

The Impact of Intergovernmental Incentives on Special Education Spending

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June 2008

Abstract

Measured disability rates among school age children and the associated spending on special education programs have risen steeply over the past 30 years. Currently, about 15 percent of U.S. school children are classified as "disabled". Many observers note that the special education funding programs established by state and federal governments create an incentive for local school districts to drive up disability rates, potentially accounting for some of the rise in measured disability rates. However, it is unclear to what extent the funds from higher levels of government are actually spent on special education programs, versus other spending needs. I use the experiences following a major reform of the special education funding system in California to examine these issues. In 1998, the state converted from a system that awarded funds based on the number of disabled students in a district (with funding rates that varied across districts) to one based on total enrollment. This reform induced changes in the total funding awarded to different districts, and also reduced the marginal revenue from classifying an additional student as disabled to zero. Consistent with standard models, I find that the California reform creates both "income" and "substitution" effects on the number of students classified as disabled. Furthermore, although additional state special education grants translate into sizeable increases in special education spending in the short run, these funds appear fungible across other spending needs in the longer run.

Thanks to Thomas Parrish, Director of the Center for Special Education Finance at the American Institutes for Research; Jack Lucas, Director of the East San Gabriel Valley Special Education Local Plan Area; and Rob Hughes, Fiscal Consultant, School Fiscal Services Division, California Department of Education for their patient responses to my questions about the funding formulas in California special education finance. Special thanks to David Card, Emmanuel Saez, Ken Chay, Enrico Moretti, Tanguy Brachet, Damon Clark, Erica Greulich, Jane Herr, and Paco Martorell for comments and suggestions throughout. All errors are my own.

I. Introduction

Reported disability rates among school-aged children and the amount of government resources devoted to their education have increased steeply over the last 30 years. Over the last decades, the total number of special education students in the United States rose from 6 percent of total enrollment in 1987-88 to 14 percent of total enrollment in 2001-02 (Figure 1). Meanwhile, the share of special education in total school spending rose from 4 percent in 1967 to 19 percent in 1996 and continues to rise (Rothstein and Miles, 1997). This paper confirms that some of this rise in disability rates is explained by fiscal incentives in state funding formulas that reward additional classification with additional grants. It goes on to ask whether increases in state special education grants translate into actual increases in special education spending by local school districts.

To overcome issues of endogeneity that hinder simple regression analyses, I use an instrumental variables approach. Prior to a major reform in 1996, California used a system that provided each district an amount of funding based on the number of students classified as disabled. The funding rates per disabled student varied across districts, based on (inflation adjusted) cost estimates from 1979-80. This system provided a strong fiscal incentive for districts to classify additional students as disabled. The reform switched the funding to a *per-total enrollment* (or "census") basis. Specifically, each district received a grant based on the census rate, calculated to be the per-total enrollment funds received in 1995-96, the previous school year. Districts were to receive year to year changes in total funding based on enrollment growth. However, any re-classification of students from regular to special education did not generate new funds for the district in the new regime. Using the changes generated by this reform, I employ instrumental variables methods to overcome issues of endogeneity in my analysis.

There are two main contributions of the paper. First, the paper confirms that districts respond to fiscal incentives in special education funding formulas by adjusting the size of their special education populations. A number of previous studies address the effect of incentives on disability classification in schools. Dempsey and Fuchs (1993) conduct case studies of schools following a reform in Tennessee to find that districts respond to incentives by changing the type of placements made. Kane and Johnson (1993) conduct case studies of schools in Vermont to find that disability rates fall by more than 17% over the three years following a reform in that state. Montgomery (1995) finds a smaller effect in Oregon. Greene and Forster (2002) use state level data to find a positive effect of incentives on classification, though Parrish (2003) finds no effect in a similar exercise.

Few studies, however, analyze large district-level data sets, accounting for endogeneity and estimating credibly causal effects. One exception is Cullen (2003). She leverages discontinuities in the funding formula in Texas to find that 35% of the rise in disability rates from 1991 to 1996 can be attributed to fiscal incentives. The results in this paper confirm responses similar to Cullen's findings by districts in California and are credibly causal effects.

Second, this paper provides an estimate of the "flypaper effect", or the degree to which additional state grants translate into additional local district expenditures. The theory of the "flypaper effect" suggests that local governments respond to additional state grant funding by spending more on the targeted program than would be indicated by its associated marginal propensity to consume (Hines and Thaler, 1995). This theory suggests that a sizeable portion of each additional dollar of a state special education grant results in increases in special education spending. I simulate the change in funds due to the reform, holding constant classification rates. I use this simulated variable in an instrumental variables strategy to address possible problems with endogeneity in estimating the causal effect of state grants on

special education expenditures. I evaluate one-, two-, and three-year responses of local governments to these grants. The distinction between short and long run effects builds on previous work on the “flypaper effect”. In particular, Nora Gordon (2004) finds similar short-run and long-run behavioral responses of state and local governments to federal Title I funding. However, this is the first paper to examine the question in a special education finance context. It is also the first to separately identify "income" and "price" effects. The results suggest that the flypaper effect holds in the short run when district budgets are set, but that districts appear to shift incremental grants to other uses in the long run when given time to adjust.¹

The remainder of the paper is as follows: in section II, I provide background on disability funding and classification; in section III, I provide background on California’s special education finance reform; in section IV I discuss a model of local bureaucratic response to state grants and describe the research design. Section V describes the data. Section VI presents results and section VII concludes.

II. Background on Disability Funding and Classification

General Trends

The bulk of special education students are learning disabled, speech-impaired, or emotionally disturbed.² The probability of being diagnosed with a speech disorder is highest in the elementary school years while the probability of being diagnosed with a learning disability is highest in the middle school and high school years (Figure 2). Though all states

¹ Short run refers to the 1996-98 change, long run refers to the 1996-1999 and 1996-2000 changes.

² Learning disabilities affect about half of all disabled children, and speech impairments affect less than a quarter; emotionally disturbed, hearing impaired, "other" (a category which includes students with attention deficit disorder), orthopedically impaired, visually impaired, deaf-blind, autistic, developmentally delayed, and children with traumatic brain injuries comprise the remainder.

exhibit an increasing pattern of disability rates over time, they differ quite widely in absolute levels and rates of increase (Figure 3).³ And while many states have followed the national trend, with disability rates rising from about 6 percent in 1987-88 to 14 percent in 2001-02, others have remained relatively stable.⁴

States further vary in their distribution of categorical special education funds.⁵ The concurrent variation in disability rates and finance systems across states begs the question how much, if any, of the state variation in disability rates is driven by the disparate fiscal incentives of finance systems across states rather than true differences in incidence of disability across states.

Disability Classification Process

Procedures for disability classification are outlined in the federal Individuals with Disabilities Education Act (IDEA) of 1975 (P.L. 94-142). However, the legislation leaves many procedural details to the discretion of states and districts. Initial referral of a student for special education can be made by the parent or the teacher. A special services committee, consisting of school and district administrators, teachers, and parents determines eligibility based on evaluations, tests, records, or reports. However, this procedure is poorly defined by federal law; in practice, districts often fail to include teachers and parents on the eligibility

³ For instance, in 2000-01, Colorado identified 9.8 percent of its school-aged population as disabled, while Rhode Island identified 19.4 percent.

⁴ Massachusetts, for example, maintained a 15 percent disability rate over this same time period, while Hawaii's rate rose from under 6 percent to over 12 percent.

⁵ For example, in the 1999-2000 school year, seventeen states distributed special education funds based on the number of disabled students in a district, nine states based on the overall enrollment in a district, six based on the ability of the local district to pay for costs, five used a percentage reimbursement system in which districts were partially reimbursed for each disabled student, three used a variable block grant scheme in which districts received a grant determined by expenditure in previous years, and ten used some combination of the above (Chambers, Parrish, and Harr, 2002).

committee (Strickland and Turnbull, 2001). As a result, eligibility is often determined almost exclusively by administrators.

The federal law is also vague in its definition of disabilities. It defines a disability as a condition that “adversely affects educational performance.” Variation in states’ interpretation of this clause may be partly responsible for cross-state variation in disability rates. The lack of reliable psychometric measures for diagnosing learning disabilities and attention deficit disorders may also account for some of this variation. Educational researchers find that “there appear to be no reliable differences between students classified as having learning disabilities and those considered to be low-achievers” (Strickland and Turnbull, 2001). Others find greater than 96 percent overlap on forty psychometric measures for learning disabled students and low-achieving students (Ysseldyke, Algozzine, Shinn et al, 1982).⁶

Once a student is identified as eligible for special education services, the district convenes a committee to formulate an Individual Education Plan (IEP). The IEP is a federally mandated statement of the student’s present level of functioning and includes disability classification, annual goals, including short term instructional objectives.⁷ The IEP process is far from standardized across states or even districts within a state. Given the widely interpretable eligibility and placement criteria and the central role of administrators in the

⁶ With no reliable psychometric measures and only widely interpretable federal guidelines, each state and district uses its own set of criteria to determine special education eligibility. For example, some states ban the use of IQ tests for eligibility decisions. Others do not. Some states rely on an achievement-based paradigm, while others rely on an achievement-ability paradigm to determine eligibility. Because eligibility criteria may differ across districts, a child is required to be re-identified and re-evaluated for special education eligibility when he moves to a new district.

⁷ The committee creating the IEP consists of at least three of the following: the student, a parent, a regular education teacher, a special education teacher, a school psychologist, a school counselor, the school principal, a district administrator and a special education program administrator. The IEP is developed through one or a series of IEP meetings in which members of the IEP committee assess the student according to a federally-prescribed set of disability descriptions (see Appendix).

classification process, it is plausible that rising disability rates reflect a local bureaucratic response to fiscal incentives in state special education grants.

III. Census-Based Special Education Finance Reforms

Between 1993 and 2000, nine states instituted census-based special education finance reforms. These reforms shifted the distribution of state special education funds from systems in which grants were determined by the number of special education pupils to systems in which calculations were made based on total student enrollments. These nine states-- Alaska, Alabama, California, Connecticut, Idaho, Massachusetts, Montana, North Dakota, Pennsylvania-- along with South Dakota and Vermont, which instituted partial reforms, vary considerably in pre-reform finance systems, as well as in their implementation of the reforms. However, the reforms divorced funding from disability rates to some degree in all cases. In this section, I give an overview of the 1996-98 California reform.

California Pre-Reform, 1979-1996

In 1980, California eliminated its existing patchwork of categorical programs financing special education programs, and instituted the extended Master Plan for Special Education (MPSE). The MPSE used Instructional Personnel Services Units (IPSU) to determine state special education allocations to districts. Each unit represented the number of personnel required to staff a special day class, a resource program, or a designated instructional service. Its value was calculated based on the local cost of personnel as reported by districts in 1979-

80.⁸ Between 1980-81 and 1996-97, state special education grants to districts were calculated as follows:

$$\text{TotSpecEd}\$ _d = \left[\sum_j (\# \text{units}_{dj} * \text{unitrate}_{dj}) * (1 + \text{ssr}_{dj}) \right] - \text{lgcf}_d \quad (1)$$

where d indexes districts, j indexes the type of unit⁹, $\#units$ is the number of units of type j in each district d , $unitrate$ is the unit rate for unit type j in district d , ssr is the support service ratio¹⁰, and $lgcf$ is the local general fund contribution.

