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Political economic determinants of school spending in federal states: Theory and time-series evidence

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Abstract

To develop the understanding of public sector growth, this paper addresses the determinants of one important component of public spending, public education. Disaggregation of school expenditure allows for an analysis of how different decisions at the national and the local government level contribute to increased spending. A bargaining model between the central government and a teacher union is combined with a demand model of educational services at the local government level. Political characteristics are assumed to influence the central government bargaining strength over teacher wages and working hours. The model is implemented using a database for economic, political and school factors in Norway during 1880–1990. Political strength, measured as stable government and low party fragmentation of parliament, is shown to be important to hold down teacher employment. Socialist orientation of the government tends to drive up both teacher wages and employment. The inelastic response of local governments to centrally determined cost factors imply that they are not able to hold back spending growth following higher costs.

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1. Introduction

The growth of public spending is a concern in most industrialized countries. Autonomous forces seem to be driving social expenditure, and political institutions struggle to control the government budget. Economic analyses emphasize price and income effects as determinants of public sector growth, identified as Baumol's disease and Wagner's law, respectively. Borcherding (1985) introduced a simple empirical demand model of public sector growth to estimate these effects, which have been confirmed for many countries. To reach a better understanding of the decision making process forming public spending, we suggest that the attention is put towards specific components of the government budget and that the demand is understood in a political-economy framework.

This analysis is concentrated to public education. In fact, education was one of the key areas mentioned by Wagner (1983) as a source of expanding public sector. When school expenditure is disaggregated, the components can be related to different decision making processes. Teacher wages and teaching requirements are typically determined in bargaining with teacher unions. Most countries have decentralized the organization of education to the local public sector. When local governments determine the school structure, the economic relationship between central and local governments is made important. We suggest to integrate a bargaining model of teacher wages and teaching requirements with a multi-level demand model of educational services. The reduced form estimated offers a rich understanding of factors contributing to primary school spending growth and is implemented using a database for economic, political and school factors in Norway during 1880–1990.

The broad literature on school spending determinants are based on cross-sectional evidence and aggregate measures of spending. Influential articles include Craig and Inman (1986) and Romer et al. (1992). Compared to them, we disaggregate school spending to look at the different decisions affecting teacher wages, teachers per class and class size and concentrate on the time series dimension. As will come clear, the time series perspective gives a different understanding of the role of cost factors.

The public choice literature has created interest in the role of interest groups and the decisions of the political system. Roubini and Sachs (1989) and Inman and Fitts (1990) have recently shown that the type of political leadership in a country influences the fiscal situation at large. In our model, the teacher union represents an explicit interest group and political strength is of importance for the bargaining between the political authority and the union. Consequently, we can offer an empirical investigation of a specific channel of interest group influence. We show that the strength and the preferences of the government affect the outcome.

The theoretical framework integrating teacher bargaining into a multi-level demand model of educational services is presented in Section 2. The political economy context is developed in Section 3. Sections 4 and 5 discuss the estimated

economic and political determinants of teacher wages, teachers per class and class size. Our results concerning sources of school spending growth are summarized in Section 6.

2. Modelling the determination of school spending [1]

To understand the spending growth process, school spending per capita is decomposed to identify different factors involved. The decomposition model applied in this study separates between price and volume factors:

$$\frac{\text{School spending}}{\text{population}} = \left(\frac{\text{Wages}}{\text{teachers}} + \frac{\text{non-wage spending}}{\text{teachers}} \right) \times \frac{\text{teachers}}{\text{classes}} \times \frac{\text{classes}}{\text{students}} \times \frac{\text{students}}{\text{population}}$$

The price factor is divided between wages and non-wage spending and is related to teacher manyears. The teacher employment per capita is disaggregated to capture three elements important in school analyses: teachers per class, class size and student share of the population. The dynamics of the factors accounting for school spending growth are very different. In our data covering primary school, teachers per class on average have had a steady growth from 0.5 in 1880 to almost 2 in 1990, while the average class size has fluctuated around 20 students. The rise in teachers per class is to a large extent related to the reduced working hours and reduced teaching load of the teachers and increased length of the school year. Since this is set by the central government, in an understanding with the teacher union, national decisions clearly have driven up the teacher–student ratio. Class size varies between municipalities and reflects school size and thereby school structure. The decentralized school structure chosen by most local governments leads to small classes, and is the key local decision taken regarding primary education.

