
Did Proposition 2 1/2 affect local public education in Massachusetts? Evidence from panel data

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Abstract: Did Proposition 2 1/2 affect local public education in Massachusetts? Using a panel data set on school district budgets (1972–1992), the authors find the following. School districts constrained by Proposition 2 1/2 have significantly less own-source revenue. However, constrained districts receive significantly more intergovernmental revenue approximately offsetting the reduced own-source revenue, leading to no significant change in education spending. On the other hand, an analysis of a cross-section of school districts shows that student achievement in constrained districts is significantly lower than unconstrained districts. Thus, the evidence indicates that Proposition 2 1/2 reduces student performance in Massachusetts, even though it has no significant impact on school resources.

Keywords: Proposition 2 1/2; public education; school quality; Massachusetts; TELs.

Reference to this paper should be made as follows: Shadbegian, R.J. and Jones, R.T. (2005) 'Did Proposition 2 1/2 affect local public education in Massachusetts? Evidence from panel data', *Global Business and Economics Review*, Vol. 7, No. 4, pp.363–380.

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1 Introduction

The purpose of this study is to augment previous studies on local Tax and Expenditure Limitations (TELS), which show that TELS are capable of reducing both the size and growth of local government. In particular, this study examines whether or not a particular local TEL, Massachusetts's Proposition 2 1/2, has any impact on the funding and quality of elementary and secondary public school education.¹⁻² Proposition 2 1/2 was passed by the Massachusetts electorate in 1980 by a near 3–2 vote. Proposition 2 1/2 required all Massachusetts cities and towns to reduce their property tax levies by 15% per year until they reached a maximum rate of 2.5% of the assessed market value. Once each city and town reaches their 2.5% limit, their property tax levy is allowed to grow by 2.5% per year, plus an allowance for new construction. The only way a city or town can raise property taxes by more than 2.5% is if the voters in that city or town approve an 'override' of Proposition 2 1/2. In 1982, the first year Proposition 2 1/2 required property tax cuts, roughly 40% of the state's cities and towns were compelled to make such cuts. In 1983–1984 approximately 10% of the cities and towns needed to make additional property tax cuts to reach their maximum limit – all cities and towns had attained their 2.5% limit by 1984.

Prior to addressing what impact, if any, Proposition 2 1/2 has on public education in Massachusetts, we must understand why voters support TELS like Proposition 2 1/2. For example, do voters support TELS to reduce the size and growth of local government, including education services? The answer to this question seems to be no, since the primary target of local TELS is the local property tax and not total revenue or expenditures. Thus, it seems voters have an alternative motive for supporting local TELS, namely to decrease their local property taxes. The property tax explanation is supported by a survey conducted by the Advisory Commission on Intergovernmental Relations (various years), which finds that voters deem the property tax the least fair. On the other hand, two studies by Ladd and Wilson (1982) and Courant *et al.* (1980) find that voters support TELS not simply to decrease the level of property taxes (or public services), but to decrease the level of government waste, thereby increasing the efficiency of the public sector. Ladd and Wilson specifically conclude that, "the favourable vote (on Massachusetts's Proposition 2 1/2) was more of an attempt to obtain lower taxes and more efficiency in government than to reduce the level of services or to substitute other revenues for the property tax (121)." It seems clear from studies like the ACIR, Ladd and Wilson, and Courant *et al.* that voters do not necessarily desire a decrease in the level of public education services, but only desire a more efficient local government. However, voters may not necessarily get what they want, as Figlio and O'Sullivan (1997) provide evidence suggesting that TELS may not cause school districts to become more efficient.

The USA relies heavily on the public education system to address several important socioeconomic issues, such as long-run increases in the standard of living and reducing income inequality. Thus, the Ladd and Wilson (1982), Courant *et al.* (1980), and Figlio and O'Sullivan (1997) findings lead to an important empirical question: What effect, if any, do TELs have on the funding and quality of public education? To address this question for Massachusetts, the authors use a unique panel data set on a sample of 139 school district budgets (1972–1992), which includes information on the heterogeneity of the property tax limits.³ In particular, the data set allows the authors to control the degree to which school districts are constrained by Proposition 2 1/2, which studies by both Figlio (1997) and Downes and Figlio (1999) argue is important in this type of analysis. Anticipating the results, the authors present evidence that school districts constrained by Proposition 2 1/2 have significantly less own-source revenue to support spending on local public education. However, the results also show that those same constrained districts receive significantly more support in the form of intergovernmental revenues from the state and federal government, approximately offsetting the reduced own-source revenue, leading to no significant decrease in education spending per student.⁴ Furthermore, more severely constrained districts raise even less own-source revenue, but receive even more intergovernmental revenue, again nearly offsetting the lower own-source revenue, and once again leading to no significant impact on education spending per student. On the other hand, an analysis of a cross-section of 134 school districts on student achievement, from the late 1980s and early 1990s, shows that student test scores in constrained districts are significantly lower than districts that are not constrained. Moreover, the evidence shows that students in school districts that are more severely constrained by Proposition 2 1/2 have lower test scores than those students in less constrained districts – although this effect is not significant. Thus, the evidence suggests that Proposition 2 1/2 reduced long-run student performance in Massachusetts, even though it has no significant impact on school resources.

Section 2 provides a brief summary of local TEL studies. Section 3 outlines the data and empirical specification. The regression results are presented in Section 4 and, finally, Section 5 offers some concluding remarks and possible extensions.