Importantly, $unitrate$, $lgcf$, and ssr were based on local levels of funding in 1979-80 levels. Following passage of the federal special education legislation (IDEA) in 1975, districts were at various stages of implementing special education programs. In 1979-80, special education spending varied widely across districts and did not reflect eventual total costs. As a result, the valuation of cost under the MPSE was largely random across districts. Parrish (1987) notes that this was a major source of controversy surrounding the MPFM:

“In 1979-80 districts filed their program cost reports just as they had done in every other year. As these reports had never been used as a basis for funding... Conventions were not well established for making these determinations... and as it was not known that future funding would be affected by the way these reports were completed,

⁸ Initially, the MPFM allowed for 10% annual increases in unit rates, but the increases were severely capped due to cost considerations.

⁹ For example, special day class, resource program, or designated instructional service.

¹⁰ The support service ratio calculates program support costs such as administration, screening, and testing. As with the unit rates, the ssr was based on the cost reports filed by districts in 1979-80, before the districts knew that these reports would be the basis for ssr calculations. As a result, there is a wide range of ssr 's for any given program type across districts. For example, in 1985, the ssr for the category of severely disabled students ranged from .01 to .78 (Parrish, 1985). With such variation, it is difficult to argue that the ssr accurately measures cost of support services.

large variations resulted... Affected districts (argued) that they should not be penalized for initiating special education programs prior to the state mandate.”

The funding formula represented by equation (1) has three key features. First, increases in the number of students classified disabled (as proxied the variable *#units*) lead to proportional increases in total state special education grants. This feature means that from 1980-81 to 1996-97, districts have a fiscal incentive to increase the number of disabled students. Second, unit rates are based on levels of services and differences in costs of providing disabled student services in 1979-80. Many of these cost differences were widely believed to reflect random factors since 1979-80 levels of service were determined and reported before districts learned of the upcoming changes to the funding scheme. Districts could not know to strategically report the values ultimately used in the funding equation. Consistent with this, Table 2 shows that pre-reform levels of funding do not vary with any observed district characteristics.

Critics of the MPFM recommended updating unit rates and advocated a system of grants that depend on the overall enrollment of the school rather than the size of its disabled population. Given the average ratio of per-pupil special education expenditures to regular education expenditures in California of 1.9 (Parrish, 2004), reformers saw eliminating this incentive from the funding scheme as an opportunity to curb rising costs.

California Post-Reform, 1998-present

In response to these pressures, the California legislature passed Assembly Bill 602 in 1997. This bill instituted three main revisions to the system of special education finance, implemented over the following two academic years. First, it allowed for a one-time updating

of per-pupil (unit) rates of funding across districts to take effect in 1997-98. This one-time update changed these rates to reflect the 1995-96 staffing costs in each district; this is largely in response to the contention that the old unit rates were random and did not accurately reflect costs.

Second, AB 602 abolished the MPFM beginning in 1998-99; state funding is no longer distributed on a per-special education student basis, but rather on a new census-based system which distributes funds based on the district's total average daily attendance. Thus, prior to the reform, each district received a total state grant equal to its unit rate, *UR*, multiplied by the total number of special education students. After the reform, each district receives a total state grant equal to its census rate, *CR*, multiplied by the total district enrollment. Under the new system, the state caps funding at 10% of special education students (with sub-caps by resource type). Growth funding is available only when the cost of operated units is less than the cap. However, the state has never fully funded the program so the caps are never binding. Districts make up the shortfall from their general funds and any additional state special education dollars ease the burden placed on these general funds by special education programs.

Third, the reform grouped districts into Special Education Local Plan Areas (SELPA's). Some SELPA's have several member districts, while others have very few or one¹¹. The state disburses funds to these SELPA's which in turn distribute funds to member districts. The SELPA's allow smaller districts to pool special education students from disparate districts into consolidated classrooms, thereby cutting costs. Each SELPA is given leeway to distribute funds across its member districts as it sees fit.

¹¹ 33 of the 120 SELPA's is its own district. 11 SELPA's have two member districts. The remaining have three or more districts with one SELPA having as many as 47 member districts.

If the funding caps bind and the SELPA's distribute funds to member districts according to the size of their disabled populations, the reform may generate different incentives for small versus large districts; small districts that share a SELPA would continue to have a fiscal incentive to classify students as disabled even after the reform, while larger districts with their own SELPA's would not. However, because the program has never been fully funded, the caps do not bind. For example, one program director describes receiving 40-50% of promised funds as "a good year". Estimates at the SELPA level show results are robust to the use of SELPA's as the unit of analysis (Table 5D). A discussion follows in section VI.

Table A lists marginal benefits and total state special education revenues that districts should have received as a result of the reform in each of four relevant time periods.

Table A. Summary of predicted marginal and total state special education revenues

School year	Marginal state special education revenue	Total state special education revenue
1996-1997	UR_{96}	$UR_{96} * SE_{96}$
1997-1998	UR_{97}	$UR_{97} * SE_{97}$
1998-1999	0	$CR_{98} * TE_{98}$
1999-2000	0	$CR_{99} * TE_{99}$

Where, for each district d , SE_t^d = total special education enrollment, or special education average daily attendance (SPADA) in year t to $t+1$, TE_t^d = total enrollment, or average daily attendance (ADA) in year t to $t+1$, UR_t^d = state reimbursement rates per SPADA (pre-reform), also called the unit rate, and CR_t^d = state reimbursement rate per ADA (post-reform), also called the census rate.

Note, UR_{96} is closely approximated by the total amount of special education expenditure in 1979 divided by the total number of *disabled* students in 1979. Due to the updating of unit rates, UR_{97} is calculated to be approximately the total amount of special education expenditure in 1995 divided by the total number of *disabled* students in 1995. Due to the move to a census-based system of finance, CR_{98} and CR_{99} are calculated to be approximately the total state grant received by the district in 1997 divided by *total* enrollment in 1997 (with an inflation adjustment).

The combined updating of unit rates and the move to a census-based system of finance created a redistribution of fiscal incentives and state special education funds across districts. In particular, the reduction of marginal incentives to zero neutralized the incentive for administrators to classify marginal students into the special education system. The redistribution provides a unique opportunity to measure the causal effect of changes in special education funds on classification rates and program expenditures.

IV. Models and Research Design

A. A Model of Disability Classification

In order to model the effect of state grants on disability classification, I assume there is only one type of disability and ignore the existence of any federal special education aid.¹² Furthermore, I assume that all state special education funds received by the district are spent on special education program expenditures. Formally, districts want to maximize a value function $V(G^S - c \cdot N, N)$, where G^S is the total amount of the special education grant

¹² The existence of federal aid implies that even when marginal incentives in state aid disappear in the census-based state reform, total marginal incentives may not be exactly zero. However, federal aid is a small fraction of total special education funding and expected effects from fiscal incentives in federal aid are small. The average federal per-pupil special education grants are about \$131 compared to the average state grants of \$721.

received from the state, c is the cost of educating one special education student, and N is the total number of special education students in the district. Thus, $V(\cdot)$ is a function of $G^S - c \cdot N$, the net gain from classifying an additional student disabled and N , the size of the disabled population in the school. I assume the value function is increasing in N and concave down: $V_N > 0$ and $V_{NN} < 0$. This assumption captures the idea that there is some gain to classifying students as disabled (reflecting perhaps, the potential improvements in achievement in special education classes) but that this gain is decreasing in the number of students classified. At large N , any additions to the special education population will be less severely disabled students for whom potential benefits of special education classes are smaller than those of more severely disabled students.

Recall that pre-reform, California awarded each district a total grant award equal to a unit rate multiplied by the number of special education students. That is, $G^S = G^O + r \cdot N$ where r is the unit rate. Each district solves the following maximization problem:

$$\max_N V(G^O + r \cdot N - c \cdot N, N)$$

Taking derivatives yields:

$$V_1 \cdot [r - c] + V_2 = 0$$

$$\frac{V_2}{V_1} = c - r,$$

where V_1 is the partial derivative with respect to the first term and V_2 is the partial derivative with respect to the second term. Notice $\frac{V_2}{V_1}$ is the marginal rate of substitution in the district's choice between classification of a student as disabled and financial resources available for other uses. $\frac{V_2}{V_1}$ is the slope of the indifference curves in Figure 4A.

Before the reform, each district faces a budget constraint with slope equal to $c - r$. The optimal N^* then occurs at the point where the slope of the indifference curves is equal to the net cost of educating a disabled child, $c - r$ (Point A in Figure 4A).

After the reform, each district solves a new maximization problem:

$$\max_N V(G' - c \cdot N, N)$$

Now the total amount of the special education grant received from the state, G^S , is equal to G' , where G' is the census based grant received by the district. And the net benefit to the district of classifying a student disabled is given by $G' - cN$. In the new maximization problem, $r = 0$ since districts no longer receive any funds on a per-disabled student basis. Thus each district faces a budget constraint with slope equal to c . Ignoring changes in enrollment, the census based grant is set to equal the pre-reform total grant received by the district. Thus, $G' = G^0 + rN^*$. This implies that the switch to the new grant system is a "compensated" change that presents a new higher "price" for each disabled student (c versus $c - r$) but allows the district to achieve its pre-reform choice. The new equilibrium is illustrated in Figure 4B with a level of disability, N' .

B. District-level instrumental variables analysis

To investigate the predictions of the model, I first consider a simple regression of changes in disability rates on changes in fiscal incentives. This specification exploits the variation in changes in special education funds across districts to identify the effect of interest. Specifically, I consider the following model of district-level disability classification:

$$\Delta \left(\frac{SE_{dt}}{TE_{dt}} \right) \equiv \frac{SE_{dt}}{TE_{dt}} - \frac{SE_{dt-1}}{TE_{dt-1}} = \beta_0 + \beta_1 \Delta G_{dt} + \beta_2 \Delta UR_{dt} + \beta_3 \mathbf{x}_d + \Delta \varepsilon_{dt} \quad (2)$$

where d indicates district, t time, SE is special education enrollment, TE is total enrollment, G is the amount of per-pupil state special education grant the district receives, UR is the unit rate, \mathbf{x} is a vector of other district characteristics, and ε is an idiosyncratic error term. The time subscript t refers to the t - ($t+1$) school year.

If ΔG and ΔUR are uncorrelated with any other district characteristics that may also affect changes in disability rates, $\Delta\left(\frac{SE_{dt}}{TE_{dt}}\right)$, $\hat{\beta}_1$ and $\hat{\beta}_2$ can be interpreted as causal parameters.

On the other hand, if ΔG depends directly on $\Delta\left(\frac{SE_{dt}}{TE_{dt}}\right)$ as it did under the old system of special education finance, or if some other district characteristic affects all three, ΔG , ΔUR and $\Delta\left(\frac{SE_{dt}}{TE_{dt}}\right)$ ¹³, then $\hat{\beta}_1$ and $\hat{\beta}_2$ may be biased and can not be interpreted causally.