This institutional setup in Norway is fairly typical to most European countries both regarding decentralized responsibility of local governments and bargaining with unions. The national control of school spending is related to the central government regulation of local government finance and central government bargaining with the teacher union. Local governments are responsible for organizing the primary education, and they decide their resource allocation to schools in competition with other local public services given their budget constraint.

The theoretical framework of our analysis assumes that the central government reaches a Nash bargaining solution with a teacher union about teacher wages and

[1] A formal analysis of the model is available from the authors on request.

teachers per class. A representative local government determines its priorities of school structure and thereby class size given the bargaining outcome at the national level and given grants from the central government. The institutional setup definitely has changed over the 110 year period studied, in particular concerning wage bargaining and local government financing. Still it seems to us worthwhile trying to reach broad generalizations about systematic factors affecting school spending growth. Falch and Rattsø (1996) have addressed the post WWII 1946–1990 period and reach conclusions consistent with this long term study.

2.1. *Local government decision*

Since the local government is assumed to be a Stackelberg follower of the central government, we start out with a description of the local decisions. A local government response function is derived from a demand model for local public services including local preferences and budget constraint. The american median voter model does not serve well as the basis of this demand model in the European situation with strong parties and centralized financing. We assume a general community preference function guiding the division of a given pie between different local public services.

The local politicians must have a hard time deciding primary school spending, since no robust relationship between resource use and student achievement has been identified (Hanushek, 1986). The key local decision parameter, class size, is not systematically related to student achievement. Politicians and parents seem to prefer small classes and small schools independent of their effect on student quality. The representative local government is assumed to produce two services, primary education and health care. The quasi-concave community preference function covers the class size St/Cl (number of students St divided by number of classes Cl) and the per capita health care output H, $V = V(Cl/St, H)$. Sociodemographic characteristics of the municipality can influence local preferences, to be taken into account in the empirical analysis.

The central government is assumed to finance the local governments by a general grant G (measured per capita in real terms), possibly including income tax revenue sharing or other regulated tax sources. The budget constraint of the local government says that the real value of the general grant finances teacher real wages and real spending to health care, $G = W/P_c * P_c/P_g * T/Cl * Cl/St * St/N + H$. [2] The wage costs of school spending separate between the real consumption wage, W/P_c, where W is the nominal wage level and P_c is consumer price index, and the relative price between private and government consumption, P_c/P_g. The volume component separates between teachers T per class, class size and student

[2] Non-wage spending is excluded from the analysis due to lack of data for the period 1957–1971.

share of the population N. The student share is exogenous since primary school is compulsory.

Given the disposable budget and given teacher wages and teachers per class determined in the national bargaining, the local government maximizes utility with respect to class size and health care output subject to the budget constraint. The demand function for class size reads:

$$\frac{St}{Cl} = \frac{St}{Cl}\left(\underset{+}{\frac{W}{P_c}}, \underset{+}{\frac{P_c}{P_g}}, \underset{+}{\frac{T}{Cl}}, \underset{+}{\frac{St}{N}}, \underset{-}{G}\right) \tag{1}$$

The comparative static effects are indicated under each variable. W/P_c, P_c/P_g and T/Cl drive up the costs of educational services and induce larger classes. The share of students in the population St/N also is a cost factor, since the spending must go up to entertain more students. If class size is a normal good, higher grants G allow smaller classes. There is a similar demand function for health care, and the two demand functions together with the direct utility function define the indirect utility function of the local government. The indirect utility function is taken into consideration by the central government when grants and bargaining strategy vis-a-vis the teacher union are determined.

2.2. *Bargaining setup*

Inman (1981) has developed a general model for bargaining over wage and employment decisions in the public sector, that we have modified to the school situation. Inman covers both approaches dominating the literature on trade unions, the 'right to manage' model and 'efficient bargains'. In the right to manage models, the union and the employer bargain over the wage level, while the employer sets the employment afterwards. When the union takes into account outsiders, this is not an efficient solution. Efficient bargains imply simultaneous bargaining over both wage and employment. Our model is somewhere between these two approaches. The national bargaining concerns a part of the employment decision, teachers per class, while the local governments decide another part, class size.