2 Local TEL studies

2.1 TELs and local government size

Many researchers, including Joyce and Mullins (1991), Preston and Ichniowski (1991), and Shadbegian (1998; 1999), have investigated the effect of local TELs on various aspects of local government. Joyce and Mullins (1991) do not control for important factors, such as income and population, which prior theoretical and empirical analysis have shown to be significant in determining public spending, thus not surprisingly, their study finds no support for the proposition that TELs reduce government size and growth.⁵ However, Preston and Ichniowski (1991) and Shadbegian (1998; 1999), using a formal multiple regression framework, do control for the important effects of both population and income, as well as other relevant factors, and do find evidence that TELs reduce the size and growth of local government.

2.2 TELs and local public education

Recent studies by Downes (1992), Downes *et al.* (1998), Figlio (1997; 1998), Bradbury *et al.* (2001), and Shadbegian (2003) examine the effect of TELs on different aspects of public education. Downes (1992), using two cross-sections of California school districts, one prior to the *Serrano vs. Priest II* and Proposition 13 (1976–1977) – California’s version of Proposition 2 1/2 – and one after (1985–1986), finds that there has been a significant convergence across school districts in education spending per student. However, Downes does not find any significant reduction in student performance, indicating that Proposition 13 has not produced any long-run adverse effects on student outcomes. Downes *et al.* (1998), using a panel data set on school districts in Illinois (1987–1988 to 1994–1995), provide only limited evidence that student performance in school districts constrained by a tax limitation has fallen relative to school districts not subject to tax limitations. Figlio (1997), using nationwide school district data for 1988 and 1991, finds that TELs lead to significantly higher student-teacher ratios, lower starting salaries for teachers and lower student performance. Figlio (1998), using a panel data set on Oregon school districts (1987–1993), provides evidence that Oregon’s Measure five has significantly increased the student-teacher ratio and that the burden of reduced revenues has been shared roughly equally by instruction and administration. Bradbury *et al.* (2001) provide evidence that Massachusetts communities constrained by Proposition 2 1/2 spent significantly less on public schools between 1990–1994. Finally, Shadbegian (2003), using a panel data set on state and local public school budgets (1966–1992), shows that local TELs: 1) decrease the level of local own-source expenditures per student on public education; 2) increase the level of per student state aid for public education, completely offsetting the decrease in local spending; 3) slightly increase student-teacher ratios; and 4) have no impact on teacher’s salaries. Furthermore, Shadbegian shows that TELs which place a greater constraint on local government budgets do lower overall spending per student, only slightly increase student-teacher ratios, and still have no significant impact on teacher salaries.

3 Data and the empirical specification

The first data set employed in this study contains information on school district finances from the five Census of Government years 1972, 1977, 1982, 1987 and 1992, and economic and demographic data from the three Decennial Census years 1970, 1980 and 1990, on a sample of 139 school districts in Massachusetts yielding 695 observations.⁶ The 1972–1992 sample period is appropriate to analyse the effects of Proposition 2 1/2 since it contains two years of school district finance data prior to Proposition 2 1/2 taking effect (1972 and 1977) and three years of school district finance data while it was in effect (1982, 1987 and 1992). To indicate the amount of variation in the sample, Table 1 contains the mean and standard deviation of all variables used in this part of the study.^{7–8}

Table 1 Summary statistics (OBS = 695)

<i>Dependent variables</i>			<i>OSREVPC^a</i>	<i>IGRPC^a</i>	<i>EDUCPS^a</i>
Mean (standard deviation)			733.971 (284.619)	293.014 (146.840)	3242.927 (1083.354)
<i>Independent variables</i>			<i>Expected signs</i>		
TEL	0.414	(0.493)	–	+	–
TEL2_3	0.121	(0.326)	–	+	–
OVERRIDE	0.062	(0.241)	+	NA	+
POP ^a (1000's)	35.224	(52.879)	–	–	–
INCOME ^a (1000's)	25.037	(8.073)	+	–	+
IGRPC ^a	293.014	(146.840)	?	NA	?
AGE18	29.197	(6.509)	–	?	–
AGE65	11.713	(3.836)	–	?	–
EDUCLEV	71.535	(14.991)	+	+	+

Note: a – Measured in logs in the regressions

OSREVPC = Local government's real own-source revenues per capita

IGRPC = Local government's intergovernmental revenue per capita from the state and federal government

EDUCPS = Local government's real direct expenditures on education per student

TEL = A dummy variable equal to 1 in 1982, 1987, and 1992 if school district *i* was required to cut property taxes for at least one year

TEL2_3 = A dummy variable equal to 1 in 1982, 1987, and 1992 if school district *i* was required to cut property taxes for two or three years

OVERRIDE_{it} = A dummy variable equal to 1 in 1987 and/or 1992 if school district *i* passed an override vote to enhance either the general operating budget or the school budget

POP = Population

INCOME = Real median family income

AGE18 = Percent of the population below the age of 18

AGE65 = Percent of the population over the age of 65

EDUCLEV = Percent of the population over 25 with at least 12 years of education

Sources: Massachusetts Municipal Profiles (various years)

– TEL, TEL2_3, and OVERRIDE

Governmental Finances (1972–1987) US Bureau of the Census

– OSREVPC, EDUCPS, and IGRPC

Census of Population (1970, 1980, and 1990)