The existence of the census-based finance reform in California presents a unique opportunity to avoid this endogeneity problem and estimate $\hat{\beta}_1$ and $\hat{\beta}_2$ as true causal parameters. The change in actual per-pupil funding before and after the reform can be written as follows:

$$Actual\Delta(G) = \frac{CR_{99} * TE_{99}}{TE_{99}} - \frac{UR_{96} * SE_{96}}{TE_{96}} \quad (3)$$

Since $CR_{99} = \frac{G_{97}}{TE_{97}}$ and $UR_{96} = \frac{G_{96}}{SE_{96}}$, I can re-write (3) as:

$$Actual\Delta(G) = \frac{G_{97}}{TE_{97}} * \frac{TE_{99}}{TE_{99}} - \frac{G_{96}}{SE_{96}} * \frac{SE_{96}}{TE_{96}} \quad (4)$$

Using the reform, I can approximately predict what per-pupil funding should have been for each district in the school years 1996-97 through 1999-00 holding constant the percent of students labeled as special education:

¹³ For example, the poverty level or racial composition of the students within a district may affect all three variables (Corman and Chaikind, 1993).

$$\text{Pred}\Delta(G) = \frac{G_{97}^{pred}}{SE_{97}} * \frac{SE_{96}}{TE_{96}} - \frac{G_{79}}{SE_{79}} * \frac{SE_{96}}{TE_{96}} \quad (5)$$

Since $UR_{99}^{pred} = \frac{G_{97}^{pred}}{SE_{97}}$ and $UR_{79} = \frac{G_{79}}{SE_{79}}$, where G_{97}^{pred} is the rate of funding allotted to each district¹⁴, I can re-write (5) as:

$$\text{Pred}\Delta(G) = \frac{UR_{99}^{pred} * SE_{96}}{TE_{96}} - \frac{UR_{79} * SE_{96}}{TE_{96}}. \quad (6)$$

This predicted variable, $\text{Pred}\Delta(G)$, can then be used to instrument for actual changes in funding, $\text{Actual}\Delta(G)$. Using this instrument, I am able to estimate equation (2) above for changes 1996-97 (before the reform) to 1999-00 (after the reform).

C. State-level analysis

A comparison of California to other states serves as a consistency check for the district-level results. Over the period 1987-2001, ten states¹⁵ in addition to California instituted some form of census-based special education reform. I drop these ten states from the analysis and argue that the remaining 39 states-- which did not undergo census-based special education finance reform-- form a valid counterfactual for what would have happened in California in the absence of such a reform. Using this construction of treatment and control groups, I compare differences in trend to see if California (the treatment group) exhibits different patterns of growth of special education populations than do non-reform states (the control group).

¹⁴ Technically, districts are grouped into Special Education Local Plan Areas (SELPA's) and the funding is allotted to each SELPA. Some SELPA's have several member districts, while others have very few or one. The state disburses funds to these SELPA's which in turn distributes funds to member districts as it sees fit. As a result, G_{97}^{pred} is only a predicted value.

¹⁵ These states are: Alabama, Alaska, Connecticut, Idaho, Massachusetts, Montana, North Dakota, Pennsylvania, South Dakota, and Vermont.

I calculate annual changes in the percent of students classified as disabled for California and for non-reform states and run the following regression:

$$y = \alpha + \beta \mathbf{1}(i \in T) + \gamma \mathbf{1}(t > t^*) + \delta \mathbf{1}(i \in T) \cdot \mathbf{1}(t > t^*) + \varepsilon \quad (7)$$

where y is the change in percent disabled, i indexes states, t indexes years, t^* is the reform year, y is the change in percent disabled, $\mathbf{1}(i \in T)$ is a dummy variable equal to 1 for California, $\mathbf{1}(t > t^*)$ is a dummy variable equal to one in post-reform years, and ε is a random error term. Then, $\hat{\delta}$ should give an estimate of the desired treatment effect:

$$\hat{\delta} \approx (\bar{y}_{post-reform}^{CA} - \bar{y}_{pre-reform}^{CA}) - (\bar{y}_{post-reform}^{non-CA} - \bar{y}_{pre-reform}^{non-CA}) . \quad (8).$$

$\hat{\delta}$ identifies any breaks in the trend of disability rates in California relative to non-reform states around the time of the reform. A simple graph of California's disability rate and the average non-reform state's disability rate shows a divergence in trend, suggesting that fiscal incentives have a positive effect on take-up rates (Figure 8). Further examination of treatment and control groups broken down by disability types shows that most of the decline in classification in California occurs among students with either learning disabilities or "other" disabilities¹⁶ (Figure 9). Because learning disabilities and attention deficit disorders lack reliable diagnostic criteria, one would expect any marginal manipulation of disability rates in response to fiscal incentives to occur in these categories. Figure 9 is consistent with these expectations.

D. *Flypaper effect*

Next, I ask to what degree additional state special education grants translate into additional special education spending. The theory of the flypaper effect predicts that an

¹⁶ "Other" includes attention deficit disorder.

increase in state grants to local districts will result in an increase of special education spending that is greater than basic microeconomic theory would predict (Figure 5). The application in this case differs from a pure flypaper effect due to the added complication of changes in price. Because the census-based reform increases state grants to districts and also increases the net cost of educating a special education pupil, the model predicts changes in spending that are smaller than in the basic model.

I examine these theories, again using the instrumental variables method described in section B. Using district-level data in California, I ask how much these additional state grants increase local special education spending on both the intensive and extensive margins. First, to what degree do additional state special education funds result in additional special education spending and to what extent are they diverted to other uses within the school? Second, how much of the additional state special education grants result in increased education spending and how much of it is diverted to tax reduction or to other local public spending?

A simple analysis would regress the change in total education expenditures, $\Delta \text{expenditures}$, on the change in state special education funds, ΔG and the change in unit rates, ΔUR :

$$\Delta \text{expenditures}_{dj} = \alpha_j + \beta_j \Delta G_d + \gamma_j \Delta UR_d + \delta_j \mathbf{x}_d + \Delta u_{dj} \quad , \quad \text{for each } j \quad (9)$$

where d indexes districts, j indexes type of education expenditure (for example instructional, support services, cafeteria, transportation, capital outlays, etc.). \mathbf{x} is again a vector of district characteristics and u is an idiosyncratic error term.

If ΔG and ΔUR are exogenous and there are no omitted variables, the model (9) yields causal parameters. The β_j 's in the model represent the extent to which state special education grants are spent on special education programs and not on other school programs.

Because unit rates in 1996 are largely determined by 1979 rates of special education spending which were random, UR_{96} is likely random. Table 2 shows no correlation between unit rates and district characteristics. In addition, the supposed randomness of the unit rates in 1996 was the main impetus for the updating that was written into the reform legislation. (See section 3 for a fuller discussion of the randomness of rates.) Since all unit rates are set to zero post-reform, ΔUR is exogenous for all districts over the period of the reform. However, ΔG , which depends on the total number of students classified disabled, is not determined exogenously. Also, $\Delta expenditures$ and ΔG are likely to be correlated through unobservable district characteristics. Hence, a causal interpretation of the β_j 's in (9) is problematic.

To mitigate the omitted variables problem in the expenditure equations given by (9), I use the simulated change in funds variable, $Pr ed\Delta(G)$ given in equation (6) to instrument for the change in state special education funds variable, ΔG . I calculate $Pr ed\Delta(G)$ for the changes 1996 to 1998, 1996 to 1999, and 1996 to 2000. I estimate (9) with the instrument and control for lagged changes in total local and federal revenues. Furthermore, because California instituted a class-size reduction initiative in 1996-97, I control for any changes in district-level pupil-teacher ratios as these might affect changes in expenditures.¹⁷ I estimate the regressions given by equation (9) for one-, two- and three-year changes and am thus able to provide short-, medium-, and long-run estimates of the effect of funding on expenditures.

In order to estimate the extent to which additional state grants stick to local education expenditures and are not used for other types of local public goods, I add the β_j 's for an

¹⁷ The class-size reduction affected only kindergarten through third grade classrooms and I do not expect it to have an effect on classification of learning disabilities and attention deficit disorders, the majority of which are first diagnosed at much later ages (Figure 4).

exhaustive list of education expenditures. If this sum is less than one, I conclude that additional state education grants are being used to boost spending in areas other than schools.

V. Data

The data used in this analysis primarily derives from three sources: the Common Core of Data (CCD), the Public Elementary-Secondary School District Financial Data (F33), and the Annual Report to Congress on the Individuals with Disabilities Education Act (IDEA). Supplementary data on actual unit rates by district was obtained directly from the California Department of Education and from Jack Lucas, Director of the East San Gabriel Valley Special Education Local Plan Area (SELPA).

State- and district-level data on school characteristics for 1991-2002 come from the Common Core of Data (CCD), a public-use dataset published by the U.S. Department of Education's National Center for Education Statistics. The CCD contains annual, district- and state-level data on all public schools in the United States. It includes the total numbers of special education students, total student enrollments, racial composition of schools, high school completion levels, grade spans¹⁸, total numbers of teachers, total numbers of free-lunch eligible students, and poverty levels.

State-level information on trends in disability classification for 1991-2002 comes from IDEA. IDEA is published by the Office of Special Education and Rehabilitative Services. It reports counts of total public and private special education students by state for the years 1996-2002. IDEA also reports special education counts by disability type and student age across states and time, allowing for detailed analyses of age profiles and trends in disability

¹⁸ Grade spans are the range of instructional grade levels offered by the district.

counts by type. In addition, I have hand-entered detailed archived information on disability counts by type and age for 1991-1996. I have also hand-entered 1991-2002 data on numbers of students in special education programs according to the following criteria: setting type; whether mainstreamed; whether placed in a public or private separate facility, public or private residential facility, or home hospital environment.

Finally, I obtain district-level financial data for 1991-2002 from the F33, part of the U.S. Census Bureau's Census of Governments. The F33 contains annual, district-level data on total revenues from federal, state, and local sources. In particular, it distinguishes revenues from state sources intended for special education programs from other categorical and general funds. The F33 also contains detailed, itemized information on total expenditures for instructional staff, operation and maintenance, administration, and debt maintenance. However, it does not distinguish expenditures by special education versus general education use. It also does not contain data on costs of special education programs.

For the district-level instrumental variables analysis described above, I merge the CCD and the F33 by school district identifiers to create a dataset of all school districts in California for the years 1991-2002. This merged dataset includes information on district characteristics such as total enrollment, percent of students classified as disabled, racial characteristics of the student body, poverty levels, and pupil-teacher ratios as well as detailed information on expenditures and revenues. Table 1 presents some summary statistics from the merged dataset.

VI. Results

I address two questions in this paper. First, what is the impact of changes in state special education grants on local districts' disability rates? Second, how much of an additional

dollar of state special education grant translates into actual increases in instructional spending by local districts? The main results for the first question are in Table 5 and the main results for the second question are in Table 7. I find that local administrators adjust disability rates in response to changes in marginal fiscal incentives (price) but they do not immediately respond to changes in total grants (income). The results provide evidence of substitution effects on disability rates. Furthermore, in the long run only small amounts of additional grant dollars translate into direct special education spending. I find that local administrators redirect the majority of additional state special education grants to other, non-special education and non-education uses.

A. Results for Disability Classification Rates

First, I verify that the reform in California had a real effect on the distribution of state grants to districts. Table 3 displays the difference in the distribution of changes in special education grants across districts before and after the reform. Before the reform, most of the changes are clustered around zero with a mean change of $-\$7$. After the reform, the distribution widens so that 10 percent of districts now see changes in funds of $-\$200$ or more in magnitude. Another 10 percent see changes of greater than $\$82$. The standard deviation of this distribution increases from $\$600$ to $\$2102$, a greater than three-fold change. Furthermore, the post-reform distribution mean shifts from a mean of $-\$7$ to $\$195$. Figure 6 illustrates this shift. Here, the year-to-year correlation in levels of state special education grant is much stronger between 1994-95 and 1996-97 (no reform) than it is between 1996-97 and 1998-99 (reform).

Next, I check the level of variation in the independent variables, change in unit rates, ΔUR , and change in total funds, ΔG . Figure 7A demonstrates that there is sizeable variation

in unit rates. The changes in unit rates range from below -\$5000 to almost \$0. Given that average total per-pupil spending for most districts is approximately \$7000 in this period, this represents quite a wide range of variation. In contrast, the changes in total state grants given in Figure 7B are smaller in magnitude than those of the unit rates. This is because in the first year of the reform, the finance formula dictates that schools be allocated an amount of grant approximately equal to the amount received prior to the reform. In other words, the move to the new system was to induce a "compensated" change that presented a new higher "price" for each disabled student but allowed the district to achieve its pre-reform choice. In reality the change was not exactly compensated and some districts received quite a bit more or less post-reform than they had in the pre-reform year. Nonetheless, this feature of the reform creates relatively small changes in the amount of the total grant from 1996-97 to 1999-00 (see Figure 7B). While changes in unit rates average in the thousands of dollars, changes in per-pupil grants average in the hundreds of dollars. This affects interpretation of the results as I show later.

