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Local public choice of school spending: disaggregating the demand function for educational services

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Abstract

The determinants of school spending are investigated using a disaggregated demand model augmented to include political factors. High school spending by county governments is disaggregated to identify the sources of variation in teacher–student ratio, non-wage spending per student, and student enrollment. The disaggregation throws new light on the role of cost factors in explaining the expansion of educational services. High school spending is shown to be highly inelastic to county revenue and major cost factors. The spending decision is analyzed as an example of the common pool problem in distributive politics. Schools offer benefits to each municipality, and municipalities fight for new schools since the costs are shared. The political decision implies a balancing between this spending pressure and the coordinated interests of the county. Political strength, measured by the party fragmentation of the council, is shown to hold down costs and allow for more student enrollment. On the other hand, the spending pressure measured by the average size of the municipalities in the county, influences all three spending components, and the effects depend on the political strength.

Keywords: Educational finance; Educational economics; Expenditures

1. Introduction

The determination of school spending has been addressed in a large empirical literature (recent important contributions are Craig & Inman, 1982, 1986; Romer, Rosenthal & Munley, 1992; Rubinfeld & Shapiro, 1989). The analysis of education has been a way of understanding public sector decision making, since the education sector is one of the biggest items in the government budget. The school sector typically is decentralized to the local public sector, and the cross section variation has allowed empirical investigation of economic determinants.

The standard framework of analysis is the expenditure demand model of education. It is assumed that the local government organizing school spending is guided by the preferences of the voters, usually assuming the decisive role of the median voter. Given preferences and budget constraints, demand equations are estimated based on cross-section data for school spending, private income level, tax price and grants. We propose to develop the methodology in two directions. First, school spending is disaggregated to separate out different components of school expenditure. The disaggregation throws new light on the role of cost factors in explaining the expansion of educational services. The decomposition identifies three elements central to the decentralized decision making: teacher–student ratio, non-wage spending per student, and student enrollment ratio.

Second, the expenditure demand model is augmented to include interest groups and political structure. The school spending decision is analyzed as an example of the common pool problem in distributive politics (Weingast, Shepsle & Johnsen, 1981). The benefits of each school are concentrated to a geographic area, while the costs are financed by general taxation at a higher

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geographic level. Both sides of this equation are included, municipalities fighting for schools in their area and political leaders at the county level trying to internalize the externalities of the school spending decisions.

The empirical basis of our investigation is the variation of high school spending across counties and over time in Norway. The high school education is an essential part of the welfare state. The national goals emphasize equalization, but the county level freedom of economic priority implies important differences in the teaching offered. In 1990, the school spending share of the county budget varied from 12 to 24%, and spending per student varied between NOK 32 000 and 52 000 (US$4500 to 7500). The county with the lowest priority of high schools enrolled only 64% of its youth, while the highest enrollment rate was 89%. Needless to say, the variation across counties is a source of political discussion. The county decision making must handle the choice between quality and quantity of high school education and the priority of high schools against other services, notably hospitals.

The centralized system of financing represents another departure from the conventional demand studies emphasizing the choice between private consumption and local public services. When local government revenue is determined by general grants and fixed income tax revenue sharing, the local decision making basically allocates a fixed budget between different services. A rationed demand system results, with local government revenue and service costs as main determinants. A comprehensive database of economic, political and school characteristics during the period 1976–93 enables us to do econometric analysis of the determinants of school spending.

The analysis covers the period after the high school reform of 1976 integrating vocational and academic training. High schools absorb about 1/5 of the current expenditures of county governments, as reported in Table 1. The spending share has been fairly constant on average, first falling and then rising. School spending per student on average also has been stable in real terms, except for a strong increase during 1990–93. The data indicate that the high school spending has been driven up by an increasing share of the youth (16–19 years old) enrolled and a rising teacher–student ratio. Close to 90% of the youth is enrolled in high schools in 1993.[1]

Table 1
Decomposition of high school spending: mean values

Year	School spending share of total county spending	School spending per student	Non-wage spending per student
1977	0.19 (0.030)	51 662 (6570)	13 555 (4175)
1980	0.16 (0.021)	53 635 (5966)	14 437 (3578)
1985	0.17 (0.023)	52 155 (5865)	14 527 (3385)
1990	0.21 (0.025)	52 327 (5831)	13 902 (2565)
1993	0.23 (0.031)	57 616 (5860)	14 388 (3908)
Year	**Teacher–student ratio**	**Student enrollment ratio**	**Youth share of population**
1977	0.085 (0.010)	0.50 (0.070)	0.062 (0.0031)
1980	0.097 (0.010)	0.57 (0.065)	0.063 (0.0033)
1985	0.099 (0.011)	0.66 (0.058)	0.067 (0.0039)
1990	0.102 (0.008)	0.79 (0.071)	0.063 (0.0026)
1993	0.114 (0.011)	0.89 (0.072)	0.056 (0.0024)

Notes: Standard deviations in parentheses. Spending measured in 1993-NOK. NOK/USD ≈ 7.

The disaggregated demand model is presented in Section 2, and the political economy of the decision making is discussed in Section 3. Following a documentation of operationalization and econometric specification, the results are presented in Sections 5 and 6, and concluding remarks are offered in Section 7.

2. Disaggregating the demand model of school spending

The starting point is the conventional expenditure demand model of education. Compared to the dominant methodology applied to the study of local fiscal choice, as initiated by Barlow (1970), Feldstein (1975), Inman (1978) and Lovell (1978), the model used here disaggregates the school spending into three endogenous components: teacher–student ratio, non-wage spending per student, and student enrollment ratio. The variation of each of these components across time and space are addressed in the literature on schooling, but they are typically not linked up to a decision making system. Schultz (1988) applies a similar decomposition in a cross-country study of school expenditures. We apply a framework where high school spending is determined by

[1] The main motivation of the 1976 Act was to reduce differences in social status between schools of theoretical and occupational orientation. In 1990, the high schools offered more than 100 different specializations. About 65% of the students were enrolled in the academic track or the commercial and business track, while the rest were enrolled in the vocational tracks comprising a large number of specializations such as public health, art, trade, and crafts. They represent higher costs than the traditional academic track because of the larger need for equipment and buildings, but also because higher teacher intensity is required. The classes or groups of students in vocational tracks are about half the size of the academic track on average. Combined schools with many study tracks, including the academic track, are now the most common school type. Private schools, excluded from this analysis, covered 5% of the students in 1990.

county governments given constraints decided by the central government, the institutional setup found in most countries.

