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FISCAL DECENTRALIZATION AND EDUCATIONAL PERFORMANCE

By

Nobuo Akai
Masayo Sakata
Ryuichi Tanaka

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Financial Decentralization and Educational Performance:

Evidence from State-level Panel Data for the United States [*]

Nobuo Akai, (School of Business Administration, University of Hyogo) [†]

Masayo Sakata, (Faculty of Politics, Economics and Law, Osaka International University)

Ryuichi Tanaka, (Graduate School of Information Science and Engineering, Tokyo Institute of Technology)

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[†]Correspondence to: 8-2-1 Gakuen-Nishimachi, Nishiku, Kobe, 651-2197, Japan, TEL:+81-(0)78-794-6161, FAX:+81-(0)78-794-6166, E-mail: akai@biz.u-hyogo.ac.jp

Abstract

The purpose of this paper is to test the real effect of financial decentralization in two levels of school. While devolution of authority and responsibility for schools from central to local levels, decentralization of school functions, and reforms to the incentive structure of schools are effective for achieving the high level of educational performance, increased local financing of schools after financial decentralization has opposite two effects, that is, (1) the local finance derives incentive for effective management (2) it may induce the lack of public resource for managing school, which is particularly needed in the basic level of education in the elementary school. This paper analyzes the effect of financial decentralization by focusing on the difference of levels of education, primary and secondary educations. Our result shows that the effect of financial decentralization is not clear in the primary level but the financial decentralization is effective in the secondary level.

Key Words: Financial Decentralization, Educational Performance

1. Introduction

While decentralizations of education in developed and developing countries have largely been driven, the role of a central government in delivering education services is also focused on in US, especially from the financial viewpoint. (Courant and Loeb [8])

The previous studies reveal that devolution of authority and responsibility for schools from central to local levels, decentralization of school functions, and reforms to the incentive structure of schools and their teachers, are effective for achieving the high level of educational performance. However, it is not often clear whether increased local financing of schools is compatible with the possible effect of management decentralization, because the local finance derives incentive for effective management but it may induce the lack of public resource for managing school, which is particularly needed in the district with disadvantaged economic backgrounds and end up reinforcing preexisting inequities. (Aaronson [1])

There is still no clear understanding of the appropriate finance system under which management decentralization leads to more effective education. Designing finance system needs careful attention.

At this standpoint, it is important to consider how the divergence of school finance among districts affects the educational outcome created in the school. This problem is related to Quality-Quantity Trade-Offs in Resource Allocation, which is discussed in Behrman et. al [3]. This

is a trade-off between allocating resources toward providing broad access to education and improving the quality of existing ones. Thus, in economies where both access to, and quality of, education are problems, should resources be expended on setting up schools in remote regions or on, say, increasing textbook availability in existing ones? Some researchers argue that the trade-off is only apparent because setting up schools without paying careful attention to quality encourages high dropout rates and grade failure, thereby leading to a failure to increase access to education in a meaningful way. The relevant issue for policy may be to identify at least approximately what constitutes a minimally acceptable quality of schooling and to determine how this level of quality may be delivered. This means that a serious attempt should be made in the primary level of education and the financial intervention by the central government may be necessary.

If decentralization involves raising the resources for education locally, it runs the risk of unfairly favoring more prosperous municipalities and regions relative to those that have a weaker revenue base. The economic shock also directly affects the local finance of educational system. It is often discussed that financial decentralization results in the cut of fund for education because of the lack of resources in weak revenue base of the local level. Then society may have social benefits beyond private benefits from a distribution perspective that accrue to the nation rather than just the locality. For this reason, it is desirable to raise some of the funds nationally and transfer them to poor or disadvantage localities in which the social benefits, for distribution reasons, are relatively

large.

Given this situation, the central government needs to compensate for such regional differences by providing larger subsidies for education to poorer local governments and municipalities. Especially, in order to achieve the basic level of education which is the purpose for primary education, this transfer scheme is needed. As suggested in Roy [24], the central government should take on a regulatory role to ensure that students from all municipalities and communities meet at least some basic learning and skills standards. Indeed, it could be argued that the regulatory role of the central government in setting and enforcing minimum education standards is even more important in a decentralized than centralized management system. If the primal regulatory goal of basic education is to maximize the performances of students at the bottom tail in the elementary school, the power of distribution, which is the degree of financial centralization, will become relatively large.[1]

[1] In this paper, we focus on central government transfer to the local district as a tool decreasing the divergence and increasing the minimum level of education in the specific disadvantage district. However, there is another tool for it, that is, the direct transfer to student. It is often called demand side financing. Examples include stipends, student loans, targeted bursaries, and vouchers. This system, by making public schools compete with private schools for students, puts pressure on public schools to improve the quality of the education that they offer. The net result is increased efficiency and greater accountability in both public and private schools. However this movement

Giving distributional advantage and informational disadvantage of financial centralization, it seems important to consider its effect in each stage, namely primary, secondary and so on. It is theoretically discussed that ***elementary school (primary education)*** should focus on the minimum level of education and the primal purpose of basic education is to provide the chance to having the minimum amount of education for all children in all districts equally. There are two main reasons for justifying this purpose, as discussed formally in Section 5. First, it is plausible that the marginal effect of education in elementary school is very high, which means that the divergence of education system is not appropriate for elementary school. Second, the lowest level of primary education affects for all students through externality. (The basic learning level in the primary stage is very important for all over economy. If the level of basic learning is very low in some district, then the student having the education in this district may not have a chance to get a job and this creates negative externality for other people in the society. Actually, some previous papers insist that financial decentralization distorts the chance to have a basic education thus financial centralization is effective for raising the educational outcome in the lowest level strongly. (Benabou [4] [2]) This

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has gained enormous political momentum in the US and the number of states that adopt this system is still low. No country in Asia has a national voucher program. So in this paper, we focus on only the central transfer. The efficiency of various types of finance system is analyzed in Fernandez and Rogerson [11].