Table 4 shows the first stage correlations between the simulated and actual change in special education funds variables for 1996-97 to 1999-00. The F-statistic of 1351.08 lies solidly in the range of significance. The R^2 of .65 implies that the simulated variable explains about 65% of the variation in the 1996-99 actual change in per-pupil funds. This indicates there is substantial endogeneity in the actual change in funds variable. Using this instrument, I estimate equation (2) above.

The main results in Table 5A show that a \$1000 increase in per-pupil state special education grants results in no significant increase in the disability rate. Furthermore, point estimates are extremely small. Column 1 of Table 5A presents results weighted by enrollment size in 1996, the year before the reform. Controlling for changes in unit rates, the

instrumental variables results show that a \$1000 increase in per-pupil state special education grants results in a .5 percentage point increase in the disability rate. Column 2 of Table 5A shows that adding some basic control variables, such as race, number of schools in the district and percent free lunch eligible, does not change the estimates. Weighting the regressions by district enrollment size does affect the estimates. In Columns 3 and 4, the estimated response is .9 and .8 percentage points respectively. However, even these larger results are still extremely small, and none are significant. I caution against generalizing interpretation of these estimates as evidence of no effect on disability rates however, because the estimates are being identified from relatively small changes in total state special education funds. It may be the case that states do *not* respond to such small changes in "income", but that they would respond to larger changes.

The second row of estimates in Columns 1 through 4 shows the effect of changes in unit rates on changes in disability rates. The sign of the estimates are negative, as theory predicts; if the net cost or "price" of classifying an additional student as disabled increases, I expect to see classification rates fall. Controlling for changes in total state funds, unweighted estimates in Columns 3 and 4 show that in fact a \$1000 increase in the "price" of special education results in a 1.5 percentage point decrease in the disability rate. The estimates in the weighted regressions, however, are much smaller and not significant (Columns 1 and 2). This indicates that smaller districts respond more strongly to changes in unit rates than do larger districts. This is reasonable since it is also the case that smaller districts tend to have higher per-pupil costs and thus are more fiscally constrained. It is important to note, too, that some of the difference between large and small districts' behavioral responses is due to the fact that there is less variation in changes in unit rates, ΔUR , for large districts. In fact, the standard

deviation of ΔUR for districts in the top third of enrollment size is about \$4000 while the standard deviation for districts in the bottom third of this distribution is about \$15000.

Columns 5 through 8 report weighted and unweighted ordinary least squares results. The estimates are different from the results in Columns 1 through 4. Row 1 of these columns shows a much larger (and significant) effect of changes in per-pupil grants on disability rates indicating a strong positive omitted variables bias. Again, the magnitude of the estimates increases in the unweighted regressions, indicating that smaller districts exhibit larger responses. Row 2 of Columns 5 through 8 shows similar estimates to those in Columns 1 through 4. This is expected since ΔUR is not instrumented in the instrumental variables analysis so both sets of columns give ordinary least squares estimates. Since there is only a price effect and no income effect at the state level, the estimates in Row 2 provide a useful context for understanding the state-level results described later in this section. Based on these estimates, I expect to see a decrease in the number of students classified disabled at the state level.

Robustness and Validity Checks

In Table 5B I present some robustness checks. I conduct the same instrumental variables analysis as in Table 5A, but drop the smallest ten percent of districts. Columns 1 and 2 in Table 5B show that for the sub-sample of larger districts, an increase of \$1000 in per-pupil state funds results in a .06 percentage point increase in the district disability rate with a standard error of .0036. As with the results on the entire sample, these estimates are again extremely small and indistinguishable from zero. The point estimates in Columns 3 and 4 change sign, but again are close to zero and insignificant. Row 2 of Columns 1 through 4 indicates a reduction in magnitude of response to the "price" changes compared to the results

in Table 5A. I conclude that the results in Table 5A are not very robust to dropping these very small districts. In other words, there is heterogeneity in response by size of the district as was foreshadowed in the main results of Table 5A. On the other hand, dropping the largest ten percent of districts, yields estimates that are similar to those found using the full sample. Row 1 of Columns 5 through 8 in Table 5B shows estimates almost identical to those in Row 1 of Table 5A. Similarly, Row 2 of Columns 5 through 8 in Table 5B is almost identical to Row 2 in Table 5A. Thus, the main results are not driven by the behavior of a few large districts.

Finally, as a validity test, I check for an effect of the change in per-pupil state special education funds due to the reform on pre-reform changes in disability rates. If I am estimating a truly causal parameter, I would not expect an effect of reform driven changes in state funds on pre-reform changes in disability rates. Table 5C accordingly shows no effect of 1996-98 change in per-pupil state special education funds on 1994-96 changes in disability rates.

B. State-level analysis

The state-level results are useful as a consistency check for the district-level results. The state-level difference-in-difference analysis tests whether changes in the unit rates have an effect on rates of special education classification. However, at the state-level I am unable to capture the effects of the change in total per-pupil grants on classification behavior. In other words, I am able to capture the price effects but am unable to capture the income effects.

Results suggest that changes in the price of special education have a negative effect on disability rates and a negative effect on total state special education classification. In other words, when the price of special education increases, as it did for all districts in California, the

quantity of students classified as disabled falls. This is in keeping with theory (Figures 5B, 5C, and 5D). The raw correlation indicating the state-level trends in disability rates is plotted in Figure 8. The reduced form difference-in-difference regression estimates for trend breaks in percent special education are presented in Table 6.

Figure 8 shows the trend in growth of special education populations for California versus other non-reform states. Consistent with the positive effect of fiscal incentives on disability classification, California breaks from trend starting in 1997-98, the first year of the census reform. That is, when fiscal incentives decrease as a result of the reform, disability rates follow. Furthermore, Figure 9 shows that much of this fall in disability classification occurs in the categories of learning disabilities and other disabilities, a category which includes attention deficit disorder.

Panel A in Table 6 quantifies the effect shown in Figure 8. The point estimate indicates that the growth of California's disability rate is .4% lower than the growth of the disability rate in the average non-reform state, though the t-statistic is only 1.61. Over a five year period, this translates into an increase of roughly two percentage points in the difference between disability rates in California and the average non-reform state.

As a falsification test, I contrast this result to a test for a break in trend at 1993-94, a non-reform year. Because there was no reform in 1993-94, I expect to see no trend break in this year. The result for this falsification test shows no difference between California's rate of growth in the disability rate and that of the average non-reform states' rate of growth.

C. Flypaper effect

Table 7A presents the main results to the second question I ask in this paper: How much of each additional dollar in state special education grants 'sticks' to special education

spending? I estimate equation (9) using the instrumental variables approach described above. Table 4 shows the first stage correlations between the simulated and actual change in special education funds variables for one-, two-, three-, four-, and five-year changes. The F-statistic is as low as 11.93 and as high as 1351.08 but all lie solidly in the range of significance. The coefficient is closest to one in the two- and three-year changes indicating the instrument most closely approximates the actual changes in those years. The R^2 is low in the one-year change which implies that the simulated variable explains a very small portion of the variation in the actual change in per-pupil funds in that year. This indicates there is very little endogeneity in the actual change in funds variable because of the reform-driven redistribution of funds in the previous year. The R^2 becomes larger in subsequent years. Five years after the reform, R^2 is .43, indicating that 43% of the variation in the actual change in funds variable can be explained by the instrument.

Because I do not have data on expenditures broken down by special-education and non-special education uses, I am unable to determine explicitly how much of each dollar results in increases in special education spending. However, special education expenditures are captured almost exclusively in current expenditures. Thus, an examination of changes in current expenditures is a reliable upper-bound for changes in special education expenditures.

Current expenditures are the sum of instructional expenditures and support-services expenditures. Instructional expenditures include special education teacher salaries. Support-services expenditures include salaries and incidental expenses for counselors, school psychologists, physical therapists, and other special education personnel. The first column of Table 7A shows that in the first year of the reform, \$.92 of every dollar is spent on current expenditures. More specifically, Table 7A shows that \$.53 of every grant dollar goes toward instructional salaries, and \$.39 goes toward increases in support services expenditures.

In the same year, the change in state special education funds does not result in any statistically significant changes in other non-special education expenditures such as capital expenditures, non-instructional expenditures, and non-elementary secondary expenditures.¹⁹ I conclude, therefore, that in the first year of the reform, a dollar increase in targeted special education revenue from the state results in a \$.92 increase in special education spending.

This result changes quite substantially however when I look at two-, three-, four-, or five-year changes in spending patterns. Column 2 in Table 7A shows that in the second year of the reform, an additional dollar of state special education grant revenue results in only a \$.26 increase in current expenditures, broken down into a \$.14 increase in instructional expenditures and a \$.12 increase in support services expenditures. By the third year after the reform, the coefficient on support services expenditures has recovered slightly to \$.14, but the overall effect on current expenditures is still much smaller than in Column 1.

In addition, there is a statistically significant increase of \$.04 in capital expenditures and a \$.11 increase in non elementary-secondary expenditures in the first year following the reform. It is important to note that these increases are sustained three years after the reform (Table 7A, Column 3). Since capital outlays and spending on non elementary-secondary programs do not include any direct special education component, I conclude that districts redistribute funds so as to permanently divert additional state special education grants to non-special education uses. Though I do not know the average marginal propensity to consume of special education program expenditures, these estimates indicate that the flypaper effect does not hold on the intensive margin in the long run.

¹⁹ Capital expenditures include upkeep of existing buildings and equipment as well as acquisition of new ones. Non-instructional expenditures include operating expenditures for food services and enterprise operations. Non elementary-secondary programs include current operating expenditures for community services, adult education, and other non elementary-secondary programs.

Next, I ask how much of each dollar of targeted state grant results in increases in education revenue versus other types of public spending. I estimate equation (9) for an exhaustive list of expenditures. If a dollar increase in targeted state grant results in changes in *total education* expenditures of less than one dollar, I conclude that some of the targeted grant is leaked out to non-education uses. For example, localities may substitute the state targeted grant for existing special education funding. They may then shift existing special education funds toward local tax relief or increased spending on crime, health, or other infrastructure. The rows in Table 7A make up an exhaustive list of education expenditures. Adding up these rows, I see that in the first year \$.92 of each additional dollar of the targeted grant is translated into additional education spending. However, in the second and third years, an additional dollar of state special education grant translates into only \$.41 and \$.44 of extra education spending, respectively. Thus, the flypaper effect holds on the extensive margin in the short run, but fails to hold in the long run.

Table 7B presents coefficients on the unit rate from estimation of equation (9). Point estimates are almost uniformly zero and none of the results is significant. I conclude that there is no price effect.

Validity Check

Finally, as a validity test, I check for an effect of the change in per-pupil state special education funds due to the reform on pre-reform changes in special education expenditures. If I am estimating a truly causal parameter, I would not expect an effect of reform driven changes in state funds on pre-reform changes in disability rates. Table 7C accordingly shows no effect of 1996-98 change in per-pupil state special education funds on 1994-96 changes in disability rates.