To derive some hypotheses, we develop a simple theoretical model where the county governments are assumed to produce two services, educational services and hospital services. Hospitals account for 50–60% of total county expenditures. School spending decisions are complex, and involve the number, size and location of schools and the composition of study tracks. We are able to identify the aggregate effect of these decisions for the employment of teachers, the student enrollment and non-teacher spending. At the national level, the central government bargains with the teacher union to set teachers' wages, working hours, teaching load and other school issues. The result of the bargaining is taken as given at the county level.

The economic conditions of the county governments are described by their budget constraint:

$$R = (1 - m)\left(W\frac{T}{St} + \frac{E}{St}\right)\frac{St}{Yo}\frac{Yo}{N} + (1 - h)H \qquad (1)$$

The disaggregation of high school spending is made explicit in Eq. (1). Exogenous net per capita revenue R is determined by general grants and fixed income tax revenue sharing. The revenue is allocated to per capita teacher wages, $W\,T/N$ (W is the wage costs per teacher, T is teacher manyears and N is the population size), non-wage school spending per capita, E/N, and per capita spending to hospital services, H. The standard volume measure of resource use, teacher manyears per capita, T/N, is disaggregated to identify three of the elements involved: teacher–student ratio, enrollment ratio, and youth share of the population,

$$T/N = T/St\ St/Yo\ Yo/N$$

(Yo is the number of youth in the relevant 16–19-year age group). Matching grants are built into the budget constraint (m and h are matching grant rates for high schools and hospital services, respectively).

The resource allocation is guided by the preferences of the majority of the county council. We would have liked to include a production function of educational services in order to identify the impact of the resource use on student achievement. However, it is not easy to establish a production function based on present school research. Bonesrønning and Rattsø (1994) find no robust relationship between teacher input and student performance measured as value added in Norwegian high schools. This is in line with international results, as summarized by Hanushek (1986). Bonesrønning and Rattsø (1994) show that teacher education matters, consistent with recent international studies. Sander (1993) and Card and Kreuger (1992) show that teacher pay has a positive influence on student achievement, possibly representing teacher education. In Norway, a teachers' salary is the same whatever county he or she lives in. Because of seniority rules and wage harmonization, the counties can hardly influence the quality of the teachers. The lack of a clear relationship between county government decisions and student achievement has serious implications for our understanding of the decision making regarding resource use.

Politicians seem to be interested in aspects other than school quality when they set their priorities, such as the location of schools, the composition of the study tracks, and the capacity of the school system. Students, parents and politicians prefer to have high schools in their own municipality, and there is consequently a demand for many small high schools. Differences in industry and trade between counties can lead to disparities in the preferences of the mix of the study tracks. The size of schools and the composition of study tracks influence the teacher–student ratio and the non-wage spending per student. We assume that county councils prefer high teacher–student ratio and high non-wage spending per student partly because of their evaluation of school size and study mix.

The preferences are represented by a conventional utility function including teacher–student ratio, T/St, non-wage expenditures per student, E/St, the share of the youth offered high school education, St/Yo, and per capita hospital services H. The preferences for the services produced by the county governments are conditioned on sociodemographic descriptives of the counties (Z). The political structure (POL) determines what preferences are decisive, to be discussed in Section 3. The general form of the utility function is:

$$U = U\left(\frac{T}{St}, \frac{E}{St}, \frac{St}{Yo}, H; \mathrm{POL}, Z\right) \qquad (2)$$

U is assumed to be strictly quasi-concave.

Given teacher wages, matching grants and per capita revenue, the county council maximizes Eq. (2) with respect to T/St, E/St, St/Yo and H, subject to the budget constraint (Eq. (1)). It should be noticed that no tax price appears, since the revenues of the counties are exogenous. The relative price between services matters, as represented by the cost components, but partly the costs are endogenous. The solution of the decision problem implies demand functions for the four variables, where we concentrate on the school sector:

$$\frac{T}{St} = \frac{T}{St}\left(\underset{+}{R},\ \underset{-}{W},\ \underset{-}{\frac{Yo}{N}},\ \underset{-}{(1 - m)},\ \underset{?}{(1 - h)};\ \mathrm{POL}, Z\right) \qquad (3)$$

$$\frac{E}{St} = \frac{E}{St}\left(\underset{+}{R},\ \underset{?}{W},\ \underset{-}{\frac{Yo}{N}},\ \underset{-}{(1 - m)},\ \underset{?}{(1 - h)};\ \mathrm{POL}, Z\right) \qquad (4)$$

$$\frac{St}{Yo} = \frac{St}{Yo}\left(\underset{+}{R},\quad \underset{-}{W},\quad \underset{-}{\frac{Yo}{N}},\quad \underset{-}{(1-m)},\quad \underset{?}{(1-h)};\quad \text{POL},Z\right) \tag{5}$$

Our economic hypotheses are based on the comparative static effects indicated under each variable. They are best interpreted using the budget constraint. More revenue available for the county allows for more teachers, more non-wage spending and more students: they are all assumed to be "normal goods". However, since the budget constraint is nonlinear, revenue elasticities can be negative, to be discussed below. More matching grants to high schools have a combined income and demand switching effect working in the same direction, while the two effects work in opposite directions for health care matching grants, $(1 - h)$, making the net effect uncertain. If the share of youth in the population, Yo/N, goes up, it will be more expensive to fund a constant student enrollment ratio. The cost effect leads to a substitution away from the school demand variables. Teacher wages have a similar cost effect. More expensive teaching will induce substitution both from high schools to hospitals and from teachers to non-wage spending. The sign of the effect on non-wage spending depends on the size of the income and substitution effects.

3. Augmented demand model including distributive politics

The expenditure demand models of education assume that the resource allocation is based on stable preferences. The establishment of these preferences is a black box, but is often related to the median voter. A better understanding can be reached by studying the decision making of the local political institutions. Schools offer particularistic benefits financed from a common financial pool. The county council consists of politicians from different municipalities, each with the desire for a high school in their municipality. This is exactly the setup of the common property approach to fiscal policy suggested by Weingast, Shepsle and Johnsen (1981). But they offer no simple decision making rule in this situation. A possible outcome is a norm of universalism, also called pork barrel politics. A coalition of all politicians work together to avoid a majority rule decision whereby some politicians "fall out". The result is excessive spending on schools and higher taxation and/or reduced supply of other public goods.