The bargaining solution is described as an asymmetric Nash bargaining game between the central government and a national teacher union. When X is the indirect utility function of the central government and U the utility function of the teacher union, the Nash product is $\Pi = (X - X^0)^\gamma (U - U^0)$. γ is the relative bargaining strength of the government, and X^0 and U^0 are the threat points of the two. The threat points represent the utility levels during conflict and are linked to political factors in the next section.

We assume that the central government has preferences regarding local public

goods, other public goods and private goods. It seems realistic to assume that central and local governments have the same preferences, and that the central government consequently adopts the indirect utility function of the representative local government. The maximization problem, taking into account the overall budget constraint of the economy measured by GDP, defines the indirect utility function of the central government:

$$X = X\left(\underset{-}{\frac{W}{P_c}}, \underset{-}{\frac{T}{Cl}}, \underset{-}{\frac{St}{N}}, \underset{+}{GDP}, \underset{-}{\frac{P_g}{P_c}}\right) \tag{2}$$

The teacher union has quasi-concave preferences regarding wages and employment, and wage comparison effects influence the utility level. W_c is the comparison wage level. The per capita teacher employment is disaggregated to fit the demand model outlined above, and the utility function of the union is:

$$U = U\left(\underset{+}{\frac{W}{P_c}}, \underset{+}{\frac{T}{Cl}\frac{Cl}{St}\frac{St}{N}}, \underset{-}{\frac{W_c}{P_c}}\right) \tag{3}$$

2.3. Bargaining solution

Maximizing the Nash-product with respect to W/P_c and T/Cl, we reach reduced forms of real wages and teachers per class:

$$\frac{W}{P_c} = \frac{W}{P_c}\left(\underset{+}{\text{GDP}}, \underset{-}{\frac{P_g}{P_c}}, \underset{?}{\frac{St}{N}}, \underset{+}{\frac{W_c}{P_c}}, \underset{-}{\gamma}\right) \tag{4}$$

$$\frac{T}{Cl} = \frac{T}{Cl}\left(\underset{+}{\text{GDP}}, \underset{-}{\frac{P_g}{P_c}}, \underset{-}{\frac{St}{N}}, \underset{?}{\frac{W_c}{P_c}}, \underset{-}{\gamma}\right) \tag{5}$$

The hypotheses to be investigated empirically are identified by the signs of the partial effects of these reduced forms. Concerning the effects of economic variables, both teacher wages and teachers per class are stimulated by a rise in GDP, an improvement of the overall budget constraint, and a fall in P_g/P_c, reduction in the relative price of public goods. The share of students in the population, St/N, acts as a price term in the local government's budget constraint. A higher student share will increase the teacher employment, which causes the union to push harder for wages at the expense of employment. This can be interpreted as a labor demand effect. Since increased student share St/N reduces

the utility of the government, the effect on wages is uncertain, but is expected to reduce teachers per class T/Cl. The comparison wage W_c/P_c only influences the union. When the comparison wage goes up, the union prefers higher wages relative to employment. The teacher wages will go up, while the effect on teachers per class T/Cl is uncertain because the union utility is reduced.

3. Political economy

We reject the median voter model as the foundation of central and local government preferences, since the relevant decisions are multi-dimensional and involve well developed party systems. When the median voter model is abandoned, many alternative decision making structures are possible. The most developed alternative is the agenda setting model of Romer et al. (1992), that we feel is too narrow to handle a situation of many political parties and outside interest groups. At this stage we can only offer empirical regularities regarding the effects of political characteristics on school spending, and must accept that the results are consistent with different political economy models.

