

# SCHOOL REFORMS AND SCHOOL SPENDING GROWTH

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## Abstract

The evolution of school spending over time is related to legislative school reforms expanding the scale and the scope of the school system. This study addresses the determination of legislative reforms and primary school spending, using a data base for Norway 1880 - 1990. Reforms are understood as the result of growth in demand for school services over time and economic and political conditions conducive to reform. 10 school reforms are identified during the period, and they are shown to be systematically related to characteristics of the political structure. School spending is analyzed both as an aspect of reform and by assuming separability between legislative reform decisions and implementation of reform through central government bargaining with teacher unions and local government priority. When legislative reform is treated as an independent determinant of school spending, we find that reforms drive up teacher employment and that local governments react with a cost saving strategy increasing the class size.

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## I. Introduction

Spending growth in public services is typically understood as the result of the development of economic demand factors interacting with political structure. In reality, services often expand in stages related to legislative reforms changing the character of the services, either major extension of old services or the introduction of new ones. The decisions about such reforms are taken at the national or state level and imply revision of old laws or establishment of new. Legislative reforms can be the result of a long process including government commissions and public debate. The implementation of the legislative reforms is the responsibility of the central government apparatus and often involves bargaining with the organizations involved and a local public sector running the services concerned. The separation between the legislative reform process and the implementation is essential in this analysis.

To investigate the generation and consequences of public sector reform, we concentrate on one public service - primary school, and a parliamentary democracy with a welfare state - Norway. The determination of primary school spending engage all the important participants of public sector decision making - the design of laws and budgets by the national parliament, central - local government interaction, and teacher unions bargaining over wage and working conditions. Legislative reforms addressing the age groups to be included, the length of the school year, the intensity of teaching in each school year, the content of the study program etc. have gradually expanded primary school. Central government bargaining with teacher unions and local government priority of the school sector have influenced the implementation.

The first part of our analysis attempts at explaining the generation of legislative school reforms. 10 primary school reforms are identified in Norway during 1880-1990. With several reform observations, we are potentially able to describe regularities that systematically predict reform. This is in contrast to most of the existing studies of reforms, which describe the decision and consequences of one specific reform.<sup>1</sup> In the US, state wide reforms have become more important with the centralization of the financing system of primary school since the 1970's and several studies are available. Notable exemptions to the case studies of reform are Bates and Kreuger (1993) and Campos and Esfahani (1996) addressing structural adjustment reforms and public

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<sup>1</sup> For discussions of school reforms see for example Shapiro and Sonstelie (1982), Downes (1992), Downes and Horowitz (1995), Silva and Sonstelie (1995), Campbell and Fischel (1996) and Fernandez and Rogerson (1997).

enterprise reforms respectively. Both use information from several developing countries and emphasize economic circumstances that may induce governments to reform. The focus is primarily on economic downturns as an important motivating factor. Economic contractions necessitate policy initiatives and the need for change of policy is easily understood. Another observation is that demand for reform accumulates over time, and that reforms are delayed. The theoretical explanation is that interest groups have veto power, and that they only accept reform when they suffer some significant losses, see Alesina and Drazen (1991), Drazen and Grilli (1993) and Velasco (1997). There is also a broad literature throwing light on the political conditions for economic policy reform, see Nelson (1990). In the great variety of developing country political regimes, one has sought generalizations of democratic or leadership characteristics that are associated with reform.

The second part of the paper analyzes school spending. As a benchmark, legislative reform and school spending are understood as simultaneous decisions and the reduced form demand for reform includes school spending as an aspect of reform. In the Norwegian case, however, spending implementation can be seen as separated from the decision about legislative reform, since central government bargaining with teacher unions and local government priorities are involved. This allows us to investigate the spending consequences of legislative reform. Based on a demand model for educational services, reforms are hypothesized to have additional explanatory power to the development of the school spending components. School spending is disaggregated to capture central government bargaining with teacher unions concerning teacher wage and teacher input per class and local government decision about class size. The three components are shown to have different dynamic paths, and they respond differently to legislative school reform.

## **II. Historical overview: Legislative reforms and data**

This study follows the expansion of primary education (teaching offered the first 9 years of schooling) over 110 years. No doubt, the school system has changed dramatically during this period, especially in connection with school reforms. However, the decision making system and the division of labor within the national school system have been stable over time. The children

have always started school when they are 7 years old. The compulsory school has increased from 7 to 9 years during the period.

#### *A. Legislative reforms*

The municipalities have always been responsible for the organizing of primary schools in addition to other local services. Primary school spending growth is channeled through local public budgets. The degree of centralized control over local government financing and school cost components has increased gradually. In the late 19th century, teacher wages were set locally and varied across municipalities, in particular between urban and rural areas. Teacher unions were formed and national bargaining soon set both teacher wages, teaching requirements and other working conditions. Since local economic conditions developed very differently, central government grants were introduced and became the major source of financing of primary school. The educational content of primary school has been regulated by law and based on a national curriculum, and the reforms have been decided nationally as revisions of the law.