– POP, INCOME, AGE18, AGE65, and EDUCLEV

The following three equations are estimated (separately) to determine the effect of Proposition 2 1/2 on the provision of public education in Massachusetts:

$$\begin{aligned}
 OSREVPC_{it} = & \alpha_0 + \alpha_1 TEL_{it} + \alpha_2 TEL2_3_{it} + \alpha_3 OVERRIDE_{it} + \alpha_4 POP_{it} \\
 & + \alpha_5 INCOME_{it} + \alpha_6 IGRPC_{it} + \alpha_7 AGE18_{it} + \alpha_8 AGE65_{it} \\
 & + \alpha_9 EDUCLEV_{it} + \sum \alpha_i TD_i + \sum \alpha_i SD_i + e_{it}
 \end{aligned} \quad (1)$$

$$IGRPC_{it} = \beta_0 + \beta_1 TEL_{it} + \beta_2 TEL2_3_{it} + \beta_3 POP_{it} + \beta_4 INCOME_{it} + \beta_5 AGE18_{it} + \beta_6 AGE65_{it} + \beta_7 EDUCLEV_{it} + \sum \beta_i TD_t + \sum \beta_i SD_i + u_{it} \quad (2)$$

$$EDUCPS_{it} = \delta_0 + \delta_1 TEL_{it} + \delta_2 TEL2_3_{it} + \delta_3 OVERRIDE_{it} + \delta_4 POP_{it} + \delta_5 INCOME_{it} + \delta_6 IGRPC_{it} + \delta_7 AGE18_{it} + \delta_8 AGE65_{it} + \delta_9 EDUCLEV_{it} + \sum \delta_i TD_t + \sum \delta_i SD_i + v_{it} \quad (3)$$

where:

- $OSREVPC_{it}$ = Log of local government's real own-source revenues per capita
 $IGRPC_{it}$ = Log of local government's intergovernmental revenue per capita from the state and federal government
 $EDUCPS_{it}$ = Log of local government's real direct expenditures on education per student
 TEL_{it} = A dummy variable equal to one in 1982, 1987, and 1992 if school district i was required to cut property taxes for at least one year
 $TEL2_3_{it}$ = A dummy variable equal to one in 1982, 1987, and 1992 if school district i was required to cut property taxes for two or three years
 $OVERRIDE_{it}$ = A dummy variable equal to one in 1987 and/or 1992 if school district i passed an override vote to enhance either the general operating budget or the school budget
 POP_{it} = Log of population
 $INCOME_{it}$ = Log of real median family income
 $AGE18_{it}$ = Percent of the population below the age of 18
 $AGE65_{it}$ = Percent of the population over the age of 65
 $EDUCLEV_{it}$ = Percent of the population over 25 with at least 12 years of education
 TD_t = A set of time dummy variables
 SD_i = A set of school district dummy variables

The above framework is similar to that employed by Figlio (1997; 1998) and Shadbegian (2003) and it takes into account both demographic and economic characteristics of school districts shown by Poterba (1997) to affect the provision of public education. Given the panel structure of the data set, it is also possible to control for unobserved heterogeneity, when analysing the effects of Proposition 2 1/2 on public school funding, by including a set of school district dummy variables. Each model also controls for time-invariant effects by including a set of time dummy variables.

The regression results presented below include models both with and without school district dummies (Fixed Effect (FE) and OLS estimates respectively); all models include time dummies. The OLS estimates reflect both the variation between and within school districts over time, whereas the fixed effect coefficients reflect only the variation within each school district over time.⁹

What are the expected effects of POP, INCOME, IGRPC, AGE18, AGE65, EDUCLEV, OVERRIDE, TEL, and TEL2_3 on the funding of public education (see Table 1 for a summary)? POP acts as a scale variable most likely decreasing local direct expenditures on education, own-source revenue and intergovernmental revenue, since higher populations should be associated with scale economies in the production of public education. Assuming public school services are normal goods, INCOME should increase

both own-source revenue and local spending on public education. Assuming the state and federal government act, at least in part, to equalise resources across school districts, INCOME should have a negative influence on intergovernmental revenue. IGRPC could have either a positive or negative effect on both own-source revenue and local spending on public education, depending on local government's response to it. In other words, the effect of IGRPC depends on whether or not local government treats it as a substitute or a complement for local revenue and spending. AGE18 should have a negative influence on local spending for education, since districts with a larger number of school-age children should be able to take advantage of scale economies; therefore, AGE18 should also decrease own-source revenue. In general, older citizens rely more heavily on state and federally provided public services (*e.g.*, Medicare and Social Security). Thus, AGE65 should decrease both the level of own-source revenue and funding for public education, as districts with a larger percentage of elderly should have a lower demand for most local public services, including public education. AGE18 and AGE65 have an uncertain effect on IGRPC. EDUC12 is expected to increase the demand for public education, thereby increasing the level of spending on public education, which in turn should increase own-source revenue and intergovernmental revenue as well. A successful OVERRIDE vote of Proposition 2 1/2 should increase both own-source revenue and local spending on public education.

Assuming school districts in which Proposition 2 1/2 requires property tax cuts find it more difficult to raise local revenue (*i.e.*, school districts cannot raise enough 'other' miscellaneous revenue to make up for lost property tax revenue), TEL should have a negative influence on own-source revenue.¹⁰ TEL2_3 indicates a school district which needs to make property tax cuts for at least two years, therefore based on the above logic TEL2_3 should have an even larger negative effect on own-source revenue than TEL. It is expected that the state government will attempt to make up for at least part of the lost local revenue due to Proposition 2 1/2, therefore both TEL and TEL2_3 are expected to have a positive influence on intergovernmental revenue, with the effect of TEL2_3 being larger.¹¹ The expected effect of TEL and TEL2_3 on local spending on education depends on the 'net' impact of TEL and TEL2_3 on total local revenue (own-source plus intergovernmental). If TEL and TEL2_3 reduce total local revenue, they would be expected to reduce local spending on education. However, if TEL and TEL2_3 have no significant impact on total local revenue, they would be expected to have no significant effect on local spending on education.