Similar broad investigations of the role of political structure have been made in an analysis of US fiscal policy by Inman and Fitts (1990) and OECD budget deficits by Roubini and Sachs (1989). Both studies are occupied with the importance of political strength to withstand pressure for more spending. The modelling of school spending allows us to identify how political strength can have an impact: through the bargaining strength in the interaction with public sector trade unions. In a multi-party political system, the party composition of the parliament and the parliamentary basis of the government determine the political control. The impact of political strength on total local public spending during 1880–1990 has been investigated by Borge and Rattsø (1994), and their three measures are applied: Dummy variables are constructed to represent two dimensions of the government, majority/minority and coalition/noncoalition, inspired by Roubini and Sachs (1989) and Edin and Ohlsson (1991). Long survival of the government also reflects strength, and political stability represented by the duration of the government is included. To investigate the role of the parliament, a Herfindahl index is constructed to represent party fragmentation. A multi-party parliamentary system is more likely to produce a strong government the less fragmented the party composition of the parliament.

The preferences of the government naturally are influenced by the dominant political ideology of the time. Ideology can be reflected both in the government utility function and the threat points of the bargaining process. The ideological climate can be important for the strategies taken by the government and the teacher union during an emerging conflict, since both parties will try to mobilize public support. Strøm (1995) has shown how the local public wage formation has

been influenced by political ideology in Norway. The ideological variable applied is the share of socialist representatives in parliament. We expect the socialists to give priority to primary school because of its importance for equalization and solidarity between income groups. Also socialists are expected to give more support for teacher union claims for higher wages and employment. A socialist oriented opinion has greater preferences for public services, and can be more union friendly during conflict.

The bargaining is influenced by background economic factors, as argued by Svejnar (1986). With unfavorable economic conditions, moderation can be seen as important to contribute to a better state of the economy; the employer's position relative to the union is strengthened. But the role of the government is more complicated than that of a firm in private markets. Public expenditures may be used as countercyclical stabilization policy. If the government increases public employment during economic decline, the union is expected to push harder for wage increases. Deviation from the real GDP trend as a proxy of the labor market situation and inflation are used as measures of bargaining power. In addition, the local public debt has emerged as an issue in the debate concerning the local government capacity to pay for primary school. Our hypothesis is that the central government can use the debt situation as an argument to reduce the wage level and the employment of teachers.

Politics is of importance at the local level also, but cannot be represented in detail in a long run time series study. One aspect has been included, however. Since primary schools and health care are the key responsibilities of the local governments, different age groups are rivals. The share of elderly in the population

Table 1
Economic effects

Dependent variable	Teacher wages	Teachers per class	Class size
Economic factors			
GDP, LRE	0.76 (8.35)	1.65 (7.78)	—
GDP, SRE	—	0.08 (4.78)	—
Relative prices, SRE	−0.27 (2.58)	0.15 (4.83)	−0.06 (3.93)
Student share, LRE	0.38 (1.69)	—	0.35 (9.46)
Student share, SRE	1.07 (3.04)	−0.27 (3.05)	0.45 (4.16)
Private wages, SRE	0.20 (2.76)	—	—
Sociodemographics			
Population size, LRE	—	−3.40 (4.46)	−0.26 (5.22)
Population size, SRE	3.66 (2.94)	−2.11 (4.24)	−0.54 (2.48)
Divorce rate, LRE	—	—	−0.03 (5.02)
Divorce rate, SRE	—	0.02 (3.47)	—
Geographical income variation, LRE	1.18 (2.89)	—	—

Notes: The calculations are based on Table 3 (Appendix A). Absolute t-values in parentheses calculated with approximated large-sample variances. LRE is long run elasticity and SRE is short elasticity.

reflects the relative strength of opposing groups. Since the competition for resources is most visible at the local level, we expect class size to be responsive to changes in the share of elderly.

4. The economics of school spending growth [3]

The reduced form bargaining solutions for teacher wages and teachers per class, Eqs. (4) and (5), and the demand function for class size, Eq. (1), have been estimated using annual data for 1880–1990. The econometric formulation of the integrated demand and bargaining equations assumes a general error correction model, and possible simultaneity between them has been taken into account. Table 1 summarizes the main empirical findings, while documentation is supplied in Appendix A, Table 3.

