Education Finance Reform and Investment in Human Capital: Lessons from California

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Abstract

This paper examines the effect of different education financing systems on the level and distribution of resources devoted to public education. We focus on California, which in the 1970's was transformed from a system of mixed local and state financing to one of effectively pure state finance and subsequently saw its funding of public education fall between ten and fifteen percent relative to the rest of the US. We show that a simple political economy model of public finance can account for the bulk of this drop. We find that while the distribution of spending became more equal, this was mainly at the cost of a large reduction in spending in the wealthier communities with little increase for the poorer districts. Our model implies that there is no simple trade-off between equity and resources; we show that if California had moved to the opposite extreme and abolished state aid altogether, funding for public education would also have dropped by almost ten percent.

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1. Introduction

A large volume of work emphasizes the importance of physical and human capital accumulation for the process of economic growth. This has generated an accompanying literature that analyzes how various policies affect investment in physical and human capital. This literature has been mainly concerned with how the taxation of income from these sources affects accumulation and growth. A distinctive feature of human capital accumulation, however, is the significant role played by government in its financing and distribution. The focus of this paper is to examine how different systems of financing education affect both the level and distribution of human capital investment.

The motivation for this undertaking is straightforward. In the US, both the fraction of personal income devoted to public elementary and secondary school and the systems used to finance public education vary widely across states. As illustrated in Table 1.1 below, the investment share for some states is nearly double that of others, a ratio similar to the relative investment shares found for physical investment in a cross section of countries.[1] It is natural, therefore, to ask to what extent differences in financing systems can account for these differences in human capital

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[1]We note that these differences in investment shares do correspond to real differences in resources. For example, the ratio of pupils in average daily attendance to number of teachers is 23.0 in California, 17.8 in Tennessee, 12.7 in Vermont, 14.6 in Wyoming and 12.3 in New Jersey.

investment shares.[2] While this question can be approached in a variety of manners, we choose to examine it from a political economy perspective.[3]

Table 1.1

Share of Personal Income Devoted to
Public Primary and Secondary Education
(Current Expenditures)

Tennessee	.033
Illinois	.034
Hawaii	.036
California	.036
New Jersey	.049
Maine	.053
Vermont	.058
Wyoming	.062

Source: Statistical Abstract of the US, 1992

We conduct our analysis in a version of the Tiebout model, which is the standard model of local public finance. In our model there are a large number of families with preferences defined over consumption and the quality of education obtained by their children. Families are distinguished by income and, a la Tiebout (1956), we assume that families are sorted perfectly by income across communities so that each community is homogeneous in family income. A school financing system is a set of rules which governs how resources are allocated to education and the extent to which resources are redistributed across communities. For a given financing system, we assume that its parameters are chosen by a process of majority vote.

Though the framework we employ can be used to analyze diverse changes in education financing systems, our analysis focuses on the experience of

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[2]See Inman (1978) for a normative analysis of several alternative education finance systems.

[3]Krusell, Quadrini, and Rios-Rull (1997) likewise use a political economy approach to examine tax systems and Persson and Tabellini (1996) to examine federalist structures.

California since this case has received considerable attention. Two events from the 1970's, the Serrano decision, which ruled California's education finance system unconstitutional, and Proposition 13, which severely limited local property tax revenues, led to a major restructuring of California's public education finance system. The result of these two events was to change California's education finance system from a foundation system in which local expenditures supplemented expenditure levels guaranteed by the state, to one in which effectively all financing is done at the state level. What makes the California experience so noteworthy is that, subsequent to these changes, California's share of personal income going to public education fell by more than ten percent relative to the US average.

Using the model sketched above, we illustrate through some examples that, absent any restriction on preferences, the range of effects associated with this reform are extremely large; simulations of a California-style reform can lead to decreases in expenditures as low as two percent and as large as forty percent. This outcome is perhaps not too surprising--a similar situation occurs, for example, if one asks how redistributive labor income taxation affects labor supply. In that context, as in others, long-run observations provide restrictions on preferences which have proven to be very useful in applied work. We follow a similar procedure here and find that a simple restriction implied by longer-run observations greatly restricts the range of outcomes predicted by the model. In particular, we constrain preferences to satisfy the requirement that expenditures on education grow at the same rate as personal income when the income distribution is scaled proportionately.[4]

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[4]This type of "balanced growth" restriction is also standard in the growth literature.

Imposing the above restriction, we obtain the result that California's reform reduces educational expenditures by about 10%, which suggests that our simple political economy view of public finance is able to account for the bulk of California's drop in educational expenditures. Our analysis also generates some interesting results concerning the relationship between equity of educational expenditures and the total amount of resources devoted to education. While we find that California's move from a foundation system to a state system achieved greater equity, our analysis suggests that this was accomplished almost entirely by decreasing educational expenditures in wealthier districts--poor families benefited very little.

The above, however, should not be taken to imply a simple trade-off between equity and total resources, with more local systems delivering greater inequality but more resources and the opposite for more centralized systems. Our analysis also suggests that had California moved from a foundation system to a pure local system (i.e., one with no redistribution), total expenditures would also have decreased on the order of ten percent, despite a doubling of inequality as measured by the coefficient of variation of per student spending.

The remainder of the paper is organized as follows. Section 2 provides an overview of education finance developments in California, and documents the changes that took place over the last twenty-five years. Section 3 lays out the theoretical structure and derives some analytical results concerning the effect of California's reform. Section 4 carries out the numerical work and identifies winners and losers from the reform. Section 5 contrasts our explanation of California's decline in education spending with some alternative interpretations. Section 6 concludes.

2. Some Background

Prior to Serrano I, public school financing in California was accomplished through a foundation system. This system, established in 1947, prescribed a minimum property tax rate which guaranteed each district that taxed at this rate a certain amount of funds for education--the foundation grant. Districts that generated revenue that surpassed the foundation amount were not given any foundation aid; districts that generated revenue below the foundation grant were allocated the difference between the foundation amount and its property tax revenues. In addition to local property taxes and foundation aid, education was financed by categorical aid distributed by the state and federal system and by basic aid of $120 per average daily attendance (ADA) assured by the state.[5] As of 1970, local property taxes constituted slightly over 50% of school revenue, and despite the fact that the state played a role in equalizing expenditures beyond what would exist in a pure local system with no redistribution, California possessed one of the least equal distributions of education expenditures in the country.[6]

The above was the prevailing state of affairs when in August 1971 the California Supreme Court ruled in the case of Serrano v. Priest that the finance system "discriminates against the poor because it makes the quality of a child's education a function of the wealth of his parents and neighbors."[7] Between 1972 and the present, the system of education finance was radically modified.

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[5]The latter resulted from a constitutional requirement. For a brief history of this, see Picus (1991).

[6]See Brown, L. et al. (1978).

[7]While some low income districts had high or average spending, such as the large urban districts, the correlation between the local tax base and spending per student was .64 in 1975 (see Downes (1992)).

