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Number 0425

December 2004

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in Education Finance in Vermont**

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Preliminary draft; please do not quote or cite without permission of the authors. The authors thank Therese McCarty for her assistance, Bill Talbot and Jonathan Cogan for help with Vermont school finance law and data, and seminar participants at Rensselaer Polytechnic Institute for helpful comments.

Abstract

In 1997, Vermont passed Act 60, which reformed its education finance system to achieve greater equality of spending within the state. Like other recent education finance reforms that included strong and transparent incentives to reduce spending, Act 60 was politically very unpopular. In February 2004, Vermont passed Act 68, an attempt to achieve court-mandated education equalization at a lesser political cost than that required by Act 60. In this paper we analyze the incentives for local spending created by Act 60 and Act 68, and estimate the effects the change will have on spending inequality in Vermont. We find that Act 68 greatly reduces spending disincentives created by Act 60, but reduces them disproportionately for wealthy towns. As a result it increases inequality of spending in Vermont relative to Act 60. Because spending is quite inelastic with respect to tax prices, however, the increase in inequality is not very large relative to existing inequality. Act 68 does result in lower tax prices in all towns in Vermont and hence produces a moderate increase in education spending statewide. It has also been more politically acceptable than its predecessor, though not unanimously supported. Our findings emphasize the importance of marginal effects of education finance, and suggest that understanding the way in which towns respond to the incentives those effects create is critical in designing successful education finance reforms. They also show that a re-reform of education finance in response to political criticism of an initial reform can reduce political concerns without greatly decreasing the equalizing incentives.

I. Introduction

Spending on education in the United States has traditionally been financed by local property taxes, with the result that wealthy school districts have been able to spend more money per student than poor districts. In the last thirty years, many states, facing criticism that their education systems perpetuated inequality among their citizens, have reformed their education finance systems in an attempt to break the link between wealth and learning. In order to meet political pressure, or in many states court requirements, to guarantee equal education to students in different school districts, states have shifted more of the costs of education finance to the state level, shifting the burden away from its traditional level. These reforms can be politically unpopular if they have strong “leveling-down” effects, reducing expenditures in wealthy districts.¹

If, as a result of an education finance reform, a state awards the same amount of money per student to all districts, or sends more money to poor districts, then the state can reduce the correlation between wealth and education expenditure in its districts. However, a change from local to state financing can also change the opportunity cost of education spending for local governments. This occurs because the link between local spending and state aid is changed; it can also occur if the state chooses to mandate minimum spending levels, or discourage local education spending above certain levels. These effects can cause the total amount of education spending in the state to rise or fall. If the change in opportunity costs differs across districts, then this can also lead to changes in spending inequality within the state, as some districts increase (or decrease) spending by more than others in the face of a stronger incentive to do so to capture state aid.

¹ Minter-Hoxby (2001) discusses the difference between leveling-down and leveling-up in detail.

In this paper we consider the case of Vermont, which has reformed its education finance system twice in an attempt to produce a version satisfactory to both its courts and its voters. In 1997, Vermont passed Act 60, a school finance reform mandated by the Vermont Supreme Court in the case of *Brigham v. State of Vermont*. Act 60 was a relatively aggressive reform, which combined a foundation grant program with a power equalization formula that required property tax rates to vary with local wealth. Act 60 was also unusually transparent about the method of financial equalization. Under Act 60, local spending above the foundation level was funded by a “sharing pool”, which was funded entirely by local property tax revenues and not commingled with state aid. Towns with high property tax values and/or high spending were required to set local property tax rates that generated revenue in excess of spending, and contribute the excess to the sharing pool. Other towns with low property values and/or spending were allowed to set property tax rates which generated revenues below local spending, and the balance was funded out of the sharing pool. Rates were set each year so that inflows to the sharing pool exactly matched outflows; thus, no state money went into the sharing pool, and wealthy towns could easily calculate the exact amount of local money that was being used to subsidize education in poorer towns. Rates were proportional to local spending, so that a town that raised local spending would also be forced to increase its contribution to the sharing pool for other towns in the state (or reduce its draw from the sharing pool, if it was a recipient from the pool). This created a substantial incentive for wealthy towns to reduce their school spending, and resulted in considerable leveling-down, with several of the wealthiest towns in Vermont reducing their spending all the way down to the foundation grant amount.

Act 60 lasted only seven years before the political backlash from such a strong and explicit sharing mechanism caught up with it. In 2004, Vermont passed Act 68, which eliminates the sharing pool, reduces local property tax rates in the wealthier towns in Vermont, increases the foundation grant substantially, and relies on an increase in state sales taxes to cover the resulting shortfall in revenues. With the elimination of the sharing pool, Act 68 reduces the incentive for wealthy towns to cut spending to avoid contributions to the sharing pool. However, it also weakens the power equalization formula, and requires the state to share a larger burden of school finance. Both of these changes will substantially affect local incentives for education spending, and may change the extent to which leveling down occurs in Vermont.

In this paper, we analyze the effects that Act 68 will have on education spending in Vermont. We use a median voter model of education spending decisions and the effects of Act 68 on the tax price of education spending to predict how Vermont towns will change their levels of spending in response to the new incentives offered by Act 68. We assess the extent to which Act 68 will raise or lower total spending in Vermont, and will change the inequality of spending across districts in Vermont. We find that Act 68 reduces tax prices of education spending in all towns in Vermont; however, the reduction is greater in wealthy towns than in poor towns. As a consequence, the result of shifting the tax burden to the state is to increase spending by more in wealthy towns than in poor towns, making inequality worse rather than better. However, because the elasticity of spending with regard to the tax price is small, the total change in inequality that arises is small compared to existing inequality. We conclude that education finance reformers

should carefully consider the marginal effects of reforms, not just total spending burdens, in order to achieve their policy goals.

II. Education Finance Reform

The education finance reform movement began in 1967 with the filing of *Serrano v. Priest*, which overturned California's education finance system and required California to take steps towards equalizing expenditures across school districts within the state. School financing in the United States, traditionally done through property taxes assessed by local districts, have permitted wealthy districts to spend more on schooling with lower tax rates than poor districts. These systems have been challenged as unconstitutionally inequitable in more than half the states in the United States; states in which courts have upheld such challenges have been forced to reform their systems of school finance in order to make spending on education more equal. Even states that have had their systems upheld, or have not been challenged, have changed their systems to encourage equality of spending across the state.² Because these reforms require wealthy districts to subsidize spending in poor districts, or reduce their own spending, they have been politically unpopular and have often generated subsequent finance reforms designed to ameliorate the equalizing effects of the court-ordered reforms, such as California's Proposition 13.

Heise (1995) has classified court-ordered reforms into three chronological waves.³ The first wave, from 1971 to 1973, relied on Federal guarantees of equality; it ended when the Supreme Court ruled, in *San Antonio Independent School District v. Rodriguez*,

² Hoxby (2001) lists dates of reforms for 35 states, and notes that a majority of the other 15 do have equalization features in their systems.