Economic models of public sector growth are based on price- and income-elasticities as driving forces of homogenous outputs. Our disaggregation shows how income affects different components of spending and how the price effect reflects various cost elements. In the bargaining model, an improvement of the central government budget constraint allows for higher wages and reduced working hours of teachers. The long run income elasticities of real consumption wage (W/P_c) and teacher input per class (T/Cl) are below 1 and above 1, respectively. The local government choice of class size is independent of the income level. The

[3] The following procedure is applied: A general dynamic model is reduced to a model with only significant effects at 10% level. The general wage equation (excluding political variables) is:

$$\begin{aligned}\Delta(w-p_c)_t = {} & \eta_1(w-p_c)_{t-1} + \eta_2 \mathrm{gdp}_{t-1} + \eta_3(\mathrm{st}-n)_{t-1} + \eta_4(p_g-p_c)_{t-1} + \eta_5 n_{t-1} + \eta_6 \mathrm{div}_{t-1} \\ & + \eta_7 \mathrm{agsha}_{t-1} + \eta_8 \mathrm{GIV}_{t-1} + \eta_9(w_c-p_c)_{t-1} + \eta_{10}\mathrm{debt}_{t-1} + \eta_{11}\mathrm{elderly}_{t-1} \\ & + \alpha_1 \Delta(w-p_c)_{t-1} + \Sigma_{i=0}^{3}(\alpha_{2i}\Delta(\mathrm{st}-n)_{t-i} + \alpha_{3i}\Delta n_{t-i}) + \Sigma_{i=0}^{1}(\alpha_{4i}\Delta \mathrm{gdp}_{t-i} \\ & + \alpha_{5i}\Delta(p_g-p_c)_{t-i} + \alpha_{6i}\Delta \mathrm{div}_{t-i} + \alpha_{7i}(w_c-p_c)_{t-i} + \alpha_{8i}\Delta p_{c,t-i} + \alpha_{9i}\mathrm{dtr}_{t-i}) \\ & + \alpha_{10}\Delta \mathrm{debt}_{t-1} + \varepsilon_t\end{aligned}$$

ε_t is a stochastic error term, Δ is a differential operator, and small letters indicate logarithmic form. See Appendix A, Table 3 for definition of the variables. The coefficients $\alpha_1 - \alpha_{10}$ express short run elasticities, while $-\eta_2/\eta_1 - -\eta_{11}/\eta_1$ can be interpreted as long run elasticities. The equation for teachers per class looks similar to the wage equation. The reduced form equation for class size, however, is different from the other two because it is assumed that class size is determined at the local level (see Eq. (1)). W/P_c, T/Cl and local government revenues G are exogenous to the local government in the theoretical model, which is a strong assumption early in the century. In the estimation of class size, $\Delta(w-p_c)_t$, $\Delta(t-\mathrm{cl})_t$ and Δg_t are therefore treated as endogenous. Three stage least squares is applied to take into account that the error terms can be correlated. Instruments in the class size equation are consequently GDP, W_c/P_c and bargaining power. Regarding political variables, we concentrate on one lag in these variables because of some political sluggishness. We utilize the error correction based test for cointegration suggested by Kremers et al. (1992), where the test statistic is the t-value of η_1. Non-cointegration is clearly rejected in all three equations, see Appendix A, Table 3. Further documentation of empirical method, unit root tests for time series properties and data sources are available from the authors on request.

absence of an income effect is surprising, since revenue shortage is a typical argument used when local politicians want to close small schools and thereby rise the average class size.

Interestingly, education comes out as an income elastic good in this time series. The income elasticity of primary school spending is the sum of the elasticities of all the components. The elasticities of teacher wage and teachers per class add up to above 2, implying a strong support of Wagner's law. The result is in strong contrast with cross-sectional analyses with an overwhelming evidence of income-inelastic educational services (see Craig and Inman, 1986; Romer et al., 1992). Also previous cross-sectional studies on Norwegian data, such as Borge and Rattsø (1995), show income-inelastic school spending. Cross-sectional analyses are limited to the variation of teacher wages and teachers per class across municipalities. In a dynamic study, we capture the growth of these two cost elements. School spending growth is driven by income-elastic decisions about teacher wages and working conditions at the national level. The local public sector have inelastic response to these national cost factors, and thereby they are not able to hold down the spending growth.

