Preliminary -- Not for Citation
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Does State Financing of Public Schools Reduce Expenditure Inequality across School Districts?

by

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August 2003

Abstract

Proponents of centralization (increased state funding of public education) argue that state financing reduces inter-district disparities in education spending by raising spending in low-spending districts, not by penalizing high-spending districts. This paper uses a well-established centralization scheme—that of Washington State in 1979—to assess centralization's impact on within-state instructional expenditure inequality. Washington was the first state to centralize school funding in response to concerns about funding adequacy. Oregon serves as a comparison state. A unique eight-year panel data set of school-district level fiscal, socioeconomic and census data was constructed to analyze this question.

Non-parametric kernel density estimation, quantile plots and inequality measures provide descriptive evidence of centralization's impact on spending inequality. Quantile regression and fixed-effects estimation identify centralization's effect on the distribution of spending independent of other factors that influence school spending. Preliminary results indicate that centralization reduced expenditure inequality in Washington. Moreover, greater equality was achieved through increased spending among the lowest-spending districts and slightly dampened spending among high-spending districts. These findings suggest that increased state funding of local public schools can have profound implications for the distribution of resources across pupils.

I thank Thomas Downes and participants in the University of California, Berkeley, Center for Labor Economics Labor Lunch for helpful advice and John DiNardo for providing the draft bootstrap program used in this paper. I am grateful to Oregon and Washington education officials who provided and interpreted their school district financial data as well as the many graduate school colleagues who helped prepare machine-readable data files.

Since the 1971 landmark *Serrano v. Priest* decision transformed public education financing in California, 45 states have faced constitutional challenges to their school finance systems' reliance on local property taxes to fund public elementary and secondary education (Education Commission of the States 2002a). Proponents of centralization argue that increased state funding of public schools ensures adequate funding and may also dampen inter-district disparities in education spending characteristic of local property tax finance. Critics contend that centralization often has the unintended consequence of lowering average spending. Most research to date has focused on centralization's impact on the level of spending, rather than its distribution.

Yet reductions in expenditure dispersion caused by increasing spending of districts at the bottom of the expenditure distribution ("leveling up") have different policy implications than those accomplished by reducing expenditures of the very highest-spending school districts ("leveling down"). This paper fills a gap in the literature by examining the impact of centralization on the within-state distribution of education spending.

I use a well-established, stable implementation of a school finance scheme—that of Washington State—to assess the impact of centralization on within-state instructional expenditure inequality. Washington provides a useful case study for analysis of the impacts of school finance centralization for three reasons. First, although Washington was the first state to centralize school funding in response to concerns about funding reliability and adequacy, centralization likely also affected within-state expenditure inequality. Washington's experience thus provides evidence on the effect of an adequacy-motivated reform on variation in school spending across districts. Second, the basic features of Washington's centralization—increased use of statewide taxes, reduced reliance on local property taxes, but maintenance of some local discretionary spending authority—closely resemble recent modifications to school finance schemes in Kentucky, Michigan, and Tennessee (Education Commission of the States 2002b). Third, Washington's school funding scheme has remained essentially unchanged since centralization, a necessary condition for identifying the impact of centralization on spending inequality. For all these reasons, Washington's

experience with centralization yields useful insights into the probable impacts of recent school finance schemes on the distribution of educational resources across pupils.

Garvey (2003a) demonstrated that Washington's centralization significantly decreased average per-pupil instructional expenditure growth in Washington by over three percent per annum. Resource losses did not appear to be evenly distributed across school districts, however. Centralization shifted spending from away from pupils in ethnically heterogeneous urban school districts and toward students in predominantly white, suburban and rural districts. Property-wealthy districts also suffered disproportionate expenditure declines as centralization severed the link between local property taxes and school spending. These results suggest that centralization has important consequences for within-state instructional expenditure inequality.

Preliminary results suggest that centralization reduced expenditure inequality in Washington through increased spending among the lowest-spending districts and slightly dampened spending among high-spending districts. These findings suggest that increased state funding of local public schools can "raise the boats" of pupils in low-spending districts without adversely impacting

Previous Research

In contrast to the large number of studies of centralization's impact on average per-pupil expenditures (see Hoxby 2001 for a review), there are few formal models of centralization's impact on spending inequality. Theoretical studies typically use a variant of the Tiebout model (1956)[1] of local public goods equilibrium with a median-voter model of expenditure determination to predict centralization's impact on the distribution of education spending. Fernández and Rogerson (1999b) use such a model to analyze the effects of alternative financing schemes on the distribution of education resources. Their simulations

[1] The Tiebout model of pure local property tax finance benchmarks most research on the impact of centralization on the distribution of school spending. Households are assumed to maximize utility by choosing among residences located in different school districts according to their preferences for public education and the local property taxes that finance education spending. A household thus chooses the district that offers its utility-maximizing school spending/property tax bundle. Local households vote over property taxes up to the point where the marginal benefit of additional school spending equals the marginal cost of higher property taxes. Since property taxes are set by majority vote, the household at the median of the district's spending preferences distribution determines the level of education spending in the district.

suggest that a foundation aid scheme[2] can reduce expenditure inequality by as much as 15 percent relative to pure local finance. The authors calibrate the parameters of this model with California data to simulate the effect of California's transition from a system of mixed state and local financing to pure state finance (Fernández and Rogerson 1999a). They find that greater expenditure equality was achieved by "leveling down," i.e., greater spending equality accompanied by lower average spending. Only the poorest districts realized significant spending gains after centralization, while wealthy, high-spending districts experienced expenditure declines.[3]

In one of the few case studies of centralization outside of California, Theobald and Hanna (1991) examine the effect of increased state funding for schools in Washington State. They document reduced dispersion in per-pupil revenue after centralization, measured as decreases in the ratio of per-pupil revenues at the pupil-weighted ninety-fifth and fifth percentiles of the revenue distribution and the ratio of per-pupil revenues at the pupil-weighted seventy-fifth and twenty-fifth percentiles. This descriptive analysis, however, fails to control for the determinants of school spending.