³ These waves are discussed at more length in Murray, Evans, and Schwab (1998) on which the present discussion is based.

that the Constitution did not guarantee equality of access to education. The second wave of cases, following immediately on the heels of the Supreme Court's ruling, focused on equal protection clauses in state constitutions. In the third wave, starting in 1989, plaintiffs instead sought reform under education requirements of state constitutions, which allowed them scope to claim broader remedies, and successful challenges in the third wave have led to broader reforms than those of the first two waves.

In 1997, *Brigham v. State of Vermont* required a third-wave reform of Vermont's education finance system. In its ruling, the Vermont State Supreme Court required that Vermont provide "substantially equal access" to education for all Vermont students. Prior to Act 60, Vermont used a traditional school finance system in which the state distributed foundation aid to towns, but spending was otherwise locally determined and locally funded, resulting in higher spending in wealthier towns than poorer ones.⁴ The Court required the Vermont legislature to reform education finance to comply with the state's requirement of equal access to education:

Absolute equality of funding is neither a necessary nor a practical requirement to satisfy the constitutional command of equal educational opportunity... Equal opportunity does not necessarily require precisely equal per-capita expenditures, nor does it necessarily prohibit cities and towns from spending more on education if they choose, but it does not allow a system in which educational opportunity is necessarily a function of district wealth. Equal educational opportunity cannot be achieved when property-rich school districts may tax low and property-poor districts must tax high to achieve even minimum standards. Children who live in property-poor districts and children who live in property-rich districts should be afforded a substantially equal opportunity to have access to similar educational revenues.

The Vermont legislature, having anticipated the decision, responded four months later with Act 60. Act 60 responded to the Court's order in *Brigham v. State of Vermont* by

⁴ Vermont's pre-reform finance system is discussed in Downes (2002).

mandating revenue sharing between wealthy and poor towns. Unlike most third-wave reforms, Act 60 did not rely on an increase in state aid to reduce inequality in spending; instead, it gave the state control over local property tax rates. Vermont towns retained control over local education spending, but tax rates were set according to a formula specified by Act 60. These rates resulted in wealthy and/or high-spending districts setting high tax rates that raised more money than the town spent on education. The excess money went into the “sharing pool”, and was distributed to poor and/or low-spending districts that had tax rates insufficient to fund their spending. Tax rates were set each year to equalize total spending and total revenue statewide; the excess money raised in contributing towns exactly equaled the money required to subsidize recipient towns. Thus, no state money had to be put into the sharing pool. State aid was set equal to a fixed amount and did not change with either district wealth or education spending.⁵

Downes (2002) finds that Act 60 was successful at achieving the Court’s requirements; it significantly weakened the correlation between wealth and equality, and equalized spending per student and, at least slightly, educational outcomes across districts. Act 60 was much less of a success with Vermont voters, particularly those in wealthy districts, which were required to make substantial contributions to the sharing pool. In the most extreme case, the town of Stratton, which contains a major ski resort and very few students, was required to contribute over \$30 to the sharing pool for every \$1 increase in local education spending.⁶ Wealthy towns, known in Vermont as “gold towns,” responded by cutting their education expenditure to avoid contributing to the

⁵ The amount varied from year to year; in FY2003, it was \$5566 per equalized pupil.

⁶ The actual tax price to Stratton voters was lower due to tax exporting (almost all of Stratton’s taxable property is owned by non-residents of the town) and the deduction of local taxes from Federal income taxes. However, Act 60 also produced high tax prices; seven of Vermont’s 254 towns had tax prices in excess of \$1.50 for education. We return to this point below.

sharing pool. Several of them eliminated local education spending altogether, reducing public funding for schools to the state's foundation amount and relying on private fundraising and other methods exempt from the sharing pool to fund the balance. Two towns, Wilmington and Whitingham, filed suit against the state, challenging the fairness of the Act 60 funding system. In a less traditional response, the town of Killington (home of another major ski resort) has threatened to secede from Vermont and join the state of New Hampshire, though it is not even on the New Hampshire border. The town claims it could save as much as \$10 million per year in taxes by doing so.⁷

Responding to these pressures, in February 2004 the Vermont legislature passed Act 68, which repealed Act 60 and replaced it with a second education finance system, aimed to achieve the requirements of *Brigham v. Young* at a much lower political cost. Like Act 60, Act 68 leaves towns in control of spending levels, and sets their tax rates as a function of the amount they choose to spend and property wealth. Unlike Act 60, Act 68 avoids any explicit redistribution of income through the sharing pool. It increases the foundation aid amount and reduces tax rates so that no district raises as much money in tax revenue as it spends. The balance is paid by increased state aid, funded primarily by an increase in the state sales tax. This represents a significant shift of education funding responsibility from towns to the state; it also lowers the tax price of education spending for local governments, since an increased share of expenditures (both total and marginal) is borne by the state government, and hence subject to the tragedy of the commons.

Manwaring and Sheffrin (1997) have studied the effects of increasing state finance of education. They find that, on average, increased state financing reduces total spending. However, the response differs considerably from state to state depending on the way in

⁷ For details, see Zicconi (2004) and Curtis (2004).

which the increase is implemented. They also find that changes in marginal subsidies significantly alter the course of reform. States that centralize control of spending are likely to see increases in equality but larger cuts in total spending, while those that increase aid to poor districts without restraining spending in wealthy ones avoid spending reductions but may not reduce inequality, or may even increase it.

Hoxby (2001) examines the effects of school finance equalizations on spending and equality across the United States. She finds that different equalizations have different effects depending on how they implement the reform. Some increase equality by raising spending in poor districts, others by lowering it in wealthy districts. The effect of an equalization depends critically on precisely how it is implemented. Well-designed ones can increase reasonable amounts of equalization at low cost; poorly designed ones can have unintended effects that make even poor districts worse off than before. Thus, it is important to carefully assess changes in a state's education finance system, such as Act 68, in order to be sure that it achieves what it is expected to achieve, and at an acceptable cost.

III. Determination of Education Spending in Vermont

To understand how the change in Vermont's education finances caused by Act 68 will change education spending, we use a median voter model of spending choice. The model is quite similar to that used by Hoxby (2001) except that, for simplicity, she assumes a representative voter instead of a median voter. If the median voter has preferences for education spending and other goods, then the level of spending selected will depend on income and the tax price of education spending. Under both Act 60 and Act 68, the tax

price of education in a given town depends on the extent to which increases in local spending change the tax rate the state will set for the town, under the formulas required by those laws.⁸ The changes in the tax prices caused by the passage of Act 68, and the change in income caused by the sales tax, will be the primary channels for changes in spending levels.