VII. Conclusion

By leveraging California's census-based special education finance in an instrumental variables design, I am able to improve on existing ordinary least squares regression estimates and case studies. This instrumental variables estimation strategy overcomes potential problems of endogeneity that make ordinary least squares estimates difficult to interpret. The instrumental variables estimates presented in this paper provide a closer approximation of the true causal estimate of interest.

In keeping with predictions of an economic model of behavior, I find that local school districts respond to fiscal incentives in state grants by adjusting the percent of students labeled disabled. Smaller districts, in particular, exhibit strong responses to changes in the price of special education programs. I also find that additional state special education grants to localities initially result in almost dollar for dollar increases in local special education spending. However, over the longer run, the additional grants are redirected to other uses.

These findings are important to both public finance economists and to educational policymakers. Understanding the impact of fiscal incentives on school districts' disability classification rates and spending behavior is crucial to designing effective special education policies. The estimates in this paper provide a crucial first step in this understanding.

Furthermore, the results help shape expectations about special education program efficacy, a question that has proven difficult to answer given data constraints. Researchers currently know little to nothing about the effectiveness of special education programs on student outcomes. However, if administrators respond to fiscal incentives by shifting added revenues to other, non-special education programs or if these additional funds are redistributed to increase spending on other public goods, such as tax reduction, maintenance

of roads, local public health services, police departments, or fire services, we should not be surprised to find zero positive effects of these programs on student outcomes.

The findings in this paper also provide general insight into local districts' behavioral responses to intergovernmental grants. The study thus adds to the existing body of literature on fiscal federalism. Though it is unclear the extent to which I can generalize these results, the estimates provide evidence for the existence of a flypaper effect in the education context, especially in the short-run. The estimates also show that the theory of the flypaper effect does not hold in the longer run, at least in this context. Thus, if states increase special education funding to local districts in order to increase spending on disabled students, their goals may be stymied by the offsetting behavior of local districts.

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Figure 1. Trend in special education rates among U.S. school children

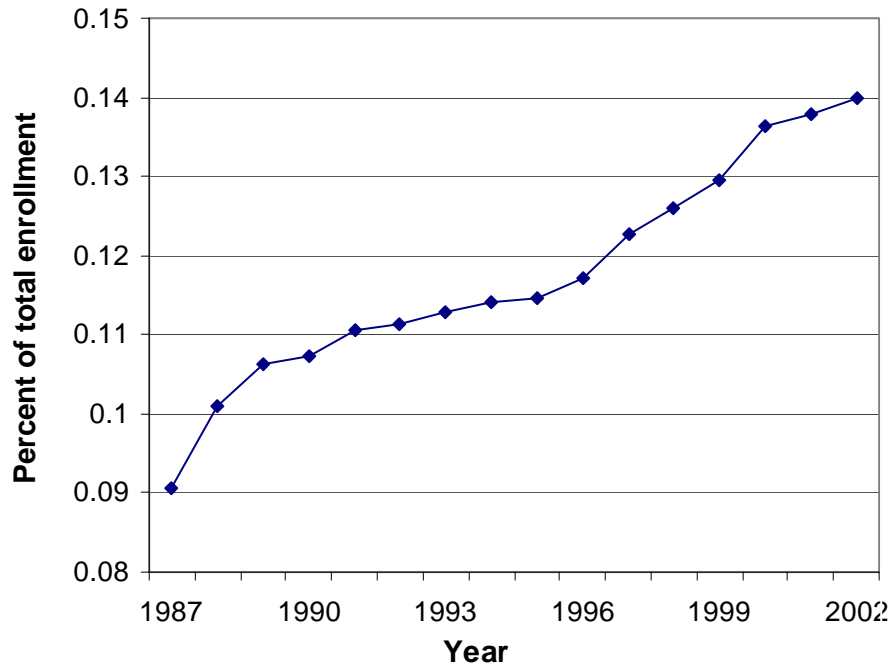


Figure 2. Age profile of disability diagnosis

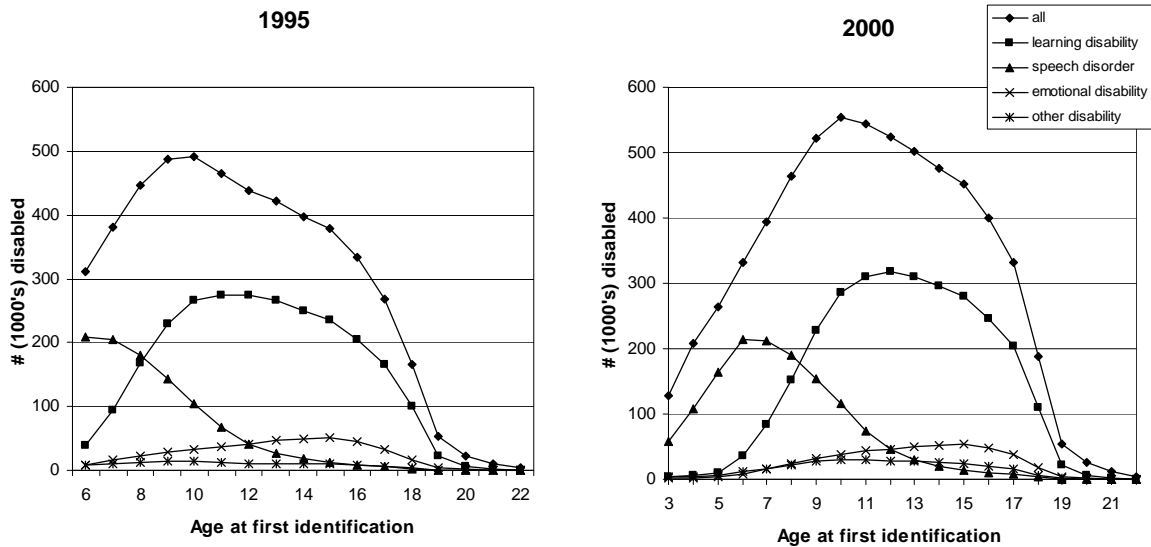


Figure 3. Distribution of states' disability rates in 1987 and 2002.