3.1 Econometric issues

The estimation of Equations (1–3) presents a number of potential econometric problems. First, it is possible that IGRPC is endogenous in Equations (1–3), since the allocation formulae for intergovernmental transfers in most instances depend on both local fiscal and socioeconomic conditions. A Hausman specification test is used to examine for the possible endogeneity of IGRPC. The results of these tests reject the exogeneity of IGRPC only in the OLS version of Equation (3); therefore, IGRPC is treated as exogenous.¹² Second, since the data set consists of pooled cross-sectional, time-series data, the error terms are likely to be both autocorrelated and heteroskedastic; a preliminary check of the disturbances confirms that in all models the disturbances are both heteroskedastic and autocorrelated. Therefore, all the standard errors have been corrected for autocorrelation and heteroskedasticity using the Huber/White/sandwich estimator of the variance.

3.2 Proposition 2 1/2 and student performance

The following equation is estimated, using a cross-section of 134 Massachusetts school districts (a subset of the 139 used to estimate Equations 1–3), to determine the effect of Proposition 2 1/2 on student performance in Massachusetts:¹³

$$\begin{aligned} MEAP_i = & \mu_0 + \mu_1 TEL_i + \mu_2 TEL2_3_i + \mu_3 OVERRIDE_i + \mu_4 EDUCPS_i \\ & + \mu_5 TEAPAY_i + \mu_6 S/T\ RATIO_i + \mu_7 PUBLIC_i \\ & + \mu_8 EDUCLEV_i + \mu_9 POOR_i + \mu_{10} SINGLE\ MOM_i + e_i \end{aligned} \quad (4)$$

Student performance is measured using student test scores on eighth grade reading and math assessment (Massachusetts Educational Assessment Program (MEAP)) exams between 1988 and 1992 (since the sample time frame for the budgetary analysis ends in 1992) – the first year MEAP was conducted was 1988.¹⁴ The MEAP exams are not designed for comparison between years, therefore the average MEAP score between 1988–1992 is used as the measure of student performance. It may seem unreasonable to use the average MEAP scores from 1988–1992 to measure the effect of Proposition 2 1/2 on student performance since Proposition 2 1/2 took effect in 1982; however, as Downes and Figlio (1999) argue, it is unlikely that TELs will affect school quality in the short-run. Also, Figlio and Rueben (2001) find that TELs substantially lower the quality of teachers entering a state's teaching force. The negative impact of lower teacher quality on public school quality will take time to work through the system. Thus, it is reasonable to use the average MEAP score (1988–1992) to analyse the long-run effects of Proposition 2 1/2 on student performance.¹⁵

To lower the likelihood of spuriously ascribing lower test scores to Proposition 2 1/2, Equation (4) includes variables previously found to be important in determining student achievement. The variables are: log of EDUCPS in 1987; TEAPAY, the log of the average teacher's salary in 1990; S/T RATIO, the log of the student-teacher ratio in 1990; PUBLIC, the log of the number of students enrolled in public schools in 1990; EDUCLEV, the percentage of the population over 25 with more than 12 years of education in 1990; POOR, the percentage of the families living below the poverty line in 1990; and SINGLE MOM, the percentage of households with school-age children that are headed by single mothers in 1990.

What are the expected effects of EDUCPS, TEAPAY, S/T RATIO, PUBLIC, EDUCLEV, POOR, SINGLE MOM, OVERRIDE, TEL and TEL2_3 on student performance (see Table 5 for a summary)? EDUCPS, TEAPAY and S/T RATIO are three key inputs in producing education. There is mixed empirical evidence on the relationship between measured school inputs and student performance. Hanushek (1986) summarises the voluminous pre-mid 1980s literature on the impact of measured school inputs on student performance by stating, 'there appears to be no strong or systematic relationship between school expenditures and student performance'. However, more recent studies by Eide and Showalter (1998) and Figlio (1999) suggest that higher spending per student, higher teacher salaries, and lower student-teacher ratios are associated with higher student performance. Thus it is unclear if higher spending per student and higher teacher salaries should be indicative of higher quality education or not. However, we expect EDUCPS and TEAPAY to have a positive effect on school performance, while recognising the possibility that they may have no significant impact. Furthermore, we expect lower student-teacher ratios to be associated with better classroom instruction,

therefore the S/T RATIO is expected to have a negative impact on school performance. A recent paper by Shadbegian and Ott (2001) suggests that the number of students (PUBLIC) has a ‘congestion’ effect and therefore it is expected to negatively impact student performance. EDUCLEV, POOR and SINGLE MOM are included to control for socioeconomic factors which, since the Coleman Report (1966), have been widely accepted as influencing student performance. EDUCLEV is expected to have a positive impact on student performance, since more highly educated households should provide a more positive learning environment, making it easier for their children to learn. On the other hand, POOR and SINGLE MOM are expected to have the opposite effect as poorer families and families headed by a single mother find it more difficult to find time to monitor their children’s education, hence making it more difficult to educate their children. A successful OVERRIDE vote of Proposition 2 1/2 should have a positive impact on local spending on public education and therefore should have a positive impact on student performance. Finally, based on previous arguments and work by Downes and Figlio (1999) and Figlio and Rueben (2001), it is expected that Proposition 2 1/2 (TEL and TEL2_3) will have a negative impact on student performance.