Under Act 60, each town in Vermont selected a level of education spending for the town. If the town spent an amount per pupil equal to the foundation aid grant provided by the state (\$5566 in fiscal year 2003), then the town's tax rate was set to \$1.10 per \$100 of property value. If it spent more than this, then its tax rate increased in proportion to the spending increase. The \$1.10 tax was known as the state share; the amount in excess of \$1.10 was known as the local share. Assuming that towns spent at least the amount of the foundation grant⁹, the local share tax rate was given by:

$$LST_i = 0.011 * \frac{(S_i - G)}{m * C_i} \quad (1)$$

where LST_i is the local share property tax rate in town i , S_i is local education spending per student in town i , G is the foundation grant amount per student, C_i is an adjustment

⁸ In Vermont, towns and school districts are essentially coterminous; a few towns for which this is not true are excluded from the regression analysis below. In rural areas, many towns form unions to provide schools jointly, particularly for secondary education, or if they have very few students, pay tuition to send their students to schools in other towns. In the results presented below, we treat all towns identically. We have also performed analysis allowing for differences between towns which form union districts, towns which do not, and towns that tuition students. The results do not change substantially when we allow for these differences. We find that towns which tuition students spend slightly less per student than other towns; there is no significant difference between towns in union districts and towns not in them.

⁹ Since the foundation grant is not local money and is lost if not spent, towns should always spend it entirely. We assume throughout the paper that towns spend at least the amount of the foundation grant under all financing systems.

factor, called the common level of appraisal (CLA) which adjusts for differences in appraisal standards across towns,¹⁰ and m , which is known as the equalized yield, is the factor of proportionality, and is the same for every town in the state. The higher the equalized yield, the lower tax rates are set. Each year the state set the equalized yield so that the amount of tax revenue raised, statewide, would exactly equal total spending. Total local share tax revenues in each town, $LSTR_i$, are equal to tax rates times property values:

$$LSTR_i = 0.011 * \frac{(S_i - G)}{m} * \frac{V_i}{C_i} \quad (2)$$

where V_i is the value of taxable property in the town, measured in hundreds of dollars. Total local share revenues are given by summing over towns; setting this equal to total spending in excess of the foundation aid and solving for m gives the formula for the equalized yield:

$$m = 0.011 * \frac{\sum \frac{V_i}{C_i} (S_i - G)}{\sum P_i S_i} \quad (3)$$

where P_i is the number of equalized pupils in each town. For FY2003 the value of the equalized yield was \$42. By construction, this formula assures that, in total, local share

¹⁰ Towns whose properties are overassessed, in the state's view, have a CLA greater than 1, and thus pay a lower tax than their appraised values would suggest; towns whose properties are underassessed have a CLA below one, and pay a higher tax. This system prevents towns from evading their state-set property tax rate by lowering the appraised values of all property within the town.

property tax revenues exactly equal local spending above foundation aid. Those towns which raise more local revenue than needed to cover their spending contribute to the sharing pool; those which raise less receive money from the sharing pool paid by the contributing towns.

Given this formula, an increase in local school spending in a town will increase the local share tax rate set by the state for that town. The cost in local property taxes from an increase of \$1 in local spending is given by differentiating (2) with respect to S_i , and dividing by the number of pupils in the district:

$$LPTC_i = 0.011 * \frac{V_i}{m * C_i * P_i} \quad (4)$$

so that wealthier towns pay a higher marginal price for additional education. Also, those towns with relatively few pupils pay a higher marginal price; in this formula, holding C_i constant, the local cost of increased school spending is proportional to V_i/P_i , that is, to taxable property value per pupil.

The budget equation for the median voter in town i is then given by

$$I_i - F_i - \left(1.10 + 0.011 * \frac{(S_i - G)}{m}\right) * \frac{H_i}{C_i} = Y_i \quad (5)$$

where Y_i is consumption on goods other than local education, F_i is federal income taxes (from which local property taxes are deductible), H_i is the value of the median voter's taxable property, and I_i is income net of all taxes except federal income taxes and local property share taxes. School spending does not appear directly in the budget constraint, because the property tax rate is set by the state, not the local government; but higher school spending indirectly reduces consumption by increasing LSR_i . Similarly, an increase in the foundation aid grant would reduce LSR_i and thus increase non-education consumption within the town.

Act 68 changed the formula for setting property tax rates; in doing so, it changed the implied tax price of school spending to the median voter, and altered incentives to spend money on education. One effect of Act 68 is primarily political; it creates separate property tax rates for property owned by town residents, and property owned by non-residents. Only the tax rate on property owned by residents increases as school spending rises, and the tax rate on non-resident property is fixed by the state (\$1.59 per \$100 value of property in FY2004, and adjusted by the CLA for each town). This prevents town residents from passing on the costs of higher local education spending to non-residents, who had objected to this feature of the Act 60 taxation system. Second, the sharing pool is abandoned, and along with it the equalized yield that ensured that local share property taxes would always exactly cover spending in excess of foundation grants. Under Act 68, a town's tax rate is equal to a fixed amount (initially \$1.10, adjusted annually by the legislature) if the town spends exactly the amount of the foundation grant (\$6800 in FY2004), and increases proportionately as the town's local spending does. Thus, if a

town spends \$8160 per student, which is 20% more than the foundation grant, then the property tax on resident property increases by 20% to \$1.32. If, however, the town spends more than 25% of the state average spending per pupil, then increases above 25% over the state average count double in increasing its resident tax rate. This creates an incentive for towns not to spend too much more than the statewide average, reducing inequality directly. Under Act 68, the resident property tax rate RT_i is given by

$$RT_i = 1.10 * \frac{S_i}{G * C_i} \quad (6)$$

This tax rate is never high enough to raise revenues equal to spending; the difference is covered by money raised by an increase from 5% to 6% in the state sales tax. This, plus the increase in the foundation grant, imply a substantial shift of education revenue from the local level to the state level. Tax revenues in the town will then be

$$R_i = 1.10 * \frac{S_i}{G * C_i} * RV_i + 1.59 * \frac{1}{C_i} * NRV_i \quad (7)$$

and the local cost of a \$1 increase in education spending is found by differentiating (7) with respect to S_i and dividing by P_i :

$$LPTC_i = 1.10 * \frac{RV_i}{G * C_i * P_i} \quad (8)$$

The primary difference between this local cost and the local cost under Act 60 in equation (4) is that it depends on resident property value per pupil, rather than total property value per pupil, resident and non-resident. The distinction is very important in several gold towns with large amounts of non-resident property (primarily related to skiing) and small populations, hence few pupils.

