ taxable property values in their statistical abstracts. When such published data were available, I used them.[22] For the remaining observations, I used data from the Census of Population and Housing to calculate total residential property value. I added the value of owner-occupied housing to the asset value of renter-occupied housing (annual rent divided by the then-prevailing 30-year mortage rate). Then, I multiplied the residential property tax base by the ratio of total property value to residential property value in the jurisdiction [*Taxable Property Values*, 1972, 1982, and 1992].[23] The estimates obtained by this method had a 0.96 correlation with published data.

After matching the data described above, I had 13,281 school districts for each of the three years (a total

[21] The procedure is as follows. Find the enumeration districts and/or block groups associated with each district in 1980 using the *1980 Master Area Reference File* [United States Department of Commerce, 1983]; check for changes between the 1970 and 1980 geographic coding using the *1970-1980 Tract Relationships* [United States Department of Commerce, 1983] and the *1970 Master Enumeration Districts List*; take statistics from the *1970 Fifth Count Summary File, Enumeration Districts and Block Groups* and aggregate them up to the district level. If this procedure does not work (the 1970 geography of a district cannot be determined), consult the biennial reports of the relevant state department of education to learn about the 1970 geography of the district.

[22] Availability depended on local library collections. Current statistical abstracts for the states are online: www.census.gov/statab/www/stateabs.html.

[23] The ratios are exact for larger jurisdictions (population of 20,000 or more); small jurisdictions are assigned ratios for the parts of their counties that are not covered by the exact ratios.
The way that a state assesses property (relative to market value) should be accounted for in the school finance *formula*. That is, assessment practices are–properly speaking–an issue for writing the correct formula, not a property value issue. States impose common assessment practices for the purpose of calculating state aid, even when they allow localities to practice idiosyncratic assessment practices for the purpose of raising local property tax revenue. Common assessment practices are necessary because districts could otherwise get state aid simply by manipulating their assessment ratios and nominal property tax rates. Property assessed according to the state’s common practice is often called the “equalized grand list.” The existence an equalized grand lists does not necessarily imply that a state has SFE. The source for states’ assessment practices is the “Taxable Property Values” section of the Census of Governments.

of 39,843 observations). The usable observations represent 92 percent of all regular districts and 94.8 percent of all students in such districts.

E. Calculation of Tax Rates, Tax Prices, and Grants

I derived basic information on school finance laws from the series *Public School Finance Programs*.[24] The editions that cover the 1968-69, 1970-71, 1978-79, and 1987-88 school years were especially helpful, as they closely precede a Census of Governments year. The laws must precede the finance data by long enough to have had an effect.[25] *Public School Finance Programs* sometimes provides full information on an SFE formula, but more often provides basic information and references to the legislation that contains the formulas. It is important to use the actual legislation for formulas with numerous GTR guarantees, different schedules for urban and rural districts, "hold harmless" clauses, *et cetera*.[26]

For each formula, I obtained the foundation tax rate, the school-related income (or sales) tax rate, the tax price, and the flat grant for each district. Foundation tax rates are the easiest to obtain because they are often stated in the legislation and one need only apply hold harmless clauses to see which districts are exempted. Foundation/flat grants are either stated explicitly in the legislation or can be calculated by applying the self-funding formula to districts that are not exempted from the foundation tax rate. The tax price is calculated by differentiating the district's budget constraint. The school-related income tax rate is set to zero if the formula is self-funding. Otherwise, one calculates the difference between the expenditures for which the formula provides and the property tax revenues for which the formula provides. This difference is divided by the state's income tax base and an implied income tax rate is generated. Although the same procedures are followed for calculating each state's school finance variables, the complexity of the actual calculations varies greatly. A self-funding FA scheme with no hold harmless clause requires a few lines of code; a GTR formula with multiple guarantees may require several pages.

VI. Facts About School Finance Equalizations

---

[24] See United States Office of Education [1969, 1972, 1974, 1979] and American Education Finance Association [1988, 1992, 1995].

[25] I have investigated the effects of including indicators for how long a law has been in effect. These results are available from the author.

[26] A hold harmless clause wholly or partially exempts districts from participating in an SFE scheme if it would have a significant negative impact on their per-pupil revenues. In some states, the districts that are most "property rich" do not participate in SFE.

Table I shows SFEs that occurred from 1970 to 1990. The first column is borrowed from Downes and Shah [1994], Marwaring and Sheffrin [1997], and Evans, Murray, and Schwab [1999]. These studies organize states by whether they had a court-ordered, legislative, or no SFE. The date of the equalization follows each state's name.

The remaining columns show actual values of the inverted tax price (the minimum and maximum in a state) and the foundation tax rate (the median in a state). Table I does *not* adequately describe equalization schemes: one needs to know how tax prices and tax rates are distributed within each state. One also needs to know about foundation grants and school-related income taxes. Nevertheless, Table I demonstrates some key points. First, the categorization into court-ordered, legislative, and “no equalization” does not accurately reflect the incentives imposed. Within the "court-ordered" category, for instance, there are equalizations that discourage spending (California and Utah), equalizations that encourage spending (New Jersey), equalizations in which the tax rates hardly change (West Virginia, Wyoming), and equalizations that are strongly anti-or pro-spending depending on how the tax prices are distributed (Connecticut and Kansas). The legislative category contains similarly various schemes. New Mexico, Oklahoma, and Arizona are apparently anti-spending; Georgia has a strong equalization that is anti- or pro-spending depending on how tax prices are distributed; and Florida, Iowa, Maine, Missouri have equalizations in which the tax rates hardly change. Moreover, the majority of states in the "no equalization" category *have* equalization activity. The “no equalization” category contains some of the strongest pro-spending equalizations (New York, Pennsylvania), an equalization that could be strongly anti- or pro-spending depending on how the tax prices are distributed (Michigan), and some stringent FA schemes (Montana, Indiana). The activity in the “no equalization” category suggests that judicial or political drama can make an SFE known, even if it is more modest than other states’ “routine” changes to their school finance laws. Finally, Table I shows that some court-ordered and legislative “equalizations” change parameters in a direction that is apparently *anti*-equalization.

In short, Table I should make one doubt whether a dummy variable for equalization will do a reasonably good job of representing the economic content of school finance schemes. One should also doubt the usefulness of an empirical strategy with two dummy variables, one for court-ordered equalization and one for legislative equalization.