4 Results

The first set of regression results are presented in Tables 2–4; as mentioned above, each model is estimated with and without school district dummy variables. Since an F-test indicates that the school district effects are jointly significant in all models, the discussion below focuses on the FE models – for comparison, all the OLS results are also presented.

Table 2 Proposition 2 1/2 and local governments own-source revenue

	2A		2B		2C		2D	
CONSTANT	1.006**	(0.489)	3.495***	(1.083)	0.954**	(0.497)	4.107***	(1.121)
TEL	–0.024	(0.032)	–0.060**	(0.025)	–0.019	(0.032)	–0.041	(0.025)
TEL2_3					–0.033	(0.044)	–0.083***	(0.032)
OVERRIDE	0.032	(0.052)	0.015	(0.035)	0.037	(0.053)	0.017	(0.034)
POP	0.160***	(0.017)	0.076	(0.107)	0.163***	(0.018)	0.033	(0.109)
INCOME	0.859***	(0.088)	0.746***	(0.115)	0.851***	(0.086)	0.680***	(0.116)
IGRPC	0.002	(0.037)	0.005	(0.026)	0.009	(0.037)	0.010	(0.025)
EDUCLEV	0.008***	(0.001)	–0.003	(0.003)	0.008***	(0.001)	–0.003	(0.003)
AGE18	0.008**	(0.004)	–0.003	(0.004)	0.008**	(0.004)	–0.002	(0.004)
AGE65	0.030***	(0.005)	0.002	(0.007)	0.031***	(0.005)	–0.000	(0.007)
R ²	0.609		0.891		0.609		0.893	
ESTIMATOR	OLS		FE		OLS		FE	

Notes: All models include year dummies

(Standard errors) have been corrected for autocorrelation and heteroskedasticity

*** = Significant at the 1% level or better

** = Significant at the 5% level or better

* = Significant at the 10% level or better

Table 3 Proposition 2 1/2 and local governments intergovernmental revenue

	3A	3B	3C	3D
CONSTANT	5.534*** (0.654)	13.563*** (2.057)	5.645*** (0.653)	12.945*** (2.076)
TEL	0.267*** (0.035)	0.180*** (0.048)	0.217*** (0.034)	0.161*** (0.048)
TEL2_3			0.242*** (0.035)	0.076 (0.047)
POP	0.140*** (0.022)	-1.109*** (0.242)	0.110*** (0.023)	-1.066*** (0.242)
INCOME	-0.659*** (0.135)	-0.295 (0.292)	-0.569*** (0.133)	-0.233 (0.293)
EDUCLEV	-0.007*** (0.002)	0.019*** (0.004)	-0.007*** (0.002)	0.020*** (0.004)
AGE18	0.027*** (0.005)	0.045*** (0.010)	0.026*** (0.005)	0.044*** (0.010)
AGE65	-0.007 (0.007)	0.016 (0.012)	-0.008 (0.007)	0.018 (0.012)
R ²	0.577	0.806	0.597	0.807
ESTIMATOR	OLS	FE	OLS	FE

Notes: All models include year dummies

(Standard errors) have been corrected for autocorrelation and heteroskedasticity

*** = Significant at the 1% level or better

** = Significant at the 5% level or better

* = Significant at the 10% level or better

Table 4 Proposition 2 1/2 and local governments' own-source spending on public education

	4A	4B	4C	4D
CONSTANT	3.853*** (0.452)	6.895*** (1.686)	3.897*** (0.461)	6.636*** (1.733)
TEL	0.071* (0.041)	0.055 (0.046)	0.066* (0.041)	0.047 (0.045)
TEL2_3			0.028 (0.023)	0.035 (0.029)
OVERRIDE	0.090*** (0.033)	0.026 (0.025)	0.086*** (0.033)	0.025 (0.025)
POP	0.093*** (0.018)	-0.029 (0.174)	0.090*** (0.018)	-0.011 (0.177)
INCOME	0.718*** (0.083)	0.337** (0.146)	0.725*** (0.084)	0.365** (0.151)
IGRPC	0.170*** (0.036)	0.127*** (0.050)	0.165*** (0.038)	0.126*** (0.050)
EDUCLEV	0.004*** (0.001)	-0.004 (0.003)	0.004*** (0.001)	-0.004 (0.003)
AGE18	-0.015*** (0.003)	-0.013** (0.006)	-0.015*** (0.003)	-0.013** (0.006)
AGE65	0.005 (0.005)	0.008 (0.007)	0.005 (0.005)	0.009 (0.007)
R ²	0.563	0.794	0.564	0.794
ESTIMATOR	OLS	FE	OLS	FE

Notes: All models include year dummies

(Standard errors) have been corrected for autocorrelation and heteroskedasticity

*** = Significant at the 1% level or better

** = Significant at the 5% level or better

* = Significant at the 10% level or better

Prior to addressing the impact of Proposition 2 1/2 on the provision of local public education, the economic impact of the control variables is considered. POP has the expected negative effect on intergovernmental revenue and educational spending; however, the impact is significant only for intergovernmental revenue. INCOME has the expected significant positive effect on own-source revenue and education spending, and the expected (yet insignificant) negative effect on intergovernmental revenue. AGE18 has the expected negative influence on own-source revenue and educational spending – however, the effect is significant only for education spending – whereas AGE65 has no significant impact on own-source revenue, intergovernmental revenue or education spending. EDUCLEV has the expected significant positive influence on intergovernmental revenues, but an unexpected negative (yet insignificant) effect on both own-source revenue and education spending. Finally, OVERRIDE has the expected positive effect on both own-source revenue and education spending, but the effect is never significant – which is not unexpected given the relatively low percentage of successful override votes (there were only 43 successful override votes to increase either the general operating budget or school budget between 1983–1992).