[2] Benabou [4] analyzes the case where negative externality due to complementarity decreases

discussion clearly reveals that the financial divergence by local school finance, especially in elementary schools, becomes the social problem. This problem may dominate the advantage due to local school responsibility. Then inequity should be decreased by the intervention of the upper level of government, state government in US.

On the other hand, at the next stage of education, namely ***secondary school (secondary education)***, this problem seems to be not so high. The local accountability may create the efficient educational outcome, by giving a chance for the student with highest level of learning ability. Noting that the imperfect information about local needs and local costs of goods and services may be disadvantage of centralization, the positive effect of decentralization in the higher level of education becomes large, compared with the low level education that is required to decrease inequity and increase the minimum learning level.

In this paper, in order to capture the difference of the effect of financial decentralization in the different stages of education, namely, primary and secondary, we examine the real effect of financial decentralization in both stages of schools separately but by using the same method. In addition, we should be careful for the indicator of financial decentralization because the effect of financial decentralization depends on distributional characteristics. So we measure the degree of financial decentralization from the viewpoint of how the central transfer or intervention affects the

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economic efficiency.

divergence of local school finance. What the decentralization measure should be captured is not the amount of transfer to local level but quality of transfer viewed from the distributional point.

The rest of paper is constructed as follows. Section 2 presents the previous empirical studies focusing on the different effects of financial decentralization. Section 3 describes a stylized model that captures the idea how decentralization of education systems affects education outcomes of children. Data and our empirical methodology for examining the effect are explained in Section 4. Our empirical findings are presented in Section 5. We provide alternative interpretation of our empirical results in Section 6. Section 7 concludes our paper.

2. Previous empirical literatures

Using data for the American states, many researchers have studied the empirical relationship between educational finance system and several educational outcomes. Some analyze the relationship between education finance system and educational expenditure (Peltzman [23] with cross-state data, Manwaring and Sheffrin [19], Murray, Evans and Schwab [21], Blankenau and Skidmore [5] with cross-state panel data, and Downes [9], Hoxby [15], Garvey [13], Wilson, Lambright and Smeeding [26] with district-level data). Others investigate the relationship between education finance system and student performance measured by test scores (Card and Payne [7],

Downes and Figlio [10], Figlio [12], Hanushek and Somers [14], Huang and Yu [16], Husted and Kenny [17], and Roy [24]). However, since most of these studies treat primary and secondary education homogenously, none of them provide information on how the effects of decentralization vary across primary and secondary education.

For developing countries, several researchers study the effects by dividing school level into elementary school and secondary school. Behrman, Deolalikar and Soon [3] estimate the effect of fiscal decentralization on schooling performance such as average test scores and dropout rates for the Philippines. King and Ozler [18] estimate the effect of a school autonomy reform (decentralization in school management) on student performance measured by test scores for Nicaragua. Their results for developing countries show in common that educational decentralization (both in finance and management) has positive effect in elementary school, while its effect is insignificant in secondary school. Since their findings imply that the effect of decentralization be different across education levels, we estimate the effects of decentralization in education finance on the student performance in the U.S. for each primary and secondary education separately. In addition, while these papers provide no explicit explanation why the effect of decentralization differs across school levels, we provide a model that generates different effects of decentralization in education finance across school levels to interpret our empirical results.

3. The Model

In this section, we construct a stylized model to capture the idea how decentralization of educational finance and management affects educational outcomes. We present a model here not because we test empirically the model but because we believe that the model is helpful to understand the empirical results we show in the later part of this paper.

Imagine the economy (call it "state") that consists of only two districts: $j = A, B$. Population sizes in *A* and *B* are *n* and *1-n*, respectively. Per-capita educational resource in district *A* is y^A, and that in *B* is y^B.

Let $q \in [0,1]$ denote the degree of decentralization in the education system of the state. Per-capita educational expenditure in district *j* with the degree of decentralization q is given by $y^j(q) = qy^j + (1-q)\bar{y}$, where $\bar{y} = ny^A + (1-n)y^B$. For example, if the state government decentralizes its education system completely, per-capita educational expenditure in the district *j* is given by its own educational resourse $y^j(1) = y^j$. On the other hand, if the state centralizes its education system completely, per-capita educational expenditure is given by the state average of educational resourses $y^j(0) = \bar{y}$.

Assume that there are two levels of education: $l \in \{\mathrm{p}, \mathrm{s}\}$ (primary and secondary). Production function of individual human capital is given by $h^{j,l}(q) = A(q)(y^j(q))^{u_l}, u_l \in (0,1)$, where $h^{j,l}$ is the measure of student's performance in education level *l* in district *j* (it corresponds

to, for example, the math test score in our empirical exercise).

$A(q)$ is the productivity of the education system that potentially depends on the degree of decentralization. Decentralization in the education system may have positive effects on students' performance because it transfers responsibility associated with accountability to local governments (school districts) that may provide incentives for them to use their educational resources more efficiently. This is one of the benefits of decentralization pointed by, for example, Oates [22], Martinez-Vazquez and McNab [20], and Thiessen [25].[3] Following the previous literature, we assume that $A'(q) > 0$.

Note that in our specification of the production function, we assume the concavity in education expenditure per student. Moreover, we allow the degree of concavity to vary across education levels. We assume that the production function in primary education is more concave than in secondary education, that is, $u_p < u_s$. This seems a plausible assumption to some extent because education in primary schools contains learning of basic skills, and the benefits of acquiring such skills are enormous in a very early stage but would decrease rapidly after some point.