VII. Estimation Strategy

As discussed above, a school finance formula affects the values of four variables: the foundation tax rate, the school-related income (or sales) tax rate, the marginal tax price, and the flat grant. My basic

Table I
School Finance Equalizations Differ in the Tax Prices and Tax Rates They Impose

	Inverted Tax Price minimum/maximum		Foundation Tax Rate median, in 1/1000ths	
	before (closest year)	after (closest year)	before (closest year)	after (closest year)
Centralized Finance				
Hawaii	0/0***	0/0***	20.0	20.0
Court-Ordered SFE				
Arkansas 1983	1/1	1/1	9.0	19.0
California 1978**	1/1	0/0***	10.0	10.0
Connecticut 1978‡	1/1	0.53/1.87	4.0	4.0
Kansas 1976**	1/1	0.57/1.96	5.0	17.0
Kentucky 1989	1/1	1/1	5.0	9.0
New Jersey 1976‡	1/1.3	1/1.5	0.0	0.0
Utah mid-1970s	1/1	1/1	17.0	48.0
Washington 1978‡	1/1	1/1	22.0	3.6
West Virginia 1979	1/1	1/1	4.2	4.5
Wyoming 1983	1/1	1/1	22.0	25.0
Legislative SFE				
Arizona 1980	1/1	1/1	13.0	47.0
Florida 1973	1/1	1/1	6.0	7.3
Georgia 1986	1/1	0.78/1.93	12.0	15.0
Idaho 1978	1/1	1/1	5.0	25.0
Illinois 1973-80	1/1	1/1	5.0	27.6
Iowa 1972	1/1	1/1	5.4	5.4
Maine 1978	1/1	1/1	10.0	9.2
Maryland 1987	1/1	1/1	4.8	2.1
Massachusetts 1985‡	1/1	1/1	0.1	0.1
Minnesota 1973	1/1	1/1	25.0	28.0
Missouri 1977	1/1	1/1	7.0	6.0
New Hampshire 1985	1/1	1/1	9.0	14.0
New Mexico 1974	1/1	0.05/0.05***	21.0	20.0
Ohio 1975-82	1/1	1/1	9.3	20.0

	Inverted Tax Price minimum/maximum		Foundation Tax Rate median, in 1/1000ths	
Oklahoma 1987	0.83/1.83	0.15/0.96	21.0	19.0
Rhode Island 1985	1/1	1/1	1.0	10.0
South Carolina 1977	1/1	1/1	15.0	3.0
South Dakota 1986	1/1	1/1	17.0	41.0
Tennessee 1977	1/1	1/1	14.0	2.2
Texas 1986‡	1/1	1/1	6.0	3.0
Vermont 1987	0.78/1.76	1/1	4.0	13.0
Virginia 1975‡	1/1	1/1	23.0	2.0
Wisconsin 1973	1/1	1/1	13.0	22.0
“No” SFE				
	1970	1990	1970	1990
Alabama	1/1	1/1	1.3	1.3
Delaware	1/1	1/1	5.0	5.0
Indiana	1/1	1/1	21.5	24.0
Louisiana	1/1	1/1	5.0	5.0
Michigan	1/1	0.85/1.62	15.0	27.0
Mississippi	1/1	1/1	0.0	0.0
Montana	1/1	1/1	15.0	28.0
Nebraska	1/1	1/1	8.0	9.0
Nevada	1/1	1/1	7.0	7.5
New York‡	1/1	1/1.46	8.0	2.0
North Carolina	1/1	1/1	18.0	0.0
North Dakota	1/1	1/1	20.0	20.0
Oregon	1/1	1/1	11.0	9.3
Pennsylvania‡	1/1	1/1.54	18.0	2.1

* The maximums, minimums, and medians in the table do not adequately describe SFE schemes because there is substantial variation in how tax prices and foundation tax rates are distributed within states. Also, income/sales tax rates and flat grants are not shown, and the variables shown incorporate the endogenous responses of school districts. The “before” year is the closest year before the equalization for which data are available (1970 or 1980). The “after” year is the closest year after the equalization for which data are available (1980 or 1990).

** These states had legislative school finance equalizations prior to their court-ordered equalizations.

*** Every district uses the mandatory minimum rate.

‡ State makes substantial use of income or sales taxes for funding equalization.

Notes: States are categorized based on Downes and Shah [1994], Manwaring and Sheffrin [1997] and Evans, Murray, and Schwab [1999]. The source is author’s calculations based on states’ school finance laws; the 1972, 1982, and 1992 Censuses of Governments; and the 1970, 1980 and 1990 Censuses of Population and Housing.

specification has these four variables and demographic characteristics as the independent variables. I include demographic characteristics that may affect or reflect a district's demand for school spending: mean household income, income inequality (the Gini Coefficient), the poverty rate, the shares of adults who are high school-educated and college-educated, the shares of the population who are school-aged and retirement-aged, the shares of the population who are black, Hispanic, and urban. I include year effects to control for factors that influence per-pupil spending across all school districts in a given year. Such factors include federal aid and the growth rate of the national economy. I also include district-specific fixed effects, which help to control for unobserved variables that are relatively fixed over time within a district–for instance, school organization and idiosyncratic factors that affect the local cost of schooling. Of course, the district fixed effects subsume state fixed effects.

The basic estimating equation for spending is:

$$\log(e_{jst}) = \alpha_1 \tau^f_{jst} + \alpha_2 t_{jst} + \alpha_3 ITP_{jst} + \alpha_4 \log(1+\frac{f_{jst}}{y_{jst}}) + \alpha_5 \log(y_{jst}) + \boldsymbol{X}_{jst}\alpha_6 + \boldsymbol{YR}_t \alpha_7 + \boldsymbol{D}_{js}\alpha_8 + \epsilon_{st} + \epsilon_{jst} \quad (13)$$

where j indexes districts, s indexes states, and t indexes years. Several variables have already been defined: spending (e), the foundation tax rate (τ^f), mean household income (y), and the vector of district-specific demographic characteristics ($\boldsymbol{X}$). t_{jst} is the income/sales tax rate that supports school finance, ITP_{jst} is the inverted tax price, $\boldsymbol{YR}_t$ is a vector of year indicator variables, and $\boldsymbol{D}_{js}$ is a vector of district indicator variables. If households spend grant income just as they spend normal income, then one would simply add the flat grant to y_{jst}. The flypaper literature suggests that households do not treat grant income and normal income similarly, so I separate the flat grant from regular income

$$\log(y_{jst}+f_{jst}) = \log[y_{jst}(1+\frac{f_{jst}}{y_{jst}})] = \log(y_{jst}) + \log(1+\frac{f_{jst}}{y_{jst}}) \quad (14)$$

and I allow separate coefficients on the flat grant and regular income variables. If households spend identically out of flat grants and regular income, α_4 will be equal to α_5. ϵ_{st} is a state-year random effect, and ϵ_{jst} is a district-state-year random effect. Since some school finance formulas make the foundation tax rate and inverted tax price vary only at the state-year level, it is necessary to have a state-year random effect in order to calculate the correct standard errors (Moulton [1986]).

I initially estimate equation (13) by least squares, but this is not strictly correct because the actual parameters we observe in a district reflect its response to SFE. I use an instrumental variables method, sometimes called "simulated instruments" to remedy the endogeneity problem. I instrument for a district's actual school finance variables with the values the variables would take on if the district retained its 1970 characteristics (except for inflation). For instance, I use the shelter price index to adjust 1970 property values, and I use the personal income series to adjust 1970 incomes.[27]

[27] Both series are created by the Bureau of Labor Statistics and are on its webpage (www.bls.gov).