Turning now to the impact of Proposition 2 1/2 on the provision of public education in Massachusetts. The results in Table 2 indicate that Proposition 2 1/2 has the expected significant negative effect on own-source revenue. More specifically, based on the mean values of the variables (in model 2D with both TEL and TEL2_3 included), the magnitude of the TEL coefficients indicate that school districts which had to cut property taxes for one year have roughly \$30 per capita lower own-source revenue than expected (just over 4%), though this effect is not quite significant.¹⁶ If the district faces more than one year of property tax cuts, own-source revenues are nearly \$90 lower than expected (almost 12%), significantly lower than districts that need to cut property taxes for only one year.¹⁷

The regression results in Table 3 indicate that Proposition 2 1/2 has the expected significant positive effect on intergovernmental revenue. In particular, based on the mean values of the variables (in model 3D with both TEL and TEL2_3 included), the magnitude of the TEL coefficients indicate that school districts which must cut property taxes for one year receive roughly \$50 per capita more in intergovernmental revenue than expected (roughly 17.5%). If the district faces more than one year of property tax cuts, intergovernmental revenues are approximately \$80 more than expected (roughly 27%), although the difference between one or more years of tax cuts is insignificant in this case (*i.e.*, the coefficient of TEL2_3 is not quite significant). These results indicate that intergovernmental revenues increase in communities constrained by Proposition 2 1/2 to make up for the lost own-source revenue.

The combined results from models 2D and 3D indicate that the net effect of Proposition 2 1/2 on total local revenue is approximately zero. More specifically, the point estimates of the impact of Proposition 2 1/2 indicate that communities which have to cut property taxes for only one year actually experienced a slight increase (\$20 per capita) in total local revenue (own-source plus intergovernmental revenue). However, communities that cut property taxes for more than one year have a slight decline in total local revenue (\$10 per capita).

The regression results in Table 4 indicate that Proposition 2 1/2 does not have a significant effect on public education expenditures – the TEL and TEL2_3 coefficients are never significant. However, this is not an unexpected result since Proposition 2 1/2

does not have any significant impact on total local revenue available to fund education. Does the finding that Proposition 2 1/2 has no significant effect on school spending imply that it will have no impact on student outcomes? Downes and Figlio (1999) argue that even though TELs may not affect spending per student if the state and/or the federal government provides intergovernmental revenue to replace lost own-source revenue, TELs may still reduce student performance. Downes and Figlio maintain that increased centralisation of the provision of public education, due to TELs, may thwart competition between local governments, thereby increasing the level of technical inefficiency, leading to a decline in student performance. Furthermore, Bradbury *et al.* (1998) show that Proposition 2 1/2 interfered with the efficient allocation of families among communities, by causing families with children to 'vote with their feet' out of communities with constrained budgets and into communities with unconstrained budgets. Thus, there is both theoretical and empirical evidence to suggest that Proposition 2 1/2 could lead to a decrease in the efficiency of the local public sector in Massachusetts, which leads to an important empirical question: has Proposition 2 1/2 led to a decline in student performance? This question is answered using a cross-section of 134 (a subset of the 139 used to estimate Equations 1–3) school districts in Massachusetts. To indicate the amount of variation in this sample, Table 5 contains the mean and standard deviation of all variables used in this analysis.

The results in Table 6 indicate that student test scores in school districts forced to make property tax cuts in the early 1980s are lower relative to school districts which did not have to make such cuts. Prior to addressing the specific impact of Proposition 2 1/2 on student outcomes, the economic impact of the control variables is considered. First, in model 6B, all the control variables have the expected sign, but not all of them are significant. In particular, PUBLIC has a significant negative impact on student performance and EDUCLEV has significant positive impact on student performance. On the other hand, the school input variables are not successful in terms of significance, although EDUCPS and TEAPAY do have the expected positive impact on student performance, and S/T RATIO has the expected negative effect on student performance.

We now return to the initial question of the impact of Proposition 2 1/2 on student performance. The TEL coefficients in model 6B indicate that student performance in school districts which are required to make property tax cuts for one year is 1.5% lower than in unconstrained districts. Furthermore, student performance in those districts forced to make property tax cuts for two or three years is 3.2% lower than in unconstrained districts. Thus, even though Proposition 2 1/2 has no 'net' effect on either total local resources available to fund public education or education spending per pupil, it does, as Downes and Figlio (1999) argue it could, reduce long-run student performance.

It is theoretically possible that student performance in school districts constrained by Proposition 2 1/2 may have been relatively worse than unconstrained school districts even prior to the passage of Proposition 2 1/2. Therefore, all our Proposition 2 1/2 dummy variables are indicating is that students in constrained school districts still perform worse than students in unconstrained districts, not that Proposition 2 1/2 caused a decline in school district quality. However, it can be reasonably argued that the constrained districts were the high quality school districts – the ones that were already spending a lot of property tax revenue on public education prior to the passage of Proposition 2 1/2 – and therefore our Proposition 2 1/2 dummy variables are really capturing the impact of the property tax constraint. Unfortunately, the MEAP exams began in 1988 and no other comprehensive statewide standardised test scores are

available in Massachusetts prior to 1988, thus we cannot directly control for student performance prior to the passage of Proposition 2 1/2. Therefore, to indirectly control for student performance prior to the passage of Proposition 2 1/2, we include a lagged version of each control variable in our model, which has been shown in previous studies to be important in determining student achievement. More specifically, we include EDUCPS in 1977; TEAPAY, S/T RATIO and PUBLIC in 1982; and EDUCLEV, POOR and SINGLE MOM in 1980.