It is well-known that decentralization of education finance reduces the average educational

[3] Empirically, Akai and Sakata [2] found the positive effect of fiscal decentralization on economic growth for the American states, and their finding is consistent with the above theoretical view if human capital investment is one of the main engines for economic growth.

output if the production function of human capital is concave, and that the larger is the degree of the concavity, the larger is the negative effect of *decentralization* in education finance. Hence, under the assumptions that the production function in primary education is more concave than in secondary one, the negative effect of *decentralization* in education finance is larger in primary education than in secondary education.

The total effect of decentralization on educational outcomes crucially depends on the tradeoff between the improvement in the efficiency of educational management (an increase of $A(q)$) and the negative impact of the rise of educational recourses inequality across districts. Hence, if the first effect is common across education levels and the degree of concavity of the production function in primary school is larger than in secondary school, the total effect of decentralization is larger in the secondary school than in the primary school.[4]

4. Data and Empirical Methodology

In this section, we first describe our regression equation. Then we explain our data and variables in detail.

[4] We will discuss another interpretation of our empirical findings using an alternative model in section 5.

4.1 Econometric Model

To examine the effects of decentralization in education finance on students' performances in primary and secondary education, we estimate the following reduced-form regression equation for each level of schooling;

$$Edu\ Out_{i,t}^{l} = a^{l} + b^{l} Dec_{i,t}^{l} + g^{l} X_{i,t}^{l} + u_{i,t}^{l},$$

where $l \in \{\mathrm{p}, \mathrm{s}\}$ is the index of education level (primary and secondary), i is the state index, and t is the time index. $Edu\ Out_{i,t}^{l}$ is a measure of educational outcome (student's performance) in education level l in state i at time t. Similarly, $Dec_{i,t}^{l}$ is a measure of decentralization in education finance, $X_{i,t}^{l}$ is the vector of control variables and $u_{i,t}^{l}$ is a stochastic disturbance in education level l in state i at time t.

4.2 Data

We estimate the above regression equation using panel data for 49 American states.[5] We explain

[5] Hawaii is dropped from all observations, because the Hawaiian system of education provision is completely different from the others. Hawaii has no School District system for public education. In addition, the total numbers of sample are different by our regression models since several variables are missing in Hawaiian data.

how we construct our data set in below (descriptive statistics of all variables used in school regressions are shown in Table 1).

4.2.1 Educational Outcome

First of all, we need to measure the educational performance, **Educational Outcome (** $Edu\ Out_{i,t}^{l}$ **)**. We select scores of test taken by students belonging to American elementary and secondary schools, and dropout rate in secondary schools as proxies for educational outcome.[6]

For the test score in primary education, we adopt mathematics score at 4^{th} and 8^{th} on 1996 and 2000 years taken from *National Assessment of Educational Progress* (NAEP) in National Center

[6] The purpose of education is to from the useful human resources in the society. It is necessary to take the education offering the basic and marginal knowledge and skill to flourish in the society. The result of education must be reflected to test scores in all levels of school.

for Education Statistics (NCES).[7] NAEP Questions ask knowledge and skills of specific content area to students at 4th, and 8th grades in all states, and scores by seven subjects (Civics, Geography, History, Mathematics, Reading, Science, and Writing) are available.[8] It is possible to compare performance on a specific question to the students across the states, but we choose math test score as a measure of students' performance in primary education because the math score may be the most "fair" measurement of educational attainment free from cultural and ethnic diversities across the states.[9] We modify these mathematics real score into deviation score (T-score) to take

[7] These data by states is derived from web site, http://nces.ed.gov/nationsreportcard/states/ (accessed on 7 December, 2005). Idaho, Illinois, Kansas New Hampshire, Ohio, Oklahoma, and South Dakota in 1996, and Alaska Colorado Delaware, Florida, New Hampshire, New Jersey, Rhode Island, South Dakota, Washington, and Wisconsin in 2000 are dropped because the value of score for the 4th grade is missing from these states. Idaho, Illinois, Kansas, Nevada, New Hampshire, New Jersey, Ohio, Oklahoma, Pennsylvania, and South Dakota in 1996, and Alaska Colorado Delaware, Florida, Iowa, New Hampshire, New Jersey, Rhode Island, South Dakota, Washington, and Wisconsin in 2000 are dropped because the value of score for the 8th grade is missing from these states.

[8] However, national assessment is conducted at 4th, 8th, and 12th grade levels.

[9] Also, the math test score provides the largest sample size among all the test scores. Test scores are not available for some subjects in some states, because not all schools carry out these tests every year.

differences of test's difficulty by year into consideration.

As a benchmark test score in secondary education, we use the mathematical test scores in Scholastic Aptitude Test (SAT) from 1995 to 2000 taken from *Digest of Education Statistics*.[10] The verbal test score is also available in SAT, but we focus on the score in mathematics because of the same reason described in the elementary school. Test scores are modified to deviation score (T-score).

SAT scores may not be a representative measure of the performances of college-bound students, because there is the American College Testing (ACT), another college entrance exam widely taken by many high school graduates.[11] The vast majority of colleges and universities adopt one of these two tests as an entrance exam, but most of high school graduates take either one of these two tests. Moreover, SAT and ACT scores may represent different characteristics of educational attainment, because the purposes of these tests are different. SAT checks ability for applying the knowledge to sophisticated graduate program, while ACT checks the learning level of high school curriculums. Due to the different perspective of these exams, test takers may be

[10] The data are taken from http://nces.ed.gov/programs/digest/(accessed on 7 December, 2005). The *Digest of Education Statistics* provides a compilation of statistical information covering the broad field of American education from pre-kindergarten through graduate school.

[11] The data are taken from http://www.act.org/news/data.html (accessed on 7 December, 2005).

self-selected based on their local idiosyncrasies as pointed by Peltzman [23].