The budget equation for the median voter under Act 68 is given by

$$I_i - F_i - 1.10 * \frac{S_i}{G * C_i} * \frac{H_i}{C_i} = Y_i \quad (9)$$

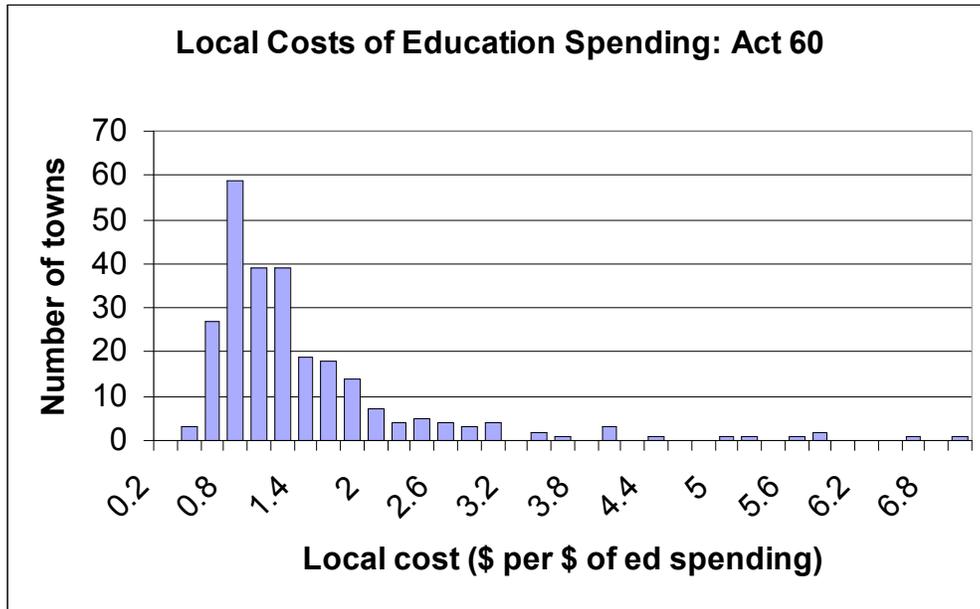
and as before, increased school spending reduces non-education consumption indirectly, by increasing the resident property tax rate the state sets for the town.

IV. Changes in Tax Prices from Act 60 to Act 68

The changes in the formula for setting local tax rates between Act 60 and Act 68 changed the cost to local governments of providing education, and hence also changed the tax price faced by the median voter. Figure 1 shows the cost to town governments, under Act 60, of increasing local education spending by \$1. Following Hoxby (2001), we refer to this as the town's tax price for education. It differs from the median voter's tax price because it does not include the effects of deducting property taxes from Federal income taxes or of exporting taxes to non-residents. Figure 1 excludes the three observations with the highest town tax prices to avoid compressing the left side of the graph. The omitted observations have values of \$8.88, \$9.19, and \$32.85. The average value is \$1.48, though this is distorted by the high-value observations; the median value

is \$0.96. In the median town, marginal expenses for education spending are borne almost entirely by the town, and in 125 of the 253 towns, the town pays more than \$1 to increase

Figure 1



local education spending by \$1. This is a consequence of the sharing pool; a \$1 increase in spending must produce exactly \$1 in local tax revenue on average. In contributing towns it costs more, in receiving towns it costs less. The variance of town tax prices, however, is extremely wide. In 37 towns, or 14.6%, the town faces a tax price of \$2 or more to increase local spending by \$1, the balance going to the sharing pool; and there are nine towns in which the tax price exceeds \$5.¹¹ At the low end, 21 towns have town tax prices less than 60 cents, and 74 have town tax prices less than 75 cents.

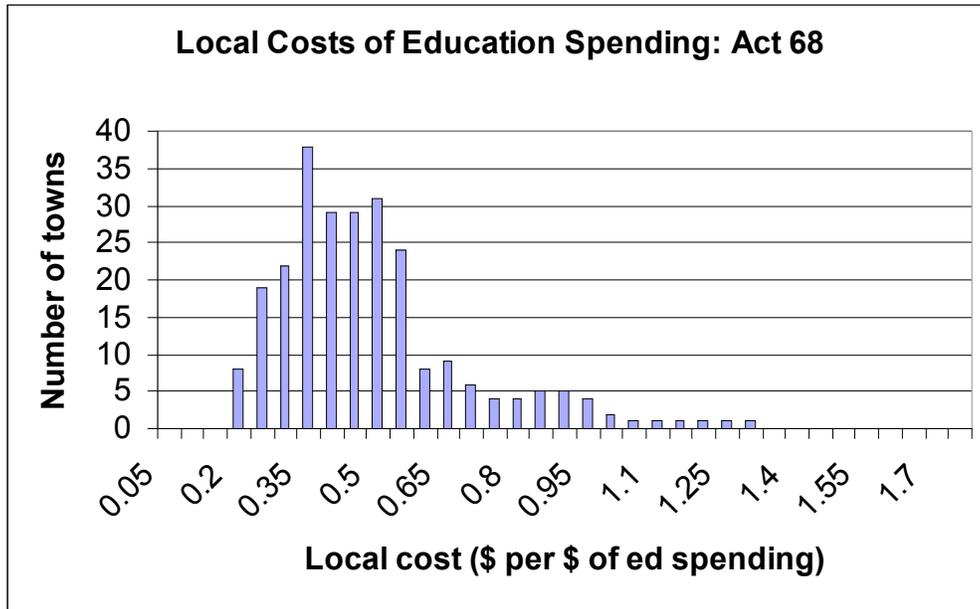
Act 68 changed the cost to towns of increased education spending substantially.

Figure 2 shows the distribution of town tax prices under Act 68. Theoretically, this cost

¹¹ The nine towns paying more than \$5 are Stratton, Killington, Winhall, Dover, Plymouth, Peru, Ludlow, Landgrove, and Victory.

can be higher or lower than it was under Act 68, depending on the fraction of the town's property that is owned by non-residents; in practice it is lower for every town in the state.

Figure 2



The average town pays 46 cents to increase local education spending by \$1 under Act 68, \$1.02 less than it did under Act 60; the median town pays 40.6 cents, 56 cents less than under Act 60. The highest town tax price has fallen from \$32.85 to \$1.27. Only 6 towns pay more than \$1 to increase local education spending by \$1 under Act 68.¹² The result is that the local cost of increased education spending has fallen markedly, statewide; the state has taken on not only a larger share of the total burden of education costs, but a much larger share of the marginal cost as well. By reducing town tax prices, Vermont has increased the incentive for its towns to spend money on education; because tax prices have fallen more at the top end of the distribution than at the bottom end, this incentive is particularly strong for the wealthiest towns in Vermont.

¹² The six towns are Landgrove, Stowe, Dorset, Weston, Killington, and Plymouth.

The cost of increased education spending is not borne entirely by local taxpayers, for two reasons. First, state taxes are deductible from Federal income taxes; thus, for taxpayers who itemize, a portion of the cost is passed on to the Federal government. Second, under Act 60, some of the marginal cost of increased education spending is borne by non-residents of the town. (Under Act 68, all marginal increases are borne entirely by town residents, because the non-resident property tax rate is independent of spending levels.) We therefore also calculate tax prices to median voters under both Act 60 and Act 68. Using data from the IRS, we find that the chance of an income tax filer, married filing jointly, itemizing deductions is equal to 50% at \$51,630. We therefore assume that the median voter itemizes if median income in the town is above that amount, and reduce the town tax price by 15% or 25%, depending on the tax bracket of the median voter's income. For Act 60 only, we multiply the local government's cost by the fraction of income in the town that is owned by residents, to allow for tax exporting.