Table 5 Summary statistics (OBS = 134)

<i>Dependent variable</i>			<i>MEAP^a</i>
Mean (standard deviation)			2.676 (0.174)
<i>Independent variables</i>			<i>Expected signs</i>
TEL	0.709	(0.456)	–
TEL2_3	0.209	(0.408)	–
OVERRIDE	0.045	(0.208)	+
EDUCPS ^a	3514.248	(757.209)	+
TEAPAY ^a (1000's)	34.455	(36.774)	+
S/T RATIO ^a	16.589	(1.860)	–
PUBLIC ^a	4401.813	(5797.446)	–
EDUCLEV	0.825	(0.098)	+
POOR	0.050	(0.045)	–
SINGLE MOM	0.159	(0.083)	–

Notes: a – Measured in logs in the regressions

MEAP = Student performance on the eighth grade reading and math assessment exams between 1988 and 1992

EDUCPS = Local government's real direct expenditures on education per student in 1987

TEAPAY = Average teacher's salary in 1990

S/T RATIO = Student teacher ratio in 1990

PUBLIC = Enrollment in public schools in 1990

EDUCLEV = Percentage of the population over 25 with more than 12 years of education in 1990

POOR = Percentage of the families living below the poverty line in 1990

SINGLE MOM = Percentage of households with children under 18 years old headed by a single mother in 1990

Sources: Massachusetts Municipal Profiles (various years)

– MEAP, TEL, TEL2_3, and OVERRIDE

Massachusetts Municipal Profiles (various years)

– TEAPAY and S/T_RATIO

Governmental Finances (1987) US Bureau of the Census

– EDUCPS

Census of Population (1990)

– PUBLIC, EDUCLEV, POOR, and SINGLE MOM

Table 6 Proposition 2 1/2 and student performance

	<i>6A</i>		<i>6B</i>		<i>6C</i>		<i>6D</i>	
CONSTANT	0.362	(0.315)	0.270	(0.315)	0.357	(0.335)	0.321	(0.338)
TEL	−0.019***	(0.007)	−0.015**	(0.007)	−0.015**	(0.007)	−0.014**	(0.007)
TEL2_3			−0.017**	(0.009)			−0.008	(0.009)
OVERRIDE	−0.001	(0.014)	0.002	(0.014)	−0.007	(0.014)	−0.006	(0.014)
EDUCPS	0.002	(0.019)	0.005	(0.019)	−0.019	(0.028)	−0.020	(0.028)
TEAPAY	0.046	(0.036)	0.052	(0.036)	0.025	(0.038)	0.028	(0.038)
S/T RATIO	−0.004	(0.030)	−0.006	(0.030)	0.009	(0.030)	0.008	(0.030)
PUBLIC	−0.013**	(0.006)	−0.012*	(0.006)	0.026	(0.033)	0.020	(0.033)
EDUCLEV	0.342***	(0.047)	0.337***	(0.047)	−0.007	(0.166)	−0.004	(0.166)
POOR	−0.308	(0.199)	−0.255	(0.199)	−0.465**	(0.234)	−0.442*	(0.235)
SINGLE MOM	−0.045	(0.111)	−0.035	(0.110)	0.223	(0.140)	0.211	(0.141)
Lagged								
EDUCPS					0.023	(0.019)	0.023	(0.019)
TEAPAY					0.040	(0.034)	0.040	(0.034)
S/T RATIO					−0.020	(0.017)	−0.021	(0.017)
PUBLIC					−0.045	(0.033)	−0.038	(0.033)
EDUCLEV					0.245**	(0.125)	0.242**	(0.125)
POOR					−0.568*	(0.303)	−0.520*	(0.308)
SINGLE MOM					−0.046	(0.002)	−0.040	(0.002)
R ²	0.770		0.776		0.807		0.808	

Notes: (Standard errors)

*** = Significant at the 1% level or better

** = Significant at the 5% level or better

* = Significant at the 10% level or better

After including the lagged versions of all our control variables, we still find that student performance is lower in constrained school districts. In particular, the TEL coefficients in model 6D indicate that student performance in school districts that are required to make property tax cuts for one year is 1.4% lower than in unconstrained districts. Furthermore, student performance in those districts forced to make property tax cuts for two or three years is 2.2% lower than in unconstrained districts – although the impact of the additional years of tax cuts is not significant.

5 Concluding remarks and future work

The purpose of this study is to augment previous studies on tax and expenditure limitations by examining whether or not a particular local TELs, Proposition 2 1/2, has any impact on the funding and quality of elementary and secondary public school education in Massachusetts. The results of this study indicate that Proposition 2 1/2 reduces the amount of own-source revenue used to fund public education in constrained

school districts. However, the state and federal government increase the amount of intergovernmental revenue to constrained districts by approximately the same amount, which neutralises the effect of Proposition 2 1/2 on total spending on public education per student. The same result occurs in school districts which are forced to make tax cuts for two or three years. More specifically, the point estimates of the impact of Proposition 2 1/2 indicate that communities which cut property taxes for only one year actually experience a slight increase in total local revenue (\$20 per capita) and communities that cut property taxes for more than one year experience a slight decline in total local revenue (\$10 per capita). Thus, the only real effect of Proposition 2 1/2 on the funding of public education is to shift more of the responsibility of funding from the local governments to the state and federal government.