The empirical literature frequently treats centralizations as discrete events, where dummy variables indicate whether a state has a court-ordered or legislatively implemented centralization in each time period. States that undergo neither event serve as a control group (Hoxby 2001 reviews this literature). Typical of research in this vein, Murray and colleagues (1998) find that court-mandated school finance centralization reduced within-state expenditure inequality on average by 19 to 34 percent. Greater equality resulted from increased spending in the lowest spending districts and unchanged spending amongst districts at the pupil-weighted ninety-fifth percentile of the expenditure distribution.

A weakness of the "dummy variable" approach is that the "tax price" of locally financed spending, the increase in local revenues necessary to raise per-pupil spending by a dollar, varies non-monotonically among school finance classifications and even across school districts in a state, which are nominally subject

[2] In a foundation system, the state establishes a per-pupil foundation aid level, f, and a foundation tax rate, τ_f. The state gives each district per-pupil aid equal to the difference between the foundation level and the revenue it would raise if it levied the foundation tax rate on its assessed valuation ($f - \tau_f v_i$).

to the "same" school finance regime. Hoxby (2001) characterizes school finance schemes by the tax prices and the level of state support local school districts face. She finds that increased state funding of schools unambiguously reduces expenditure inequality. Centralizations that impose extremely high tax prices on local spending achieve greater equalization than more modest schemes. However, it is unclear whether increased equality is achieved by leveling up spending in low-spending districts, leveling down spending in high-spending districts, or some combination of both.

Economic theory suggests a number of mechanisms through which the transfer of spending authority from the local school district to the state may affect the distribution of resources across districts. Yet there is no clear prediction of the effect of centralization on expenditure inequality; it depends on the funding mechanism used to increase state support of schools, the level of state financing, the tax price of locally financed spending under the school finance scheme, and the response of households in each school district to changing incentives. Thus, any assessment of centralization's impact on education spending must account for these factors.

Data

Previous empirical research on centralization's impact on spending inequality is often plagued by two key data limitations. First, since the Census of Governments, the most common source of historical school district financial data, is collected for the universe of school districts only at five-year intervals, data must be drawn over a long period (typically twenty years) in order to consistently estimate parameters of interest. Yet funding systems are rarely stable over long periods (National Center for Education Statistics 2001), which implies that the impact of a particular school finance scheme on district spending may not be identified. The effects of one policy may be confounded by subsequent alterations to a school funding system and/or the contemporaneous imposition of tax and expenditure limits on state or local governments (Downes and Figlio 1998). Second, the census definition of expenditures is problematic. Current expenditures, the only reasonably consistently defined spending measure over time, includes spending on

[3] Downes (1992) documents a similar decline in per-pupil expenditure inequality after California's centralization.

instruction, support services and non-instructional activities such as transportation and food service. Current expenditures are thus a noisy measure of resources devoted to classroom instruction, the actual object of most centralization schemes.[4] Analyzing instructional spending provides a direct test of centralization's impact on resources available to students and avoids confounding centralization's impact with temporal variation in non-instructional spending.[5]

I overcome census data deficiencies and the absence of historical school district fiscal data by collecting a unique eight-year panel data set of school-district level fiscal and socioeconomic data from a variety of annual state education reports and 1980 decennial census data (*Summary Tape File 3F, School Districts*) for Washington and Oregon school districts. The panel covers the 1976-77 through 1983-84 school years, which straddles Washington's centralization in the 1979-80 school year.[6]

Oregon serves as a comparison state to control for macroeconomic conditions and unobserved tastes for education spending, which permits identification of centralization's impact on the distribution of instructional expenditures. Oregon is shown to be a valid statistical control in Garvey (2003a). Oregon is representative of national education spending patterns in the period under study, while closely resembling Washington in the socioeconomic and demographic factors that influence education spending. Test statistics of differences in mean state characteristics in the pre- and post-centralization periods in Table 1 indicate that with the exception of having significantly more white students and somewhat lower median family incomes, Oregon districts have similar enrollment, ethnic composition, age distribution and poverty rates as Washington districts. Of equal importance, Oregon experienced no changes to its school finance

[4] Although current and instructional spending per pupil are correlated at about 0.9 for public elementary and secondary school districts in the 1977 Census of Governments, instruction comprises only about 60 percent of total spending. Garvey (2003b) examines the reliability of historical census school district fiscal data.

[5] Cullen (1999) documents the rapid growth in the fraction of school budgets devoted to special education services over the past two decades.

[6] The Common Core of Data (CCD), the National Center for Education Statistics' annual database of fiscal, staffing and pupil demographic data for all public school districts, commenced only with the 1987-88 school year, too late to observe Washington's pre-centralization period. Several other "comparison" Western states did not alter their school finance systems from the late 1970s to the mid-1980s and were candidates for inclusion in the analysis (Hoxby 2001). However, data unavailability and small sample sizes in states with reasonably complete data restricted my attention to Oregon. Data availability and consistency of expenditure definitions confined the panel to the 1976 through 1983 school years.

system that altered incentives for locally financed spending or the level of state financing during the period under study.

In 1985, 296 school districts operated in Washington and 303 were open in Oregon. In order to make valid comparisons, only "regular" school districts that offered general classroom instruction, operated for all years of the panel, and were "unified" districts, i.e., offered both primary and secondary grades, are included in the analysis.[7] The last restriction is imposed because the significantly higher per-pupil costs of exclusively elementary or secondary districts are reflected in state aid formulas (Wyckoff 1992). It is important to note that unified districts educated over 95 percent of public school students in Washington and 85 percent in Oregon. Two very small unified Washington districts were dropped from the analysis sample due to suppressed census data, leaving an analysis sample of 241 unified school districts in Washington and 152 in Oregon. **[TO DO: Sensitivity of results to including non-unified districts]**