Baumol's disease says that the public spending goes up with the price of public services since the demand is price-inelastic. Borcherding (1985) and others confirm the Baumol concern. In our model, the price of school services is endogenously determined by wage bargaining. The Baumol effect has no simple interpretation in this formulation. The endogenous wage costs clearly are part of the spending growth.

The theory model predicts that a higher share of students in the population reduces teachers per class and increases class size through the cost side of the public budget constraint. We find that even though class size is increased with higher student share, the number of teachers increases. When the student share goes up by 1%, the number of teachers is raised by 0.65% in the long run. The relationship between the share of students of the population and the teacher real wage can be interpreted as a conventional labor demand relation. When the student share rises, more teachers are demanded and the wage level is driven up. In the bargaining model, the teacher union will push for higher wages when teacher employment rises.

Private sector wages have a small effect on teacher wages. Fluctuations in the relative wage are large, and it is not stationary. The high relative wage between the two wars may be the result of greater nominal wage rigidity during deflation in the public compared to the private sector, consistent with the observations of Ashenfelter (1977).

A variety of sociodemographic descriptives has been investigated. A social characteristic, the ratio of divorces to marriages, reduces the class size in the long run and increases teachers per class in the short run. The result possibly reflects a compensating strategy whereby schools are given higher priority to deal with kids. Geographical income variation motivates central government spending as part of

Table 2
Political economy

Dependent variable	Teacher wages	Teachers per class	Class size
Political strength and ideology			
Government duration, LRE [a]	—	−0.03 (1.80)	—
Party fragmentation, LRE [a]	—	−0.12 (2.57)	—
Minority coalition [b]	−0.11 (2.30)	—	—
Socialist share, LRE [a]	0.23 (2.80)	0.10 (1.72)	—
Social democratic hegemony:			
GDP 1950–1961 [c], LRE	2.17 (3.55)	2.36 (6.44)	—
GDP rest of period [c], LRE	0.76 (8.35)	1.65 (7.78)	—
Bargaining power			
Local gov. debt., SRE	−0.22 (4.59)	—	—
Deviation from trend in GDP, SRE	−0.43 (4.37)	0.11 (2.56)	
Inflation, SRE	−0.67 (11.2)	−0.13 (6.40)	—
Share of elderly, LRE	—	—	0.42 (9.31)

The calculations are based on Table 3, Appendix A. Absolute t-values in parentheses calculated with approximated large-sample variances. LRE is long run elasticity and SRE is short run elasticity.
[a] Elasticity at mean.
[b] Long run percentage effect.
[c] Long run effect significantly different during the period of social democratic majority at 5% level.

the regional policy, often channeled through the local public sector. The results indicate that regional income variation is associated with higher real wage level of teachers. The regional policy funds end up as higher wages, not employment.

5. The politics of school spending growth

Politics matter too. Characteristics of the political system must be taken into account to understand school spending growth. The results reported in Table 2 show that two of the measures of political strength are important: political stability and political fragmentation in the parliament. Both long duration and little fragmentation hold back on teachers per class. When a government is reelected and its duration is doubled (that is an increase of 1 standard deviation in the sample), the number of teachers per class is reduced by 3% in the long run. When the party fragmentation is reduced with one standard deviation, the number of teachers is reduced by 4% in the long run.

Ideology is clearly of importance for school priority. The socialist share of the parliament is positively related to the teacher wage level and teachers per class. When the share increases from 40% to 60% (about one standard deviation in the sample), real wages increase by 12% and teachers per class by 5% in the long run. The wage effect may be the result of higher demand. The socialists want more

teachers per class, and this demand increases wages. Given the general evidence that socialist parties tend to increase the public sector, the results here mean that this effect goes through both employment and wages.

The ideology factor can influence the national bargaining through the general public opinion. If the socialist share in the parliament reflects the general opinion, and a higher share of socialist votes means higher preferences for public services, the bargaining position of the teacher union improves via the threat points. The claims of the union are met more favorably, because the government receives less public support during a conflict. In an attempt to investigate whether the socialist effects reflect socialist influence in the parliament or the public opinion, the variable has been reformulated to allow non-linearity around a socialist share of 50%. Presumably, a majority in the parliament offers the socialists an opportunity of decisive influence, while the public opinion factor more continuously reflects socialist share. The real wage effect is linear. However, the effect of socialist share on teachers per class go up above a share of 50%, indicating that socialism affects the teacher employment via parliamentary decisions.