The big issue in common pool problems is what mechanisms can hold back the pressure for excessive spending. The party system certainly may help coordinate, sine the parties will have representatives from many municipalities and at the same time have a responsibility for the county as a whole. It follows that the party composition and the party basis of the county political leadership are of importance to control pork barrel politics.

We suggest that the demand model be extended to include the balancing between representatives for municipalities and the county political leadership. The battle is first and foremost related to school size. All municipalities want to have a high school in their own municipality, which means that the small municipalities without a high school will work for new schools. The municipalities clearly benefit from having new high schools, by increased employment and thereby increased tax revenues. In addition, the presence of a high school within the municipality means a shorter commute for the students from that municipality, thereby making it more attractive to be a student and increasing the enrollment. In the 1970s and 1980s, the number of new high schools in small municipalities rapidly increased. We capture this demand for schools as part of redistributive politics by including the mean municipality size (MUNSIZE), and expect that all elements of spending increase with smaller size of the municipalities.

We are not aware of any school studies using this approach. But empirical studies of the common pool problem are forthcoming. Notably Inman and Fitts (1990) investigate how parties and presidents control universalism in the US fiscal history. More broadly, Roubini and Sachs (1989) have stimulated the interest of characteristics of the political structure to explain country differences in economic outcomes. They show that political strength, measured by the basis of the county leadership in terms of majority/minority and one party/coalition, is important for fiscal deficits. Kalseth and Rattsø (1998) have shown the importance of political strength in an analysis of administrative overspending in Norwegian municipalities. In the context of school analyses, an interest group model based on income groups has been developed by Craig and Inman (1986).

The political leadership of the county councils presumably try to control the decentralized forces of excessive school spending. The county council is elected every 4th year to lead the county government. The representatives are elected on the basis of party nomination. The county council does not work as a parliamentary system establishing a "cabinet" based on a voting bloc. Instead an executive board is elected among the members of the county council, with proportional representation of the parties. The system of joint rule is likely to facilitate consensual properties, and allows for a more open political struggle regarding the political priorities. The mayor and the deputy mayor are elected by and from the council and are the leaders of the executive board. The party constellation behind the political leadership will generally hold a majority in the executive board.

How is political strength assumed to influence the distribution of county expenditure? Political strength will reduce school expenditure per student when particularistic benefits are related to school size and small schools drive up spending per student. Our main hypothesis is therefore that the indexes of strength will have a negative effect on teacher–student ratio and non-wage spending per student. The resources released can be used to increase the student enrollment ratio, and to improve on other services, notably hospitals.

To represent political strength, two measures are developed, which characterize the party composition of the county council. We use information about the party affiliation of the mayor and the deputy mayor as well as the party composition of the county council, as suggested by Kalseth and Rattsø (1998). Three political situations are classified:

COAL1—The mayor and the deputy mayor are from different parties.
COAL2—The mayor and the deputy mayor are from the same party and the party is in minority.
COAL3—The mayor and the deputy mayor are from the same party and the party is in majority.

This classification is similar to the one adopted by Roubini and Sachs (1989). The dummy variable formulation takes into account the criticism of Roubini and Sachs by Edin and Ohlson (1991). Political strength is assumed highest in COAL3.

A Herfindahl index for party fragmentation in the county council (HERF) is constructed as

$$\text{HERF} = \sum_{p=1}^{P} sh_{\text{p}}^2 \tag{6}$$

where sh_{p} is the share of the seats held by party p. A fragmented county council can lead to a weak executive board since all the major parties are represented there. It is likely that fragmented councils will lead to more bargaining and increase the number of possible outcomes in the council, and thereby creates more room for lobbying. HERF is positively correlated with strength.

Since political strength is assumed to hold back interest group pressure, HERF is interacted with the interest group variable in the empirical specifications. We expect that political strength is most important, and therefore has strongest effect, when interest group pressure is large.

The third aspect included concerns ideology and preferences. The county council utility function is assumed to depend on ideology. We will test the effect of the share of socialist representatives in the county council (SOCSHA). Our hypotheses are based on observation of the political debate: socialists have had high priority of broad student enrollment to achieve equity, and socialists have worked for the centralization of the school structure in large high schools. If the socialist parties prefer a higher student share, resources have to be reduced in other areas given the budget constraint. Large high schools are a way of taking benefit from economies of scale to reduce the costs. SOCSHA is expected to have a positive effect on student share and a negative effect on teachers per student and non-wage school spending. The socialist priorities may depend on the level of the county revenues.[2]

4. Operationalization and econometric specification

The study covers the 18 counties in Norway for the period after the reform integrating vocational and academic training, 1976–93. The three demand variables, *T/St*, *E/St* and *St/Yo*, have different time paths, as seen in Table 1. The student enrollment ratio and the teacher–student ratio have been steadily increasing in all counties. The expansion of teacher-intensive vocational training immediately after the reform and later as a response to the youth unemployment in the 1990s are related to the sharp rise in the teacher–student ratio during these periods. Non-wage spending per student varies strongly between counties and over time, and shows on average no clear time pattern.

Sluggish adjustment towards the desired allocation of high school resources is likely. Since the full high school education lasts up to three years, the length of the study program itself represents some inertia. Decisions about school structure and the mix of the study tracks require long run planning. Many of the resources are locked up by agreements with teacher unions, municipalities and others that take time to change. The political decision making system needs time to decide and implement new policies. The sluggishness of the system is captured by lagged dependent variable and one year lag in all the exogenous variables. Appendix A Table 5 outlines unit root tests for the time series properties of the dependent variables, indicating that they all can be interpreted as stationary when time specific effects are taken into account.[3]

Since the political and economic system is common for the counties, equal constant terms between counties may seem like a fruitful starting point. But county specific factors such as cultural differences can operate outside our model. When the constant term varies between

[2] The correlation between the measures of the political economy is shown in Appendix A Table 4. Because the socialist block is dominated by a single party, the social democrats, and because the variables only change in connection with elections every fourth year, there is a high correlation between SOCSHA and the indexes of strength.