The simulated instruments include the variation in school finance variables generated by laws, but exclude the variation generated by endogenous district responses to the laws. Thus, simulated instrumental variables identify the effect of changing the laws. The least squares results exaggerate the true effects of laws (in absolute value, they are overestimates) because the school finance variables would vary more if districts did not respond to them. Intuitively, districts' endogenous responses soften the treatment that the state intends for them. For instance, suppose that a scheme assigns a very high tax price to a district. The district is likely to choose a lower local tax rate, and property values are likely to fall in the district. Both reactions will make the district's observed tax price more modest than the tax price initially assigned to it.

Endogeneity will likely make the least squares estimates exaggerated, but it is hard to say whether the least squares estimates will be exaggerated or attenuated overall because instrumenting may reduce attenuation bias caused by measurement error. Imperfect matching of the Census of Population to districts is the primary source of measurement error in the school finance variables. The simulated instruments fit the potentially endogenous school variables extremely well. In each of the first stage regressions, the p-value is less than 0.0000 for the F-test that the simulated instruments are jointly equal to zero.[28]

There are a few other estimation issues. It is difficult to say whether the equation should estimated with weights based on the number of students in each district. If all districts follow the same the behavioral model, then each district's observation should be weighted equally for estimating the effects of equalization schemes. If districts follow a variety of models, however, then one would like the estimated effects to reflect the behavior of districts in proportion to the number of children controlled by those districts. I show both unweighted and weighted estimates.

Also, it is unclear whether it is desirable to include district demographic variables as independent variables. On the one hand, these variables help control for exogenous changes in a district's circumstances that affect its conduct. Such changes would not be picked up by year effects or district fixed effects. On the other hand, some of the changes in a district's demographic variables could be endogenous to the school finance program in effect. Rather than attempt to decide whether including the demographic variables is mainly good or bad, I show estimates with and without the demographic variables.

Finally, California's equalization has influenced researchers because the state's population is large and because the equalization is extreme. But, California also has trends (like immigration) that are potentially

[28] This is not surprising since, for instance, all districts in a state with a self-funding FA scheme have tax prices equal to one and a school-related income/sales tax equal to zero. Districts' responses cannot affect these values so the simulated instruments and the potentially endogenous variables are identical. Similarly, in a GTR scheme with three guarantees, only a small share of districts will react so much that they change the guarantee that applies to them.

confounding. Also, if Proposition 13 was not a consequence of equalization, then its effects are also confounding. I show estimates with and without observations from California.

VIII. Spending Results

Table II shows the results of estimating equation (13). The least squares and instrumental variables estimates turn out to be very similar, and I focus on the instrumental variables results.

The coefficients on the demographic variables are much as one would expect. The elasticity of per-pupil spending with respect to mean household income is 0.292 (0.072). Per-pupil spending is increasing in the Gini coefficient and the share of the population who are Hispanic. It is decreasing in the share of the population who are school-aged. The remaining demographic variables do not have coefficients that are statistically different from zero at conventional levels of significance. This is probably because of the district fixed effects, which absorb much of the effect of demographic variables that vary little over time.

The effect of the foundation tax rate is -2.121 (0.851). The introduction of a stringent FA scheme might increase the foundation tax rate by 30 mils, or 0.030. The coefficient indicates that a 30 mil increase would generate a 6.4 percent fall in per-pupil spending.

The coefficient on the inverted tax price is 0.161 (0.068). This suggests that states like California and New Mexico, which reduced districts' inverted tax prices from 1 to 0 (or nearly zero), generated 16 percent reductions in per-pupil spending. Conversely, districts whose inverted tax prices rose from 1 to 1.5 (such districts exist in New Jersey, Connecticut, Kansas, Georgia, Michigan, and New York) should have experienced 8 percent increases in per-pupil spending. Note that *all* districts in California and New Mexico experienced inverted tax prices close to zero, but that only some districts in states like New Jersey experienced inverted tax prices greater than or equal to 1.5. Inverted tax prices that are greater than 1 are subsidized, and the expense of offering the subsidies makes states offer them to only some districts.

The coefficient on the flat grant variable is 0.537 (0.264), which indicates that districts spend much more out of flat grant income than out of a similar change in mean household income. A ten percent increase in income that comes from a flat grant induces a 5.3 percent increase in per-pupil spending. Recall, in contrast, that a ten percent increase in income from regular sources induces only a 2.9 percent increase in per-pupil spending.

Income/sales tax revenues are what supports some of the observed flat grants and subsidized tax prices, yet the coefficient on the income or sales tax rate is not statistically different from zero. (The point estimate is positive.) This suggests that income/sales taxes that support grants and subsidized tax prices have little or no depressing effect on per-pupil spending. Of course, higher tax rates on income and sales must lower households'

Table II: The Effect of School Finance Equalization on Per-Pupil Spending
Dependent Variable: ln(per-pupil spending)

	Least Squares	Instrumental Variables	Instrumental Variables weighted by students	Instrumental Variables with few covariates	Instrumental Variables excluding CA
Foundation tax rate*	-2.252 (0.537)	-2.121 (0.851)	-1.781 (0.891)	-2.521 (0.921)	-1.781 (0.858)
Income/Sales tax rate in support of school spending*	0.167 (0.271)	0.153 (0.631)	0.804 (1.934)	0.607 (0.714)	0.384 (0.931)
Inverted Tax Price*	0.160 (0.009)	0.161 (0.068)	0.145 (0.068)	0.148 (0.063)	0.150 (0.049)
ln(1+flat grant/mean income)*	0.482 (0.038)	0.537 (0.264)	0.529 (0.276)	0.497 (0.281)	0.676 (0.278)
ln(mean income)	0.284 (0.057)	0.292 (0.072)	0.310 (0.072)		0.298 (0.076)
share of population who are black	-0.071 (0.047)	-0.063 (0.080)	0.040 (0.159)		-0.005 (0.088)
share of population who are Hispanic	0.297 (0.051)	0.299 (0.123)	0.402 (0.121)		0.380 (0.145)
share of adult population with 12+ years of education	-0.082 (0.036)	-0.091 (0.085)	0.263 (0.145)		-0.118 (0.088)
share of adult population with 16+ years of education	-0.245 (0.049)	-0.257 (0.185)	-0.413 (0.170)		-0.196 (0.200)
share of households in poverty	0.049 (0.044)	-0.065 (0.107)	0.029 (0.174)		-0.081 (0.112)
Gini Coefficient, household income	0.204 (0.052)	0.210 (0.127)	0.148 (0.165)		0.226 (0.130)
share of population urban	0.010 (0.010)	0.010 (0.027)	-0.054 (0.030)		-0.011 (0.027)
share of population who are school-aged	-1.321 (0.062)	-1.320 (0.229)	-1.742 (0.345)		-1.392 (0.238)
share of population who are 65+ years old	-0.137 (0.062)	-0.151 (0.145)	-0.096 (0.208)		-0.129 (0.144)
year effects	yes	yes	yes	yes	yes
individual district effects	yes	yes	yes	yes	yes
observations	39843	39843	39843	39843	35154