We resolve these problems by considering the following two points.[12] First, we consider the **Participation Rate** (of each test) as one of the control variables. Second, we consider regional specific effects in panel regressions in order to capture unobservable geographic differences.

In order to check the robustness, we consider the total test scores (not separated by subjects) in ACT during the same period and the dropout rate of students in between 9th and 12th graders as an alternative measure of educational attainment. The dropout rates from 1995 to 2000 are available in the *Digest of Education Statistics*.

4.2.2 Decentralization in Education Finance

[12] Peltzman [23] points out that there are substantial differences in the geographic distribution of the SAT and ACT populations, because some regional universities adopt one of two tests as a formal test. A correlation coefficient between percentages of graduates taking the SAT and the ACT on 2000 year is -0.96. Moreover, a correlation coefficient between percentages of graduates taking the SAT and mathematical score in SAT on 2000 year is -0.857. This strong negative correlation between the math test score and the participation rate implies that the student who wants to enter small but high level university that requires one of two tests, However, that of ACT represents -0.170. As a remedy, he adopts a single index of average test score by combining two data by weighting the participation rate, but this weighted average score is not persuasive.

The key variable in our regression equation is a measure of decentralization in education finance ($Dec^{l}_{i,t}$).

In the previous research (e.g., Behrman, Deolalikar and Soon [3]), the degree of decentralization in educational finance between two levels of government is defined as a share of local expenditure to central and local governments' total financial size. This traditional measure, however, may be inappropriate to capture the role of the state government that is to decrease the divergence of financial positions among jurisdictions.

To overcome this problem, we consider a new indicator, **Redistribution Power** measuring the distributional role of the state government to reduce a disparity of local education. **Redistribution Power** is defined as the ratio of a coefficient of variation of education expenditure per pupil for public education service in each state to a coefficient of variation of own tax revenue per pupil for education service in each state. This measure is overall non-negative, and captures how the state government behaves in each state to decrease the disparity of education finance across school districts by redistributing resources in each state (the lower is the measure, the more effective is the state government to reduce the education finance inequality across districts). For example, this measure becomes zero for a state where the state government perfectly eliminates the disparity of education finance across districts.[13] This indicator is different from existing one because our

[13] This measure can be larger than one if a state government redistributes regressively educational

indicator captures the *quality* of transfer while the total transfer share, which is almost equal to the own revenue share in the total budget, captures only the *amount* of transfer.

We construct **Redistribution Power** using the school-district level data on per-pupil education expenditures on primary and secondary education for each state. The data are taken from *Public Primary-Secondary Education Finance Data* in U.S. Census Bureau.[14] In order to consider different education levels in each school district explicitly, we should calculate its indicator for each level of education. However, almost school districts have style of "elementary/secondary school system", which manages both levels of school. We should separate the data for elementary school system and secondary school system as strict as possible. Unfortunately, we are not able to make it due to limitations of data. Hence, when we calculate the primary school's **Redistribution Power**, we use data of "elementary school system only", and "elementary/secondary school system". On the other hand, the indicator of secondary school is calculated by data of "secondary school system only" and "elementary/secondary school system".[15] Appendix A shows each state's

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resources across districts.

[14] The web site is http://www.census.gov/govs/www/school.html (accessed on 9 December, 2005)

[15] "Elementary school system only" indicates a public school system that typically serves grades Pre-Kindergarten through 8. "Elementary/secondary school system" indicates a public school system that serves grades Pre-Kindergarten through 12.

average data of **Redistribution Power** at each level of school.

4.2.3 Other Controls

We control several variables related with input on education service and socio-economic characteristics suggested by the existing empirical studies of educational effect. All variables but **Corruption Index** and **Educational Institution** are taken from the *Statistical Abstract of the United States* published by the US Department of Commerce.

First, we consider **Pupil per Teacher ratio (**proportion of number of students to number of teachers**)** that represents the size of educational finance. This variable is supposed to control the effect of class size on educational performance.[16]

Second, **Share of Public School** (number of public school on state as a proportion of total number of public and private schools) is used to control the difference in state's school composition. Since we obtain the data on 1993, 1995, 1997, and 1999 years, we substitute those

[16] We tried to estimate with other variables; a share of state population living in metropolitan areas, average salary of teacher in each public school, unemployment rate, and academic background of teacher. We drop them from variables in main results representing on tables, because they show strong correlation between other variables. And although we tried to estimate regressions with educational grants from other governments per pupil, we found out the insignificant result.

pre-year data for data of missing year.

Third, **Educational Institution** associated to compulsory attendance on state is used to estimate the effect of disparity of educational institution on education performance. In primary education, the variable is defined as the data of each age taken the test on grade 4th and 8th. These data are different across states, because the disparities among states are on the starting old year of compulsory attendance. In secondary education, we adopt the data of terms of compulsory attendance. The maximum is thirteen and the minimum is nine. Because only the data on 1996, 1997, and 2000 years are available, we substitute 1996, 1997, and 2000 for data of 1995, 1998, and 1999 year, respectively. This variable is available from *Digest of Education Statistics*.[17]

Forth, **Households Income** (median household income of in constant (1999) dollars) is used to capture a different level of household income.

Fifth, **Black Rate** (black population on state as a proportion of total population) is used to account for difference in state's racial composition.

Sixth, **Corruption Index** is used to account for political environment in a state. If governance or political stability is well, the provision for education service could be efficient. Corruption

[17] In the case of secondary school, we are also able to use the credit requirements for high school graduation as an observation of educational institution. We did not find out the significant result statistically.

would create the less competitive pressure in a state, and any distortion in a distribution of public finance. We adopt the data obtained from Boylan and Long [6], who conducted a survey of state house reporters' perceptions of public corruption in their state in 1998. The variable captures corruption on the level of elected officials, political appointees, and civil servants. The value takes from one (less corruption) to seven (most corruption). We are not able to obtain data of Massachusetts, New Hampshire, and New Jersey.