The history of school finance reform in California over the last twenty five years is too complex and lengthy to attempt a review of it here. Its main features, however, were established early on and can be conveniently summarized by listing its main components prior to the passage of Proposition 13 in June 1978 and the effect of the latter. The principal components of the various bills passed were i) foundation program increases, ii) revenue limits, iii) reduction in permissive overrides, and iv) categorical programs.[8]

Revenue limits were introduced in response to the initial Serrano ruling as a way to help reduce the disparity in spending between districts. It ensured that if a district's assessed valuation grew at a faster rate than its revenue limit, it had to reduce its tax rate. The revenue limit for these districts was allowed to adjust upwards by at most 6% a year. On the other hand, districts with revenues below the foundation amount were allowed to increase their revenue limits by 15% a year. These limits, however, were allowed to be overridden by the voters of a district, but no longer by the school boards. In addition to the foundation amount, funds were also appropriated for different categorical programs designed to aid districts with large percentages of lower-income families.

During this same period in which further reforms were being considered in response to court rulings, Californian voters approved Proposition 13.[9] The latter prohibited state and local governments from passing new property taxes, limited the tax rate on all property to 1% of its 1975-76 assessed

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[8]The first major reform bill (SB90) took effect in fiscal year 1973-74. The second major reform bill (AB65) was to take effect in fiscal year 1978-79 but was made obsolete by the passage of Proposition 13.

[9]One reform under consideration was a move to a system of power equalization which would have guaranteed all districts the same tax base but allowed local variation in tax rates and hence expenditure levels. See Picus (1991) for an account.

value (allowing reassessments only if the property were sold), and required a two-thirds vote of the people residing in a jurisdiction to impose any special tax and two-thirds of the legislature for any change in state taxes.[10] This, combined with the legacy of Serrano, had the effect in practice of removing the decision for how much revenue should be allocated to education from the hands of the individual district to those of the state. Revenue limits were kept in place (now adjusted solely by the statutory Cost of Living Adjustment and the type-unified, primary, or secondary--of district) and the revenue limit aid again determined by the difference between the revenue limit and property tax collections.[11]

Put briefly, the joint effect of Serrano and Proposition 13 was to change the financing system from a foundation system in which the state redistributed educational resources across districts but which allowed individual districts to increase spending by increasing their tax rate if desired, to essentially a state system which left the amount of spending up to the state and guaranteed virtually equal spending (per student) across districts.[12]

We next turn to a review of what we believe to be the salient features of the California reform. Table 2.1 provides some information about the system in place prior to the reforms.

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[10]See O'Sullivan et al. (1995) for a comprehensive review of Proposition 13.

[11]As before, each district received $120 per ADA independently of its need for revenue limit aid.

[12]It should be noted that official statistics indicate that roughly twenty-five percent of total spending comes from local sources. Local tax rates, however, are forcibly low and the same across localities. Therefore, revenues raised in this fashion are all inframarginal with respect to the revenue limits, and the system behaves as if all revenues are delivered directly to the state and are then distributed to the school districts.

Table 2.1
Distribution of Average Education Revenue per Student Across Districts
Relative to Mean District, 1971-1972

Range	Local			State & Local		
	Unified	High	Elem	Unified	High	Elem
< .40	.036	.025	.044	0	0	0
.4 - .5	.021	.025	.044	0	0	0
.5 - .6	.057	.050	.044	.014	0	0
.6 - .7	.121	.100	.110	.008	.025	.022
.7 - .8	.171	.075	.154	.064	.050	.055
.8 - .9	.100	.250	.077	.278	.125	.297
.9 - 1.0	.093	.150	.143	.221	.350	.176
1 - 1.1	.071	.075	.044	.171	.250	.176
1.1 - 1.2	.064	.075	.099	.114	.100	.110
1.2 - 1.3	.050	.075	.033	.064	.075	.099
1.3 - 1.4	.043	.025	.033	.007	.025	.033
1.4 - 1.5	.036	0	0	.029	0	.022
1.5 - 1.6	.036	.050	.055	0	0	0
1.6 - 1.7	.043	0	.033	.007	0	.011
1.7 - 1.8	.014	0	.033	.014	0	0
1.8 - 1.9	.014	0	.033	0	0	0
1.9 - 2	.007	0	0	.007	0	0
> 2	.021	0	.022	0	0	0

Source: Calculated from figures from Census of Governments, 1972.

The first three columns show the distribution across districts, relative to the mean district, of average education revenues per student generated solely by local property taxes. The last three columns show the same information for local and state revenues combined. In both cases the distribution is shown for three types of districts: Unified (consisting of both elementary and high schools), High (only high schools) and Elem (only elementary schools). For example, row four of the table indicates that the percentage of districts with average revenue per student generated by local tax rates that lie between 60 and 70% of the mean district is approximately 12%, 10%, and 11% depending on whether the district is unified, high school or elementary school, respectively. The key piece of information to draw from this table is that, even prior to the reforms, the California system involved a substantial amount of redistribution; state aid clearly worked to compress the distribution of spending per student across districts.[13]

The combined effects of Serrano and Proposition 13 on the distribution and pattern of spending on education in California are dramatic. Table 2.2 shows the distribution of average spending per student across districts and across students, relative to their respective means, for the years 1971-72 (i.e. prior to the reforms taking effect) and 1986-87 (i.e. some years after the reforms are in place). The distribution of average spending per student across districts relative to mean student is calculated by weighting the average spending per student in a district by the number of students in that district and comparing it to the weighted mean.

Table 2.2
Distribution of Education Revenue per Student
1971-72

	Across Students Relative to Mean Student				Across Districts Relative to Mean District			
Range	Unified	High	Elem	ALL	Unified	High	Elem	ALL
< .75	.01	.10	.03	.01	.05	.05	.04	.10
.75 - .9	.38	.06	.31	.36	.31	.15	.33	.30
.9 - 1.05	.19	.47	.36	.25	.35	.50	.33	.28
1.05 - 1.20	.29	.28	.18	.20	.15	.20	.13	.17
1.20 - 1.35	.06	.06	.10	.11	.07	.08	.13	.09
1.35 - 1.5	.03	.03	.02	.04	.03	.03	.02	.04
> 1.5	.03	0	.01	.03	.03	0	.01	.03

[13]The evidence though is only suggestive since the data alone cannot tell us what the distribution would have been had there been no redistribution.

1986-87

Range	Across Students Relative to mean Student: Unified	High	Elem	ALL	Across Districts Relative to mean District: Unified	High	Elem	ALL
< .75	0	0	0	0	0	0	0	0
.75 - .9	.11	.03	.03	.16	.07	.03	.02	.16
.9 - 1.05	.60	.73	.86	.55	.73	.71	.87	.57
1.05 - 1.20	.27	.19	.08	.26	.16	.19	.07	.21
1.20 - 1.35	.01	.05	.02	.02	.02	.07	.02	.04
1.35 - 1.5	0	0	0	.01	.01	0	0	.02
> 1.5	.01	0	.02	0	.02	0	.02	.01

Source: Calculated from Census of Governments, 1972 and 1987.