[3] Since we will include time specific effects in all the empirical models, the unit root tests which include time specific effects are most interesting. Rejection of non-stationarity in this case indicates that the variables are stationary around the national unweighted average.

counties, the variation in background factors is taken care of. It is well known that applying OLS to dynamic models yields consistent estimators only when the number of time periods goes to infinity. When the number of time periods is fixed, the bias implied by the lagged dependent variable will be positive without county specific effects included in the model, and negative with such effects. The bias is reduced with increased number of time periods. Results from both specifications are reported, and a range for the consistent estimators consequently is obtained.

The model formulation allows us to distinguish between short and long run effects.[4] Appendix A Table 6 reports the results of the models of the three demand variables. The political variables embody limited time variation and are alternative measures of the same characteristics. The results presented are robust to alternative specifications and are documented in Table 6.

As expected, the difference between the models with and without county specific effects is largest with respect to the lagged dependent variables and the variables with small time variation. Adjustment inertia are documented, the effects of the lagged dependent variable are in the range of 0.23–0.33 for teacher–student ratio, 0.33–0.41 for non-wage spending per student and 0.17–0.24 for student enrollment ratio. These numbers indicate the amount of the desired change implemented the first year. Because the null hypotheses of no county specific effects cannot be rejected at the 1% level in 5 out of 6 cases, the discussion below concentrates on the model without such effects.

5. The economics of high school spending

The county government demand for high school education forms the basis of the decision model outlined. The impact of the economic variables, presented in Table 2, is fairly consistent with the literature on demand models of local services. The revenue elasticity of the teacher–student ratio is 0.33 in the long run and 0.21 in the short run, while non-wage spending only has a significant short run revenue elasticity of 0.97. It seems like non-wage spending "overshoots" its long run adjustment. Our understanding is that non-wage spending takes most of the short run adjustment, while changing teacher employment takes a longer time. When teacher employment is adjusted, non-wage spending per student returns to the initial value.

The results for the student enrollment ratio are puzzling. We find negative Engel elasticities both in the short and long run, in contradiction to the predictions of the demand model and the cross-country results of Schultz (1988). The robustness of the negative revenue effect can be questioned.[5] Theoretically, however, a negative Engel effect is perfectly possible. The result can be explained by the non-linear budget constraint, which implies that counties with higher revenues give so much more priority to school quality (teachers and non-wage spending) that student enrollment goes down. The technicalities of revenue elasticities with a multiplicative budget constraint are illustrated by Edlefsen (1981) and Falch (1998).

The above elasticities add up to a low Engel elasticity for total high school spending. The revenue elasticity of total spending is a weighted sum of the elasticities of the three components.[6] Based on the budget constraint (Eq. (1)), we find that an increase in the county revenue of 10% will increase total high school spending by 0.5% in the long run and 2.5% in the short run. The large short-run elasticity follows from the quick adjustment of non-wage spending explained above.

The revenue elasticity derived from our rationed demand system is different from those estimated in median voter studies. By definition, the weighted average of the revenue elasticities of all services equals 1. To compare the results to international estimates of elasticities with respect to private income, we must take into account the elasticity of county revenues with respect to

[4] The equation for the teacher–student ratio illustrates the model formulation:

$$\Delta(t-st)_{it} = \eta_i + \eta_t + \alpha_0(t-st)_{it-1} + \alpha_1\Delta x_{it} + \alpha_2 x_{it-1} + \alpha_3 pol_{it-1} + \alpha_4(r^*\text{socsha})_{it-1} + \alpha_5(\text{munsize}^*\text{herf})_{it-1} + \alpha_6 z_{it} + \epsilon_{it}$$

Small letters indicate logarithmic form, Δ is a differential operator, η_i and η_t are county and time specific effects, respectively, and ϵ_{it} is a stochastic error term for county i at time t. X is a vector including the economic variables R, W, $(1-m)$, $(1-h)$, and $(yo-n)$, and POL includes MUNSIZE, HERF, COAL2, COAL3, and SOCSHA. The control variables included in Z are described in Appendix A Table 6. Since all variables are logarithms, constant elasticities are estimated. α_1 is a short run elasticity and α_2/α_0 and α_3/α_0 are long run elasticities. The long run effects of R, SOCSHA, MUNSIZE, and HERF are nonlinear. The equations for non-wage spending per student and student enrollment ratio are similar.

[5] An alternative econometric strategy is to reject the negative revenue elasticity as a possible result of inadequate representation of matching grants. When the revenue variable at differenced form is excluded, both the long run negative revenue effect, the long run positive effect of teacher wage, and the effect of the grants up to 1985 disappear.

[6] The revenue elasticity of total high school spending is

$$El_{Sp} \approx El_{St/Yo} + El_{T/St}\lambda + El_{E/St}(1-\lambda)$$

where El is a symbol of elasticity, Sp is total high school spending and λ is the wage spending share of total spending, $(W^*T/St)/(W^*T/St + E/St)$. λ is measured at mean, where $\lambda = 0.74$.

Table 2
Regression results of economic variables

	Teacher–student ratio	Non-wage spending per student	Student enrollment ratio
Revenue, LRE[a]	0.33 (2.82)	0.48 (1.18)	−0.32 (2.33)
Revenue, SRE	0.21 (4.63)	0.97 (4.15)	−0.16 (3.99)
Teacher wages, LRE	−0.06 (0.90)	0.30 (1.17)	0.18 (2.04)
Teacher wages, SRE	−0.17 (5.91)	0.47 (3.04)	−0.03 (0.96)
Spending share high schools 1977–1985, LRE	−0.15 (1.89)	−0.13 (0.46)	0.28 (3.07)
Spending share high schools 1986–1993, LRE	−0.23 (1.00)	−0.03 (0.04)	−0.35 (1.26)
Spending share high schools 1977–1985, SRE	−0.14 (3.56)	0.37 (1.82)	0.05 (1.44)
Spending share high schools 1986–1993, SRE	0.06 (0.75)	0.27 (0.66)	−0.25 (3.64)
Spending share hospitals, LRE	0.04 (0.44)	0.15 (0.43)	−0.23 (2.11)
Spending share hospitals, SRE	0.04 (1.46)	0.34 (2.19)	−0.04 (1.70)
Youth share, LRE	−0.47 (1.52)	−0.89 (0.82)	0.10 (0.25)
Youth share, SRE	−0.09 (0.51)	1.08 (1.22)	−0.52 (3.45)

Notes: LRE is long run elasticity and SRE is short run elasticity. Calculated from columns (2), (5) and (8) Appendix A Table 6. Absolute *t*-values in parentheses.
[a]Calculated at mean value of the socialist share.

private income, estimated to about 1.5 by Borge and Rattsø (1996). It follows that the long run private income elasticity is about 0.1, while the short run elasticity is about 0.4. A full understanding of the long run elasticity must take into account the development of cost components exogenous to the counties, notably teacher wage levels. The income elasticity of teacher wages in primary school has been estimated to 0.76 by Falch and Rattsø (1997). If we use this estimate for high school teachers, the long run income elasticity is 0.6.