The results of this study also show that although Proposition 2 1/2 has no 'net' effect on total spending on education per student, it does reduce student performance. In particular, student performance in school districts that had to make property tax cuts for one year is 1.4% lower than student performance in unconstrained districts. Furthermore, those districts forced to make property tax cuts for two or three years have 2.2% lower student performance – although the difference is not significant. These results lend credence to the Downes and Figlio (1999) argument that TELs may lower student outcomes even if they have no 'net' impact on education spending.

The impact of Proposition 2 1/2 on student outcomes in Massachusetts is consistent with Figlio's (1997) nationwide results and the Downes *et al.* (1998) third grade reading results in Illinois, but not with the Downes (1992) Proposition 13 results in California. The differences in the findings of these studies highlight the importance of additional research in this area to determine why some TELs reduce student outcomes while others do not.

We plan to extend this paper in a number of ways. First, we would like to examine the impact of Proposition 2 1/2 on individual student outcomes, where it would be possible to control for individual characteristics as well as school district characteristics. Second, we would like to examine whether or not a decrease in teacher quality is caused by Proposition 2 1/2, and if it is, to examine whether or not it is at least partly responsible for the decline in student performance. Third, we would like to extend our data set on both school district finances and student performance beyond 1992 to examine the longer term impact of Proposition 2 1/2 on student performance in Massachusetts. Finally, we plan to examine the issue raised by Bradbury *et al.* (1998): did Proposition 2 1/2 decrease the efficiency of the public sector in Massachusetts?

Acknowledgements

We would like to thank Katharine Bradbury for providing some of the data for this study. We would also like to thank Wayne Gray and Attiat Ott, the participants in the 'Public sector reforms: good intentions, bad outcomes?' session at the 47th Annual International Atlantic Economic Conference in Montreal, Canada, 1999, and two anonymous referees for useful suggestions. All remaining errors or omissions are of course our own.

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Notes

- 1 A local TEL is a TEL imposed exclusively on local government budgets, whereas a state-level TEL refers to a TEL imposed exclusively on state government budgets – a state may have either or both of these TELs. This study focuses exclusively on a particular local TEL, Massachusetts' Proposition 2 1/2; so TEL and local TEL are used interchangeably.
- 2 For the remainder of the paper, elementary and secondary public school education will be shortened to public education.
- 3 All 139 school districts in this study are coterminous with the city or town where they are located.
- 4 This is not unlike California's experience with Proposition 13. Galles and Sexton (1998) note that while Proposition 13 reduced local property taxes, as expected, local governments found other forms of revenues to approximately offset the loss of property tax revenue.
- 5 See Borchering and Deacon (1972), Bergstrom and Goodman (1973), Borchering (1977) and Oates (1985).
- 6 In Massachusetts, school districts are coterminous with a city or town (municipality). All the municipalities used in this study operate their own K-12 public schools or operate their own K-8 public schools and then participate in a regional high school. In the latter case, the district's enrollment and expenditures in the regional high school have been attributed back to them.
- 7 All variables used in this study are measured in real terms (1982–1984 dollars).
- 8 The population and school enrollment data come from the 1970, 1980 and 1990 decennial censuses, while the expenditure and revenue data come from the 1972, 1977, 1982, 1987 and 1992 Census of Governments. Therefore, we have estimated (based on linear interpolation) population and school enrollment to match the Census of Government years.
- 9 See Hsiao (1989) pp.25–32 or Greene (2000) pp.560–567.

- 10 Shadbegian (1999) finds that local governments constrained by TELs try to increase 'other' revenues to offset the decrease in property tax revenue.
- 11 It is also possible that Massachusetts's congressional delegation will lobby for and receive increases in federal support for communities constrained by Proposition 2 1/2.
- 12 The lagged value of IGRPC and the lagged value of the percent of the population living below the poverty line are used as instruments. All results are available upon request.
- 13 A similar equation was estimated by Sander (1993).
- 14 Test scores are far from a perfect measure of 'school quality' from the point of view of educational value-added derived from the resources in place at the school (teacher quality, quality of the infrastructure, *etc.*), since they reflect influences, such as peer effects – the quality of a student's classmates and its influence in determining expectations and performance – which are not part of the school districts budgetary decisions. However, from the parents' perspective of wanting the finest education for their children, these peer effects can also be a very important factor, therefore test scores can be a practical way to think about school quality.
- 15 The combined eighth grade reading and math MEAP scores for the individual years 1988, 1990 and 1992 were also used as a measure of school quality in place of the 1988–1992 MEAP average – there were no qualitative differences in the results. For a more detailed description of the school quality measure, see Bradbury *et al.* (1998). We also wish to thank Katharine Bradbury for providing us with this data.
- 16 The marginal effect of a dummy variable when the dependent variable is measured in logs is calculated as $\exp(\alpha) - 1$ as suggested by Halvorsen and Palmquist (1980).
- 17 Equation (1) is also estimated when own-source revenues are disaggregated into its component parts taxes per capita and miscellaneous revenues per capita. The results indicate that Proposition 2 1/2 significantly reduced taxes, yet had no significant effect on miscellaneous revenues. All these results are available upon request. The reason we do not use property taxes per capita as the dependent variable is that data on property taxes is not available at school district level in 1982 and 1987. However, at the aggregate level property taxes remain 97%–99% of total local taxes in Massachusetts during the 1972–1992 period.