The social democratic party had one party majority during 1946–1961. The effect of this control is investigated by a dummy and by allowing separate long run income effect for this period. The wage growth of the school sector and teachers per class took advantage of the socialist majority. The income elasticity of total school spending is 4.5 in this period. The school orientation of the social democratic party is confirmed, as shown also by the positive dummy effect of the period and the influence of the socialist share of the parliament.

The economic development influences the bargaining outcome. The bargaining strength of both parties is related to the macroeconomic situation, and booms are expected to improve the relative strength of the union. The deviation from the GDP trend is the measure of short run cyclical variation. The estimates imply countercyclical teacher wages and procyclical teacher employment. The countercyclical wages are in conflict with prevailing studies of private sector wage formation, including Svejnar (1986). Our interpretation of the result brings in countercyclical policy: More educational spending during recessions ends up as teacher wages.

Inflation represents another aspect of the macroeconomic situation. Sluggishness in price expectations can explain the negative effect of inflation on teacher real wages. Higher inflation also tends to reduce teachers per class. This can be interpreted in a bargaining power framework, consistent with the findings of Svejnar (1986). During booms with high inflation, and during slumps with high unemployment, the bargaining power of the government is increased.

We have described local politics as a battle of resources between age groups dividing a given pie. The share of elderly is positively associated with class size, thereby confirming a similar result in cross section studies such as Borge and Rattsø (1995). Finally, the size of the local government debt is included as a factor affecting the bargaining power of the public sector. Teacher wages are influenced

by the debt situation. The results of the bargaining power variables are encouraging for our broad understanding that bargaining positions have a role to play in the understanding of public sector wages.

6. Concluding remarks

Sources of school spending growth have been analyzed in the context of central government bargaining with a teacher union and decentralized responsibility of schools to the local public sector. The approach can be seen as an extension of the demand model of public sector growth to include bargaining over costs and central–local interaction. The teacher union represents interest group pressure for higher spending, and the political strength of the central government to withstand pressure is assumed important. Based on this theoretical framework, reduced form demand functions for teacher wages, teachers per class and class size are estimated based on data for Norway 1880–1990.

A broad literature of cross-sectional analyses of school spending provides evidence of income-inelastic demand, implying that education is not a driving force in public sector growth. Our disaggregated and time-series perspective offer a very different understanding. Wagner's law is supported. Cross-sectional analyses are limited to the variation of teacher wages and teachers per class across municipalities. In a dynamic study, we capture the growth of these two cost elements. School spending growth is driven by income-elastic decisions about teacher wages and working conditions at the national level. The local public sector have inelastic response to these national cost factors, and thereby they are not able to hold down the spending growth.

The price of educational services is endogenously determined in our analysis by various cost components. Student share of the population is the main background factor. The relationship between the student share and the teacher real wage can be interpreted as a conventional labor demand relation. When the student share rises, more teachers are demanded and teacher wages are driven up. Class size is increased with higher student share, but not sufficiently to avoid increased teacher demand.

Important cost factors are determined in national bargaining, and characteristics of the political structure are shown to be important. Stable governments and low fragmentation of parliament hold back teacher employment. Ideological differences matter too. When the share of socialist representatives goes up, both teacher wages and teacher employment are increased. The teacher union takes advantage of a better bargaining position during periods of strong socialist orientation. The bargaining situation is affected both by macroeconomic factors, demographics and public debt. High inflation, more elderly and high public debt are to the disadvantage of the teacher union.