Notes: In the instrumental variables regressions, the variables with asterisks are instrumented with the values the variables would take on if the districts maintained their pre-SFE conduct. Standard errors that allow for state-year clustering are in parentheses. All financial variables are in 1999 dollars. The pupil-weighted means and standard deviations of the dependent variable are: 8.204 and 0.295 (1971-72), 8.297 and 0.293 (1981-82), and 8.721 and 0.290 (1991-92). The R-squared of the least squares regression is 0.616. The source is author's calculations based on states' school finance laws; the 1972, 1982, and 1992 Censuses of Governments; and the 1970, 1980, and 1990 Censuses of Population.

consumption of *something*, but the direct effect on per-pupil spending is evidently weak. Presumably, income/sales taxes depress consumption across the board, so that the small income/sales tax rate that supports equalization has an undiscernible negative effect on per-pupil spending. This is in contrast to the foundation tax rate, which has a statistically significant negative effect on per-pupil spending.

Overall, there are two important findings in the table. One is the magnitude of the effect of the inverted tax price: changing the inverted tax price that a district faces can generate dramatic changes in its spending. The second important finding is that flat grant categorical aid apparently has almost no potential to generate leveling down.[29]

The estimated effects of the school finance parameters are quite robust to changes in the specification. Weighting the equation by districts' student populations reduces the effect of the foundation tax rate (-1.781 with a standard error of 0.891) and the inverted tax price (0.145 with a standard error of 0.068), but does not change the overall picture. Excluding time-varying demographic variables or California districts changes the coefficients only slightly.

In Table III, I show the how the coefficients estimated in Table II clarify actual equalization experiences. The two left-hand columns of Table III present, for each state: (1) actual mean per-pupil spending in 1990 (1999 dollars), (2) an estimate of the change in mean per-pupil spending due to the state's equalization scheme. In order to generate the predictions for the second column, I calculated what mean per-pupil spending would have been if no equalization scheme were in effect (that is, I set the foundation tax rate to zero, the equalization-related income/sales tax rate to zero, the inverted tax price to one, and the flat grant to zero). For instance, consider the entry for New Hampshire, which had a moderate FA program in 1990. Its mean per-pupil spending was $6,654, and this mean spending was 2.9 percent lower than it would have been if there had been no equalization program. In other words, New Hampshire had mild leveling-down.

The second column of Table III shows that equalization schemes have generated both leveling up and leveling down. Noteworthy leveling-down states are Arizona (10.1 percent lower), California (15.0 percent lower), New Mexico (13.3 percent lower), Oklahoma (9.6 percent lower), and Utah (10.4 percent lower). Noteworthy leveling-up states are New Jersey (7.2 percent higher), New York (6.8 percent higher), and Pennsylvania (7.7 percent higher).

The remaining columns of Table III show how equalization schemes have affected measures of spending inequality. In the third column, I show the pupil-weighted coefficient of variation in per-pupil spending for each state in 1990. The next column contains an estimate of the *change* in the coefficient of variation due to

[29] It is not possible to draw a similarly strong conclusion about matching grant categorical aid because, though it uses income/sales taxes, it also affects tax prices (like GTR schemes).

Table III
Leveling Up and Leveling Down due to States' School Finance Schemes
Statistics based on States' Actual Per-Pupil Spending in 1990 (expressed in 1999$) and
Predictions of how the Statistics would Change if no School Finance Equalization were in Effect

State	Mean Per-Pupil Spending	Percent Change in Mean due to State's Scheme	Coefficient of Variation in Per-Pupil Spending	Change in Coefficient of Variation due to State's Scheme	Log(90th percentile) - Log(10th percentile)	Change in Log(90th)-Log(10th) due to State's Scheme
Alabama	4258	-0.051	0.178	-0.065	0.323	-0.146
Arizona	5789	-0.101	0.271	-0.095	0.464	-0.129
Arkansas	4524	-0.046	0.156	-0.068	0.372	-0.148
California	5826	-0.150	0.192	-0.151	0.309	-0.189
Connecticut	8845	0.039	0.140	-0.062	0.284	-0.158
Delaware	6904	-0.001	0.063	-0.055	0.156	-0.129
Florida	6586	-0.008	0.119	-0.048	0.320	-0.122
Georgia	5464	-0.076	0.174	-0.071	0.455	-0.138
Idaho	4535	-0.048	0.175	-0.074	0.404	-0.152
Illinois	5982	-0.054	0.346	-0.071	0.734	-0.168
Indiana	5901	-0.041	0.154	-0.070	0.375	-0.147
Iowa	5800	-0.002	0.146	-0.042	0.324	-0.109
Kansas	5826	-0.001	0.168	-0.054	0.350	-0.132
Kentucky	4597	-0.019	0.111	-0.063	0.309	-0.125
Louisiana	5089	-0.038	0.133	-0.055	0.303	-0.134
Maine	6363	-0.012	0.231	-0.051	0.454	-0.124
Maryland	7450	-0.004	0.147	-0.045	0.407	-0.107
Massachusetts	6577	-0.004	0.252	-0.055	0.584	-0.149
Michigan	6408	-0.002	0.236	-0.091	0.596	-0.124
Minnesota	6730	-0.046	0.208	-0.071	0.484	-0.170
Mississippi	3869	0.001	0.163	-0.030	0.328	-0.081
Missouri	5635	-0.013	0.427	-0.050	0.972	-0.110
Montana	5842	-0.061	0.386	-0.071	0.661	-0.155
Nebraska	6229	-0.009	0.210	-0.056	0.416	-0.101
Nevada	6655	-0.015	0.156	-0.035	0.194	-0.096
New Hampshire	6654	-0.029	0.196	-0.056	0.466	-0.127
New Jersey	10093	0.072	0.173	-0.083	0.385	-0.107
New Mexico	5038	-0.133	0.172	-0.167	0.355	-0.198
New York	9801	0.068	0.219	-0.089	0.461	-0.101
North Carolina	5787	0.006	0.163	-0.033	0.420	-0.059
North Dakota	5064	-0.043	0.218	-0.067	0.449	-0.151
Ohio	5902	-0.042	0.328	-0.065	0.645	-0.154
Oklahoma	4651	-0.096	0.169	-0.113	0.306	-0.139
Oregon	6660	-0.020	0.207	-0.044	0.352	-0.105
Pennsylvania	7262	0.077	0.214	-0.064	0.561	-0.106
Rhode Island	7108	-0.018	0.084	-0.048	0.145	-0.126
South Carolina	5251	-0.006	0.123	-0.044	0.330	-0.116