Figure 3

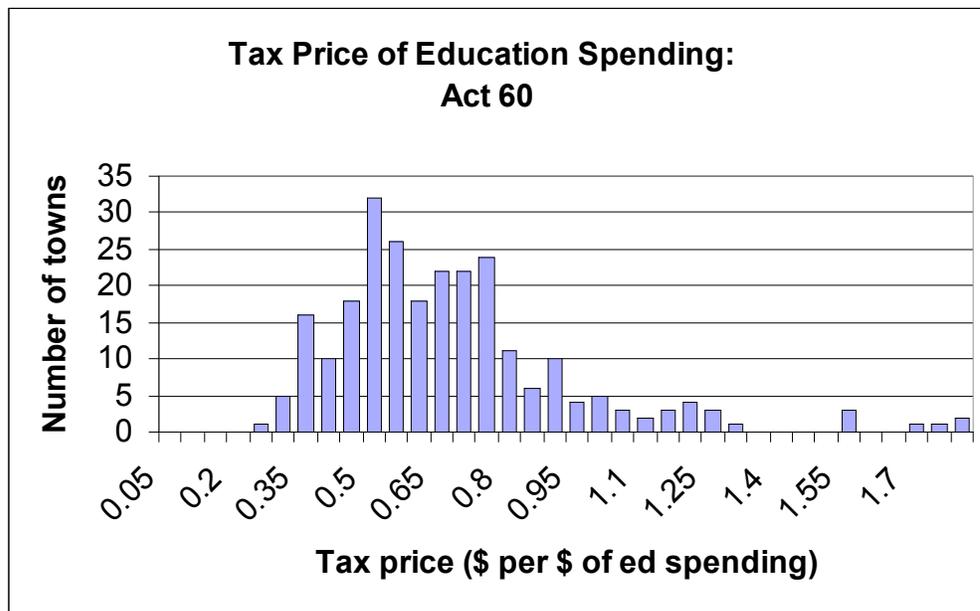


Figure 3 shows the tax price to the median voter of increased education spending under Act 60. The average value is 65 cents per dollar of education spending; this is much lower than the \$1.48 cost to the local government, and is lower primarily because the towns with very high town tax prices also tend to have very high fractions of property owned by non-residents, and hence can export most of the town's cost to non-residents. The most extreme example is Stratton, which has a town tax price of \$32.85, but which has 96.4% of its property owned by non-residents. Its median voter's tax price is \$1.18. Similar effects lower the tax price in the other towns with extremely high local costs of education spending and thus reduce the extreme right-tailedness of the distribution of tax prices. Still, there are 23 towns in Vermont where, even after tax exporting and Federal deductions, the tax price of education spending was more than \$1 under Act 60.

Figure 4

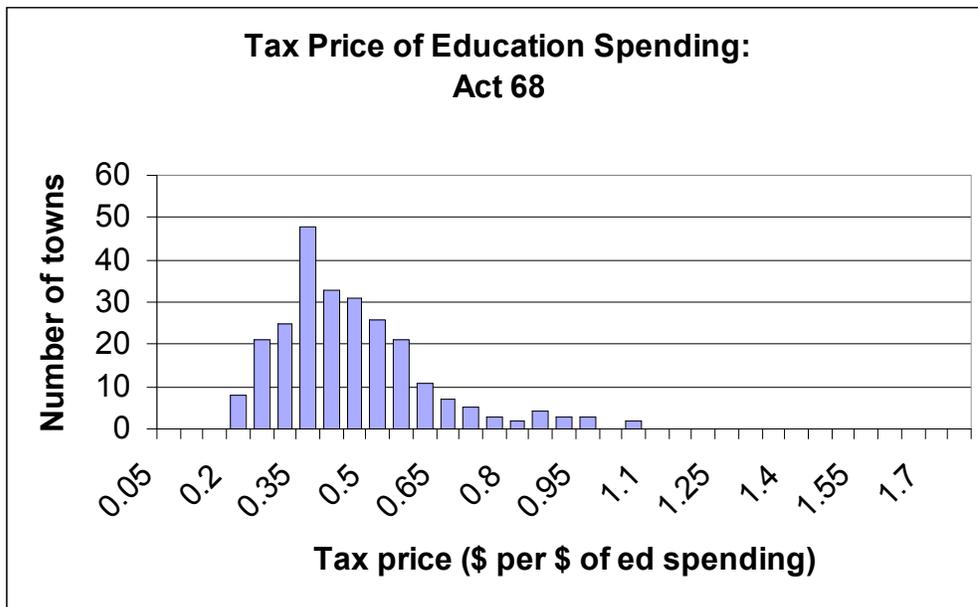


Figure 4 shows tax prices under Act 68. As with the town tax prices, the median voter's tax price is lower under Act 68 than it was under Act 60 in every one of the 253 towns in

Vermont. The largest drop for a single town is 98 cents (Rupert: from \$1.78 to \$0.81) and the smallest drop is 5 cents (Stannard: from 21 cents to 16 cents). The average tax price under Act 68 is 42 cents per dollar of education spending, 23 cents below the average under Act 60, and the median is 39 cents, 21 cents less than the median of 60 cents under Act 60. Thus, the reduced cost of education spending to local governments created by Act 68 is passed on to the median voter in each town, providing an incentive to increase local spending at the expense of the state government.

V. Response to Changes in Incentives for Local Education Spending

The changes in tax prices caused by the passage of Act 68, along with the income effects from the increased sales tax, create incentives for local governments to change spending on education. Lower tax prices should increase spending, but higher sales taxes for state funding should reduce it; the total effect is ambiguous, depending on whether the response to the lower tax price, or the sales tax increase, is stronger. The effect also varies between wealthy towns and poor ones, depending on how much the tax price has changed and how much sales tax is paid by the town.