School Finance in Washington and Oregon

Foundation aid, the most common form of state aid, was the basic school finance scheme in Washington and Oregon over the period. Let ppe_i, v_i, and τ_i denote district i's per-pupil spending, per-pupil assessed valuation, and local property tax rate, respectively. Under a foundation aid system, the state establishes a foundation guarantee level of state support, f, and a statewide property tax rate called the foundation tax rate, τ^f. The state distributes per-pupil aid equal to the difference between the foundation level and the per-pupil revenue a district would raise if it levied the foundation tax rate on its property wealth. Such a system yields a school district budget constraint of the form:

$$(1)\quad \begin{aligned} ppe_i &= \tau_i v_i + \left(f - \tau^f v_i\right) && \text{if } f > \tau^f v_i \\ ppe_i &= \tau_i v_i && \text{if } f \le \tau^f v_i. \end{aligned}$$

Washington historically provided a relatively high level of state support for public elementary and secondary schools (Theobald and Hanna 1991 and Table 1), although by the mid-1970s local property taxes

[7] School districts that ceased operations were usually very small rural districts that consolidated with adjacent districts. As such, they incurred atypically high per-pupil expenditures prior to closure. 303 of Oregon's 334 school districts and 298 of Washington's 301districts operated continuously from 1976 through 1984.

accounted for an increasing share of district revenues. Repeated property tax levy failures prompted the Seattle school district to sue the state in 1976, arguing that the existing finance scheme violated the state constitution. The legislature responded to a court ruling in Seattle's favor by enacting the Basic Education Act of 1977, which provided for full state funding of regular instructional programs starting in the 1979-80 school year (Billings et al. 1992). The legislature attempted to impose a local property tax limitation of 10 percent of the foundation level, which was effectively eliminated by 1981 (Theobald and Hanna 1991).

Washington's school finance scheme following centralization was simply a foundation aid system with a higher foundation level and a nominal cap on local property tax revenues at 10 percent of the foundation level during the first two years.

Descriptive Findings

[TO DO: Is measured inequality sensitive to adjusting expenditures for variation in the cost of providing education a la Chambers]

As a first estimate of centralization's impact on the entire distribution of school spending, Figure 1 presents kernel density estimates of per-pupil instructional spending in selected years (substantive conclusions are unaffected by the choice of years). Three features are worthy of note. First, prior to centralization, Washington districts generally had higher spending than Oregon districts at all points in the distribution. Simply put, Washington's spending distribution roughly "first-order stochastic dominated" Oregon's distribution. This relationship disappeared after centralization as Oregon experienced accelerated spending growth relative to Washington throughout the distribution. Plotting a few selected expenditure percentiles (Figure 2) elucidates this point.[8] Second, spending growth stagnated most dramatically at the upper end of the spending distribution. There is less density in the right tail of Washington's distribution after centralization (Figure 1), which is reflected in steeper relative declines in spending at the 75th and 90th expenditure percentiles (Figure 2). Finally, Oregon had less overall dispersion in the distribution of

[8] Garvey (2003a) shows that the stagnation in spending in Washington relative to Oregon evident in Figures 1 and 2 is attributable to centralization, not to idiosyncratic shocks to Oregon's spending patterns.

instructional spending throughout the period, although spending disparities declined more rapidly in Washington.

Four summary measures of within-state instructional expenditure inequality—the coefficient of variation (CV), the Gini coefficient, the Theil index, and the ratio of spending at the 95th percentile to spending at the 5th percentile—quantify the relative decline in expenditure inequality in Washington. Since each measure has unique advantages and drawbacks, multiple measures are used to ensure that inferences about the expenditure distribution are not sensitive to the choice of indicator[9] All measures reveal a consistent pattern, although the magnitude varies somewhat depending on the measure (Table 2 and Figure 3). Washington experienced a 25 to 50 percent reduction in spending inequality over the period versus a 15 to 25 percent drop in Oregon. Compression in Washington's spending distribution began in 1977, two years prior to centralization, accelerated sharply in the 1979-80 school year, and continued uninterrupted after reform. The temporal pattern of expenditure variation in Oregon, by contrast, was more erratic.

These descriptive results suggest that centralization did not increase expenditure inequality and may even have reduced within-state disparity.

Methods

A natural starting point for exploring the differential impact of centralization across the expenditure distribution is through use of quantile regression. Unlike OLS, which measures the effect of explanatory variables on the conditional mean of the dependent variable, quantile regression is a semi-parametric estimation technique that permits the effects of explanatory variables to vary at different percentiles (quantiles) in the conditional distribution of the dependent variable. Estimating reduced-form quantile

[9] All are scale invariant, and the first three measures have the desirable property that a dollar transferred from a higher-spending district to a lower-spending district always lowers inequality. The CV, which divides the enrollment-weighted standard deviation of per-pupil instructional expenditures by the enrollment-weighted mean, is sensitive to extreme values of the distribution. The Gini coefficient indicates the extent to which the poorest *g* percent of pupils receives less than *g* percent of total instructional expenditures. The 95/5 ratio is less sensitive to extreme values than the other indices, but measured inequality is unaffected if resources are transferred from a wealthier to a poorer district between the 5th and 95th percentiles of the enrollment-weighted expenditure distribution. Murray et al. (1998) and Wyckoff (1992) provide excellent summaries of the sensitivity of various inequality measures to the properties of the distribution under consideration.

regression models of school district instructional expenditures isolates centralization's impact on students at different points in the spending distribution.

Following Koenker and Bassett (1978), the θ^{th} conditional quantile of the per-pupil expenditure distribution can be described by a linear function of the form:

$$\text{Quant}_{\theta}\left(\ln(\text{ppe}_{ijt})\middle|\mathbf{X_{ijt}},\mathbf{t}\right)=\mathbf{X_{ijt}}\boldsymbol{\beta}_{\theta}+\gamma_{\theta}\text{time}+\delta_{\theta}(\text{WA}*\text{time})+\varpi_{\theta}\text{posttime}+\rho_{\theta}(\text{WA}*\text{posttime})+\varepsilon_{\theta}, \quad (2)$$

where $\ln(\text{ppe}_{ijt})$ is the natural logarithm of weighted instructional spending per pupil in district *i* in state *j* in year *t*, $\boldsymbol{X_{ijt}}$ is a vector of school district attributes described above, *time* is a linear time trend, *posttime* is a post-centralization time trend, *WA* is an indicator variable that equals 1 for Washington school districts and 0 otherwise, and ε_{θ} is a random error term. Deviation from trend expenditure patterns, measured by $\rho_{\theta,}$ identifies centralization's impact at a given percentile of the spending distribution.