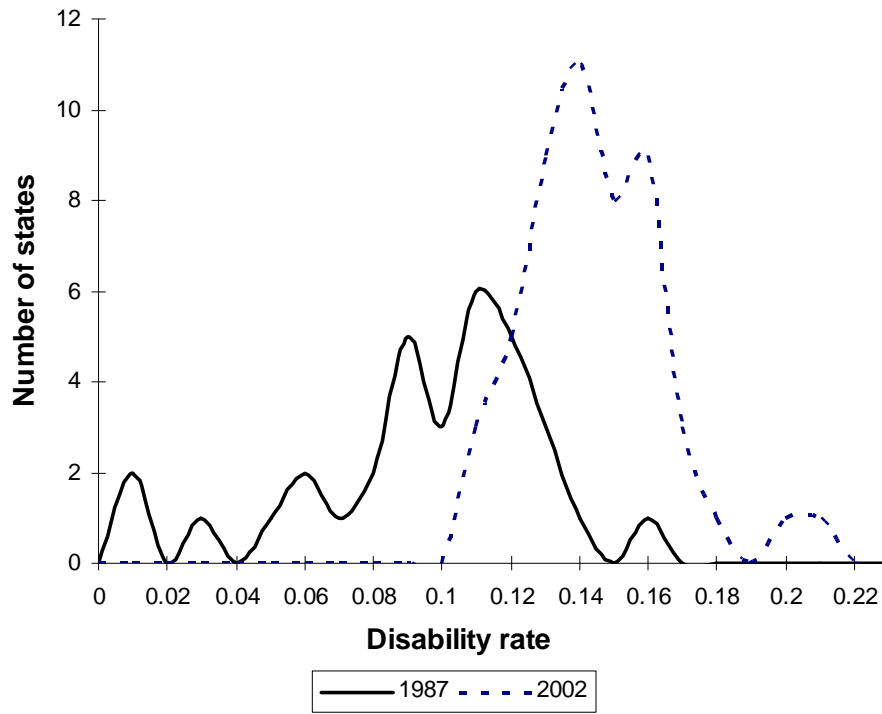


Figure 4A. Effects of increased grants on disability classification, pre-reform

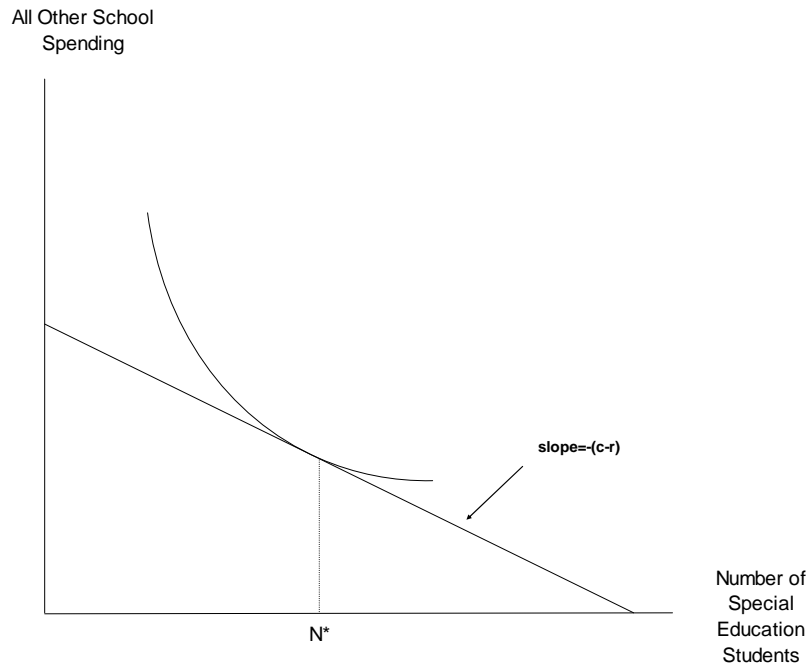


Figure 4B. Effects of increased grants on disability classification, post-reform

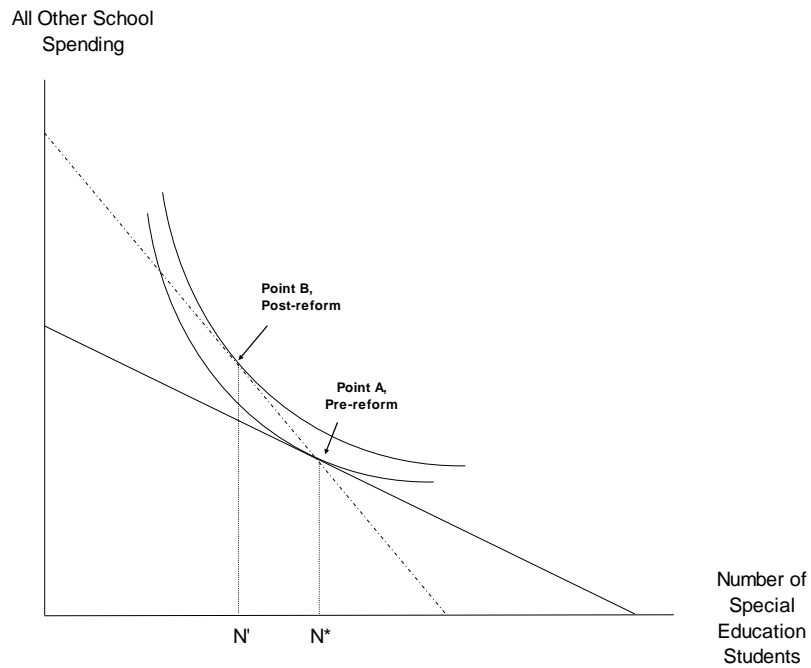


Figure 5. Pure flypaper effect with no change in price

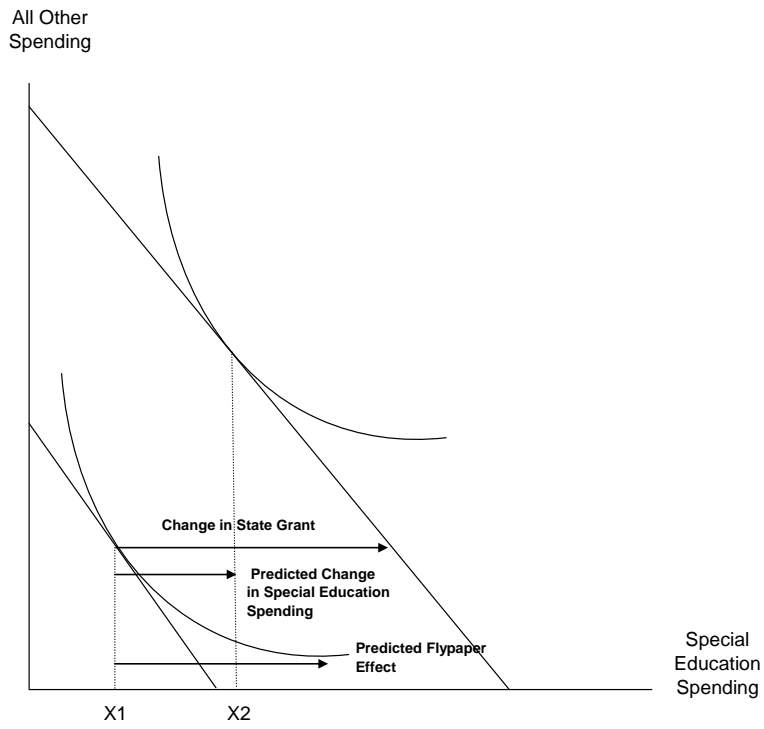


Figure 6. Year-to-year correlation of state funds before and after the reform

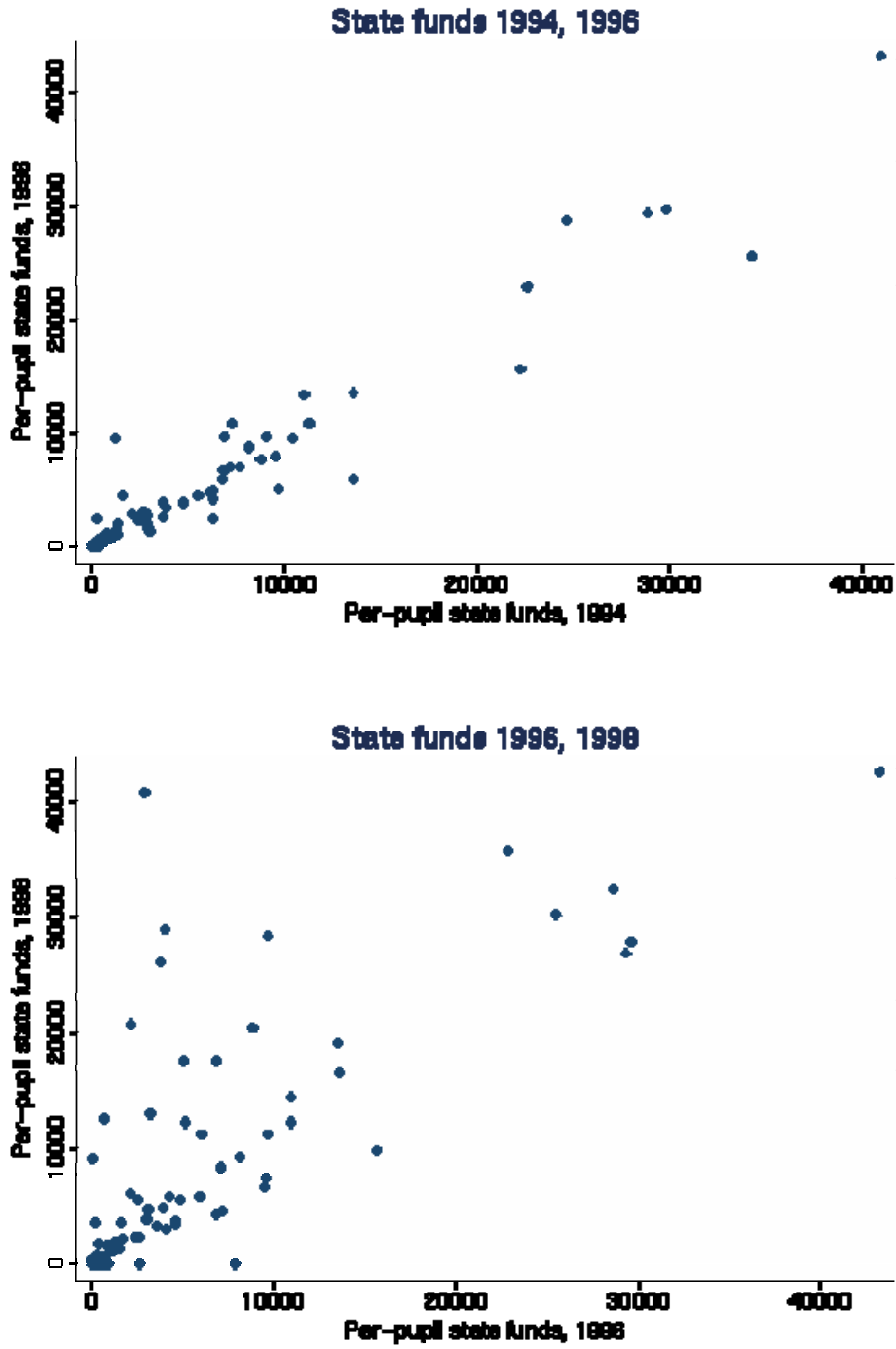


Figure 7A. Variation in change in unit rates 1996 to 1999

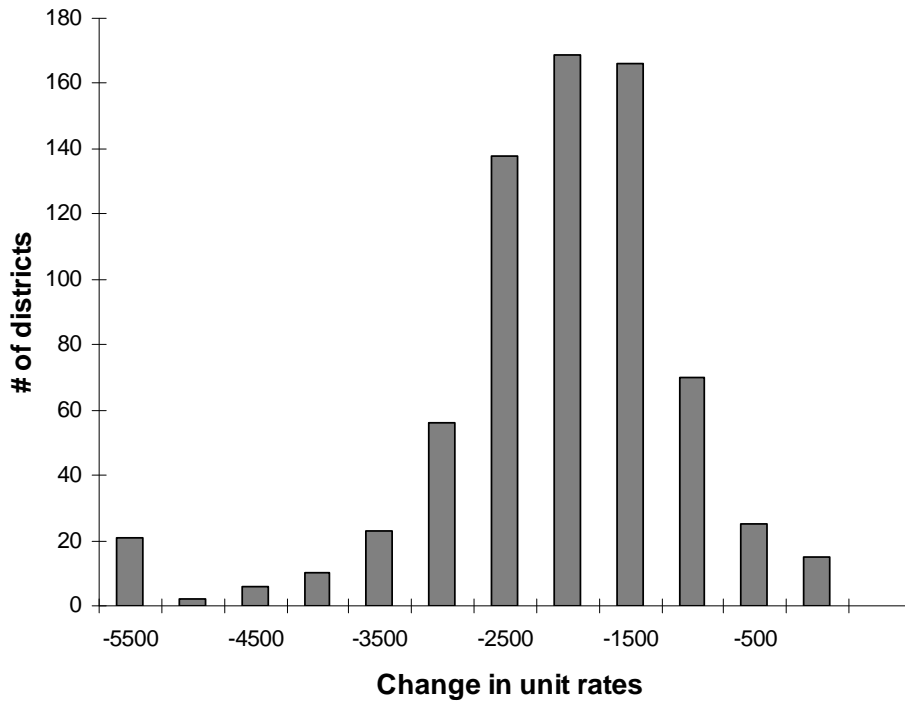


Figure 7B. Variation in change in per-pupil state special education funds 1996 to 1999