It is fairly obvious that the distribution in 1986-87 is significantly less spread out than it is in 1971-72.[14] More formally, the coefficient of variation in spending per student was reduced from .23 in 1972 to .11 in 1987 (across all district types).[15]

Accompanying the above change in the distribution of education expenditures was an equally dramatic change in the share of personal income devoted to public primary and secondary education. As Table 2.3 demonstrates, prior to the reforms California's investment share for public primary and secondary education was roughly the same as the US average. After the reform this share dropped on the order of ten percent.[16]

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[14] Although the current system is basically designed to obtain equal spending per student across all districts, there are two reasons why there is still variation across districts. First, elementary and high school students are weighted differently in funding formulas, and hence different student body compositions lead to different levels of per student spending. Second, some categorical aid is not included in the revenue limits, e.g. aid to districts with proportionally higher rates of children in families receiving AFDC. Finally, for a small number of very wealthy districts, the cap on local tax rates is not binding.

[15] Similar numbers are obtained for each type of district separately.

[16] We note also that prior to reform, California was spending a similar fraction of its personal income on education as other states with similar per capita incomes such as Connecticut, New Jersey and Maryland.

Table 2.3
Current Expenditure on Education As a Share of Personal Income

Year	CA	USA	CA/USA
1969	.042	.043	.97
1970	.040	.043	.95
1972	.038	.042	.90
1973	.040	.041	.97
1974	.037	.041	.89
1976	.039	.042	.91
1977	.035	.041	.86
1979	.035	.041	.86
1980	.034	.041	.85
1982	.032	.039	.82
1983	.032	.039	.84
1984	.033	.039	.84
1985	.034	.040	.85
1986	.035	.040	.87
1987	.034	.040	.85
1988	.035	.041	.86
1989	.036	.041	.87
1990	.036	.042	.86
1991	.036	.042	.86
1992	.035	.041	.85

Source: Digest of Educational Statistics, 1993; Statistical Abstract of the United States, various; State Personal Income, Department of Commerce.

To recapitulate, Serrano and Proposition 13 had a quantitatively important effect on equity and on the fraction of total resources that California dedicated to education.

3. The Model

In this section we provide a simple model that allows us to highlight the distributional consequences of different education finance schemes, bringing the political economy aspect of these into the forefront. Our analysis is consistent with many variants of a human-capital growth model. Nonetheless, to provide context for the analysis that follows it is helpful to discuss one such model. The model sketched below is similar in spirit to that of Loury (1981).

Consider an overlapping generations model with constant population in which individuals live for two periods. Individuals belong to families, each consisting of one young (first period) and one old (second period) individual. An old individual is endowed with some number of efficiency units of labor which are supplied inelastically. There is an aggregate production technology that is linear in efficiency units of labor. Each old individual has preferences described by a utility function u(c,q), where c is a private consumption good and q is the quality of education obtained by the child, measured in units of the consumption good.[17] A child's quality of education when young influences the number of efficiency units of human capital they are endowed with when old. Young individuals do nothing other than obtain education, and all decisions are made by old individuals. Depending upon the technology which maps investment in human capital today (i.e., q) into efficiency units of labor tomorrow, the model may exhibit endogenous growth or may possess a steady state. For our purposes this distinction is not be important and hence we do not further specify these details.

The subsequent analysis examines how different systems used to finance the accumulation of human capital affect both the total quantity of resources devoted to education and their distribution. Our focus is on how these finance systems affect the decisions made by a particular generation given their distribution of income. Hence, ours is effectively a static analysis.[18]

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[17]Modeling parents as caring about the quality of a child's education, rather than about her utility, is a by now standard way of getting around the complicated dynmic programing problem that ensues otherwise.

[18]See Fernandez and Rogerson (1994,1997) for an analysis that does take into account the dynamic aspects of education finance reforms.

While, on the one hand, an analysis that traced out the longer-run implications of a change in financing rules would be of additional interest, its absence has the advantage of requiring far less structure (e.g., the exact mapping from educational resources to future income can be left unspecified), some of which is controversial.[19] Furthermore, given our interest in the specific experience of education financing in California, the fact that reforms have been in place for roughly twenty years suggests that it is appropriate to abstract from the potential longer-term effects of the reform on the distribution of income.

3.1 Basic Assumptions

The economy is described by an initial income distribution $F(y)$, where $F(.)$ is a cumulative distribution function and y is income. Reflecting the US (and Californian) income distribution, we assume $F(\mu)>.5$, i.e. median income is less than mean income, μ. To make this model as simple as possible, we assume that individuals have identical preferences over only two goods: consumption, c, and education, q. Preferences are described by the utility function:

$$u(c) + v(q) \tag{3.1}$$

where u and v are both increasing and concave with $u'(0)=v'(0)=\infty$.[20]

[19] See Hanushek (1986) and Heckman et al. (1995) for reviews and critical assessments of this controversy.

[20] This utility function should really be interpreted as an indirect utility function that results from combining a utility function over current consumption and the child's future income with a mapping from educational expenditures to future income. The assumption of separability is not key to our analysis. Note also that because there is no uncertainty, we are only assuming that some monotone transformation yields separability.

The amount or quality of education that an individual receives is assumed to be a function solely of spending (T) per student (N) which, without loss of generality, we take to be linear, i.e.

$$q = T/N \tag{3.2}$$

Financing systems usually involve a mix of financing at the local and state levels.[21] In these cases, outcomes are dependent on how families sort themselves into communities. As is standard in much of the local public finance literature, we assume that individuals sort themselves perfectly into communities, so that each community consists of families that are homogeneous.[22] This implies that all redistribution is across, rather than within, communities.

We study the equilibrium outcomes under three different financing rules. The first is a pure local finance system. The second, a foundation system, is meant to capture essential elements of the pre-Serrano environment, whereas the third reflects the rules post Serrano and Proposition 13. Along the spectrum of finance systems, these correspond to the two extreme cases (pure local and pure (egalitarian) state) and one intermediate system (foundation).

In all cases the political economy of the environment is modelled as corresponding to majority rule. That is, the tax rates, foundation grant, state funding, etc. are taken to be the outcomes of a system in which

[21] In general, private funding may also be involved, e.g. private schools. We do not permit that alternative in the analysis that follows, though it is subsequently discussed in section 5.

[22] See Hamilton (1975) for an analysis of mechanisms which support perfect separation in equilibrium. See Fernandez and Rogerson (1996) for an analysis of inefficiencies that may arise in a pure local system in which heterogeneous individuals reside within the same community. See Durlauf (1996) for a dynamic analysis of the possible poverty traps that can arise.

individuals can choose the value of the variable via (pair-wise) majority vote.