South Dakota	5412	-0.080	0.233	-0.082	0.382	-0.188
Tennessee	4314	-0.003	0.180	-0.046	0.424	-0.102
Texas	5300	-0.068	0.160	-0.059	0.307	-0.147
Utah	3924	-0.104	0.159	-0.091	0.316	-0.175
Vermont	7202	-0.022	0.227	-0.052	0.507	-0.128
Virginia	6310	0.013	0.204	-0.070	0.497	-0.142
Washington	7057	0.010	0.187	-0.057	0.319	-0.141
West Virginia	5732	-0.002	0.105	-0.050	0.240	-0.136
Wisconsin	7344	-0.049	0.164	-0.068	0.362	-0.133
Wyoming	7140	-0.052	0.281	-0.065	0.391	-0.159

Notes: The table shows predictions that are based on the estimates shown in the "Instrumental Variables" column of Table II. See Table II for details on the estimates. The first, third, and fifth columns show statistics on actual per-pupil spending in 1990 (1999$). The second, fourth, and sixth columns show how the per-pupil spending statistics would change if there were no SFE scheme in effect. To generate the numbers shown in these columns, I used the coefficients and variables fromTable II and generated the per-pupil spending statistics using the foundation tax rates, equalization-related income/sales tax rates inverted tax prices, and flat grants that were actually in effect in 1990. I compare these statistics to no-SFE statistics generated by setting the foundation tax rate to zero, the equalization-related income/sales tax rate to zero, the inverted tax price to one, and the flat grant to zero.

the state's equalization scheme. Consider the entry for New Hampshire. Its coefficient of variation is 0.196, and this coefficient of variation was 0.056 lower than it would have been if there had been no equalization program. In other words, the standard deviation of New Hampshire's per-pupil spending would have been 5.6 percent more of its mean per-pupil spending if it had had no equalization program.

In the fifth column, I show the log 90-10 ratio (the log of the ratio of per-pupil spending at the pupil-weighted 90th percentile and per-pupil spending at the pupil-weighted 10th percentile). The far right-hand column contains an estimate of the *change* in the log 90-10 ratio. For instance, New Hampshire's log 90-10 ratio is 0.466, which implies that the pupil who experiences spending at the 90th percentile enjoys per-pupil spending that is about 46.6 percent higher than the pupil who experiences spending at the 10th percentile. New Hampshire's log 90-10 ratio would be 0.127 higher if it had no equalization program. That is, the students at the 90th and 10th percentiles would experience spending that differed by about 59.3 percent if there had been no no equalization scheme.

New Hampshire had a moderate FA scheme in 1990, and its experience is reasonably representative of states with moderate schemes. Per-pupil spending is partially equalized, particularly because the foundation grant brings up per-pupil spending among otherwise low-spending districts. New Hampshire's equalizing–relatively mild overall, substantial for otherwise low-spending districts–is not achieved without downward pressure on mean per-pupil spending.

The majority of states have equalization experiences as moderate as that of New Hampshire. Their mean per-pupil spending changes by zero to three percent (positive or negative); their coefficients of variation fall by zero to 0.05; and their log 90-10 ratios fall by zero to 0.15. Although the most common equalization experience in the United States is a moderate one, it is not necessarily an optimal one. Among states that experience similar equalizing, there is still variation in whether the state is leveling-down or leveling-up. If one takes the rhetoric of school finance legislation seriously, then much of the leveling-down that occurs is unintentional.

Notice that the states with the most dramatic equalizing are all leveling-down states: California, New Mexico, South Dakota, Utah. In these states, the difference between spending at the 90th and 10th percentiles would be almost 20 percent greater if no equalization program were in effect.[30]

Less dramatic equalizing occurs in the states with the greatest increases in mean per-pupil spending (New Jersey, New York, Pennsylvania). In these states, the difference between spending at the 90th and 10th percentiles would be only about 10 percent greater if no equalization program were in effect.

In short, Table III suggests that–in practice–some equalizing but not dramatic equalizing is compatible with leveling up. This is a statement about the schemes that states have actually enacted–*not* a statement about what states could accomplish in theory. The reason that leveling up schemes tend to attempt more modest equalizing than leveling down schemes is probably that states face little or no direct cost when they set inverted tax prices close to zero but face substantial costs when they set inverted tax prices far above 1. It is expensive to bribe districts that would prefer low spending into spending a lot. It is inexpensive to forbid high spending.

Usually, courts and legislatures are mandated to achieve a combination of equity and adequacy in school finance. Do the states that achieve dramatic equalizing through leveling down go too far? A *minimal* standard for whether a scheme is achieving a good mix of equity and adequacy is the criterion: "Do no harm to poor districts." That is, if in pursuit of equity goals, a scheme makes mean spending fall so much that spending is *less* adequate in poor districts, it has almost certainly gone too far. In order to determine whether any states' equalization schemes actually make spending fall in poor districts, I calculated the number of poor districts that would be predicted to have higher per-pupil spending under pure local finance. I considered two definitions of poor districts: those in which mean household income is at or below the state's 20th percentile and those in which per-pupil property value is at or below the state's 20th percentile. Regardless of which definition I use, California and New Mexico (and only these two states) have a majority of their poor districts being *worse off* under equalization. These are also the two states that allow districts to keep only a negligible portion of the revenues they raise to support local schools.[31]

---

[30] In California, the observed log 90-10 ratio is non-zero largely because of non-regular spending on special education spending, bilingual education spending, *et cetera*.

[31] Define districts as "poor" if they had mean household income at or below the twentieth percentile for their state in 1970. Then, between 1970 and 1990, real per-pupil spending grew by only 3.5 percent in poor California districts and by only 3.9 percent in poor New Mexico districts. The poor California districts experienced the lowest growth rate among poor districts in the United States, except for poor districts in Utah, which experienced a 3.3 percent growth rate. (Recall that Utah also had a strong leveling down SFE.) Only two other states' poor districts had growth rates similar to that of poor districts in New Mexico and California: Louisiana and Iowa. California and New Mexico

IX. Other Effects of School Finance Equalization

SFE can affect outcomes other than school spending. Some of these outcomes (property values, private school attendance) can feed back into the determination of school spending.

<u>The Effects of School Finance Equalization on Property Values</u>

SFE schemes can change property values, both because SFE schemes tax school productivity that has been capitalized in house prices and because SFE schemes themselves can be capitalized. In the left-hand panel of Table IV, I investigate how property values are affected by estimating a version of equation (13) in which the dependent variable is the log of property value per pupil in a district.[32]

The coefficient on the foundation tax rate is -2.666 (0.632) in the left-hand column, which shows unweighted IV estimates. Recall that introducing a stringent FA program might raise the foundation tax rate by 30 mils (0.030). Therefore, the coefficient indicates that a stringent FA program might lower property value per pupil by about 7.9 percent.