Finally, we prepare the **Coefficient of Variation** on own tax revenue to control the size of initial variation. In our regression, we estimate two cases, which use or don't use this variable, to compare the results. Note that all variables are in log.

5. Regression Results

The aim of this paper is to estimate the effects of financial decentralization on educational performances of elementary and secondary schools, respectively. Moreover, we compare among both results. We represent the results based on both pooled data and panel models with one-way and two-way fixed effects.

5.1 Empirical Results of Elementary School

The results of regressions using unbalanced panel data of two years (1996, 2000) of forty-nine states are summarized in Table 2.[18] Table 2 shows the results of mathematical T-scores for 4^{th} and 8^{th} grades.

Before examining the estimated marginal effects of our control variables, we discuss the appropriateness of our model specification. First, we check the problem related to collinearity among independent variables, by calculating VIF (variance inflation factors) of each independent variable (not-reported). Since the mean of VIF is quite low (about 1.5) for each regression, we do not need to be concerned about multicolinearity.

The basic empirical findings from pooled data and panel regressions can be stated as follows. The most important finding is that the estimated coefficient on educational decentralization of **Redistribution Power** is statistically insignificant in all regressions for both mathematics scores at 4^{th} and 8^{th}. These findings support that decentralization in elementary school has insignificant effect on educational performance. In addition, it is not founded that enough differences on the

[18] Regressions with using Redistribution Power calculated by GINI coefficient give the similar results to Table 2 and 3. In the case of elementary, we show the results of negative and significant statistically in the redistribution power on several regressions. And the results of secondary school also have positively sign and significantly on several regressions.

estimated results of **Redistribution Power** between the model with **Coefficient of Variation** and the model without one.

Table 2 also shows some other interesting findings. First, **Pupil per Teacher** is negative and significant in all models, confirming that small size of class is progressed educational level. Second, **Share of Public School** is found to be insignificant in almost regressions. Third, **Black Rate** also has negative effect on educational performance in US states. Test scores would be sensitive to the racial composition. Forth, **Corruption** is negative and significant in several regressions, implying that an inefficient allocation resource or a distortion of political power has negative effects on educational performance. Fifth, the positive effect of **Household Income** is also significant in all regressions. This result implies that educational performance depends on economic level of household in US states. Finally, **Educational Institution** is insignificant in all regressions.

5.2 Empirical Results of Secondary School

The estimated results of regressions in secondary school by using data collected with six years (period from 1995 to 2000) and forty-nine states are presented in Table 3[19]. There are three

[19] Appendix B shows the result using weighted average score of SAT and ACT. The single score is sum of t-score in SAT and t-score in ACT multiplied by share of percentage of graduates taking the SAT and the ACT, respectively. The result holds that educational decentralization contributes to

independent variables indicating educational outcome in secondary school, mathematical test's t-score on SAT, t-score on ACT, and dropout rate (this variable is modified by 100 minus dropout rate).

It should be emphasized that the results of **Redistribution Power** are positively signed and statistically significant in all regressions for SAT score and in some regressions for ACT score. The positive significant coefficient of this indicator suggests that smaller degree of concernment to educational management of state government develops more educational performance in secondary school. And in the case for dropout rate, we can obtain positive significant coefficients in regressions without **Coefficient of Variation**. In the case with **Coefficient of Variation**, coefficient is negative but insignificant in the panel regression with two way fixed effects.

The estimated results of other variables derived are also interesting. First, the sign of **Pupil per Teacher** is negative but statistically insignificant in regressions excluded from dropout rate. Second, **Share of Public School** has negative effect on educational performance significantly in almost regressions. This shows that private school contributes to improve the educational performance. **Educational Institution** shows negative sign in test scores and positive sign in regression of dropout rate (1-dropout rate). The results imply that the longer of terms in compulsory attendance contributes to reduce numbers of dropout, but might go down test score.

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educational achievement in secondary school.

6. Discussion

We discussed the results in elementary and secondary schools in the previous section. In nutshell, we found that fiscal decentralization in elementary school has no effect, while in secondary school, the effect is positive significantly. These findings are consistent with the implication derived from the model we present in the section 3.

Our model in section 3 features the different degree of concavity of the production function of human capital, but another model also provides the implications consistent with our empirical findings. Among others, One explanation relies on the presence of externalities (complementarity) among schools (districts) a la Benabou [4]. The magnitude of externalities among school districts may differ across primary and secondary education, and thus the effects of decentralization also differ across primary and secondary education.

Now suppose that the human capital of a student in the education level l under the education system k in district A is given by $h^{A,k,l} = [a(y^{A,k})^{r_l} + (1-a)(y^{B,k})^{r_l}]^{1/r_l}, \quad r_l \in (0,1]$, $a \in (0,1)$, and that in district B is given by $h^{B,k,l} = [a(y^{B,k})^{r_l} + (1-a)(y^{A,k})^{r_l}]^{1/r_l}$, . This production function captures the idea that the educational outcome of students in district A depends not only on educational input in district A but also on that in district B through educational externalities. Assuming that the two districts have the same population size normalized to one, we

have the state average test score in the education level *l* under the education system *k*; $\bar{h}^{k,l} = (h^{A,k,l} + h^{B,k,l})/2$.

Now assume that the magnitude of externalities differs across education levels; more precisely, $r_p < r_s$, implying that the primary education is more complement than the secondary education. This assumption seems plausible because the main task of primary education is to form basic skills such as reading, writing and calculus in an early stage of child development, and the interaction of students within and across schools is more important to acquire such basic skills (through learning from others) in primary education than in secondary education the contents of which are advanced and specialized.