A drawback of quantile regression is that cross-sectional fixed effects are not identifiable in short panels. Previous research has shown, however, that unobserved, relatively time-invariant factors are important determinants of districts' observed spending (see Garvey 2000 for a survey). For example, if Washington districts have greater unobserved tastes for equalized education spending than Oregon, omitting school district effects biases upward the estimated effect of centralization. Including district fixed effects also controls for state fixed effects, i.e., unobservable permanent differences across states. If states with below-average expenditure disparities also tend to have strong preferences for state-financed education spending, ρ_{θ} will be biased upward if state effects are omitted from the model.

The following fixed-effects reduced-form regression is therefore estimated:

$$\begin{aligned}\ln(\text{ppe}_{ijt}) &= \boldsymbol{\beta}_1\mathbf{X_{ijt}}+\gamma\text{time}+\delta(\text{WA*time})+\varpi\text{posttime}+\rho(\text{WA}*\text{posttime})+\boldsymbol{\beta}_2\mathbf{D_i}\\ &\quad+\beta_3(\text{posttime}*\text{I}_0)+\beta_4(\text{WA}*\text{posttime}*\text{I}_0)+\varepsilon_{ijt},\end{aligned} \quad (3)$$

where $\boldsymbol{X_{ijt}}$ includes only time-varying school district attributes, $\mathbf{D}_i$ is a vector of school district indicator variables, and I_0 is an indicator of the school district's initial position in the 1976-77 expenditure distribution. β_3 and β_4 are initially constrained to be zero. Removing the constraints permits the effect of

greater state funding on school spending to differ along the pre-centralization expenditure distribution, which identifies *how* centralization reduced expenditure inequality. Since all school districts in a state are subject to the same school funding regime in any given year, Moulton's (1990) correction for within-state/year correlation of the disturbances is used to estimate robust standard errors.

Preliminary Results

[NOTE: will examine other "initial conditions:" e.g, income poor, property poor, and high proportion minority districts to determine if redistribution occurs across income, property wealth, or some other characteristic]

Quantile regression estimates of equation (1) are shown for the 0.1, 0.25, median, 0.75 and 0.9 percentiles in Table 3. Bootstrapped standard errors are reported in parentheses below the associated parameter estimate.[10] Model 1 is a parsimonious specification with only state-specific time trends as covariates, while Model 2 includes socioeconomic and demographic characteristics that also affect district preferences for school spending. Since the models yield similar results, the discussion focuses on the parameter estimates from Model 2.

Prior to centralization, instructional spending grew between 5 and 6 percent more rapidly in Washington than Oregon at all measured percentiles. This pattern, however, reversed after 1980. Whereas spending grew 3 to 4 percent per year throughout the Oregon distribution, net spending growth among Washington pupils was much lower, averaging less than half a percent. Spending growth slowed most dramatically for pupils at or above the median of the expenditure distribution, i.e., for pupils in high-spending districts.

Controlling for unobserved time-invariant state and district factors dampens the temporal and distributional impacts of centralization, but yields qualitatively similar results to quantile regression (Table 4). Relative to Oregon, Washington pupils experienced nearly 2 percent less annual growth in spending,

[10] Koenker and Hallock (2000) point out that bootstrapped standard errors are preferable to the "analytic" standard errors reported by Stata's qreg procedure, which incorrectly assumes homogenous, independent, identically distributed error terms. The choice of the number of bootstrap replications was guided by Andrews and Buchinsky (2000).

although this difference is statistically insignificant once robust standard errors are estimated (Model 2). The secular reduction in inequality noted in the descriptive results is due to more rapid expenditure growth among lower-spending districts rather than spending decreases among students in the upper tail of the distribution. Spending grew approximately 2 percent and 1 percent per year for pupils at or below the 25th percentile and between the 25th and 75th percentiles of the expenditure distribution, respectively. Pupils in Washington districts spending at or below the median in 1977 enjoyed marginally significant 2 percent additional growth while pupils at or above the 75th percentile had no additional change in resources. In other words, reduced expenditure inequality was achieved through increased spending among the lowest-spending districts and essentially unchanged spending among high-spending districts.

Preliminary Conclusions

These findings suggest that increased state funding of local public schools can have profound implications for the distribution of resources across pupils. The adequacy-motivated increase in state funding undertaken in Washington in 1979-80 closely resembles recent changes to other states' school finance schemes. This paper demonstrates that centralizations, even those whose stated goal is to increase the level of resources, not reduce expenditure inequality, have important effects on the distribution of resources across pupils. State funding significantly increases the level of resources available to pupils in low-spending districts and may dampen spending on pupils above the 75th percentile of the distribution.

Recent research demonstrates that school inputs do matter for academic performance (Card and Krueger 1992; Dewey et al. 2000). An important avenue for further research is thus to examine whether centralization's impact on the expenditure distribution differentially affects academic outcomes for students who receive increased school resources.