Micro analyses of primary school expenditure determination in the US tend to find income elasticities smaller than one, see Feldstein (1975) and Rubinfeld and Shapiro (1989). Rubinfeld and Shapiro argue that the coefficients based on micro data are not seriously biased, and show that the income elasticity of school expenditures, when the expenditures are an input to the production of educational output, can both understate and overstate the income elasticity of output demand. Romer et al. (1992) estimate income elasticities in the range 0.76–0.98, typical to US studies at school district level.

The theoretical model includes four variables that can be interpreted as price effects; the teacher wage level, the county spending shares to high schools and hospitals when adjusted for matching grants, and the share of youth in the population. The short run wage elasticity of the teacher–student ratio is − 0.17, and the wage effect is sharply determined. When wages increase, the counties react by reducing the number of teachers in the short run. In the long run, however, the effect on the teacher–student ratio is insignificant, while we find a positive effect on student enrollment ratio. This positive effect is consistent with the negative revenue elasticity. The demand function for teachers does not seem to be downward-sloping in the long run. The wage effect on non-wage spending is a cross-price elasticity. The consequences of wage changes depend on whether employment and non-wage spending are complements or substitutes in demand. We find that they are gross substitutes, higher costs of hiring a teacher increase non-wage spending.[7] When wages go up by 10%, wage spending per student ($W*T/St$) increases by 8.3% (9.4%) and total high school spending rises by 7.1% (9.5%) in the short (long) run.

The counties take into account demographic changes affecting the share of youth in the population. The youth share serves as a cost factor in the sense that per capita spending to keep the school variables constant goes up when the age composition shifts towards the young. As expected, a rise in the youth share reduces the enrollment ratio with a short run elasticity of − 0.52. To be part of a baby boom has a cost, the opportunity to enter secondary education is limited. When the youth share of the population increases by two standard deviations from the sample mean (from 0.064 to 0.072), the student enrollment ratio decreases by 6.5% (from 0.655 to 0.612 at mean) in the short run. However, resource use per student, as measured by teacher–student ratio and non-wage spending, seems to be independent of the youth share. Poterba (1997) shows a strong negative effect of student cohort size and spending per student in the US,

[7] Because teachers' seniority and level of education also differ between study tracks, and the mix of study tracks is a county decision, the wage level is not fully exogenous. However, if teacher wages are excluded from the models, the other results remain the same.

as do Borge and Rattsø (1995) in primary education in Norway.

The grant reform of 1986 abolishing most of the matching grants changed the relative price of high school education to county governments. The higher local cost share of high school spending is expected to shift resources out of the sector, according to standard theory of grant systems. It is hard to do a convincing study of the grant reform, since the matching grant system was complicated and limited data are available. The matching rates were dependent on county characteristics, and the average cost shares applied in this study may reflect the variation of sociodemographic factors built into the formulas. On the margin the stimulating effect of the matching grants can be higher than estimated.

The counties covered a share $(1 - m)$ of high school spending equal to 0.489 on average before 1986, while the share was increased to 0.859 on average for the period after 1986. A few years after the reform, new matching grant schemes gradually emerged, partly as a response to rising unemployment among the youth. The central government wanted to encourage student enrollment by paying subsidies for new classes. The details of the grant reform have been investigated by separating out the effects of the different sub-periods. There seem to be changes in the responses to grants between the two periods. We cannot reject that resources per student were independent of the grant system after 1986. The cost share had a significant influence on the teacher–student ratio only when matching grants were in full operation. The new matching grants oriented towards the establishment of new classes were successful in mobilizing more students without influencing resource use per student significantly. The matching grants oriented towards hospitals were reformed both in 1980 and 1986. We only find small effects of this relative price, and they seem to be the same in the whole period. The results indicate that hospital services and high school spending per student are substitutes in demand, while hospitals and student enrollments are complements.

6. The politics of high school spending

The political story outlined in Section 3 describes the interaction between municipalities and politicians demanding high schools and the county political leadership trying to coordinate. In this situation, both characteristics of the municipalities and the political structure will be important in addition to the economic factors. The results confirm this understanding of the political decision making. The key elasticities are reported in Table 3.

The spending pressure of the municipalities is represented by the average municipality size in the county. The size of the municipalities has a clear impact on school spending, and the effect depends on the strength of the county council measured by the Herfindahl index. As expected, the spending pressure is most important in counties with weak leadership. Resource use per student goes up when the average size of the municipalities is reduced, and both teacher–student ratio and non-wage spending per student rise more the weaker the governments. The municipalities seem to be successful in influencing the number of and the location of high schools. The teacher–student ratio increases because smaller schools mean smaller student groups in each subject. Non-wage spending rises because more schools means more administration and maintenance. The results are robust with respect to inclusion of variables representing the settlement pattern (see Appendix A Table 6).

The effect of municipality size on student enrollment is strong and depends critically on political strength. The negative impact of smaller size in weak county councils fits our understanding that school size is the controversial issue, and that the interests of student enrollment are not well represented in the decision making process. Strong county councils are able to move resources from spending per student to more students. The high coefficients on student enrollment indicate that strong county governments release resources from other sectors as well.

To investigate the robustness of the result, we have experimented with other measures of spending pressure, notably the share of small municipalities in the county. A decentralized school structure will be most costly in counties with a high share of small municipalities. Replacing municipality size with the share of municipalities with less than 5000 inhabitants in the model gives qualitatively the same results, supporting our hypothesis of the importance of municipalities in the school spending decision.