In order to measure the responsiveness of Vermont towns to these changes, and hence predict the effects of Act 68 on local education spending, we estimate a model of education spending determination. Our equation, based on the median voter model, assumes the median voter obtains his or her desired level of education spending based on the tax price of education spending and his or her after-tax income. In addition, demographic factors that affect the identity of the median voter cause spending to differ between towns. The initial equation we estimate is:

$$\begin{aligned} \log(\text{SPEND}_i) = & \beta_0 + \beta_1 * \log(\text{TAXPRICE}_i) + \beta_2 * \log(\text{INCOME}_i) + & (10) \\ & \beta_3 * \text{COLLEGE}_i + \beta_4 * \text{OVER64}_i + \beta_5 * \text{UNDER18}_i + \beta_6 * \text{WHITE}_i + \\ & \beta_7 * \text{GOREVOTE}_i + \beta_8 * \text{NADERVOTE}_i + \varepsilon_i \end{aligned}$$

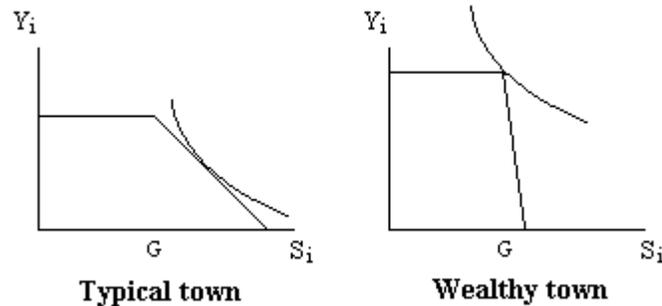
where SPEND_i is local spending per student on education in town i , COLLEGE_i is the fraction of the town's population which is college-educated, OVER64_i , UNDER18_i , and WHITE_i are the fraction of the town's population which are over age 64, under age 18, and identify ethnically as Caucasian respectively, and GOREVOTE_i and NADERVOTE_i are the fraction of the town's population which voted for Al Gore and Ralph Nader, respectively, in the 2000 Presidential election.¹³ The equation is estimated using data from fiscal year 2004 on 249 Vermont towns (four small towns are excluded because they did not file separate election returns). Spending data come from the Vermont Department of Education; property value data from the Vermont Department of Taxes; voting data from the Vermont Secretary of State; demographic data from the US Census.

Equation 1 cannot be estimated by ordinary least squares because the tax price of education spending drops to 0 when spending is below the foundation amount. Figure 5 shows two possible cases for the budget set and preferences of the median voter. The horizontal axis is education spending and the vertical axis is all other spending. The budget set is horizontal until education spending reaches the amount of the foundation grant; thereafter it slopes downward, with a slope equal to the tax price. In most towns in

¹³ Patrick Buchanan received a little over 1% of the vote for President in Vermont in 2000; however, the fraction of voters voting for Buchanan was never statistically significant in any regression in which we included it.

Vermont, the tax price is sufficiently low that the town prefers to spend more than the foundation grant; such a town is described by the graph on the left. However, if the town

Figure 5



is wealthy and thus has a very high tax price, the optimal budget point can be to spend only the amount of the foundation grant, due to a corner solution at the point where the town begins to face the high marginal cost of additional spending. Several towns in Vermont did precisely this in 2002. For example, the town of Dorset set local education spending to \$5792, just below the foundation grant amount of \$5810. Although its median household income is \$54,219, one of the highest in the state, its tax price of \$1.54, more than double the state average, gives it a strong disincentive to spend any local money on education.¹⁴ In order to correct for this, we estimate equation (10) using a Tobit model, with the data being left-censored at the amount of the foundation grant.¹⁵

Results of estimating the initial equation, and a reduced final version that drops a number of insignificant right-hand side variables, are found in Table 1. The elasticity of education spending with respect to tax prices is low, at -0.071 in the final equation, but

¹⁴ Other wealthy towns setting education spending equal to, or slightly below, the foundation grant amount include Buels Gore, Weston, Stowe, Landgrove, Peru, Manchester, Winhall, and Warren; the average of median household income in those nine towns is \$47,700 versus a statewide average of \$40,135.

¹⁵ Estimates obtained using OLS are not very different from the Tobit estimates, probably because the number of censored observations is low (less than 10% of the sample).

statistically significantly different from zero. The elasticity of education spending with respect to income is 0.238.¹⁶ These elasticities are relatively inelastic compared to estimated values from other states; this may have to do with the small size of towns (and school districts) in Vermont, which has only about 400 students per town. None of the demographic variables, except for the political ones, are statistically significant in the initial equation, and all are dropped in the final equation. The fraction of the population

Table 1. Results of estimation equation (10)

Dependent variable: local education spending

Variable	Full equation	Final equation
Intercept	5.740 (1.019)	6.215 (0.568)
log(TAXPRICE)	-0.048 (0.039)	-0.072 (0.030)
log(INCOME)	0.217 (0.073)	0.238 (0.030)
COLLEGE	-0.049 (0.143)	
OVER64	0.168 (0.347)	
UNDER18	0.590 (0.466)	
WHITE	0.518 (0.777)	
GOREVOTE	0.432 (0.174)	0.374 (0.166)
NADERVOTE	0.772 (0.357)	<i>0.593</i> (0.313)
σ_ε	0.157 (0.08)	0.158 (0.008)

Estimates in **bold** are statistically significantly different from zero at the 5% level; estimates in *italics* are statistically significantly different from zero at the 10% level.

¹⁶ Hoxby (2001), estimating a similar regression, finds income elasticities in the range 0.284 to 0.310 depending on specification. The difference between her estimates and our value is not statistically significant. We cannot compare our tax price elasticity to her results because she uses inverted tax price, rather than log of tax price, in her regression (because in some states, such as California, tax prices are essentially infinite).

that is college-educated is strongly collinear with household income; the others have little variance in Vermont, where the population is relatively homogenous. The fraction of votes cast for Gore and Nader appear to be capturing variation in political preference. A one percent increase in the vote for Nader increases education spending by almost double the increase caused by a one percent increase in the vote for Gore, which is consistent with Nader being the more liberal candidate.

Using these estimated elasticities, we calculate the effect of Act 68 on education spending in Vermont. Act 68 has two effects on spending; it changes tax prices, and also reduces income because of the increase in sales taxes.¹⁷ If the town is spending above the foundation grant under both Act 60 and Act 68, then the effect of Act 68 on spending is given by the equation:

$$\% \Delta \text{spending} = -0.071 * \% \Delta \text{ tax price} + 0.238 * \% \Delta \text{ income} \quad (11)$$

Since Act 68 lowers tax prices but also lowers after-tax incomes, the sign of the effect of Act 68 on spending is theoretically ambiguous. The calculation of the effect of Act 68 is also complicated by the possibility that the town chooses to spend only the foundation amount under either or both of the two acts.¹⁸ We calculate predicted changes in spending between Act 60 and Act 68, correcting for censoring at the amount of the foundation grant, and using the fact that

¹⁷ Doing this requires an assumption about the distribution of the burden of the state sales tax across towns. For simplicity, we assume that the burden is proportional to income. Vermont has a number of exemptions to its sales tax which reduce its regressivity. Because of the small effect of the sales tax on spending, due to the low estimated elasticity, assuming that the tax is somewhat regressive (which would be more realistic) and places a higher burden on poor towns does not substantially affect the calculations that follow.

¹⁸ In practice, no town is predicted to spend below foundation grant under Act 60 and only two are predicted to spend below foundation grant under Act 68.