3.2 A Pure Local System

In this system there is no redistribution and each community chooses the tax rate that funds its own education expenditures. Since each community is composed of identical families, there is no disagreement over desired tax rates. Community i's (or, equivalently, in this set up, family i's) per student expenditure is given by:[23]

$$q_i = t_i y_i. \tag{3.3}$$

Each community is faced with the problem of choosing t_i to maximize utility given by:

$$u(y_i(1-t_i) + v(t_i y_i) \tag{3.4}$$

This yields a community tax rate implicitly defined by:

$$-u'(y_i(1-t_i)) + v'(t_i y_i) = 0 \tag{3.5}$$

3.3 The Pre-Serrano Environment: A Foundation System

The essence of a foundation system is that all participating districts tax at some minimum level in return for some guaranteed base level of expenditures per student, but there is no restriction on the ability of districts to raise additional revenue through local taxation. We model this system in the following manner. We assume that the foundation grant is financed by a proportional tax τ on income, and that the proceeds are then divided equally across all students. Thus, the relationship between the

[23]Note that given perfect sorting of individuals across communities, it does not matter if local taxation is lump-sum or proportional.

state's mean income μ, the foundation grant f, and the tax rate τ_f is given by:

$$f = \tau_f \mu \tag{3.6}$$

We also assume that each community i may choose to augment the foundation grant through a local proportional tax on income, denoted t_i. This tax can be thought of as being chosen once the majority vote decision over τ_f has occurred. Thus, community i's per student school budget is

$$q_i = f + t_i y_i \tag{3.7}$$

An individual with income y_i, therefore, has utility given by

$$u(y_i(1-\tau_f-t_i(\tau_f))) + v(\tau_f \mu + t_i(\tau_f) y_i) \tag{3.8}$$

where $t_i(\tau_f)$ corresponds to that individual's optimal choice of t_i given τ_f. Thus, $t_i(\tau_f) \geq 0$ is implicitly defined by:

$$-u'(y_i(1-\tau_f-t_i))y_i + v'(\tau_f \mu + t_i y_i) y_i + \gamma_i = 0 \tag{3.9}$$

where γ_i is the Lagrange multiplier for the non-negativity constraint on t_i, and $\gamma_i \geq 0$, $\gamma_i t_i = 0$.

Similarly, this individual's preferred foundation amount and therefore implied preferred foundation tax rate, τ_{fi}, is given by maximizing (3.8) with respect to τ_f subject to $\tau_{fi}, t_i(\tau_{fi}) \geq 0$, which, after making use of the envelope theorem, yields:

$$-u'(y_i(1-\tau_{fi}-t_i(\tau_{fi}))y_i + v'(\tau_{fi}\mu + t_i(\tau_{fi} y_i))\mu + \lambda_i = 0 \tag{3.10}$$

as the first-order condition, where λ_i is the Lagrange multiplier for the non-negativity constraint on τ_{fi}, and $\lambda_i \geq 0$, $\lambda_i \tau_{fi} = 0$.

It is easy to see that any individual whose income is strictly smaller than μ will have a preferred foundation tax rate that implies that her own $t_i=0$. Similarly, any individual whose income is strictly greater than μ would prefer a foundation tax rate of zero and to finance her entire education through her local tax rate t_i. This reflects the redistributional incentives of the foundation system: Individuals whose income is higher than the mean prefer as small a foundation level as possible; individuals whose income is below the mean prefer their entire educational expenditures to be financed through the foundation.

Note that the only variable that is assumed to be an outcome of majority vote at the state level is τ_f. Furthermore, utility as expressed in (3.8) is single peaked in τ_f. This ensures the existence of a majority voting equilibrium. Nonetheless, it is useful to further constrain preferences in order to be able to characterize equilibrium more fully. We next turn to this task.

A natural constraint to impose on preferences is to require that the desired level of the foundation grant be increasing in income for $y_i<\mu$. This is equivalent to requiring that τ_{fi} be strictly increasing in y_i for $y_i<\mu$.

Using the implicit function rule on (3.10) yields, for $y_i<\mu$,:

$$\frac{d\tau_{fi}}{dy_i} = \frac{u''(y_i(1-\tau_{fi}))c_i + u'(y_i(1-\tau_{fi}))}{u''(y_i(1-\tau_{fi}))y_i^2 + v''(\tau_{fi}\mu)\mu^2} \qquad (3.11)$$

(recall that for these individuals $t_i(\tau_{fi})=0$). Thus, a sufficient and necessary condition to obtain τ_{fi} increasing with y_i is:

$$u''c + u' < 0 \qquad (3.12)$$

which we henceforth impose.[24]

It follows that the decisive voter in a majority vote system will be $\tilde{y}_f$ such that:

$$F(\mu) - F(\tilde{y}_f) = .5 \tag{3.13}$$

The logic behind this result is that all individuals with income greater than μ have a preferred tax rate of zero, whereas all those with income smaller than μ have a preferred tax rate that is increasing in their income.

Given the equilibrium income tax rate τ_f, who will wish to "top-up" the foundation level by imposing a positive t_i? Note that all individuals with income lower than $\tilde{y}_f$ will set $t_i=0$. The range of individuals with income greater than $\tilde{y}_f$ but smaller than some cut-off level, y_T, will also set $t_i=0$. For these individual $u'y_i<v'\mu$ (so they would prefer a greater foundation tax rate than that chosen by majority vote), but $u'>v'$ (so despite desiring a higher foundation tax, they are unwilling to further tax their income to supplement the foundation grant). Lastly, all individuals with income strictly greater than y_T set a positive tax rate, where y_T is implicitly defined by:

$$u'(y_T(1-\tau_f))=v'(\tau_f\mu) \quad \text{and} \quad u'(\tilde{y}_f(1-\tau_f))\tilde{y}_f/\mu=v'(\tau_f\mu) \tag{3.14}$$

Note that an implication of $\tilde{y}_f<\mu$ and (3.14) is that y_T is smaller than mean income μ.

We are now set to characterize equilibrium under a foundation system. The decisive voter under this system, $\tilde{y}_f$, is implicitly defined by (3.13), and imposes a tax rate τ_f as given by (3.10) (with $\lambda_i=0$) for $y=\tilde{y}_f$. All

[24]This condition is often imposed in multi-community models without perfect sorting to be able to characterize equilibria. See Westhoff (1977).

individuals with $y_i > y_T$ top up their educational expenditures by an amount $t_i y_i$ where t_i satisfies (3.9) (and $\gamma_i = 0$). Individuals with $y_i \le y_T$ spend only the foundation amount $f = \tau_f \mu$ on education, hence $t_i = 0$. We next turn to a comparison of this system with that implied by the post Serrano and Proposition 13 environment.

3.4 The Post Serrano and Proposition 13 Environment: A State System

As described in section 2, the effect of Serrano and Proposition 13 was to take away districts' ability to make their own school-financing decisions and to replace this with state funding. Thus, a state system was created which guaranteed that virtually all districts spent the same amount (per student) on education.[25] We assume that this amount is financed by a state income tax, τ_s, so that for each district

$$q = \tau_s \mu \ . \tag{3.15}$$

Unlike the foundation system, however, districts are not able to supplement state spending with local spending--the legacy of Proposition 13.

Utility for family i under the state system is:

$$u(y_i(1-\tau_s)) + v(\tau_s \mu) \tag{3.16}$$

Maximizing (3.16) with respect to τ_s yields the preferred state tax rate, τ_{si}, for an individual with income y_i, defined implicitly by

$$-u'(y_i(1-\tau_{si}))y_i + v'(\tau_{si}\mu)\mu = 0 \tag{3.17}$$

[25]Note that we are not stating that Serrano in and of itself was responsible for this outcome, rather its combination with Proposition 13 seved to produce this system. See, however, Fischel (1989, 1996) for an analysis that singles out Serrano and rising property values as leading to Proposition 13.