Table 3
Estimation results

	Teacher wages $(w - p_c)$	Teachers per class $(t - Cl)$	Class size $(st - cl)$
$(w - p_c)_{t-1}$	−0.232 (7.89)	—	0
$(t - cl)_{t-1}$	—	−0.131 (5.94)	0
$(st - cl)_{t-4}$	—	—	−0.299(8.68)
gdp_{t-1}	0.176 (9.26)	0.216 (10.1)	—
$(st - n)_{t-1}$	0.088 (1.68)	0	0.106 (6.00)
GIV_{t-1}	0.273 (3.00)	0	0
$elderly_{t-1}$	0	0	0.126 (7.21)
div_{t-1}	0	0	−0.009 (4.82)
n_{t-1}	0	−0.446 (7.44)	−0.077 (3.94)
$\Delta(w - p_c)_{t-1}$	0.336 (5.18)	—	0
$\Delta(t - cl)_{t-1}$	—	0.196 (2.89)	0
$\Delta\Delta(st - cl)_{t-1}$	—	—	0.550 (8.51)
Δgdp_t	0	0.085 (4.78)	—
Δgdp_{t-1}	0	−0.164 (6.28)	—
$\Delta(st - n)_t$	1.067 (3.04)	0	0.449 (4.16)
$\Delta(st - n)_{t-1}$	0	−0.268 (3.05)	-0.449^R
$\Delta(st - n)_{t-2}$	0	0	0.237 (3.48)
$\Delta(p_g - p_c)_t$	0	0	−0.063 (3.93)
$\Delta(p_g - p_c)_{t-1}$	−0.269 (2.58)	0.146 (4.83)	0
Δn_t	0	−2.106 (4.24)	0
Δn_{t-1}	3.657 (2.94)	0	−0.535 (2.48)
Δn_{t-3}	0	1.778 (4.14)	0
Δdiv_t	0	0.020 (3.47)	0
Δdiv_{t-1}	0	0.017 (2.94)	0
$\Delta(w_c - p_c)_t$	0.196 (2.76)	0	—
$\Delta p_{c,t}$	−0.666 (11.2)	−0.129 (6.40)	—
dtr_{t-1}	−0.427 (4.37)	0.111 (2.56)	—
$\Delta debt_{t-1}$	−0.215 (4.59)	0	—
$COAL1_{t-1}$	−0.025 (2.45)	0	0
DUR_{t-1}	0	−0.0005(1.80)	0
$HERF_{t-1}$	0	−0.046 (2.87)	0
$SOCSHA_{t-1}$	0.171 (2.40)	0.040 (1.88)	0
SDM_t	2.665 (2.54)	0.766 (3.25)	−0.010 (2.57)
$gdp_{t-1} * SDM_t$	0.328 (2.56)	0.093 (3.24)	—
SSR	0.061	0.0061	0.0024
DW	2.028	2.098	1.966
AR(1)	0.028	0.454	0.058
AR(2)	1.207	2.722	3.514
CHOW	0.744	1.495	0.819

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Appendix A. Estimation results

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Note to Table 3:

The data cover the period 1880–1990 except for WWII. Due to lags, the estimation is for the period 1885–1939 and 1950–1990, 96 observations. Estimated absolute t-values in parentheses. Estimation method is three stage least square implemented in TSP. Small letters denote logarithmic form. GIV is an index for geographical income variation, ELDERLY is the share of the population above age 65, DIV is the share of divorces to total marriages, AGSHA is the share of total employment in agriculture as a measure of centralization, COAL1 is a dummy variable for coalition governments in minority, DUR is the duration of the government in years, HERF is a Heffindahl index for party fragmentation, SOCSHA is the share of socialist representatives in the parliament and SDM is a dummy variable for the majority government of the social democracy party in 1946–1961. The sign — indicates that the variable is not included in the general model, while 0 indicates that the variable is not significant at 10% level. In addition to reported variables, a dummy variable equal 1 in 1959–1990 is included in the wage equation at level and at differenced form, and a dummy variable equal 1 in 1973–1990 is included in the equation for teachers per class at level and at differenced form, both because of break in data, and a dummy equal 1 in 1959–1975 is included in the class size equation to represent the introduction of the compulsory secondary school. SSR is sum of squared residuals, DW is the Durbin–Watson statistic, AR(j) is a LM-test for autocorrelation of order j, F-form presented, and CHOW is the Chow test for parameter stability where WWII is the break point. All test statistics are individual equation diagnostics.

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