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Table 1: Descriptive Statistics of Washington and Oregon Unified School Districts: 1976-77 to 1983-84 School Years

(Standard errors in parentheses)

	Washington		Oregon	
Characteristic	1976-78	1979-83	1976-78	1979-83
Weighted instructional expenditures per pupil	$1126.05 (211.50)	1113.79 (163.98)	950.72 (106.48)	1030.04 (121.17)
Weighted revenues per pupil	$1663.85 (302.07)	1754.44 (263.80)	2244.23 (542.28)	2291.79 (466.10)
Fraction of district revenues from state sources	59.96% (9.67)	77.45 (7.89)	28.19 (9.65)	28.77 (9.31)
Fraction of district revenues from local sources	29.13% (10.92)	14.69 (5.95)	65.79 (10.99)	66.55 (10.44)
Fraction of district revenues from federal sources	10.93% (9.35)	7.86 (7.10)	6.02 (4.75)	4.68 (3.01)
Fraction of districts with a property tax levy	81.88% (38.54)	83.65 (37.00)	98.68 (11.43)	98.82 (10.82)
Pupil-weighted assessed valuation per pupil	$70,861 (34,783)	103,579 (60,328)	83,838 (27,866)	100,824 (30,852)
Pupil enrollment	3084.59 (5743.32)	2969.88 (5111.75)	2521.39 (5298.80)	2414.05 (4911.0)
Percent of pupils in urban districts	59.49% (49.13)	57.38 (49.47)	50.16 (50.05)	49.36 (50.03)
Percent white pupils	90.94% (12.76)	89.55 (13.43)	94.77 (6.47)	93.56 (6.98)
Percent Hispanic pupils	3.35% (7.95)	4.05 (8.75)	2.58 (5.24)	3.12 (5.37)
Percent American Indian pupils	4.06% (9.67)	3.92 (9.85)	1.60 (3.54)	1.81 (4.15)
Percent black pupils	0.65% (1.76)	0.86 (2.08)	0.33 (1.13)	0.45 (1.23)
Percent Asian pupils	1.01% (1.25)	1.61 (2.00)	0.73 (0.78)	1.06 (1.16)
Percent of households in poverty, 1979	11.57% (4.39)		11.94% (3.26)	
Percent of population that rents, 1979	25.68% (8.36)		26.84% (6.68)	
Percent of population school age, 1979	23.59% (3.36)		23.29% (2.63)	
Percent of population 65 or older, 1979	11.28% (4.24)		11.88% (3.51)	
Percent of adults with a college degree, 1979	14.10% (7.13)		12.88% (5.90)	
Median family income, 1979	$19,583 (3,454)		$18,258 (2,929)	

Notes: Nominal dollar values are deflated to 1977 dollars using the CPI-U. Fiscal statistics are pupil weighted as indicated. Revenue, expenditure, and pupil demographic statistics are author's calculations from state reports. Revenue data for Oregon school districts are not available until the 1978-79 school year. School district demographic characteristics are computed from the U.S. Bureau of the Census, *Census of Population and Housing, 1980: Summary Tape File 3F, School Districts* (1983).

TABLE 2: Enrollment-Weighted Instructional Expenditure Inequality Measures
Washington and Oregon Unified School Districts: 1976 to 1984

	School Year							
	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
Within-state inequality measures								
Oregon								
Coefficient of variation (x 100)	11.65	11.04	10.97	11.24	10.94	10.06	10.81	10.26
Gini coefficient (x 100)	6.34	6.11	6.10	6.27	5.96	5.44	5.85	5.38
Theil index (x 1000)	6.84	6.08	5.95	6.23	5.86	4.94	5.71	5.08
95/5 ratio	1.42	1.38	1.38	1.38	1.34	1.32	1.33	1.35
Washington								
Coefficient of variation (x 100)	18.35	19.88	17.75	15.76	15.25	14.74	13.57	13.45
Gini coefficient (x 100)	10.42	11.04	9.70	8.60	8.37	7.86	7.35	7.14
Theil index (x 1000)	16.75	19.18	15.22	11.94	11.23	10.30	8.83	8.59
95/5 ratio	1.78	1.92	1.89	1.68	1.63	1.59	1.53	1.48

Notes: Instructional expenditure inequality measures are author's calculations from state expenditure reports.

Table 3: Impact of Centralization on Enrollment-Weighted Instructional Spending, Pooled Quantile Regression: 1976-77 to 1983-84
(Standard errors in parentheses)

Dependent variable: Log per-pupil instructional expenditures (1977 dollars)				
	Quantile			
Explanatory Variables	0.10		0.25	
	Model 1	*Model 2*	*Model 1*	*Model 2*
Log real assessed valuation per pupil		0.0309*		0.0365*
		(0.0170)		(0.0154)
Percent black pupils		0.2359		0.4559
		(0.2700)		(0.3342)
Percent Hispanic pupils		0.3667*		0.2944*
		(0.0620)		(0.0633)
Percent Asian pupils		0.1748		0.1160
		(0.4609)		(0.5159)
Percent American Indian		0.1765		0.4046*
		(0.1492)		(0.0752)
Log enrollment		0.0054		-0.0051
		(0.0079)		(0.0067)
Percent of households in poverty, 1979		0.9184*		0.6783*
		(0.2669)		(0.2666)
Urban school district		0.0343*		0.0565*
		(0.0125)		(0.0119)
Log median family income, 1979		0.4094*		0.2435*
		(0.0801)		(0.0720)
Fraction of population that rents, 1979		0.2316		0.2312*
		(0.1232)		(0.1107)
Fraction of population school age, 1979		-1.1658*		-0.7667*
		(0.3430)		(0.3485)
Fraction of population 65 or older, 1979		0.1693		0.0858
		(0.2003)		(0.2102)
Fraction of adults with a college degree, 1979		0.0744		0.1850
		(0.0815)		(0.0967)
Pre-1980 time trend	-0.0112	0.0026	-0.0330*	-0.0335*
	(0.0079)	(0.0159)	(0.0156)	(0.0164)
Washington-specific trend	0.0331*	0.0431*	0.0457*	0.0502*
	(0.0059)	(0.0080)	(0.0077)	(0.0074)
Post-1980 time trend	0.0485*	0.0234	0.0711*	0.0602*
	(0.0100)	(0.0199)	(0.0199)	(0.0208)
Washington-specific trend	-0.0539*	-0.0662*	-0.0753*	-0.0745*
	(0.0108)	(0.0138)	(0.0142)	(0.0138)
Constant	6.7252*	2.3623*	6.8440*	4.0622*
	(0.0191)	(0.7183)	(0.0347)	(0.6996)