The main effect of political strength is to hold back on resource use per student. When party fragmentation is reduced with two standard deviations and the size structure of municipalities is on average, teacher–student ratio is reduced by 5.1% in the long run (from mean 0.099 to 0.094), non–wage spending per student is reduced by 18% (from mean NOK 14 000 to 11 500), and student enrollment is increased by 0.1% (from 0.655 to 0.661). Our understanding of the background factors is that political strength increases the average school size and reduces administrative spending. The effect on student enrollment is sensitive to the pressure. With high pressure, a strong council increases the enrollment a lot. It seems that strong county councils react less to high pressure for reduced school size and increased hospital spending, and thereby they create room for increased quantity of schooling. With low interest group pressure, we do not expect political strength to increase student enrollment because “overspending” on other components is expected to be small. We have classified the political

Table 3
Regression results of political variables

	Teacher–student ratio	Non-wage spending per student	Student enrollment ratio
Interest group pressure, LRE			
Strong county council (herf)	0.07 (2.16)	0.22 (1.99)	0.66 (5.93)
Weak county council (herf)	0.12 (2.16)	0.41 (1.99)	−0.29 (3.56)
County council strength (measured by herf), LRE			
High interest group pressure	−0.22 (2.14)	−0.79 (2.39)	0.94 (5.06)
Low interest group pressure	−0.11 (1.06)	−0.42 (1.19)	−0.88 (4.71)
One party majority in the county council, LRE	0.06 (2.39)	—	−0.17 (5.54)
Socialist share, LRE			
High revenue county	0.18 (1.98)	0.54 (1.82)	0.20 (1.79)
Low revenue county	−0.09 (0.91)	0.54 (1.82)	−0.10 (0.84)
Revenue, LRE			
High socialist share	0.49 (3.80)	0.48 (1.18)	−0.16 (1.05)
Low socialist share	0.17 (1.30)	0.48 (1.18)	−0.49 (3.07)

Notes: LRE denotes long run elasticity. Absolute *t*-values in parentheses. Calculated from columns (2), (5) and (8) Appendix A Table 6. High/strong and low/weak refer to mean values ± 2 standard deviations.

situation of the counties dependent on majority control and coalitions (the COAL-variables). The classification is of little importance for high school spending.

The ideological orientation of the county council influences the high school policy, and the role of the ideology is conditional on the per capita revenue level of the county. We find weak support for our hypothesis emphasizing a socialist priority of student enrollment at the expense of spending per student. SOCSHA has a positive effect on enrollment at the 10% level only in high-revenue counties. A higher share of socialist representatives in the council is also associated with higher teacher–student ratios and higher non-wage spending per student. The higher resource use typically reflects small schools and vocational training. Different from our hypotheses about socialism in Section 3, the socialists seem to give priority to these factors, first and for all with a bias towards vocational training. The strong effect of socialist influence on non-wage expenditures can reflect socialist preferences for administration, as found by Kalseth and Rattsø (1998). The lack of socialist influence on the teacher–student ratio and student enrollment in low-revenue counties may reflect the reduced room for ideology when available resources are small.[8]

[8] The role of ideology can be interpreted as modifications of the revenue effects. The long run revenue elasticity of the teacher–student ratio is 0.33 at mean value of the socialist share, and increases to 0.49 when the socialist share increases by two standard deviations.

7. Concluding remarks

The disaggregation of school spending has thrown new light on the role of cost factors in explaining the expansion of educational services. The revenue level of the counties is important for the teacher–student ratio and non-wage spending per student. Total high school spending, however, is highly inelastic with respect to county revenue. Since high schools are revenue inelastic, the differences in high school spending are smaller than the variation in total county budgets. The price effect must be understood in terms of cost components of the high schools and matching grants. Higher teacher wages represent the main driving force in the continuous growth of per capita high school spending. It follows from the quite inelastic response of the teacher–student ratio to higher wages. Teacher wages have a positive substitution effect on non-wage spending.

Many countries have moved their grant systems from matching grants to lump sum grants. In Norway the 1986 grant reform consolidated grants into lump sum, and the role of matching grants was strongly reduced. Before 1986, matching grants were paying about 50% of the high school spending on average. When most of the matching grants were abolished, in particular the teacher–student ratio responded downwards. This partial effect was counterbalanced by the higher general grant and the positive revenue-elasticity of the teacher–student ratio. Later new matching grants have been introduced to stimulate more classes established during a period of high youth unemployment. They were successful in mobilizing more students, and they did not significantly influence the resource use per student.

The disaggregated county demand model for educational services has been augmented to represent the common property approach to fiscal policy. Representatives for municipalities fight for new schools, while the political leadership of the counties try to control the spending pressure. The analysis confirms an important role of municipality size and characteristics of the political leadership. Strength, measured by the party fragmentation of the council, is able to hold down the costs and allow for more student enrollment. A county council with no clear majority and a fragmented council ends up with the highest costs. Political strength is most important when the spending pressure is strong.

It is well known from the public debate that municipalities fight for high schools in their own neighborhood. The analysis indicates that municipalities are able to influence the resource use of the counties. When the average size of municipalities in a county is small, the high schools tend to be small, and both the teacher–student ratio and non-wage spending per student are high. Consolidating the municipalities into bigger units may reduce the high school costs.

The analysis implies that the decentralization of the responsibility for high school education to counties has led to systematic differences in the teaching offered. The decentralization is in conflict with the equalization goals of the welfare state. The decentralization is usually motivated by the desire to adjust to variation in local preferences. The importance of political strength documented suggests that the differences between the counties does not necessarily reflect the preference variation.

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Appendix A

Table 4. Correlation matrix for variables describing political economy

	socsha	herf	munsize	COAL1	COAL2	COAL3
socsha	1					
herf	0.84	1				
munsize	−0.21	−0.02	1			
COAL1	−0.66	−0.56	0.21	1		
COAL2	0.30	0.13	−0.07	−0.71	1	
COAL3	0.55	0.62	−0.21	−0.55	−0.20	1

Notes: Small letters denote logarithmic form.

Table 5. Unit root tests for the dependent variables

	$(t - st)$	$(e - st)$	$(st - yo)$
DF(time specific effects)	−3.45[a]	−4.83[a]	−5.95[a]
DF(county specific effects)	−6.20	−8.67[a]	−1.91
ADF(time specific effects)	−3.18[a]	−4.66[a]	−6.26[a]
ADF(county specific effects)	−5.28	−7.95[a]	−4.28

Notes: DF is the Dickey–Fuller test statistic for stationarity and ADF is the Dickey–Fuller test statistic augmented with one lagged difference. The period is 1976–1993.