Neither the equalization-related income/sales tax rate nor the flat grant has a statistically significant effect on property values. The coefficient on the inverted tax price is statistically significant, however, and ranges from 0.159 (0.058) to 0.178 (0.054), depending on the specification. These estimates suggest that the most extreme GTR schemes (those that lower the inverted tax price from one to zero) reduce property values by 16 to 18 percent. Of course, these changes in property values will not necessarily be distributed equally across districts. In most schemes that vary the inverted tax price, "property-rich" districts face lower inverted tax prices than "property-poor" districts.

To the extent that policy makers have considered any reactions to equalization schemes, they have considered only how districts might change their property tax *rates*. The results shown suggest that policy makers also need to consider how the property tax *base* reacts.

<u>The Effects of School Finance Equalization on Private School Attendance</u>

The right-hand panel of Table IV shows estimates of the effect of equalization on private school

---

stand out, however, because between 1970 and 1990 the growth rate of income per student was 6 percent in California and 5 percent in New Mexico, but only 3 percent in Utah, 4 percent in Louisiana, and 4 percent in Iowa. Put another way, in a regression of poor districts' spending growth on their states' per-student income growth, an indicator for California and New Mexico has a highly statistically significant coefficient of -1.8.

[32] I show just the unweighted and weighted IV estimates, but the results are similar for the specification with few covariates and the specification that excludes California (available from the author).

attendance.[33] The equation estimated is the same as equation (13), except for the fact that the dependent variable is the share of students who attend private school. Over the period from 1970 to 1990, the mean private school share in America was about 0.11, so that an increase of 0.03 (3 percentage points)–say–would represent a substantial increase in private schooling.

The coefficient on the foundation tax rate varies between 0.301 and 0.361, depending on the specification. A stringent FA program might raise the foundation tax rate by 30 mils, so the coefficient estimates suggest that a stringent FA program might increase the share of students who attend private school by about 0.01 (1 percentage point).

Neither the equalization-related income/sales tax rate nor the flat grant has a statistically significant effect on property values. The coefficient on the inverted tax price is statistically significant, however, and ranges from -0.026 (0.005) to -0.032 (0.005). These estimates suggest that the most extreme leveling-down schemes (those that lower the inverted tax price from one to zero) increase the share of students who attend private school by about 0.03 (3 percentage points). The same estimates suggest that the private school share falls by about 1.5 percentage points in districts that experience the inverted tax prices of 1.5. Of course, only a minority of districts have inverted tax prices of 1.5 or more, even under the most extreme leveling-up schemes. In general, the private school share will rise in "property-rich" districts and fall in "property-poor" ones.

Recall that the private school share matters, in part, because the departure of high demand parents from the public sector can lower spending targets built into school finance formulas–either because the targets are affected by state-wide politics or because the targets are a function of spending in high demand districts.

The Effects of School Finance Equalization on the Drop-Out Rate

Table V focuses on the only measure of student performance that is available for every school district in the United States over the 1970-90 period: the high school drop-out rate. This measure has several advantages. It is measured consistently (in the Censuses of Population), it reflects the entire population of students (unlike average scores on college admissions tests, which are strongly affected by sample selection), and it reflects the achievement of students who disproportionately live in districts that are the intended beneficiaries of equalization. Of course, it would be optimal to use scores from a test that was universally or randomly administered, but such a test does not exist. Even the National Assessment of Educational Progress

[33] I show just the unweighted and weighted IV estimates, but similar results for the specification with few covariates and the specification that excludes California are available from the author.

Table IV
The Effect of School Finance Equalization on Property Prices and Private School Attendance

	Dependent Variable: ln(per-pupil property value), 1999$		Dependent Variable: Share of Students in Private School	
	IV	IV weighted by students	IV	IV weighted by students
Foundation tax rate*	-2.666 (0.632)	-2.641 (0.778)	0.361 (0.092)	0.301 (0.143)
Income/Sales tax rate in support of school spending*	-0.432 (2.309)	2.429 (2.067)	-0.007 (0.566)	0.130 (0.980)
Inverted Tax Price*	0.166 (0.088)	0.178 (0.054)	-0.032 (0.005)	-0.026 (0.005)
ln(1+flat grant/mean income)*	0.095 (0.272)	0.200 (0.226)	0.008 (0.021)	0.004 (0.048)
ln(mean income)	0.188 (0.162)	0.164 (0.176)	0.035 (0.006)	0.034 (0.012)
share of population who are black	-0.474 (0.265)	-0.070 (0.364)	-0.040 (0.021)	-0.008 (0.019)
share of population who are Hispanic	0.670 (0.384)	1.358 (0.419)	-0.059 (0.021)	-0.047 (0.045)
share of adult population with 12+ years of education	0.200 (0.267)	0.688 (0.385)	-0.079 (0.017)	-0.076 (0.028)
share of adult population with 16+ years of education	3.551 (0.392)	2.320 (0.335)	0.134 (0.019)	0.132 (0.029)
share of households in poverty	-0.120 (0.322)	-0.139 (0.321)	0.003 (0.018)	-0.072 (0.032)
Gini Coefficient, household income	-0.580 (0.289)	-0.340 (0.714)	0.017 (0.017)	-0.038 (0.042)
share of population urban	0.357 (0.081)	0.226 (0.108)	0.030 (0.004)	0.036 (0.005)
share of population who are school-aged	-3.417 (0.467)	-3.771 (0.618)	-0.012 (0.026)	-0.201 (0.052)
share of population who are 65+ years old	3.360 (0.433)	4.606 (0.663)	-0.027 (0.020)	-0.035 (0.055)
year effects	yes	yes	yes	yes
individual district effects	yes	yes	yes	yes
observations	39843	39843	39843	39843

Notes: In these instrumental variables regressions, the variables with asterisks are instrumented with the values the variables would take on if the districts maintained their pre-SFE conduct. Standard errors that allow for state-year grouped effects are shown in parentheses. All financial variables are in 1999 dollars. The pupil-weighted means and standard deviations of log per-pupil property value are: 12.009 and 0.547 (1970), 12.806 and 0.772 (1980), and 12.737 and 0.707 (1990). Per-pupil property value is constructed as described in the text using states' administrative data, the *Taxable Property Values* section of the Census of Government, and the Census of Population. The pupil-weighted means and standard deviations of the share of students in private schools are: 10.819 and

8.677 (1970), 12.616 and 7.522 (1980), and 12.853 and 7.329 (1990). The share of students in private schools derives from Census of Population data. It is the ratio of the number of 3- to 19-year-olds enrolled in private elementary and secondary schools to the number of 3- to 19-year-olds enrolled in all (public and private) elementary and secondary schools. The overall source is author's calculations based on states' school finance laws; the 1972, 1982, and 1992 Censuses of Governments; and the 1970, 1980, and 1990 Censuses of Population.

is not available at the state level before 1990.