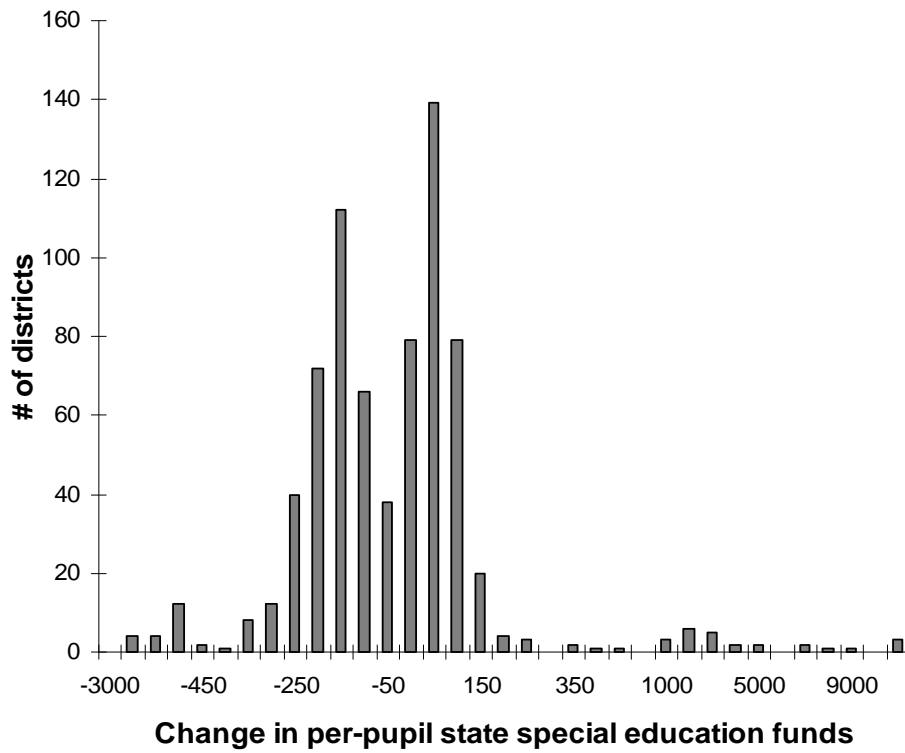


Figure 8. State trends in percent of students classified as disabled

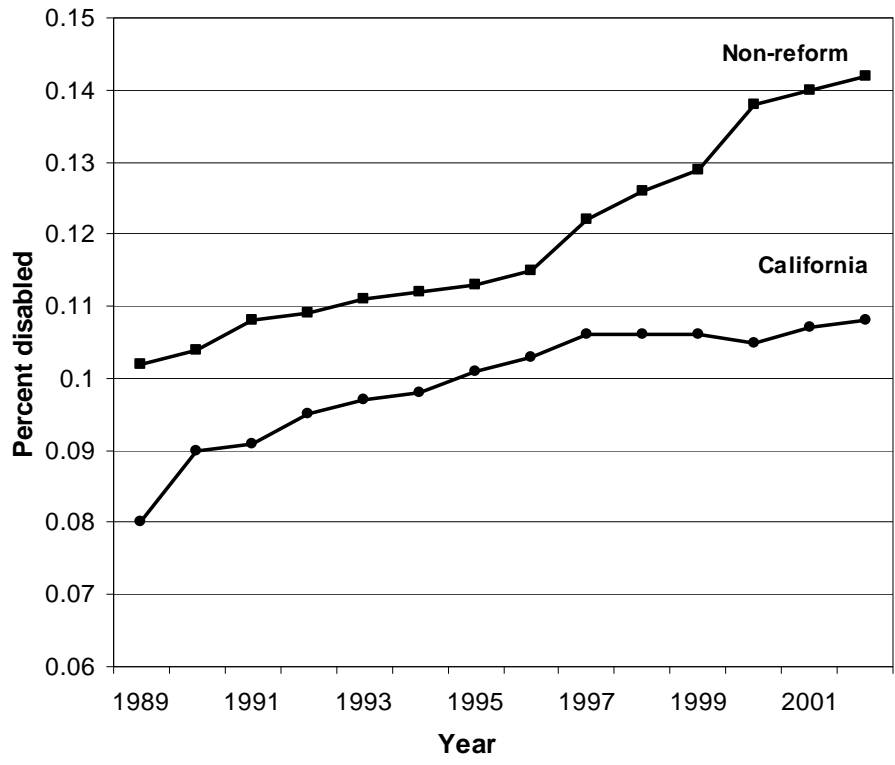


Figure 9. California trends by disability

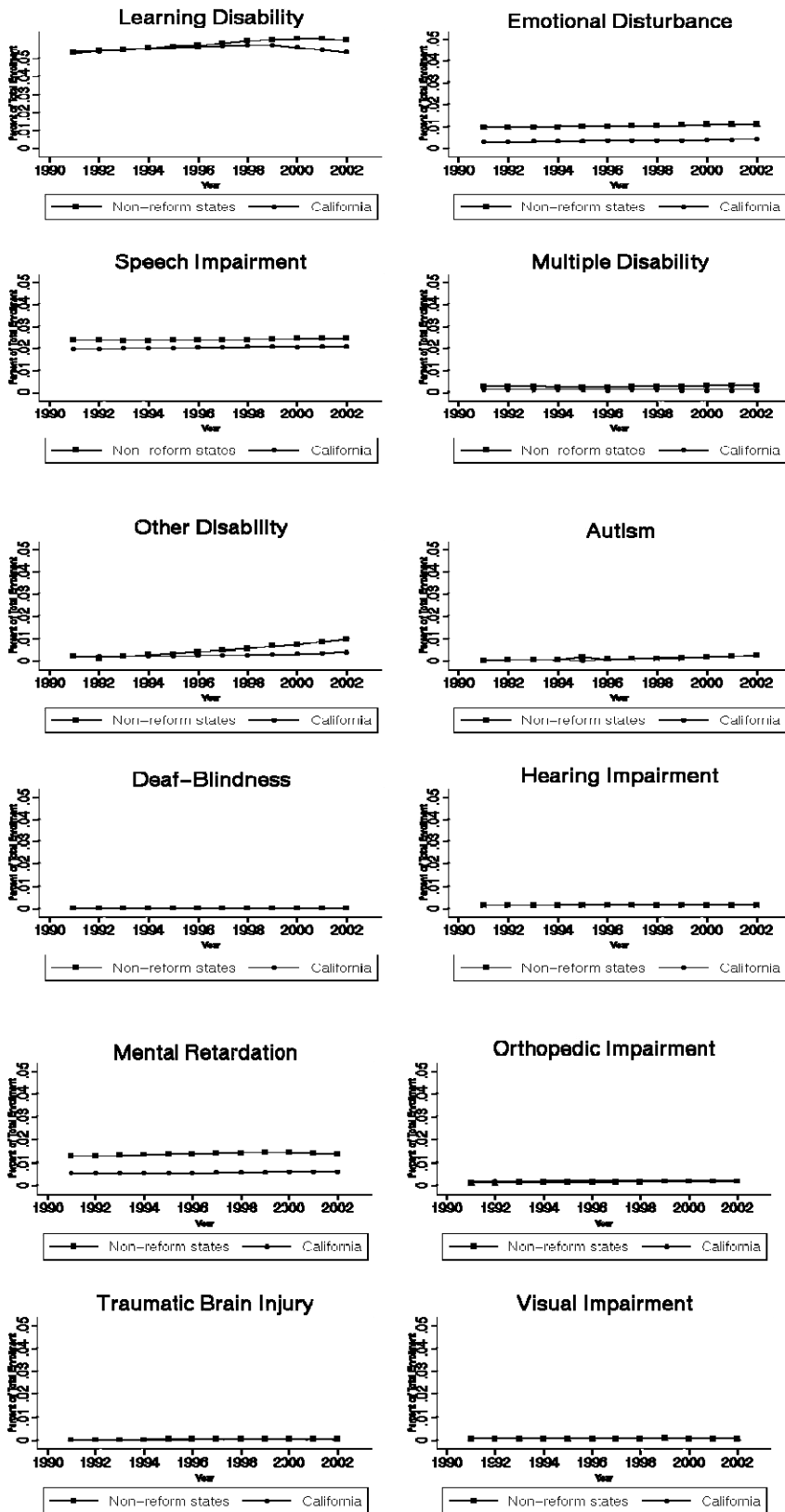


Table 1. Summary statistics by district size

	Small	Medium	Large	Large minus LA	Total
Total enrollment ^{1,2}	216.27 (154.13)	1569.87 (791.40)	14481.75 (37689.81)	12561.78 (12800.46)	5423.71 (22675.21)
Number of schools	1.35 (.73)	3.54 (1.91)	18.17 (37.55)	16.34 (16.22)	7.69 (22.94)
Pupil-teacher ratio	18.77 (5.34)	20.82 (4.36)	23.33 (2.10)	23.33 (2.10)	20.97 (4.56)
Total expenditure ³	8811.75 (13917.67)	7362.26 (8428.03)	4789.31 (1540.78)	4788.63 (1543.04)	7002.11 (9602.00)
Instructional expenditures	4077.22 (4718.98)	3649.15 (3901.12)	2570.98 (604.29)	2570.02 (604.94)	3437.96 (3616.63)
Support services expenditures	3022.00 (5410.05)	2366.38 (3470.53)	1385.07 (571.04)	1384.76 (571.87)	2263.04 (3794.13)
Capital expenditures	716.37 (1034.41)	809.14 (1081.06)	482.12 (491.27)	482.91 (491.79)	670.74 (921.11)
Other expenditures	184.66 (161.88)	191.94 (324.34)	171.91 (68.47)	171.69 (68.46)	183.04 (213.70)
Total revenues	9399.57 (14223.58)	7668.02 (9029.04)	4968.20 (1523.37)	4966.67 (1525.40)	7360.83 (9956.89)
Federal revenues	1095.08 (3778.37)	894.33 (2576.12)	312.94 (316.85)	312.28 (317.10)	770.70 (2673.42)
State revenues	5195.73 (7771.50)	3849.27 (4234.05)	2810.49 (938.08)	2807.90 (938.28)	3958.26 (5241.16)
Local revenues	3108.77 (4287.90)	2924.42 (3482.37)	1844.77 (1049.4)	1846.50 (1050.50)	2631.88 (330.52)
State special ed revenues	930.02 (4121.37)	551.40 (2026.07)	224.21 (223.39)	223.81 (223.61)	570.92 (2676.05)
Change in state special ed revenues ⁴	223.59 (3061.38)	300.40 (3296.84)	15.54 (1242.72)	15.64 (1244.58)	181.30 (2703.02)
Percent special ed enrollment	.11 (.22)	.14 (.20)	.10 (.05)	.10 (.05)	.12 (.18)
Change in percent of students special ed ⁴	.09 (.69)	.01 (.13)	.00 (.02)	.00 (.02)	.03 (.41)
Percent black	.02 (.05)	.03 (.07)	.07 (.08)	.07 (.08)	.04 (.07)
Percent white	.68 (.25)	.61 (.27)	.46 (.25)	.46 (.25)	.59 (.27)
Percent hispanic	.24 (.25)	.28 (.26)	.36 (.24)	.35 (.23)	.29 (.25)
Percent free-lunch eligible	.42 (.30)	.36 (.27)	.41 (.23)	.41 (.23)	.40 (.27)
N	341	341	341	340	1023

Notes: Standard deviations in parentheses.

¹ All dollar amounts are expressed in 1990 dollars. All figures are per-pupil district averages unless states otherwise.

² All variables are for 1996-1997 school year unless stated otherwise.

³ All revenues and expenditures are in per-pupil terms.

⁴ Change between 1996-1997 and 1999-2000 school years.

Table 2. Raw correlations between unit rates and district characteristics pre-reform

	Unit rate
% Black	-.0076 (.0854)
% White	-.0977 (.0639)
Free-lunch equivalent	-.0063 (.0202)
Special education enrollment	-.0593 (.1429)
Total enrollment	-.0072 (.0132)
Locale	-3.1000 (165.6329)
Graduation rate	-.1796 (.3221)
Total instructional spending	.0000 (.0000)
Total capital spending	-.0000 (.0000)
Total expenditures	.0000 (.0000)

Notes: Standard errors are in parentheses.

Table 3A. Distribution of change in per-pupil state special education revenues

	1994-96 change	1996-98 change
1st percentile	-1198	-1008
10th percentile	-25	-200
20th percentile	-9	-132
30th percentile	-1	-20
40th percentile	0	0
50th percentile	0	0
60th percentile	3	7
70th percentile	11	24
80th percentile	22	43
90th percentile	41	82
99th percentile	629	9798
Mean	-7	195
Standard deviation	600	2102
N	1017	1017

Note: All amounts expressed in 1990 dollars.

Table 3B. Distribution of change in per-pupil federal special education revenues

	1994-96 change	1996-98 change
1st percentile	-695	-99
10th percentile	-11	0
20th percentile	-5	0
30th percentile	-3	0
40th percentile	-1	10
50th percentile	0	13
60th percentile	0	16
70th percentile	0	18
80th percentile	1	22
90th percentile	4	33
99th percentile	75	627
Mean	-21	28
Standard deviation	178	194
N	1017	1017

Note: All amounts expressed in 1990 dollars.

Table 4. First-stage results: Correlation between simulated and actual change in funds

Dependent variable	Independent variable	Coefficient	F	R ²
Actual change in per-pupil state funds 1996-97 to 1998-99	Simulated change in per-pupil state funds 1996-97 to 1998-99	.2755	11.93	.0160
Actual change in per-pupil state funds 1996-97 to 1999-00	Simulated change in per-pupil state funds 1996-97 to 1999-00	.8367	1351.08	.6489
Actual change in per-pupil state funds 1996-97 to 2000-01	Simulated change in per-pupil state funds 1996-97 to 2000-01	.6372	429.99	.3720

Table 5A. Effects of change in state special education funds on change in disability rates

	Dependent variable: change in disability rates							
	IV 1996-99				OLS 1996-99			
	(1)	(2)	(3)	(4)	(9)	(10)	(11)	(12)
Change in per-pupil state funds (\$1000)	.0049 (.0043)	.0048 (.0044)	.0088 (.0128)	.0078 (.0130)	.0089 ** (.0038)	.0088 ** (.0038)	.0356 ** (.0172)	.0360 ** (.0175)
Change in unit rate (\$1000)	-.0027 (.0021)	-.0024 (.0021)	-.0153 ** (.0071)	-.0146 ** (.0070)	-.0023 (.0020)	-.0021 (.0021)	-.0139 ** (.0070)	-.0138 ** (.0067)
Controls	N	Y	N	Y	N	Y	N	Y
Weighted by enrollment	Y	Y	N	N	Y	Y	N	N
N	785	785	785	785	795	795	795	795

Notes: Robust standard errors in parentheses. Weighted regressions are weighted by 1996 total enrollment. Controls include race, number of schools in the district, and percent of enrollment that is free-lunch eligible. * indicates significance at 10% level, ** indicates 5% level and *** indicates 1% level.