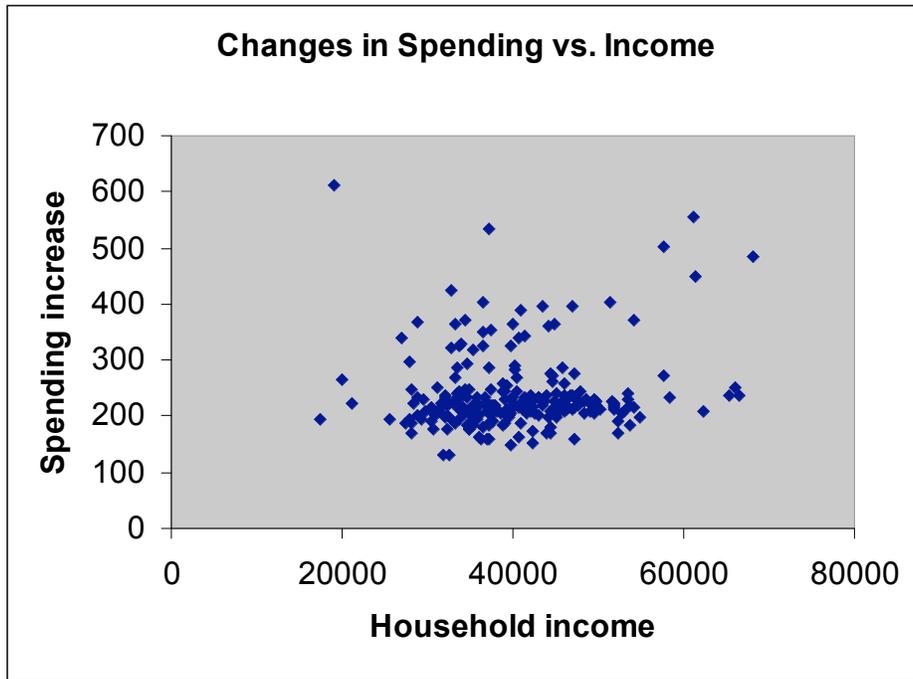
$$E(S) = \exp(E(\log S) + \sigma^2/2) \quad (12)$$

which is necessary because of the log-linear functional form of equation (10) on which the expectations are based.

We predict spending to rise in all towns in the state. The increases range from a maximum of \$610 to a minimum of \$148, or in percentage terms, a maximum of 9.8% to a minimum of 1.8%. The average increase is \$237, which is 3.04% of spending. The total increase, statewide, in spending on education is \$24.4 million. In two towns, the increase occurs because of the increase in foundation grant aid; towns that were predicted to spend between \$5800 and \$6800 per student increase spending to \$6800 as a consequence of the rise in the foundation aid. In all other towns the rise is due to the marginal incentive of lower tax prices. The average tax price has fallen from 65 cents to 42 cents; this produces a change of 0.031 in log spending or \$256 in spending. The income effect of the sales tax increase is comparatively small. Log income falls by only 0.0079 (the \$100 million increase in sales tax is 0.79% of state income) and log spending falls by 0.00186 as a result; spending declines by \$15. The effect on spending from the lower tax prices greatly exceeds the effect of the higher taxes, leading to an increase in every town; the higher the fall in tax price, the greater the increase in local spending.

The consequences of this could be to decrease spending inequality if tax prices fell more in the towns with lower incomes. Unfortunately, that is not the case; tax prices fell more, on average, in towns with higher incomes. Figure 6 shows a scatter plot of changes in spending against per capita income. The correlation is not extremely strong, but it is positive; Act 68 leads to larger increases in school spending in high-income towns than it

Figure 6



does in low-income ones. Table 2 shows the ten districts with the largest predicted increases in spending and the ten districts with the smallest predicted increase, and their incomes. The average income in the towns with the largest increases is \$8,818, or 23%,

Table 2. Towns with largest and smallest changes in spending

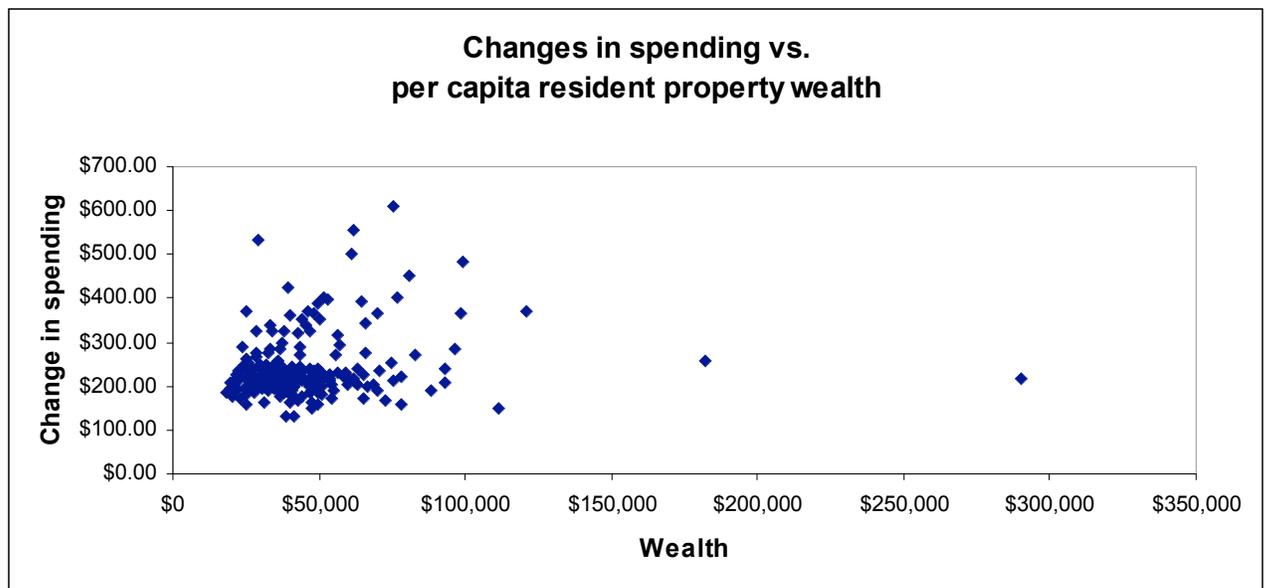
10 largest increases			10 smallest increases		
Town	Increase	Income	Town	Increase	Income
Maidstone	\$610.45	\$19,167	Tinmouth	\$129.87	\$32,604
Westford	\$556.37	\$61,205	Guildhall	\$132.36	\$31,750
St. Albans City	\$534.22	\$37,221	Stratton	\$148.37	\$39,688
Richmond	\$502.85	\$57,750	Grafton	\$150.69	\$42,313
Shelburne	\$484.71	\$68,091	Stannard	\$157.91	\$36,250
Williston	\$450.37	\$61,467	Ludlow	\$157.91	\$36,969
Granville	\$424.60	\$32,679	Manchester	\$158.15	\$47,196
Pawlet	\$403.66	\$36,429	Danby	\$160.77	\$37,137
Colchester	\$402.60	\$51,429	West Fairlee	\$162.61	\$40,667
Plymouth	\$397.70	\$43,438	Isle LaMotte	\$163.75	\$36,125
Average income		\$46,888	Average income		\$38,070

higher than average income in the towns with the smallest increases. Four of the ten towns with the largest increase are also among the ten towns with the highest incomes in the state.