Note that the first order condition above is identical to the one obtained under the foundation system (i.e. equation (3.10) with $t_i=0$ and $\lambda_i=0$). This implies that the individuals with $y_i<\mu$ have the same preferred tax rate under both systems, i.e. $\tau_{fi}=\tau_{si}$ for $y_i<\mu$. Individuals whose income is strictly greater than μ, on the other hand, do not prefer the same tax rate under both systems. Under a foundation system they prefer a tax rate equal to zero whereas under a state system they prefer a positive tax rate. Note, furthermore, that how preferred tax rates under a state system vary with income is given, for all y_i, by equation (3.11). Hence, given (3.12), τ_{si} is increasing in y_i.

The above dichotomy can be easily understood by noting that under the foundation system individuals have the alternative of funding their education expenditures out of mean income and/or out of individual income. Of course, any individual whose income is greater than the mean prefers to fund out of individual income and the opposite is true for those whose income is below the mean. Under a state system, however, individuals do not have the option of funding education out of personal (or district level) income. Consequently, while preferred tax rates for individuals whose income is below the mean remains unchanged, individuals with high income now desire a positive state level tax.

It is now easy to describe equilibrium outcomes under the state system. Since τ_{si} is increasing in y_i, the decisive voter in this system is $\tilde{y}_s$ such that:

$$F(\tilde{y}_s) = .5 \tag{3.18}$$

Thus, the equilibrium state tax rate, τ_s, is given by (3.17) for $y_i=\tilde{y}_s$ and all individuals have equal education expenditures of $\tau_s\mu$.

3.5 A Comparison of Two Systems

In this section we contrast the foundation system with the state system. Two important concerns in evaluating an education finance system are: (i) the total resources that the system devotes to education, and (ii) the distribution of those resources.[26] The next three propositions offer a partial characterization of the differences among the two systems.

Proposition 1: (i) The decisive voter under a state system has higher income than the decisive voter under a foundation system, i.e., $\tilde{y}_s > \tilde{y}_f$.

(ii) The foundation tax rate is less than or equal to the state system tax rate, i.e., $\tau_f \leq \tau_s$.

Proof: (i) This follows immediately from a comparison of equations (3.13) and (3.18) that define $\tilde{y}_s$ and $\tilde{y}_f$.

(ii) For all i such that $y_i < \mu$ we have $\tau_{fi} = \tau_{si}$. Moreover, by (3.12), these preferred tax rates are increasing in income for $y < \mu$. Since both $\tilde{y}_s$ and $\tilde{y}_f$ are less than μ, the result follows from (i).||

The key intuition underlying Proposition 1 is that, as a consequence of the different distributional incentives in both systems, while under a foundation system the preferences of the poorest and richest individuals are relatively close, under a state system they are relatively far apart.

The next proposition establishes that all individuals with income lower than median income have lower total spending on education in a foundation system relative to a state system. First, define $\tilde{y}$ as the individual whose income is median in the distribution, i.e. $F(\tilde{y}) = .5$.

[26] From a welfare perspective, of course, there is no reason to believe that a system that delivers greater resources to education is necessarily better.

Proposition 2: For all i such that $y_i \le \tilde{y}$, $q_{fi} \le q_{si}$.

Proof: If the inequality holds for an individual with income equal to $\tilde{y}$, the result follows immediately since q is non-decreasing in income under a foundation system and constant under a state system. Hence, we examine the individual with income equal to median income. If this individual does not top-up, the inequality follows from Proposition 1. Assume, therefore that this individual does top-up. By (3.10), the first-order condition $u'(\tilde{y}(1-\tau_f-t)) = v'(\tau_f\mu+t\tilde{y})$ holds, where t is the local tax used to top up the foundation grant by the individual with $y_i=\tilde{y}$. Since this individual is decisive under a state system, we also have $u'(\tilde{y}(1-\tau_s)) = v'(\tau_s\mu)\mu/\tilde{y}$. If $q_s=\tau_s\mu<q_f=\tau_f\mu+t\tilde{y}$, then, $v'(\tau_s\mu)\mu/\tilde{y} > v'(\tau_f\mu+t\tilde{y})$ (since $v''<0$ and $\mu/\tilde{y}>1$). It follows that $u'(\tilde{y}(1-\tau_s)) > u'(\tilde{y}(1-\tau_f-t))$, but this implies that $\tau_s>\tau_f+t$ which yields $q_s>q_f$, a contradiction.||

Next we show that, on the other hand, individuals with income greater than the mean have greater spending on education under a foundation system relative to a state system.

Proposition 3: For all i such that $y_i>\mu$, $q_{fi}>q_{si}$.

Proof: Note that by (3.10), $u'(y(1-\tau_f-t)) \ge v'(\tau_f\mu+ty)$ and, by (3.17) and given $y>\tilde{y}_s$, we have $u'(y(1-\tau_s))y/\mu < v'(\tau_s\mu)$. Suppose it were not the case the $q_{fi}>q_{si}$, and instead $q_{fi}\le q_{si}$. It follows that $v'(q_{fi}) \ge v'(q_{si})$ and hence that $u'(y(1-\tau_f-t))>u'(y(1-\tau_s)(y/\mu)$. But, given $y/\mu>1$, this implies $\tau_s<\tau_f+t_i$ and hence $q_{fi}>q_{si}$, a contradiction. ||

Given our conclusion that the state system delivers greater resources to education for all individuals with income below the median (in fact, to all individuals who are topping up by less than the difference between the state spending level and the foundation grant level), it is important to ascertain whether indeed the foundation system delivers greater total resources to education and what the tradeoff is in terms of spending for lower income individuals.

To see, however, that the foundation system may in fact do well under the first criterion and actually not badly under the second, it is instructive to consider the extreme case of $u(c)=\log(c)$ and $v(q)=\log(q)$ (this case is extreme in the sense that it implies $u''c+u'=0$). With these preferences all individuals with income below the mean have the same preferred tax rate. Thus, the equilibrium tax rate will be the same under both systems, i.e. $\tau_f=\tau_s$. Under the foundation system individuals can top up and, it is easy to show that for these preferences all individuals with income greater than the mean will do so and those with income below the mean will spend only the foundation grant. Under the state system, of course, individuals are not able to top up. Consequently, for these preferences spending is unambiguously higher in the foundation system and not at the expense of lower spending for low income individuals.

Equilibrium for a pure local system is also easily characterized in this case. Note that under this system, all individuals choose the same tax rate, and hence $t_i=\tau_s$. Consequently, state and local systems deliver equal resources to education, but very different distributions of resources across individuals. In this example, there is no monotone relationship between redistribution and total resources. While this case is an extreme, it is instructive since, as our next section will argue, the data suggests that preferences are close to this description.

4. The Quantitative Effects of Reform

In this section we use data to restrict the model of the previous section and explore the implications of the restricted model for California's education finance reform. This requires that we specify both the income distribution and explicit functional forms for preferences.