Table 5B. Robustness checks: Dropping smallest or largest districts in sample

	Dependent variable: change in disability rates							
	IV Drop smallest 10% of districts				IV Drop largest 10% of districts			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Change in per-pupil state funds (\$1000)	.0006 (.0036)	.0004 (.0036)	-.0052 (.0041)	-.0065 (.0044)	.0035 (.0034)	.0033 (.0035)	.0075 (.0171)	.0090 (.0191)
Change in unit rate (\$1000)	-.0014 (.0017)	-.0009 (.0017)	-.0035 (.0044)	-.0027 (.0041)	-.0028 (.0022)	-.0026 (.0022)	-.0152 ** (.0071)	-.0145 ** (.0071)
Controls	N	Y	N	Y	N	Y	N	Y
Weighted by enrollment	Y	Y	N	N	Y	Y	N	N
N	701	701	701	701	700	700	700	700

Notes: Robust standard errors in parentheses. Weighted regressions are weighted by 1996 total enrollment. Controls include race, number of schools in the district, and percent of enrollment that is free-lunch eligible. * indicates significance at 10% level, ** indicates 5% level and *** indicates 1% level.

Table 5C. Validity check: Effects of change in state special education funds on pre-reform change in disability rates

	Dependent variable: change in disability rates			
	(1)	(2)	(3)	(4)
Change in per-pupil state funds (\$1000)	.0246 (.0189)	.0250 (.0191)	.0349 (.0267)	.0360 (.0268)
Change in unit rate (\$1000)	.0017 (.0028)	.0015 (.0027)	.0099 (.0018)	.0026 (.0015)
Controls	N	Y	N	Y
Weighted by enrollment	Y	Y	N	N
N	738	738	738	738

Notes: Robust standard errors in parentheses. Weighted regressions are weighted by 1996 total enrollment. Controls include race, number of schools in the district, and percent of enrollment that is free-lunch eligible. * indicates significance at 10% level, ** indicates 5% level and *** indicates 1% level.

Table 5D. Robustness checks: IV Regressions at the SELPA level

	Dependent variable: change in disability rates							
	Drop Los Angeles Unified School District		Drop SELPA's with one district		Drop SELPA's with fewer than 11 districts		OLS estimates at the SELPA level	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Change in unit rate (\$1000)	-.0009* (.0005)	-.0011** (.0005)	-.0014** (.0007)	-.0014** (.0007)	-.0031*** (.0011)	-.0028* (.0015)	-.0004** (.0002)	-.0005*** (.0002)
Controls	N	Y	N	Y	N	Y	N	Y
Weighted by enrollment	Y	Y	Y	Y	Y	Y	Y	Y
N	113	113	82	82	41	41	119	119

Notes: Robust standard errors in parentheses. Weighted regressions are weighted by 1996 total enrollment. Controls include race, number of schools in the district, and percent of enrollment that is free-lunch eligible. * indicates significance at 10% level, ** indicates 5% level and *** indicates 1% level.

Table 6. State-level reduced form difference-in-difference estimates for percent disabled

	Treatment status	
	California	Non-California
	(1)	(2)
A. Break in trend, 1998-99		
Change in percent special education		
1989-90 to 1997-98	.0031810	.0026083
1998-99 to 2002-03	-.0006533	.0030988
	<i>Difference:</i> -.0038343	.0004905
	<i>Difference in Difference:</i> -.0043248	
	(.0026846)	
	[-1.61]	
B. Break in trend, 1993-94		
Change in percent special education		
1989-90 to 1992-93	.0041462	.0036568
1993-94 to 1996-97	.0025564	.0021703
	<i>Difference:</i> -.0015898	-.0014865
	<i>Difference in Difference:</i> -.0001033	
	(.0034845)	
	[-.03]	

Notes: "Non-CA" excludes ten states that have had census-based reforms over the time period in question. Standard errors are in (), t-statistics are in [].

Table 7A. IV Estimates: Income effects of change in state special education funds on change in local expenditures

Dependent variables	Instrumented variable: change in state special education funds		
	First year change 1996-1998	Second year change 1996-1999	Third year change 1996-2000
	(1)	(2)	(3)
Change in per-pupil current expenditures	.92 *** (.26)	.26 *** (.09)	.26 *** (.08)
Change in per-pupil instructional expenditures	.53 *** (.16)	.14 *** (.03)	.12 *** (.05)
Change in per-pupil support-services expenditures	.39 ** (.15)	.12 * (.07)	.14 * (.08)
Change in per-pupil capital expenditures	.03 (.07)	.04 ** (.02)	.05 *** (.02)
Change in per-pupil non- instructional expenditures ¹	.01 (.01)	-.00 (.00)	-.00 (.01)
Change in per-pupil non el-sec expenditures ²	-.00 (.00)	.11 ** (.05)	.14 ** (.07)
Change in all other expenditures ³	.00 (.01)	-.00 (.00)	-.01 ** (.00)
N	793	785	778

* indicates significance at 10% level, ** indicates 5% level, and *** indicates 1% level.

¹Non-instructional spending includes current operation expenditures for food services, enterprise operations.

²Non el-sec programs include current operating expenditures for community services, adult education and other non elementary-secondary programs.

³All other expenditures include payments to local and state governments and interest payments on debt.

Notes: Robust standard errors in parentheses. Regressions are weighted by 1996 total enrollment. Regressions include controls for 1991 to 1995 changes in per-pupil federal and local revenues. Each cell represents a separate regression.

Table 7B. IV Estimates: Price effects of change in state special education funds on change in local expenditures

Dependent variables	Instrumented variable: change in state special education funds		
	First year change 1996-1998	Second year change 1996-1999	Third year change 1996-2000
	(1)	(2)	(3)
Change in per-pupil current expenditures	.01 (.03)	.00 (.02)	-.00 (.03)
Change in per-pupil instructional expenditures	-.01 (.03)	-.02 (.01)	-.01 (.02)
Change in per-pupil support-services expenditures	.02 (.02)	.02 (.02)	.01 (.03)
Change in per-pupil capital expenditures	-.01 (.01)	-.01 (.01)	.00 (.01)
Change in per-pupil non- instructional expenditures ¹	.00 (.00)	-.00 (.00)	-.00 (.00)
Change in per-pupil non el-sec expenditures ²	.00 (.00)	-.01 (.01)	-.01 (.02)
Change in all other expenditures ³	.00 (.00)	-.00 (.00)	-.00 (.00)
N	793	785	778

* indicates significance at 10% level, ** indicates 5% level, and *** indicates 1% level.

¹Non-instructional spending includes current operation expenditures for food services, enterprise operations.

²Non el-sec programs include current operating expenditures for community services, adult education and other non elementary-secondary programs.

³All other expenditures include payments to local and state governments and interest payments on debt.

Notes: Robust standard errors in parentheses. Regressions are weighted by 1996 total enrollment. Regressions include controls for 1991 to 1995 changes in per-pupil federal and local revenues. Each cell represents a separate regression.

Table 7C. Validity Check: Effects of change in state special education funds on pre-reform change in local expenditures

Dependent variables	Instrumented variable: change in state special education funds		
	First year change 1996-1998 (1)	Second year change 1996-1999 (2)	Third year change 1996-2000 (3)
Change in per-pupil current expenditures	.06 (.12)	.04 (.03)	-.02 (.04)
Change in per-pupil instructional expenditures	-.08 (.09)	-.02 (.02)	-.04 (.02)
Change in per-pupil support-services expenditures	.18 (.12)	.06 ** (.02)	.03 (.03)
Change in per-pupil capital expenditures	-.04 (.04)	-.06 * (.03)	-.07 * (.04)
Change in per-pupil non- instructional expenditures ¹	-.05 (.05)	-.00 (.00)	-.00 (.00)
Change in per-pupil non el-sec expenditures ²	-.07 (.05)	-.10 (.05)	-.09 * (.05)
Change in all other expenditures ³	.27 (.23)	-.00 (.08)	-.06 (.10)
N	857	830	821

* indicates significance at 10% level, ** indicates 5% level, and *** indicates 1% level.

¹Non-instructional spending includes current operation expenditures for food services, enterprise operations.

²Non el-sec programs include current operating expenditures for community services, adult education and other non elementary-secondary programs.

³All other expenditures include payments to local and state governments and interest payments on debt.

Notes: Robust standard errors in parentheses. Regressions are weighted by 1996 total enrollment. Regressions include controls for 1991 to 1995 changes in per-pupil federal and local revenues. Each cell represents a separate regression.

APPENDIX Descriptions of Disability Categories As Defined By IDEA

Reference: Federal Register, Vol. 64, No. 48, March 12, 1999. Rules and Regulations, pp. 12421-2.

Autism means a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age 3, that adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences. The term does not apply if a child's educational performance is adversely affected primarily because the child has an emotional disturbance, as defined in this section. A child who manifests the characteristics of "autism" after age 3 could be diagnosed as having "autism" if the criteria of this section are satisfied.

Deaf-blindness means concomitant hearing and visual impairments, the combination of which causes such severe communication and other developmental and educational needs that they cannot be accommodated in special education programs solely for children with deafness or children with blindness.

Deafness means a hearing impairment that is so severe that the child is impaired in processing linguistic information through hearing, with or without amplification, that adversely affects a child's educational performance.

Emotional disturbance means a condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child's educational performance:

- (A) An inability to learn that cannot be explained by intellectual, sensory, or health factors.
- (B) An inability to build or maintain satisfactory interpersonal relationships with peers and teachers.
- (C) Inappropriate types of behavior or feelings under normal circumstances.
- (D) A general pervasive mood of unhappiness or depression.
- (E) A tendency to develop physical symptoms or fears associated with personal or school problems.

The term includes schizophrenia. The term does not apply to children who are socially maladjusted, unless it is determined that they have an emotional disturbance.

Hearing impairment means an impairment in hearing, whether permanent or fluctuating, that adversely affects a child's educational performance but that is not included under the definition of deafness in this section.

Mental retardation means significantly sub-average general intellectual functioning, existing concurrently with deficits in adaptive behavior and manifested during the developmental period, that adversely affects a child's educational performance.

Multiple disabilities means concomitant impairments (such as mental retardation-blindness, mental retardation-orthopedic impairment, etc.), the combination of which causes such severe educational needs that they cannot be accommodated in special education programs solely for one of the impairments. The term does not include deaf-blindness.

Orthopedic impairment means a severe orthopedic impairment that adversely affects a child's educational performance. The term includes impairments caused by congenital anomaly (e.g., clubfoot, absence of some member, etc.), impairments caused by disease (e.g., poliomyelitis, bone

tuberculosis, etc.), and impairments from other causes (e.g., cerebral palsy, amputations, and fractures or burns that cause contractures).

Other health impairment means having limited strength, vitality or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment, that—

- (i) Is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, and sickle cell anemia; and
- (ii) Adversely affects a child’s educational performance.

Specific learning disability is defined as follows:

- (i) *General.* The term means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.
- (ii) *Disorders not included.* The term does not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

Speech or language impairment means a communication disorder, such as stuttering, impaired articulation, a language impairment, or a voice impairment, that adversely affects a child’s educational performance.

Traumatic brain injury means an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a child’s educational performance. The term applies to open or closed head injuries resulting in impairments in one or more areas, such as cognition; language; memory; attention; reasoning; abstract thinking; judgment; problem-solving; sensory, perceptual, and motor abilities; psychosocial behavior; physical functions; information processing; and speech. The term does not apply to brain injuries that are congenital or degenerative, or to brain injuries induced by birth trauma.

Visual impairment including blindness means an impairment in vision that, even with correction, adversely affects a child’s educational performance. The term includes both partial sight and blindness.