Under these assumptions, it can be confirmed that the negative effect of decentralization on the state average of test score is larger in primary education than that in secondary education. By the same token in the previous explanation, if the decentralization of educational management improves efficiency in primary and secondary education by the same magnitude, we observe a negative effect of decentralization only in primary education.

In summary, decentralization in education finance may have positive effects on students' performance through improvement in the allocation of educational resources. However, it may deteriorate equity in educational resources among districts and result in low educational outcome. The negative effect of decentralization is larger in primary than in secondary education because of

large marginal products of education and/or high complementarity among districts in primary education.

Both the models (the one in section 3 and the above) give the intuitive result of disadvantage of decentralization in the primary level. These results imply that the negative effect of decentralization of education finance in primary education may cancel out the positive effect of decentralization through efficient education management, and therefore we observe a positive effect of decentralization only in secondary education. These theoretical observations are consistent with our empirical results shown in Section 5.

7. Conclusion

The effect of financial decentralization on educational performance has been a major focus of debate and discussion in the context of recent public reforms. This paper has presented new empirical evidence on this important issue, which is that financial decentralization may contribute to educational performance in secondary school, not in elementary school because the positive incentive effect by decentralization may be erased by the negative effect in elementary level. Two stylized models provide theoretical explanations of this trade off mechanism, which is consistent with our empirical findings that the positive effect exists only in secondary level. Our analysis

suggests that we must consider the characteristics of schooling in each education level carefully when we decentralize education systems.

To investigate the contribution of financial decentralization more thoroughly, it is necessary to construct accurate indicators that capture the distribution effect in American educational system.

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Appendix A: Average Data of Redistribution Power (Primary School and Secondary School)

State	primary school (1996 and 2000)	secondary school (during 1995-2000)	State	primary school (1996 and 2000)	secondary school (during 1995-2000)
Alabama	0.137	0.145	Montana	0.724	0.688
Alaska	.	.	Nebraska	0.642	0.590
Arizona	0.365	0.417	Nevada	0.284	0.295
Arkansas	0.259	0.247	New Hampshire	0.705	0.531
California	0.646	0.362	New Jersey	0.487	0.375
Colorado	0.601	0.563	New Mexico	0.430	0.424
Connecticut	.	.	New York	0.451	0.416
Delaware	0.508	0.347	North Carolina	.	.
Florida	0.257	0.240	North Dakota	0.572	0.617
Georgia	0.292	0.243	Ohio	0.697	0.487
Hawaii	-	-	Oklahoma	0.227	0.287
Idaho	0.372	0.439	Oregon	0.629	0.548
Illinois	0.449	0.463	Pennsylvania	0.495	0.500
Indiana	0.373	0.399	Rhode Island	.	.
Iowa	0.699	0.706	South Carolina	0.421	0.378
Kansas	0.244	0.233	South Dakota	0.672	0.624
Kentucky	0.256	0.260	Tennessee	.	.
Louisiana	0.169	0.181	Texas	0.372	0.315
Maine	0.224	0.181	Utah	0.443	0.463
Maryland	.	.	Vermont	0.551	0.185
Massachusetts	.	.	Virginia	.	.
Michigan	0.288	0.306	Washington	0.598	0.538
Minnesota	0.636	0.542	West Virginia	0.194	0.252
Mississippi	0.306	0.283	Wisconsin	0.520	0.490
Missouri	0.545	0.469	Wyoming	0.449	0.459

Note: We have unavailable data on several states. And Hawaii is excluded from original data.

Appendix B: Weighted Average T-Score of SAT and ACT assessment

		Secondary School Weighted Average T-Score of SAT and ACT					
		Pooled	Pooled	Panel	Panel	Panel	Panel
	Constant	-2.318	-2.187	-	-	-4.005	-4.132
		[.009]	[.025]	-	-	[.000]	[.000]
Educational Variables	Pupil per Teacher	-0.036	-0.039	-0.184	-0.186	-0.158	-0.219
		[.623]	[.599]	[.040]	[.039]	[.029]	[.021]
	Share of Public School	0.425	0.415	0.605	0.598	0.573	0.603
		[.005]	[.007]	[.000]	[.000]	[.000]	[.000]
	Educational Institution	-0.080	-0.083	0.065	0.065	0.008	0.081
		[.331]	[.318]	[.491]	[.497]	[.914]	[.410]
Economic and Social Variables	Household Income	0.580	0.572	0.782	0.773	0.745	0.787
		[.000]	[.000]	[.000]	[.000]	[.000]	[.000]
	Black Rate	-0.050	-0.050	-0.050	-0.050	-0.050	-0.053
		[.000]	[.000]	[.000]	[.000]	[.000]	[.000]
	Corruption, 1998	-0.007	-0.007	-0.006	-0.005	0.004	0.002
		[.832]	[.831]	[.879]	[.886]	[.891]	[.952]
Educational Decentralization	Redistribution Power	0.132	0.138	0.140	0.146	0.135	0.157
		[.000]	[.000]	[.000]	[.000]	[.000]	[.000]
Size of Initial Variation	Coefficient of Variation (Own Revenue)	-	0.009	-	0.008	-	0.010
		-	[.763]	-	[.815]	-	[.775]
	Adj R-squared	0.546	0.544	0.560	0.558	0.559	0.552
	Number of obs	232	232	232	232	232	232
	State Dummy	no	no	yes	yes	yes	yes
	Time Dummy	no	no	no	no	yes	yes
Hausman test							
	CHISQ	-	-	31.689	31.843	5.433	5.422
	P-value	-	-	[.0000]	[.0001]	[.9419]	[.9647]

Note: Figures in parentheses are the absolute values of p-statistics.Hawaii is exculed from original sample. The Hausman test tests the null hypothesis of a random effects model against a fixed effects model. The dependent variable is the average score adjusted.