Predicted changes in spending are similarly correlated with wealth. Figure 7 shows the correlation of spending with per capita resident property wealth. Again, the correlation, though not very strong, is positive; wealthy towns increase spending more than poor ones do. The average increase in spending in the poorest 25 towns Vermont (that is, the bottom decile of the wealth distribution) is \$217, or about 2.72% of spending in those towns. The average increase in the wealthiest 25 towns is \$281, or about 3.53% of spending in those towns.

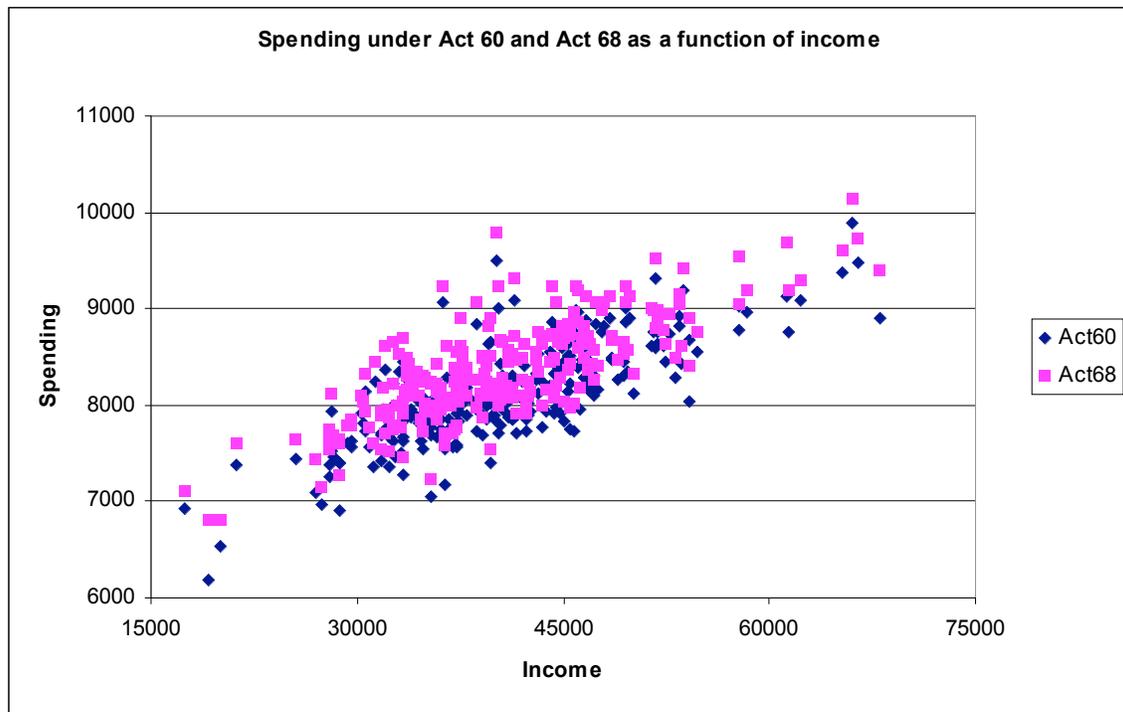
Fortunately, because of the small elasticities of spending with respect to tax prices and income (-0.072 and 0.238 respectively) the changes in inequality of education by income and wealth caused by the change to Act 68 are not terribly large. The correlation between

Figure 7



income and education spending rises under Act 68, but not greatly. An extra dollar of town income increases education spending by 4.82 cents under Act 60, and by 4.92 cents under Act 68; an increase in the effects of income, but not a large one. This occurs because the increases in inequality caused by Act 68, though significant, are relatively small compared to the inequalities that already exist. Figure 8 demonstrates this graphically. In all towns, the effect of Act 68 is to increase spending, changing the town from a diamond plot on the graph to a square one located directly above it. Because high-income towns (located on the right hand part of the graph) increase spending by somewhat more than low-income towns (on the left hand part of the graph), the line becomes steeper; a one-dollar increase in income causes a greater increase in spending than previously. However, since the highest-income towns already spend almost \$2000

Figure 8



per student more than the lowest-income towns, the effects of Act 68, which are on the order of \$50 to \$100, do not increase the slope of the relationship by much.

VI. Conclusions

In 2004, Vermont passed Act 68, changing its education finance system so that aid to poor towns was generated by state funding, instead of local property taxes in wealthy towns. In doing so, Vermont substantially altered the incentives of both poor and wealthy towns to spend money on local education. This was desirable, as shown by the number of wealthy towns that had virtually eliminated local education spending in response to the strong incentives to reduce spending created by Act 60. However, the removal of incentives to reduce education spending in wealthy towns had the undesirable side effect of increasing spending disproportionately in wealthy towns. With state money providing the subsidization of poor towns, rather than property taxes from high-spending towns, the incentive for wealthy towns to reduce spending was weakened. This countered the intent of the original reform, which was to reduce inequality in spending caused by differences in wealth.

We analyze the state tax rate formulas created by Act 60 and Act 68 to measure the changes in incentives for local education spending created by the passage of Act 68. We find that Act 68 lowered both tax prices of education spending for both local governments and voters. In response, towns increased local spending; the total increase of education spending statewide was \$24.4 million as a consequence of Act 68. The decrease in tax prices was larger in wealthier towns than it was in poor towns. This made it substantially easier for wealthy towns to afford increases in education spending after

the passage of Act 68. The effect was to substantially narrow the range of tax prices for education spending across Vermont towns, and thus reduce the ability of the finance system to reduce inequality across towns.

We find that Act 68 did indeed result in increased inequality of education spending in Vermont. However, because state spending is quite inelastic with respect to tax prices, and even more so with respect to income, the increase in inequality that occurs is quite small, relative to existing inequality. Spending increases in the wealthiest towns are only about \$65 than those in the poorest towns. This happens partly because the increase in the sales tax is borne more heavily by wealthier towns, but more because the changes in spending induced by Act 68 are small relative to the already-existing inequalities in education spending in Vermont. Act 68 makes the problem of inequality worse than before, but not very much worse. As a result, Vermont has been able to reduce the political cost of its reform at a relatively small cost in spending inequality.

We conclude that states reforming their education finance system should be aware of the changes reform makes, not only in the total burden borne by local governments, but also in the marginal burden borne by local governments when they increase or decrease education spending. Reforms that, like Vermont's, give a stronger incentive to spend to wealthy communities than to poor ones can have an effect on spending contrary to the one the reform was intended to produce. This can easily happen if a reform that shifts the burden of education spending from school districts to state governments also shifts the burden on the margin from districts to states. If, as is the case with Act 68, the shift is greater in wealthy towns, the ability of the reform to equalize spending can be undercut. Designing reforms that set marginal incentives for spending well can, in contrast, help

reduce inequality even if they do not result in large changes in the burden of inframarginal funding from local governments to the state.

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