Explanatory Variables	Quantile					
	0.50		0.75		0.90	
	Model 1	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
Log real assessed valuation per pupil		0.0127 (0.0159)		0.0102 (0.0139)		0.0031 (0.0147)
Percent black pupils		1.1881* (0.4031)		1.4883* (0.2429)		1.6858* (0.2436)
Percent Hispanic pupils		0.1943* (0.0743)		0.1341* (0.0602)		0.0580 (0.0667)
Percent Asian pupils		-0.7346 (0.5940)		-0.7501 (0.4877)		-0.8032* (0.3695)
Percent American Indian		0.3736* (0.0622)		0.4582* (0.0811)		0.4406* (0.0914)
Log enrollment		-0.0166* (0.0079)		-0.0409* (0.0055)		-0.0736* (0.0069)
Percent of households in poverty, 1979		0.3897 (0.2490)		-0.2146 (0.2163)		-0.5613* (0.2277)
Urban school district		0.0738* (0.0117)		0.1069* (0.0144)		0.1285* (0.0135)
Log median family income, 1979		0.1980* (0.0609)		0.1103* (0.0590)		0.0790 (0.0642)
Fraction of population that rents, 1979		0.3020* (0.1272)		0.5545* (0.1229)		0.6577* (0.1145)
Fraction of population school age, 1979		-0.5301 (0.3755)		0.3459 (0.3482)		0.6559 (0.3518)
Fraction of population 65 or older, 1979		0.0716 (0.2442)		0.6468* (0.2145)		0.8396* (0.2327)
Fraction of adults with a college degree, 1979		0.2180* (0.0812)		0.2950* (0.0900)		0.4113* (0.0994)
Time trend	-0.0523* (0.0150)	-0.0626* (0.0131)	-0.0551* (0.0195)	-0.0681* (0.0102)	-0.1148* (0.0318)	-0.0796* (0.0117)
Washington-specific trend	0.0517* (0.0087)	0.0620* (0.0064)	0.0685* (0.0136)	0.0609* (0.0055)	0.1003* (0.0188)	0.0558* (0.0057)
Post-1980 time trend	0.0926* (0.0202)	0.1007* (0.0171)	0.0880* (0.0246)	0.1032* (0.0131)	0.1430* (0.0328)	0.1149* (0.0137)
Washington-specific trend	-0.0872* (0.0170)	-0.0990* (0.0122)	-0.1069* (0.0247)	-0.0954* (0.0104)	-0.1413* (0.0351)	-0.0856* (0.0100)
Constant	6.9812* (0.0341)	4.9489* (0.6470)	7.0731* (0.0460)	5.8300* (0.6418)	7.3029* (0.0939)	6.4711* (0.6970)

Notes: Standard errors calculated by 1000 repetitions of the bootstrap are in parentheses below the parameter estimates. * Indicates parameter estimate is significant at the 5 percent level. All dollar figures are deflated to 1977 values.

Table 4: Impact of Centralization on Enrollment-Weighted Instructional Spending, School District Fixed Effects Models: 1976-77 to 1983-84

(Robust standard errors in parentheses)

Dependent variable: Log per-pupil instructional expenditures (1977 dollars)		
Explanatory Variables	*Model 1*	*Model 2*
Log real assessed valuation per pupil	0.0306	0.0128
	(0.0298)	(0.0223)
Percent black pupils	-0.1506	0.3196*
	(0.1846)	(0.0944)
Percent Hispanic pupils	-0.0892	0.0706
	(0.3352)	(0.3175)
Percent Asian pupils	-1.3412*	-0.4119
	(0.3725)	(0.2730)
Percent American Indian pupils	-0.1658	-0.0040
	(0.1410)	(0.1602)
Log enrollment	-0.0786	-0.1746*
	(0.0525)	(0.0301)
Time trend	-0.0016	-0.0040
	(0.0068)	(0.0073)
Washington-specific trend	-0.0154†	-0.0163†
	(0.0068)	(0.0071)
Post-1980 time trend	0.0347*	0.0227†
	(0.0099)	(0.0102)
Washington-specific trend	-0.0066	-0.0183
	(0.0099)	(0.0132)
Post centralization effects 1977 expenditures:		
At or below the 10th percentile	---	0.0246*
		(0.0038)
Between the 10th and 25th percentile	---	0.0223*
		(0.0016)
Between the 25th and 50th percentile	---	0.0116*
		(0.0016)
Between the 50th and 75th percentile	---	0.0089*
		(0.0024)
Between the 75th and 90th percentile	---	-0.0072
		(0.0076)
Washington districts' 1977 expenditures:		
At or below the 10th percentile	---	0.0259
		(0.0154)
Between the 10th and 25th percentile	---	0.0258
		(0.0139)
Between the 25th and 50th percentile	---	0.0208
		(0.0105)
Between the 50th and 75th percentile	---	0.0107
		(0.0066)
Between the 75th and 90th percentile	---	0.0164

		(0.0102)
Constant	6.8917*	7.8167*
	(0.7037)	(0.4249)

Notes: School district fixed effects are estimated using a least squares dummy variable model. Robust standard errors are corrected for within-group correlation of the disturbances (see text). *Indicates parameter estimate is significant at the 5 percent level; †indicates parameter estimate is significant at the 10 percent level.