Table 1: Descriptive Statistics

Variable	Period	Obs	Average	Std. Dev.	Min	Max
Mathematical T-Socre for 4th Grade	1996, 2000	65	49.46	10.29	29	65
Mathematical T-Socre for 8th Grade	1996, 2000	62	50.07	10.56	27	67
Mathematical T-Socre in SAT assessment	1995 - 2000	232	51.88	10.22	32	72
ACT T-Score	1995 - 2000	232	50.14	10.11	22.71	70.21
Dropout Rate	1995 - 2000	165	5.270	1.979	2.40	11.60
Redistribution Power	1996, 2000	65	0.425	0.186	0.129	0.934
	1995 - 2000	232	0.398	0.163	0.107	0.860
Coefficient of Variation (Own Revenue)	1996, 2000	65	0.755	0.291	0.298	1.681
	1995 - 2000	232	0.698	0.308	0.217	2.183
Pupil per Teacher	1996, 2000	65	16.456	2.459	12.128	24.415
	1995 - 2000	232	16.504	2.289	12.128	24.415
Share of Public School	1996, 2000	65	0.807	0.071	0.620	0.917
	1995 - 2000	232	0.803	0.077	0.615	0.931
Educational Institution for 4th Grade	1996, 2000	65	9.369	0.762	8	11
Educational Institution for 8th Grade	1996, 2000	62	13.339	0.745	12	15
Educational Institution for secondary school	1995 - 2000	232	10.284	1.197	9	13
Participation Rate of SAT	1995 - 2000	232	28.401	24.175	4	77
Participation Rate of ACT	1995 - 2000	232	47.625	25.409	2	84
Household Income	1996, 2000	65	36,957	4,892	26,637	47,240
	1995 - 2000	232	37,215	5,007	26,637	48,984
Black Rate	1996, 2000	65	0.099	0.102	0.003	0.363
	1995 - 2000	232	0.095	0.095	0.003	0.363
Corruption	1998	46	3.484	1.137	1.500	5.500

Table 2: Empirical Results of Elementary School

		Elementary School Mathematical T-Score for Grade 4						Elementary School Mathematical T-Score for Grade 8					
		Pooled	Pooled	Panel	Panel	Panel	Panel	Pooled	Pooled	Panel	Panel	Panel	Panel
	Constant	-2.198	-2.816	-2.331	-2.912	-4.984	-5.707	-3.050	-3.416	-3.123	-3.421	-5.268	-4.635
		[.270]	[.180]	[.238]	[.161]	[.019]	[.010]	[.087]	[.065]	[.075]	[.059]	[.006]	[.000]
Educational Variables	Pupil per Teacher	-0.462	-0.454	-0.463	-0.457	-0.668	-0.662	-0.272	-0.273	-0.280	-0.278	-0.418	-0.423
		[.004]	[.005]	[.003]	[.003]	[.000]	[.000]	[.042]	[.042]	[.032]	[.034]	[.003]	[.000]
	Share of Public School	0.211	0.274	0.204	0.258	0.588	0.656	0.059	0.088	0.031	0.064	0.374	-0.100
		[.560]	[.458]	[.576]	[.486]	[.112]	[.081]	[.856]	[.788]	[.924]	[.846]	[.272]	[.684]
	Educational Institution	0.339	0.331	0.345	0.343	0.295	0.291	0.321	0.298	0.274	0.274	0.286	0.048
		[.210]	[.222]	[.199]	[.202]	[.246]	[.252]	[.346]	[.385]	[.420]	[.423]	[.379]	[.849]
Economic and Social Variables	Household Income	0.610	0.660	0.623	0.669	0.908	0.966	0.646	0.681	0.670	0.692	0.879	0.914
		[.002]	[.001]	[.001]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]
	Black Rate	-0.052	-0.055	-0.050	-0.053	-0.053	-0.057	-0.071	-0.075	-0.072	-0.074	-0.072	-0.087
		[.022]	[.016]	[.021]	[.016]	[.010]	[.006]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]
	Corruption, 1998	-0.080	-0.089	-0.091	-0.102	-0.013	-0.026	-0.102	-0.110	-0.116	-0.119	-0.051	-0.150
		[.322]	[.274]	[.258]	[.211]	[.870]	[.751]	[.132]	[.110]	[.086]	[.082]	[.457]	[.004]
Educational Decentralization	Redistribution Power	0.039	0.012	0.031	0.005	0.027	-0.005	0.068	0.048	0.061	0.046	0.059	-0.007
		[.464]	[.842]	[.560]	[.932]	[.589]	[.937]	[.131]	[.344]	[.166]	[.361]	[.170]	[.838]
Size of Initial Variation	Coefficient of Variation	-	-0.060	-	-0.055	-	-0.066	-	-0.047	-	-0.041	-	-0.019
	(Own Revenue)	-	[.341]	-	[.382]	-	[.266]	-	[.406]	-	[.462]	-	[.642]
	Adj R-squared	0.484	0.484	0.484	0.483	0.538	0.541	0.655	0.653	0.654	0.653	0.683	0.650
	Number of obs	65	65	65	65	65	65	62	62	62	62	62	62
	State Dummy	no	no	yes	yes	yes	yes	no	no	yes	yes	yes	yes
	Time Dummy	no	no	no	no	yes	yes	no	no	no	no	yes	yes
Hausman test													
	CHISQ	-	-	8.668	9.891	9.552	11.377	-	-	7.967	8.127	7.599	1.698
	P-value	-	-	[.2774]	[.2727]	[.2979]	[.2507]	-	-	[.3355]	[.4212]	[.4736]	[.9954]

Note: Figures in parentheses are the absolute values of p-statistics.Hawaii is exculed from original sample. The Hausman test tests the null hypothesis of a random effects model against a fixed effects model.