There are two ways to show the effect of equalization schemes on the drop-out rate. One can estimate equation (13) with the drop-out rate as the dependent variable. Alternatively, one can treat simulated equalization parameters as instruments for school spending. The latter procedure is based on the idea that equalizations are spending shocks to districts that can be used estimate "education production functions." Such estimates are likely to suffer from relatively little simultaneity bias because SFE shocks spending while the district's underlying characteristics are held constant by the district fixed effects and district-level demographic variables.

The two left-hand columns of Table V show the results of the first procedure. The drop-out rate is not statistically significantly affected by the foundation tax rate, the school-related income/sales tax rate, or the inverted tax price. The flat grant variable does, however, have a statistically significant effect. This suggests that dropping-out is affected only in districts that would otherwise be very low-spending–that is, in districts constrained to raise spending by the imposition of the flat grant. A flat grant that is 10 percent of mean income, say, is estimated to reduce the drop out rate by 0.0076 to 0.0101 (0.76 to 1.01 percentage points)

The two right-hand columns of Table V present the results obtained if one instruments for per-pupil spending with the simulated parameters that describe equalization schemes. The coefficient on per-pupil spending is not statistically significantly different from zero in either of the specifications that are shown. It is also not statistically significant in alternative specifications that I estimated to check robustness.

The mixed results should make one wary about drawing firm conclusions about the effect of equalization on the drop-out rate, but they hint that equalization improves student achievement the most (perhaps only) in schools that would have very low spending if left to their own devices.

VII. Conclusion

In this paper, I explain how school finance equalization works and why equalization schemes have such varying effects on school spending. I demonstrate that schemes can level spending up or down, depending on the price and income effects they impose. Schemes can be characterized by a few variables, and–by choosing the values of these variables–a state should be able to implement the scheme that best meets its objectives.

While equalization schemes can level up or down, near-equality of per-pupil spending is achieved only

Table V
The Effect of School Finance Equalizations on Dropping-Out
Dependent Variable: Share of Students who Drop Out

	Equalization Parameters		log(per-pupil spending), instrumented	
	unweighted	weighted	unweighted	weighted
log(per-pupil spending)			0.035 (0.050)	0.032 (0.049)
Foundation tax rate*	0.027 (0.093)	0.246 (0.175)		
Income/Sales tax rate in support of school spending*	0.017 (0.593)	-0.209 (0.529)		
Inverted Tax Price*	-0.002 (0.009)	-0.004 (0.007)		
ln(1+flat grant/mean income)*	-0.076 (0.044)	-0.101 (0.036)		
ln(mean income)	-0.030 (0.010)	-0.024 (0.009)	-0.017 (0.016)	-0.012 (0.015)
share of population who are black	0.099 (0.027)	0.022 (0.013)	0.102 (0.029)	0.032 (0.012)
share of population who are Hispanic	0.127 (0.034)	0.073 (0.028)	0.111 (0.041)	0.066 (0.039)
share of adult population with 12+ years of education	-0.216 (0.020)	-0.291 (0.025)	-0.219 (0.024)	-0.311 (0.030)
share of adult population with 16+ years of education	-0.015 (0.021)	0.050 (0.027)	-0.001 (0.027)	0.066 (0.039)
share of households in poverty	0.143 (0.025)	0.279 (0.034)	0.156 (0.026)	0.278 (0.036)
Gini Coefficient, household income	-0.110 (0.034)	-0.190 (0.032)	-0.124 (0.040)	-0.201 (0.033)
share of population urban	0.006 (0.006)	0.009 (0.006)	0.007 (0.006)	0.012 (0.007)
share of population who are school-aged	-0.210 (0.040)	-0.320 (0.055)	-0.151 (0.079)	-0.298 (0.111)
share of population who are 65+ years old	-0.095 (0.041)	-0.162 (0.044)	-0.102 (0.043)	-0.203 (0.054)
year effects	yes	yes	yes	yes
individual district effects	yes	yes	yes	yes
observations	39843	39843	39843	39843

Notes: In these instrumental variables regressions, the variables with asterisks are instrumented with the values the variables would take on if the districts maintained their pre-SFE conduct. Log per-pupil spending is also instrumented with the simulated SFE parameters. Standard errors that allow for state-year grouped effects are shown in parentheses. All financial variables are in 1999 dollars. The pupil-weighted means and standard deviations of the dependent variable are: 0.152 and 0.078 (1970), 0.137 and 0.068

(1980), and 0.115 and 0.057 (1990). The share of students who drop-out derives from Census of Population data. It is the number of 16- to 19-year-olds who are neither enrolled in school nor high school graduates divided by the total number of 16- to 19-year-olds. The overall source is author's calculations based on states' school finance laws; the 1972, 1982, and 1992 Censuses of Governments; and the 1970, 1980, and 1990 Censuses of Population.

under schemes that level down. This is because a state faces no direct cost of equalizing through leveling down–it only need set prohibitively high tax prices for districts that would prefer to spend a lot. The direct costs of leveling up are considerable: a state must bribe some districts to spend a lot more than they would prefer to.

FA schemes, which leave the tax price of local school spending untouched, tend to cause moderate leveling-down. A middle-of-the-road FA scheme like that of New Hampshire causes mean per-pupil spending to fall by about 2.9 percent, and a stringent FA scheme like that of Arizona causes mean spending to fall by 10.1 percent. Such reductions in per-pupil spending are an average of spending decreases in "rich" districts and increases in "poor" districts. GTR schemes, which affect the tax price of local school spending, can cause substantial leveling-down (15 percent) or more modest leveling-up (7 percent).

Strikingly, it appears that some students from poor households would actually have better funded schools if their states did not attempt such complete equalization. These students live in California and New Mexico, where districts face nearly infinite tax prices. More generally, because equalization schemes can contain feedback mechanisms by which their consequences depress their own spending targets, poor students can be worse off under school finance equalization schemes are apparently more generous than the categorical aid schemes they replaced.

I show that house prices fall in districts that are penalized for having high property value per pupil The converse is also true. Such capitalization partially un-does the effect of a school finance equalization scheme. I show that parents are induced to send their children to private schools in districts that are penalized for having high property value per pupil. While the estimated effects of equalization on student achievement are generally weak, it does appear that the drop-out rate falls in districts that are constrained to raise spending by the imposition of a per-pupil spending floor.

If these were my only results, I would simply conclude that states should choose their equalization schemes carefully, in order to move towards their equality *and* adequacy goals.

The paper has, however, more general economic content. First, school districts respond like economic agents to the incentives created by equalization schemes. Their conduct is not perplexing if one understands the constraints and prices they are facing. Second, school finance equalization schemes have unintended consequences because they base redistribution among jurisdictions on assets (property) whose prices depend on how households value the jurisdictions. One unintended consequence is that school finance equalization does not merely redistribute from people with greater to people with lower ability-to-pay; it redistributes schools that are more productive to schools that are less productive. It can also redistribute from people with greater taste for education to people with lower taste for education, un-do its own formula over time, and generate feedback that amplifies its intended effect. Categorical aid, which is an alternative method of redistributing among schools, does not produce similar unintended consequences.