[a]Stationarity cannot be rejected at the 5% level. Critical values (see Levin & Lin, 1992) are − 2.17 when time specific effects are included in the regression and − 6.95 when county specific effects are included in the regression.

Table 6. Documentation of the regression results of economic and political variables

Dependent variable	Mean	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			$\Delta(T\text{-}St)$			$\Delta(E\text{-}St)$			$\Delta(St\text{-}Yo)$	
Lagged dep. variable	—	−0.233	−0.233	−0.326	−0.339	−0.328	−0.406	−0.173	−0.173	−0.240
		(6.88)	(7.74)	(8.27)	(7.27)	(7.36)	(7.92)	(7.75)	(7.91)	(7.32)
r_{it-1}	9.262	0.141	0.141	0.115	0.187	0.156	0.120	−0.005	−0.007	−0.002
	[0.22]	(3.97)	(4.15)	(2.36)	(0.99)	(1.14)	(0.61)	(0.14)	(0.24)	(0.04)
Δr_{it}	0.032	0.211	0.210	0.213	0.978	0.970	0.916	−0.161	−0.159	−0.152
	[0.08]	(4.58)	(4.63)	(4.39)	(4.07)	(4.15)	(3.64)	(3.93)	(3.99)	(3.53)
w_{it-1}	5.790	−0.016	−0.015	−0.041	0.132	0.100	0.155	0.033	0.030	0.037
	[0.13]	(0.93)	(0.89)	(1.92)	(1.42)	(1.15)	(1.37)	(2.12)	(2.07)	(2.01)
Δw_{it}	−0.012	−0.176	−0.175	−0.182	0.477	0.467	0.400	−0.024	−0.025	−0.008
	[0.05]	(5.88)	(5.91)	(5.91)	(3.06)	(3.04)	(2.49)	(0.89)	(0.96)	(0.30)
$\log(1-m^{I})_{it-1}$	−0.430	−0.035	−0.035	−0.071	−0.040	−0.041	0.054	0.048	0.048	0.034
	[0.38]	(1.95)	(1.97)	(3.12)	(0.43)	(0.46)	(0.47)	(2.87)	(2.90)	(1.64)
$\log(1-m^{II})_{it-1}$	−0.058	−0.053	−0.054	−0.042	−0.079	−0.011	−0.003	−0.064	−0.060	−0.083
	[0.08]	(0.96)	(1.01)	(0.69)	(0.28)	(0.04)	(0.01)	(1.29)	(1.24)	(1.53)
$\Delta\log(1-m^{I})_{it}$	−0.001	−0.140	−0.139	−0.145	0.379	0.369	0.443	0.053	0.050	0.039
	[0.04]	(3.53)	(3.56)	(3.64)	(1.83)	(1.82)	(2.13)	(1.49)	(1.44)	(1.10)
$\Delta\log(1-m^{II})_{it}$	−0.009	0.058	0.058	0.075	0.240	0.265	0.406	−0.252	−0.251	−0.247
	[0.02]	(0.75)	(0.75)	(0.95)	(0.59)	(0.66)	(0.99)	(3.63)	(3.64)	(3.50)
$\log(1-h)_{it-1}$	−0.600	0.009	0.010	−0.004	0.096	0.048	−0.152	−0.037	−0.040	−0.009
	[0.34]	(0.38)	(0.44)	(0.16)	(0.79)	(0.43)	(1.08)	(1.83)	(2.13)	(0.37)
$\Delta\log(1-h)_{it}$	0.051	0.042	0.043	0.041	0.360	s0.335	0.256	−0.042	−0.044	−0.043
	[0.23]	(1.40)	(1.46)	(1.36)	(2.29)	(2.19)	(1.62)	(1.58)	(1.70)	(1.59)
$(yo-n)_{it-1}$	−2.747	−0.111	−0.110	−0.152	−0.267	−0.291	−0.878	0.017	0.017	0.012
	[0.06]	(1.42)	(1.54)	(1.72)	(0.65)	(0.81)	(1.90)	(0.25)	(0.25)	(0.16)
$\Delta(yo-n)_{it}$	−0.007	−0.089	−0.086	0.087	0.863	1.075	1.028	−0.517	−0.517	−0.510
	[0.02]	(0.51)	(0.51)	(0.43)	(0.94)	(1.22)	(0.98)	(3.32)	(3.45)	(2.82)
$socsha_{it-1}$	−0.835	−0.684	−0.685	−0.242	0.398	0.177	−0.023	−0.540	−0.532	−0.647
	[0.25]	(2.66)	(2.76)	(0.74)	(0.30)	(1.84)	(0.13)	(2.21)	(2.24)	(2.19)
$(r{*}socsha)_{it-1}$	−7.727	0.075	0.075	0.027	−0.019	—	—	0.059	0.058	0.071
	[2.26]	(2.70)	(2.82)	(0.73)	(0.13)			(2.25)	(2.30)	(2.16)
$munsize_{it-1}$	8.952	0.003	—	—	0.124	—	—	−0.305	−0.305	−0.356
	[0.40]	(0.06)			(0.48)			(6.47)	(6.49)	(4.87)
$herf_{it-1}$	−1.398	−0.200	−0.182	−0.506	−1.375	−0.861	2.024	1.756	1.751	2.261
	[0.21]	(0.65)	(2.53)	(2.30)	(0.92)	(2.50)	(1.79)	(6.42)	(6.45)	(5.08)
$(munsize{*}herf)_{it-1}$	−12.51	0.018	0.016	0.052	0.126	0.074	−0.263	−0.196	−0.195	−0.248
	[1.97]	(0.53)	(2.11)	(2.17)	(0.75)	(1.95)	(2.11)	(6.44)	(6.47)	(5.03)
COAL2_{it-1}	0.203	−0.001	—	—	0.016	—	—	0.003	—	—
	[0.40]	(0.30)			(0.68)			(0.64)		
COAL3_{it-1}	0.144	0.014	0.015	0.009	−0.009	—	—	−0.028	−0.030	−0.036
	[0.35]	(1.75)	(2.28)	(0.83)	(0.21)			(3.78)	(5.14)	(3.46)
dens_{i}	−1.136	−0.001	—	—	0.085	–	—	0.003	—	—
	[0.35]	(0.07)			(1.19)			(0.23)		
acreage_{i}	−1.923	−0.011	−0.012	—	−0.017	—	—	−0.001	—	—
	[1.02]	(2.28)	(2.97)		(0.65)			(0.34)		