Figure 1: Density of Log Per-Pupil Instructional Spending, Washington and Oregon Unified Districts, Various Years

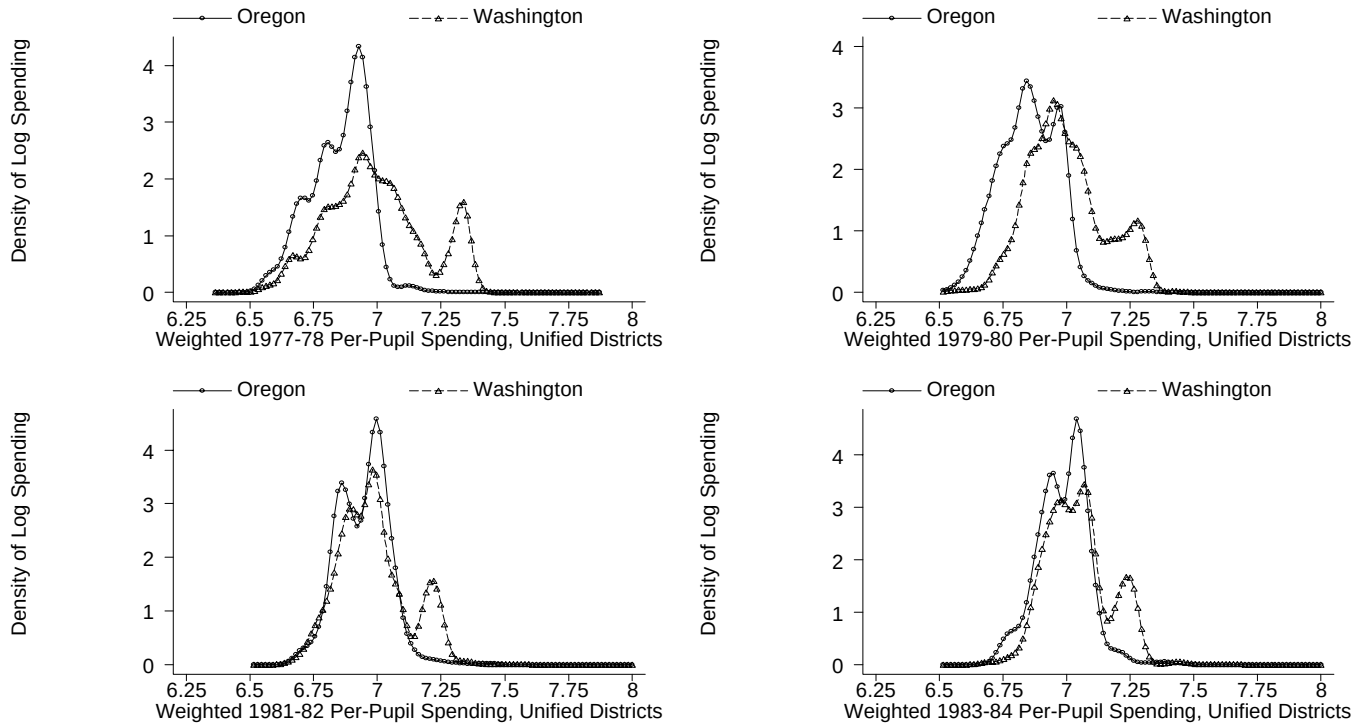
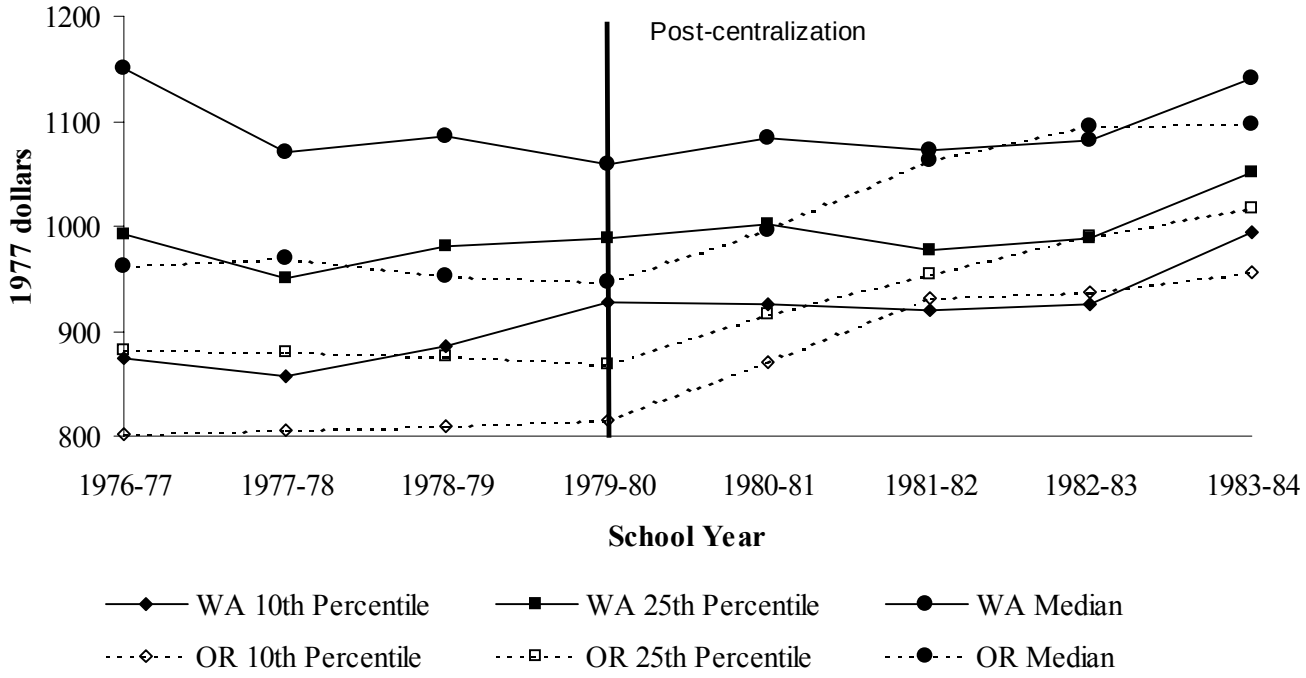


Figure 2: Distribution of Pupil-Weighted Instructional Expenditures Per Pupil Unified School Districts: 1976-77 to 1983-84