4.1 Functional Forms

The model has adults making decisions over consumption and education for one period. Hence, a more appropriate income distribution for our purposes is the distribution of lifetime income, rather than the income distribution for a particular year. Fullerton and Rogers (1993) estimate the distribution of lifetime household income for the US using data from the PSID for the years 1970-1987. They compute mean lifetime income for each decile (subdividing the lowest and highest deciles each into two groups) for both pretax income as well as income net of taxes and transfers. We used both of these distributions in our analysis, but found that the results did not differ in any significant way. Consequently, we only report results for the case of income net of taxes and transfers. Table 4.1 displays the income distribution.[27]

[27] Ideally we would use the Californian lifetime household income distribution, but this is not available.

Table 4.1 Lifetime Income Distribution

Percentile	Mean Lifetime Income (000's of 1986 dollars)
0-2	217
2-10	355
10-20	433
20-30	515
30-40	565
40-50	665
50-60	735
60-70	814
70-80	911
80-90	1028
90-98	1305
98-100	1734

Source: Fullerton and Rogers (1993)

For some issues of interest, it is desirable to employ a less coarse distribution of income. There are many ways in which such a distribution can be produced. Here we use a lognormal distribution whose parameters are chosen by selecting those which do the best job of reproducing the distribution of mean income for the deciles depicted in the above table. Our criterion of best is the sum of absolute deviations of the mean incomes.

As a starting point we consider preferences given by the functional form:

$$u(c) + v(q) = \frac{c^{\alpha}}{\alpha} + A\,\frac{q^{\gamma}}{\gamma} \qquad A>0 \qquad (4.1)$$

Condition (3.12) is satisfied if and only if $\alpha<0$. Just to indicate the range of possibilities that this specification permits, the table below shows results obtained for selected values of α and γ. In each case A is chosen so that total spending in the foundation system is .048 of total income, which is the corresponding ratio for state plus local educational revenues in California in 1971.[28] We use the income distribution of Table 4.1.

[28]Here we use revenues rather than current expenditures since although the latter is more comparable across states, the former is a more comprehensive measure of total resources.

Table 4.2

Comparison of State Versus Foundation System,
Selected Parameter Values

α	γ	$(Q_s-Q_f)/Q_f$
-0.01	-5.0	-.02
-1.0	-2.0	-.04
-0.01	-0.01	-.13
-2.0	-0.50	-.24
-2.0	-0.01	-.41

Table 4.2 shows for different parameter specifications how total spending on education differs in the state system, Q_s, from that under a foundation system, Q_f. For a given income distribution the model predicts a drop in educational spending as small as 2% or as large as 40% depending upon parameter values. Obviously, obtaining sharper predictions requires additional restrictions on preferences. Somewhat surprisingly, we show that a simple restriction implied by longer-run evidence greatly reduces the model's range of predicted responses, even without assigning values for all parameters. Given the wide range of possible outcomes suggested by Table 4.2, this is a very useful finding.

The restriction that we impose arises from the finding that over the long run, educational expenditures and personal income grow at (approximately) the same rate. To motivate this finding we consider data for the US over the period 1960-1993. Real personal income (Y) and real expenditures for public primary and secondary education (Q) are both obtained by using the CPI to deflate nominal quantities. We run the two following regressions:

$$\log(Q_t) = a + b\log(Y_t) + \epsilon_t \tag{4.2}$$

$$Q_t/Y_t = a + bt + \epsilon_t \tag{4.3}$$

The results are displayed in Table 4.3.

Table 4.3

Regression Results for Equations (4.2) and (4.3)
(standard errors in parentheses)

	a	b	R^2
eq (4.2)	-3.14 (.18)	1.02 (.06)	.92
eq (4.3)	.0461 (.0015)	-.00002 (.00007)	.0021

Both sets of results support the finding that there is no sign of a secular trend in the fraction of personal income going to public primary and secondary education.[29]

The finding that personal income and educational expenditures grow at approximately the same rate can be used to restrict the set of allowable preferences. In particular, it is straightforward to show for foundation, state and local systems of finance that a proportional scaling of the income distribution leads to the same proportional increase in educational expenditures if and only if preferences are homothetic, i.e. the slope of an indifference curve in c-q space is a function only of the ratio of c to q.

Given a restriction to homothetic preferences, a natural class of utility functions to consider is that of constant elasticity of substitution (and monotone transformations). This requirement is equivalent to imposing $\alpha=\gamma$ in

[29]In addition to the secular trend in personal income there has also been a decrease in fertility rates over this period which has not been taken into consideration in the above regressions. Fernandez and Rogerson (1997) use a panel data set for US states over the period 1971-1992 to show, however, that the same conclusion holds when this is accounted for. An additional concern is how changes in the relative price of education may be affecting demand. This question is difficult to answer. While, for example, significant increases in teachers' wages over time may correspond to a relative price increase, it may also induce changes in the quality of teachers, and hence of education. This aspect of the analysis is left unexplored.

the preferences displayed in equation (4.1), and in what follows we restrict our attention to this class.

It is useful to determine the equilibrium values of the variables for the class of preferences discussed above. Using equation (3.10) and (3.17), it is easy to show that:

$$\tau_f = [A^{1/\beta}(\mu/\tilde{y}_f)^{\alpha/\beta} + 1]^{-1} \tag{4.4}$$

$$\tau_s = [A^{1/\beta}(\mu/\tilde{y}_s)^{\alpha/\beta} + 1]^{-1} \tag{4.5}$$

where $\beta=\alpha-1$. An individual with income y_i tops up her educational expenditures under the foundation system by an amount:

$$t_i y_i = \max\{0, \tau_f A^{1/\beta}[(\mu/\tilde{y}_f)^{\alpha/\beta} y_i - \mu]/(1+A^{1/\beta})\} \tag{4.6}$$

So, for CES preferences we note from the above that (i) the amount by which individuals top up is linear in income (for $y_i>y_T$), and (ii) as α decreases in absolute value, the number of individuals that top up falls, i.e., y_T is increasing in α.

4.2 Impact on Total Expenditures on Education

Table 4.4 shows the predicted effects of the Californian reform for various settings of $\alpha=\gamma$.[30] As before, the constant A is chosen so that the fraction of income devoted to education in the foundation system is equal to .048.

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[30]Results are very similar if one simply requires that α and γ be "close" in value. In particular, if we require that the difference between the two be less than 0.5, then the range of predictions for the fall in spending is basically the same.

Table 4.4
Comparison of Foundation vs. State System
Results for CES Utility Function

α	$(Q_s-Q_f)/Q_f$	$(Q_f-f)/Q_f$	Q_s/f	σ/μ
-5	-.08	.45	1.67	.38
-3	-.08	.42	1.59	.38
-1	-.08	.32	1.35	.35
-.5	-.09	.25	1.21	.32
-.3	-.10	.22	1.15	.29
-.2	-.11	.19	1.10	.28
-.1	-.12	.16	1.05	.26
-.01	-.13	.13	1.00	.23

The third column, headed $(Q_f-f)/Q_f$, shows the fraction of total expenditures that are accounted for by spending over and above the foundation amount f. The next column, headed Q_s/f, shows the amount by which total spending in a state system exceeds the foundation grant level. Equivalently, it is the ratio of the tax rate under the state system to the foundation tax rate. The last column, headed σ/μ, shows the coefficient of variation for the distribution of spending per student across students. As can be seen, under a CES specification, the model predicts a drop of spending on education roughly on the order of 10%, with a range between 8 and 13% depending upon the exact value of α.