Continued

Table 6. Continued

Dependent variable	Mean	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Δ(*T-St*)			Δ(*E-St*)			Δ(*St-Yo*)		
County sp. effects	—	no	no	yes	no	no	yes	no	no	yes
SSR	—	0.114	0.114	0.104	3.099	3.132	2.875	0.090	0.091	0.082
F(reduction)	—	—	0.031 (3,255)	4.383 (2,240)	—	0.450 (6,255)	1.067 (4,240)	—	0.146 (3,255)	0.704 (4,240)
F(no fixed effects)	—	2.240 (15,240)	1.537 (16,242)	—	1.531 (15,240)	1.285 (17,244)	—	1.812 (15,240)	1.536 (17,241)	—

Notes: Absolute *t*-values in parentheses, standard deviations in brackets. Small letters denote logarithmic form and Δ is a differential operator. The sample comprises the 18 counties in Norway in 1977–1993, 306 observations. SSR is the sum of squared residuals. *F*(reduction) is an *F*-test of the restrictions on the general model including all explanatory variables and *F*(no fixed effects) tests the validity of equal constant terms between counties ($\eta_i = \eta$), degrees of freedom in parentheses. m^{I} indicates matching grants in 1977–1985 and m^{II} indicates matching grants in 1986–1993. Time specific effects and 14 control variables are included. The coefficients of the two control variables measuring settlement pattern are reported. DENS is the share of the population living outside towns and city centers with more than 2000 inhabitants in 1980 and ACREAGE is the inverse of population per km^2 in 1980. The other control variables are the share of the population employed in manufacturing, the share of total manufacturing employment in the three largest manufacturing sectors, the unemployment rate, the share of the students in private and state owned schools, the share of the population above 80 in age, and population, all included on differenced form and with one lag.

The general models without county specific effects are reported in columns (1), (4) and (7). Few significant effects of the political variables may indicate a multicollinarity problem. The models in columns (1), (4) and (7) are reduced by omitting the variable out of socsha, (*r**socsha), munsize, herf, (munsize*herf), COAL2, COAL3, dens and acreage with lowest *t*-value until the remaining of these variables are significant at 10% level. The results after this procedure are presented in columns (2), (5) and (8). These models with county specific effects are reported in columns (3), (6) and (9).

References

Barlow, R. (1970). Efficiency aspects of local school finance. *Journal of Political Economy*, *78*, 1028–1039.

Bonesrønning, H., & Rattsø, J. (1994). Efficiency variation among the Norwegian high schools: consequences of equalization policy. *Economics of Education Review*, *13*, 289–304.

Borge, L. E., & Rattsø, J. (1995). Demographic shift, relative costs and allocation of local public consumption in Norway. *Regional Science and Urban Economics*, *25*, 589–598.

Borge, L. E., & Rattsø, J. (1996). *Local government spending growth and redistributive politics: Norway 1880–1990*. Mimeo: Norwegian University of Science and Technology, Department of Economics.

Card, D., & Kreuger, A. (1992). Does school quality matter? Returns to education and the characteristics of public schools in the United States. *Journal of Political Economy*, *100*, 1–40.

Craig, S., & Inman, R. P. (1982). Federal aid and public education: an empirical look at the new fiscal federalism. *Review of Economics and Statistics*, *64*, 541–552.

Craig, S., & Inman, R. P. (1986). Education, welfare and the "new" federalism: State budgeting in a federalist public economy. In H. Rosen (Ed.), *Studies in state and local public finance* (pp. 187–227). Chicago: University of Chicago Press.

Edin, P., & Ohlson, H. (1991). Political determinants of budget deficits: coalition effects versus minority effects. *European Economic Review*, *35*, 1597–1603.

Edlefsen, L. E. (1981). The comparative statics of hedonic price functions and other nonlinear constraints. *Econometrica*, *49*, 1501–1520.

Falch, T. (1998) *Public sector decision making when public services include quantity and quality components*. Mimeo: Norwegian University of Science and Technology, Department of Economics.

Falch, T., & Rattsø, J. (1997). Political economic determinants of school spending in federal states: theory and time-series evidence. *European Journal of Political Economy*, *13*, 299–314.

Feldstein, M. (1975). Wealth neutrality and local public choice in public education. *American Economic Review*, *65*, 75–89.

Hanushek, E. (1986). The economics of schooling: production and efficiency in public schools. *Journal of Economic Literature*, *24*, 1141–1177.

Inman, R. P. (1978). Optimal fiscal reform of metropolitan schools: some simulation results. *American Economic Review*, *68*, 107–122.

Inman, R. P., & Fitts, M. (1990). Political institutions and fiscal

policy: evidence from the US historical record. *Journal of Law, Economics and Organization*, *6*, 79–132.
Kalseth, J., & Rattsø, J. (1998). Political control of administrative spending: the case of local governments in Norway. *Economics & Politics*, *10*, 63–83.
Levin, A., & Lin, C. F. (1992) *Unit root tests in panel data: asymptotic and finite-sample properties*. Discussion Paper 92–23. San Diego, CA: University of California, Department of Economics.
Lovell, M. (1978). Spending for education: the exercise of public choice. *Review of Economics and Statistics*, *60*, 487–495.
Poterba, J. (1997). Demographic structure and the political economy of public education. *Journal of Policy Analysis and Management*, *16*, 48–66.
Romer, T., Rosenthal, H., & Munley, V. (1992). Economic incentives and political institutions: spending and voting in school budget referenda. *Journal of Public Economics*, *49*, 1–33.
Roubini, N., & Sachs, J. (1989). Government spending and budgetary deficits in the industrial counties. *Economic Policy*, *8*, 100–132.
Rubinfeld, D., & Shapiro, P. (1989). Micro-estimation of the demand for schooling. *Regional Science and Urban Economics*, *19*, 381–398.
Sander, W. (1993). Expenditures and student achievement in Illinois. *Journal of Public Economics*, *52*, 403–416.
Schultz, T. P. (1988). Expansion of public school expenditures and enrollments: intercountry evidence on the effects of income, prices and population growth. *Economics of Education Review*, *7*, 167–183.
Weingast, B., Shepsle, K., & Johnsen, C. (1981). The political economy of benefits and costs: a neoclassical approach to distributive politics. *Journal of Political Economy*, *89*, 642–664.