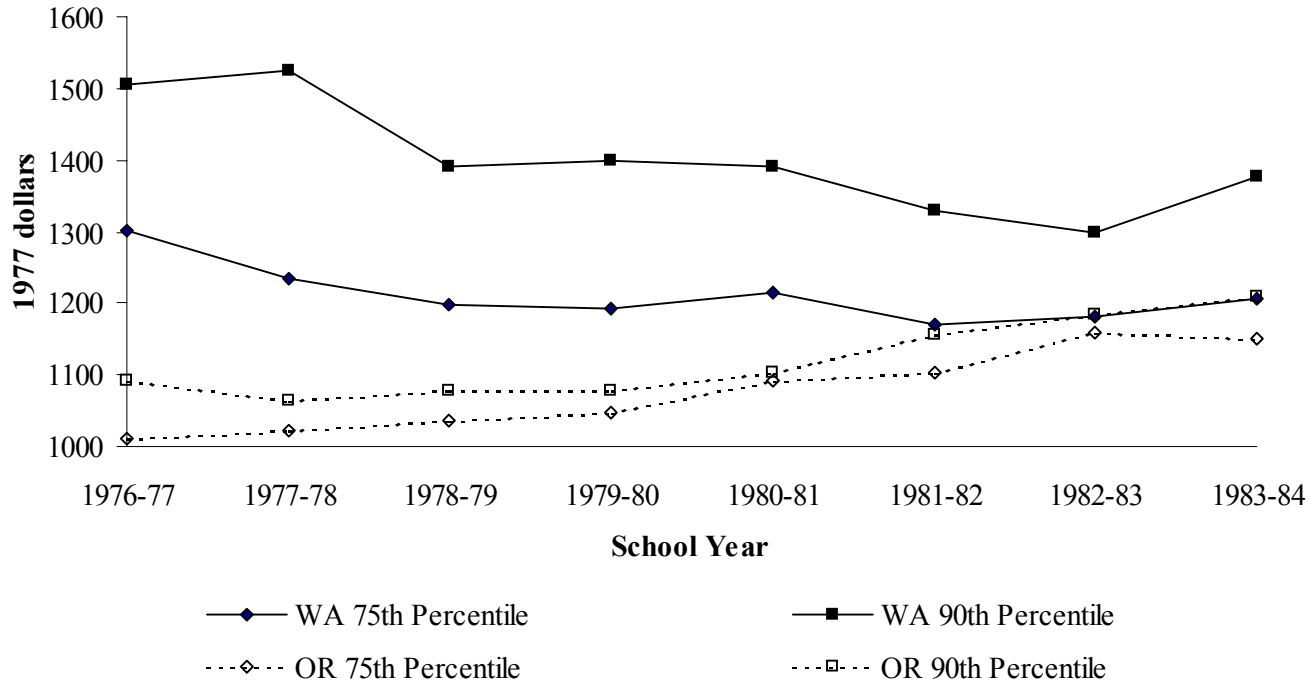
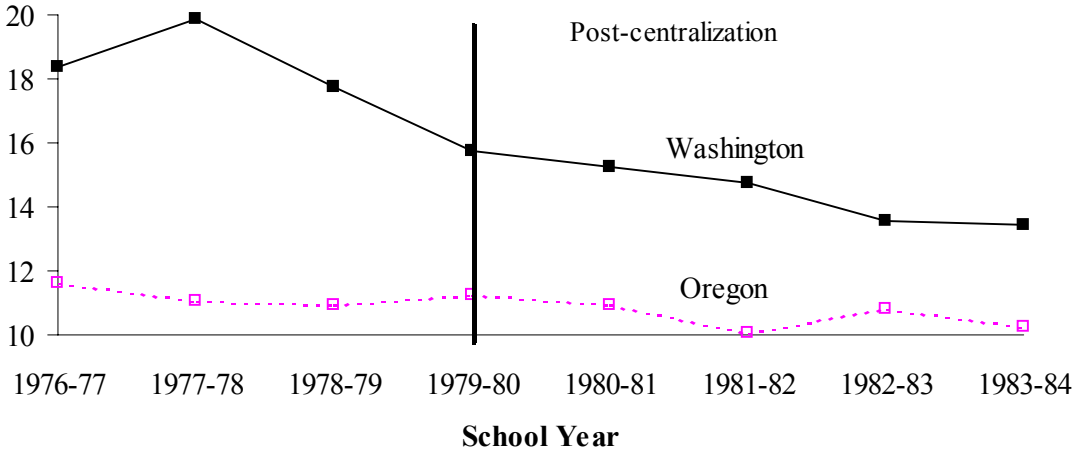
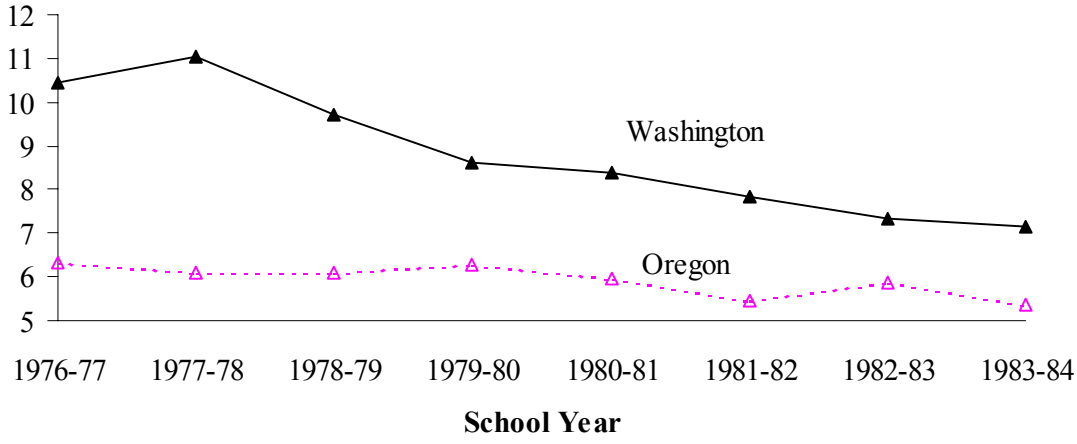


Figure 3: Spending Inequality, Unified School Districts, 1976-77 to 1983-84

Coefficient of Variation, Weighted Per-Pupil Instructional Expenditures



Gini Coefficient, Weighted Per-Pupil Instructional Expenditures



Theil Coefficient, Weighted Per-Pupil Instructional Expenditures