A clear pattern emerges as the absolute value of α decreases: the effect of the reform on total expenditures becomes greater, the coefficient of variation decreases, the fraction of spending accounted for by the foundation grant alone increases, and the level of state spending relative to the foundation grant decreases. Note that the above is more than a comparative statics exercise with respect to α since in the background A is changing so as to keep the fraction of income spent on education constant under the foundation system. Nonetheless, from the results in the previous subsection, it is clear that as α increases the number of individuals that top up decreases.

Recalling the discussion in Section 3.5, there are two opposing effects on total education expenditures associated with a change from a foundation system to a state system. On the one hand, spending decreases because districts cannot supplement state aid (the importance of this amount to total spending under the foundation system can be seen in column 3), and on the other hand, spending increases relative to the foundation grant level because, as can be seen in column 4, the decisive voter in the state system prefers a greater tax rate (note that $Q_s/f=\tau_s/\tau_f$). As the table shows, both of these effects become smaller as the absolute value of α decreases, but the size of the second effect decreases at a faster rate, thus leading to the overall pattern of a greater decrease in total spending as $|\alpha|$ increases. Hence, rather paradoxically, it is in those economies in which the amount of topping-up is greatest that the move to a state system results in the smallest drop in total spending.

Given the abstract nature of the model and the relative tightness of the range obtained in Table 4.4, we take our findings to imply that the analysis predicts a decrease of total spending on the order of 10%. In what follows we attempt to say something about reasonable values of α by comparing the distribution of expenditures across students implied by the model with the corresponding distribution found in the data for California in 1971-1972.[31]

For this part of the analysis we now use the income distribution with a finer grid, generated using the procedure described previously. Table 4.5

[31]It should be noted that there is nothing particularly special about the '71-'72 distribution--the '67-'68 distribution, for example, is similar and could have been used instead.

shows, for several values of α, the implied distribution of spending per student across students relative to mean spending as well as the distribution for three different school data sets for California in 1971-72: unified districts, high school districts and elementary districts. In each case only districts with more than 3000 students are included.[32]

Table 4.5
Distribution of Students by Spending per Student, Relative to Mean

	Model					Data		
Range	α=-1.25	α=-.35	α=-.25	α=-.15	α=-.05	Unified	High	Elem
<.7	.24	0	0	0	0	.01	0	.02
.7-.8	.13	.42	0	0	0	.03	.11	.03
.8-.9	.13	.12	.55	.57	.59	.22	.04	.29
.9-1.0	.11	.11	.10	.10	.11	.33	.33	.21
1.0-1.1	.10	.09	.09	.09	.08	.21	.32	.19
1.1-1.2	.07	.07	.07	.07	.06	.08	.11	.13
1.2-1.3	.06	.05	.05	.05	.05	.06	.03	.07
1.3-1.4	.05	.04	.04	.03	.03	.01	.06	.03
1.4-1.5	.03	.03	.03	.03	.02	.02	.00	.02
1.5-1.6	.03	.02	.02	.02	.02	0	0	0
1.6-1.7	.02	.01	.01	.01	.01	0	0	.01
1.7-1.8	.01	.01	.01	.01	.01	.01	0	0
1.8-1.9	.01	.01	.01	.01	.01	0	0	0
1.9-2.0	.01	.01	.01	.00	.00	0	0	0
>2.0	.02	.01	.01	.01	.01	0	0	0
σ/μ	.34	.29	.27	.26	.24	.18	.15	.17

Source: Calculations based on data from 1972 Census of Governments.

The clearest discrepancy between the model and the actual data is the greater concentration of students at the foundation level implied by the model. This is not very surprising; although the model predicts a mass point at the foundation grant level of spending, in reality, state aid is delivered through additional channels as well, serving to disperse the distribution. While the data does not show the degree of concentration predicted by the

[32]The data for unified districts does not include the district of Los Angeles, since the reported number of students for this district seems to be incorrect.

simple model, it does show a significant amount of bunching at the lower end of the distribution, e.g. 55% of the students fall within the range .8-1.0 for the unified school systems. We conclude that for α close to zero, the predicted distributions are not wildly at odds with those in the data.

As α is varied from -1.25 to -.05, the level of the foundation grant increases and the dispersion of individuals in the lower end of the distribution falls, resulting in a lower coefficient of variation. Since the data is concentrated in the range .8-1.0, this suggests that values of α closer to zero will provide a better match with the data. A comparison of the coefficient of variation for the range of α's depicted in Table 4.5 with the actual data also suggests a value of α close to zero. In an attempt to say which α best "matches" the observed distribution we find the value of α which minimizes the sum of absolute deviations from the actual distribution for unified districts. This occurred for $\alpha=-.25$, although as can be seen in the table, there is not a great deal of difference between the distributions for α between -.25 and $\alpha=-.05$.[33]

An alternative piece of information that may be used to pin down a value of α is the price elasticity for education expenditures. In our model one can compute this elasticity numerically. Bergstrom, Rubinfeld and Shapiro (1982) survey the literature that attempts to estimate this elasticity and report a range between -0.5 and -0.25. This suggests a range for α between -2 and -1.

These last two calculations suggest conflicting values for α. One interpretation of this is that our model may be too simple to match all features of the distribution of spending across districts. As Table 4.4

[33]The same exercise carried out using the decile distribution of Table 4.1 resulted in $\alpha=-.2$. Using the elementary or high school distributions instead did not significantly effect this outcome.

indicates, however, our basic finding is quite robust to variation of α within this range of estimates.

We next examine more closely the distributional impact of the education finance reform. One way to think about the distribution of gains and losses is to first assume that the combined effect of the reforms left total spending constant and simply distributed resources equally across districts. From the third to last column in Table 4.5, one can read off that, had this occured, then among students in unified districts 26% of all students would experience an *increase in excess of 10%, whereas* 18% percent of all students experience a decrease of more than 10%. Next, to take into account that along with equalized spending there was also a substantial drop in total spending, consider the impact of an across the board decrease of 10%. Now, it is only those students whose spending was less than .8 of mean spending that gain in excess of 10%, while all students initially above mean spending suffer a loss of greater than 10%. Hence, among students in unified districts only 4% have gains in excess of 10% whereas 39% have losses in excess of 10%. We conclude from this analysis that it is likely that the reform led to significant gains in the level of expenditures for only a very small fraction of the population, and significant losses for a substantial fraction.

A similar exercise can be carried out for the model simulations. Given that the model predicts greater concentration at the lower part of the distribution than is found in the actual data, the distribution of gains is somewhat more concentrated as well. For the case where α=-.25, for example, 55% of the students experience a net gain of 6%. Nobody gains in excess of this amount, and 35% of the students experience a loss in excess of 10%. Table 4.5 allows the reader to contrast the implications for various values of α.