Table 3: Empirical Results of Secondary School

		Secondary School Mathematical T-Score for SAT						Secondary School T-Score for ACT						Secondary School 100 - percentage of Dropout Rate					
		Pooled	Pooled	Panel	Panel	Panel	Panel	Pooled	Pooled	Panel	Panel	Panel	Panel	Pooled	Pooled	Panel	Panel	Panel	Panel
	Constant	2.218	3.194	-	-	-	-	-3.223	-2.504	-	-	-	-	4.701	4.419	4.665	-	4.651	-
		[.000]	[.000]	-	-	-	-	[.000]	[.012]	-	-	-	-	[.000]	[.000]	[.000]	-	[.000]	-
Educational Variables	Pupil per Teacher	0.011	-0.011	-0.002	-0.022	-0.031	-0.053	0.010	-0.010	-0.099	-0.105	-0.130	-0.136	-0.056	-0.051	-0.062	-0.067	-0.062	-0.078
		[.769]	[.753]	[.972]	[.597]	[.496]	[.220]	[.896]	[.895]	[.266]	[.247]	[.168]	[.152]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]
	Share of Public School	-0.339	-0.476	-0.251	-0.358	-0.250	-0.358	-0.798	-0.877	-0.614	-0.628	-0.618	-0.635	-0.074	-0.051	-0.066	-0.030	-0.066	-0.025
		[.000]	[.000]	[.006]	[.000]	[.007]	[.000]	[.000]	[.000]	[.002]	[.002]	[.002]	[.002]	[.002]	[.026]	[.002]	[.260]	[.008]	[.342]
	Educational Institution	-0.088	-0.116	-0.080	-0.096	-0.062	-0.081	-0.138	-0.155	-0.155	-0.156	-0.149	-0.150	0.050	0.054	0.044	0.041	0.049	0.045
		[.038]	[.004]	[.091]	[.035]	[.204]	[.085]	[.106]	[.069]	[.103]	[.101]	[.132]	[.129]	[.000]	[.000]	[.000]	[.004]	[.000]	[.002]
	Participation Rate	-0.205	-0.213	-0.199	-0.206	-0.199	-0.205	0.021	0.023	0.023	0.023	0.025	0.025	-	-	-	-	-	-
		[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.121]	[.083]	[.109]	[.108]	[.092]	[.090]	-	-	-	-	-	-
Economic and Social Variables	Household Income	0.265	0.205	0.350	0.274	0.356	0.281	0.736	0.688	0.992	0.976	1.013	0.993	-0.004	0.017	0.002	0.043	0.002	0.046
		[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.763]	[.168]	[.852]	[.006]	[.853]	[.003]
	Black Rate	-0.019	-0.017	-0.017	-0.016	-0.019	-0.018	-0.110	-0.109	-0.105	-0.105	-0.107	-0.107	-0.003	-0.004	-0.003	-0.003	-0.003	-0.004
		[.000]	[.000]	[.001]	[.002]	[.000]	[.001]	[.000]	[.000]	[.000]	[.000]	[.000]	[.000]	[.035]	[.003]	[.055]	[.063]	[.030]	[.016]
	Corruption, 1998	-0.048	-0.049	-0.054	-0.052	-0.049	-0.047	-0.041	-0.042	-0.062	-0.061	-0.056	-0.055	-0.013	-0.011	-0.013	-0.012	-0.011	-0.008
		[.005]	[.002]	[.004]	[.003]	[.008]	[.008]	[.232]	[.218]	[.096]	[.101]	[.138]	[.145]	[.016]	[.022]	[.008]	[.042]	[.041]	[.161]
Educational Decentralization	Redistribution Power	0.029	0.071	0.024	0.070	0.033	0.079	0.048	0.081	0.013	0.024	0.018	0.031	0.007	-0.006	0.008	-0.012	0.008	-0.008
		[.013]	[.000]	[.083]	[.000]	[.024]	[.000]	[.051]	[.007]	[.649]	[.527]	[.543]	[.424]	[.026]	[.148]	[.010]	[.040]	[.019]	[.136]
Size of Initial Variation	Coefficient of Variation (Own Revenue)	-	0.075	-	0.070	-	0.072	-	0.057	-	0.015	-	0.018	-	-0.022	-	-0.026	-	-0.025
		-	[.000]	-	[.000]	-	[.000]	-	[.060]	-	[.657]	-	[.600]	-	[.000]	-	[.000]	-	[.000]
	Adj R-squared	0.886	0.898	0.899	0.909	0.899	0.910	0.647	0.651	0.678	0.676	0.672	0.671	0.302	0.390	0.277	0.402	0.298	0.428
	Number of obs	232	232	232	232	232	232	232	232	232	232	232	232	165	165	165	165	165	165
	State Dummy	no	no	yes	yes	yes	yes	no	no	yes	yes	yes	yes	no	no	yes	yes	yes	yes
	Time Dummy	no	no	no	no	yes	yes	no	no	no	no	yes	yes	no	no	no	no	yes	yes
Hausman test																			
	CHISQ	-	-	24.549	22.400	27.492	26.856	-	-	32.943	31.844	30.429	29.201	-	-	2.244	19.038	16.471	24.897
	P-value	-	-	[.0019]	[.0077]	[.0106]	[.0201]	-	-	[.0001]	[.0002]	[.0041]	[.0098]	-	-	[.9451]	[.0147]	[.1706]	[.0238]

Note: Figures in parentheses are the absolute values of p-statistics.Hawaii is exculed from original sample. The Hausman test tests the null hypothesis of a random effects model against a fixed effects model.