Harvard University
and the National Bureau of Economic Research
Cambridge, Massachusetts

References

American Education Finance Association. *Public School Finance Programs of the United States and Canada*. 1986-87, 1990-91, and 1993-94 editions. (Blacksburg, VA: 1988, 1992, and 1995).

Benabou, Roland, "Heterogeneity, Stratification, and Growth: Macroeconomic Implications of Community Structure and School Finance," *American Economic Review,* LXXXVI (1996), 584-609.

Black, Sandra, "Do Better Schools Matter? Parental Valuation of Elementary Education," *Quarterly Journal of Economics*, CXIV (1999), 577-99.

Brunner, Eric, and Jon Sonstelie, "Coping with Serrano: Voluntary Contributions to California's Local Public Schools," *1996 Proceedings of the Eighty-Ninth Conference on Taxation held under the auspices of the National Tax Association*, 1996, 372-381.

Card, David, and Abagail Payne, "School Finance Reform, the Distribution of School Spending, and the Distribution of SAT Scores," National Bureau of Economic Research Working Paper 6766, 1998.

Downes, Thomas, and Mona Shah, "The Effect of School Finance Reforms on the Level and Growth of Per Pupil Expenditures," Tufts University manuscript, 1994.

Downes, Thomas and David Schoeman, "School Finance Reform and Private School Enrollment: Evidence from California," *Journal of Urban Economics,* XLIII (1998), 418-43.

Epple, Dennis, and Richard Romano, "Ends Against the Middle: Determining Public Service Provision When There Are Private Alternatives," *Journal of Political Economy*, LXII (1996), 297-325.

Epple, Dennis, and Glenn Platt, "Equilibrium and Local Redistribution in an Urban Economy When Households Differ in Both Preferences and Income," *Journal of Urban Economics*, XLIII (1998), 23-51.

Evans, William, Sheila Murray, and Robert Schwab, "Education Finance Reform and the Distribution of Education Resources," *American Economic Review*, XIII (1999), 205-16.

Fernandez, Raquel, and Richard Rogerson, "Equity and Resources: An Analysis of Education Finance Systems, National Bureau of Economic Research Working Paper 7111, 1999.

Fischel, William, "Did *Serrano* Cause Proposition 13?" *National Tax Journal*, XLII (1989), 465-73.

—, "How *Serrano* Caused Proposition 13," Working Paper No. 94-23, Dartmouth College Economics Department, 1994.

Glomm, Gerhard and B. Ravikumar, "Opting Out of Publicly Provided Services: A Majority Voting Result," *Social Choice and Welfare*, XV (1998), 187-99.

Hamilton, Bruce, "Capitalization of Intrajurisdictional Differences in Local Tax Prices," *American Economic Review*, LXVI (1976), 743-53.

Hines, James, and Richard Thaler, "The Flypaper Effect," *Journal of Economic Perspectives*, IX (1995), 217-26.

Hoxby, Caroline, "All School Finance Equalizations are Not Created Equal," Harvard University manuscript (http://www.economics.harvard.edu/faculty/hoxby/papers.html), 1999.

Manwaring, Robert, and Steven Sheffrin, "Litigation, School Finance Reform, and Aggregate Educational Spending," *International Tax and Public Finance*, IV (1997), 107-27.

Moulton, Brent, "Random Group Effects and the Precision of Regression Estimates," *Journal of Econometrics,* XXXII (1986), 385-97.

Nechyba, Thomas, "Public School Finance in a General Equilibrium Tiebout World: Equalization Programs, Peer Effects and Private School Vouchers," National Bureau of Economic Research Working Paper 5642, 1996.

— , "Local Property and State Income Taxes: The Role of Interjurisdictional Competition and Collusion," *Journal of Political Economy*. CV (1997), 351-84.

— , "Existence of Equilibrium and Stratification in Local and Hierarchical Tiebout Economies with Property Taxes and Voting," *Economic Theory*, X (1997), 277-304.

Silva, Fabio, and Jon Sonstelie, "Did *Serrano* Cause a Decline in School Spending?" *National Tax Journal*, XLVIII (1995), 199-215.

Tiebout, Charles, "A Pure Theory of Local Expenditures," *Journal of Political Economy*, LXIV (1956), 416-24.

United States Department of Commerce, Bureau of the Census. *Census of Governments: Government Employment and Finance Files*. 1972, 1982, and preliminary 1992 editions. Computer files. (Washington, DC: Bureau of the Census, 1974, 1984, and 1999).

----. *Census of Governments: Taxable Property Values and Assessment-Sales Price Ratios*. 1972, 1977, 1987, and 1992 editions. (Washington, DC: United States Government Printing Office, 1974, 1979, 1984, 1989, and 1994).

----. *Census of Population and Housing, 1970: Fifth Count Summary File, Enumeration Districts and Block Groups*. Computer file. (Washington, DC: Bureau of the Census, 1975).

----. *Census of Population and Housing, 1970: Master Enumeration District Lists*. Computer file. (Washington, DC: Bureau of the Census, 1973).

----. *Census of Population and Housing, 1980: 1970-1980 Tract Relationships*. Computer file. (Washington, DC: Bureau of the Census, 1983).

----. *Census of Population and Housing, 1980: Master Area Reference File*. Computer file. (Washington, DC: Bureau of the Census, 1983).

----. *Census of Population and Housing, 1980: Summary Tape File 3F*. Computer file. (Washington, DC: Bureau of the Census, 1983).

----. *Office of Revenue Sharing, Fifth Count File, 1970*. Computer file. (Ann Arbor, MI: Inter-university Consortium for Political and Social Research, 1974.

United States Department of Education, National Center for Education Statistics. *School District Data Book: 1990 Census School District Special Tabulation*. Computer file. (Washington, DC: National Center for Education Statistics, 1994).

United States Department of Education, National Center for Education Statistics. *Digest of Education Statistics*. 1979 through 1999 annual editions. (Washington, DC: United States Government Printing Office 1980 through 2000).

United States Department of Health, Education, and Welfare, National Center for Education Statistics. *Digest of Education Statistics*. 1975 through 1978 annual editions. (Washington, DC: United States Government Printing Office, 1976, 1977, 1978, and 1979).

United States Office of Education, Division of Educational Statistics. *Digest of Education Statistics*. 1970 through1974 annual editions. (Washington, DC: United States Government Printing Office, 1971, 1972, 1973, 1974, and 1975).

United States Office of Education, Bureau of School Systems. *Public School Finance Programs*. 1968-69, 1971-72, 1973-74, and 1978-79 editions. (Washington, DC: United States Government Printing Office, 1969, 1972, 1974, and 1979).

Vigdor, Jacob, “The Economic Effects of Reducing Local Tax Burdens,” chapter in Essays on the Economics of Location Price, Harvard University. Ph.D. 1999.