5. Alternative Explanations

It is of interest to consider alternative explanations for the drop in expenditures in California. We are aware of three different explanations. The first, as exposited in Rubinfeld (1995), suggests that voters dislike centralized systems and therefore reduce their support for services if their provision becomes more centralized. We do not see any discrepancy between his story and ours; one interpretation of our work is that it provides a possible formalization of Rubinfeld's argument.[34]

A second explanation, (see, for example, Downes and Schoeman (1992)), is that the reforms of the 1970's led to increased enrollment in private education by children of wealthier families, thus leading to decreased support for public education. This explanation is plausible qualitatively. How important is it quantitatively? Below, we provide an assessment of this in the context of a simple political economy model. We find that it may be a non-negligible factor, though not as important as the effects stressed in our analysis.

Over the period 1970-1990, an additional three percent of all students chose to attend private school in California (see Downes and Schoeman (1992) for details). In a majority voting model, an increase in private school enrollment affects spending on public education in two ways. First, the tax base per student in public education increases. With normal income and substitution effects, ceteris paribus, one would expect that this would lead to increased spending, but lower than three percent.

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[34]There are other formalizations which may account for why individuals prefer to avoid centralized systems; e.g., centralized systems may be less efficient. See Hoxby (1995) for some evidence on this question.

Second, there is a change in the identity of the decisive voter, since those families with children in private schools no longer desire positive tax rates to support public education. While the existence of a private alternative can introduce non-existence of a majority voting equilibrium in this model because of non single-peaked preferences (see Epple and Romano (1993) and Glomm and Ravikumar (1996) for a treatment of this issue), we avoid this problem in the following fashion. We assume that an exogenous three percent of families from the upper part of the income distribution send their children to private school. Since these individuals do not benefit from public education, their preferred tax rate is zero. This shifts the identity of the decisive voter to an individual with lower income. Since we are interested solely in the magnitude of the change in spending that this change in decisive voter would generate, we compute the change in funding that would result within the context of a state system.

Employing the lognormal distribution used to generate Table 4.6, and given our restriction to CES preferences, we solve for the effects associated with the change in decisive voter. For $\alpha=-.25$ we find a decrease in the tax rate equal to 1.15%, whereas for $\alpha=-1$ and $\alpha=-3$ the decreases in tax rates are 3% and 4.5% respectively. Expenditures on public education, of course, decrease by the same percentage as the tax rate. These calculations suggest that the effects can be sizable for α sufficiently negative, though we conclude that it is not likely that the increased enrollment in private education was the dominant factor in the decline in educational spending.

The third explanation, put forward by Silva and Sonstelie (1995), is most similar in spirit to ours since they too offer a political economy interpretation of the consequences of switching finance systems. They, however, interpret the drop in spending as resulting from a reform of a pure local system to a pure state system. Using estimates of education demand functions, they find that their model can also explain a drop in spending of about ten percent.

Although we are in agreement with their general political economy approach, there are two key differences between their analysis and ours: the interpretation of the pre-reform system, and the procedure used to restrict preferences. With regard to the first matter, we have shown that the pre-reform system did involve a substantial amount of redistribution across districts and hence that it should not be viewed as a pure local system. With regard to the second matter, whereas we use long-run properties to restrict preferences, they estimate a demand function from a cross-section regression involving US states. There are two problems with this procedure. First, it implicitly assumes that each state has a pure local system in place. This is certainly not the case. Second, it does not distinguish between permanent and transitory components in income fluctuations. As a result, their estimates are not consistent with the longer-run properties of educational spending, as evidenced by the instability of parameter estimates based on cross-section regressions carried out for different years.[35]

The conjunction of these two differences is very significant. For, as we next go on to argue, if one adopts a local system and uses the parameter estimates suggested by the data, then California's education finance reform would produce a relatively small effect on spending. In particular, using the income distribution described in Table 4.1 and a pure local finance model as described in section 3.2, then setting $\alpha=-.25$ yields a drop in spending of 2%.

[35]In fact, the functional form that they used for their educational demand function is not consistent with the long run facts for income and spending for any parameter values.

For α equal to zero, the model predicts no decrease in spending (though of course a very different distribution of that spending) due to a move to a state finance system, and if $\alpha=-1$, the decrease is 5%. So, for reasonable values of α, this reform would explain at most half of the decreased spending that our model predicts.

6. Conclusion

In this paper we argue that the decrease in California's public education spending relative to the rest of the US can be understood using a simple political economy model of public finance. From this perspective, a move from a foundation system to a pure state system entails two key opposing effects. On the one hand, wealthier districts can no longer supplement state aid, thereby leading to lower spending. On the other hand, precisely because wealthier districts cannot supplement state payments, they desire a greater amount of state aid--in particular, greater than the foundation grant level obtained under the foundation system. Absent any restrictions on preferences, the range of predicted changes in education spending is very large. We show that a simple restriction implied by long-run considerations greatly restricts the range of predicted outcomes and conclude that a simple political economy interpretation of the incentives introduced by the change in financing systems can account for the bulk of California's drop in spending.

Though our analysis has been restricted to California, we note two pieces of supporting evidence for the view that state systems may lead to lower levels of resources. The first is the case of Hawaii, which has a pure state system, and as seen in Table 1.1, also has an investment share very similar to California. Second, the state of Washington also moved much closer to a state system as a result of court rulings, and likewise experienced a drop in its investment share of roughly 15% relative to the US between 1971 and 1992.

We close with a few cautions about interpreting our results. First, since our analysis found that the switch from a foundation to pure state system of financing accounts for a decrease in total education spending on the order of ten percent, one may be tempted to take this as evidence of a negative trade-off between equity and resources devoted to education. As we have emphasized, however, this simple trade-off does not exist. We showed that while the reform greatly increased equity in educational expenditures across students, it did so largely by decreasing spending in wealthy districts, with increases only for students in extremely poor districts. Furthermore, if we were to consider a move to the other extreme--i.e. a move to a pure local system of financing--the falsity of the conclusion becomes evident. In particular, using the same income distribution as in our prior analysis, our model predicts that had California instituted a reform to a pure local system, this would have occasioned a drop in spending of 8.5% for $\alpha=-.25$, 13% for $\alpha=-.001$, and 5% for $\alpha=-1$. In all cases the coefficient of variation for the distribution of per student expenditures would equal .41. In short, for α close to zero, a move to a pure local system would have led to a decrease in expenditures on the same order of magnitude as the move to a pure state system, while at the same time resulting in a much greater level of inequality.

A second and related point to keep in mind is that this paper does not trace out the longer term implications of California's drop in educational expenditures. In general, it would be necessary to know both how changes in the level and distribution of expenditures affect the income distribution and how, in turn, the latter affects the growth rate of the economy.[36] Thus, it is possible that there are efficiency gains associated with changes in the distribution of resources across students which can offset the losses associated with decreased total spending.

[36]There are a few papers that attempt to examine some of the theoretical implications of different income distributions on growth, for example, Galor and Zeira (1993) and Banerjee and Newman (1993).

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