In Table 1, the 10 nation-wide primary school reforms in the period 1880 - 1990 are listed. Four reforms represent major changes in the primary school system by introducing new laws in 1889, 1936, 1959 and 1969. The other six reforms are major revisions of the existing law. Broadly speaking, the reforms change both the schooling time, the number of subjects and the content of the subjects.

Insert Table 1: Legislative primary school reforms

The new school law in 1889 increased the minimum schooling time per student, set a maximum class size and a minimum teacher wage. During the period 1915-1920, three changes in the school system were made, partly related to different laws directed towards rural and urban areas. In 1920, a 7 year comprehensive school was introduced as a result of socialist initiative and influence in the parliament. Before 1920, the kids could choose between a 7 years primary education and 5+4 years continuation to secondary school. The changes after WW1 started a new debate about school organization. After several commissions, a new school law was decided in 1936. The changes were extensive, and the local governments were given 5 years to implement the reform. The maximum class size was reduced from 35 to 30 students per class, but the main goal of the reform was to reduce the differences between schools in rural and urban areas.

After WW2, lower secondary education increased rapidly. One aim of the new school act of 1959 was to start up the experiments with 9 years compulsory school. In addition, the school systems in rural and urban areas were equalized. The school law of 1969 stated 9 years compulsory school for all. The next reform concerns the handling of schooling for disabled children. Up to 1975, the state had been responsible for special schools for disabled children. The responsibility for these kids was taken over by the local governments in 1975. In the last reform, a new curriculum was decided.

### *B. Decomposition of school spending*

To relate reforms to school spending, we split the aggregate spending in price and volume components. Comparable decompositions are used in the cross country analyses of Schultz (1988) and the US historical investigation of Hanushek and Rivkin (1997). In this section, we present growth rates both in different decades and around the reform periods.

The growth in primary school spending has been remarkable. Primary school spending per capita has increased from 119 1990-NOK in 1880 to 3.865 1990-NOK (about 600 USD) in 1990, 32 times higher or an annual real growth of 3.2 %. The first step of the disaggregation involves the following decomposition:

$$\frac{\text{School spending}}{\text{population}} = \frac{\text{School spending}}{\text{students}} * \frac{\text{students}}{\text{population}}$$

The per capita school spending consists of two components, the school spending per student and the share of students in the population. The real per student expenditure has increased from 918 1990-NOK in 1880 to 35.954 1990-NOK (about 5.500 USD) in 1990, an average real growth of 3.3 %. The time path is very similar to the US data of Hanushek and Rivkin (1997), except that their spending per student has only reached USD 4.600 in 1990. The share of students in the population was about 12 % both in 1880 and 1990. Consequently, the growth in the spending per capita is a growth in the spending per student.

School spending per student covers different decision variables. The decomposition model applied in this study is:

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

The dynamics of the components accounting for school spending growth are very different. The number of teacher man-years per class has increased from less than 0.5 to almost 2, while the average class size has not changed much, from about 21 students per class to 19. The different development of the two components, a steady growth in teacher input per class with an average growth of 1.3% per year and the fluctuations around the mean of 20 in students per class, show two distinctly different factors affecting the teacher-student ratio. The increasing teacher input 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. Class size varies across the country and over time and reflects school size and thereby school structure. The growth in real wages and non-wage spending fluctuates over time. The most striking pattern compared to Hanushek and Rivkin (1997) is that the real wage costs continued to grow in the 1970s, while non-wage spending was about constant in the 1970s and was even reduced in the 1980s. Hanushek and Rivkin report that expenditure other than to instructional staff became more important during this period. Presumably the definitions vary, but nevertheless the differences in development and relative size of non-wage spending between the two countries are remarkable. Unfortunately, data for non-wage spending are not available during the 1960s, and this component therefore is excluded from the empirical analysis of school spending.

By comparing the development of each component, the driving forces of the growth can be identified for different periods. 10 year average growth rates are presented in Table 2. The expansion before the turn of the century was led by real wages and the student share, and during WW1 the number of teachers per class was the prominent growth factor. The rise in the spending per teacher explains the sharp expansion in the 1920's, first of all through real wages because non-wage spending is only about 20% of spending per teacher. We believe that deflation and nominal wage rigidity is an important part of the development during the depression. After the end of the depression, real wages decreased, while the employment components started to rise. The spending growth was held back by the demographic shift reducing the number of children.

Insert Table 2: Accounting for the growth in school spending: 10 years average growth rates

After WW2, the teacher input per class has been the major force in expanding school spending. The improvement of working hours and teaching load for teachers and the longer school day for the students must be paid for. The rise of the class size until 1970 contributed to holding back the spending per capita. Demographics have shifted dramatically over the period. The share of students in the population had a strong growth following the post-war baby boom (1950s), but has fallen since 1963. The number of students expanded about as fast as the spending during the 1950s, but spending per student rose when the number of students fell during the 1980's.

The development around reforms is presented in Figure 1, where we concentrate on the decision variables analyzed in this paper.<sup>2</sup> Teacher input per class seems to have the most systematic pattern around reforms. In the years  $\pm 4$  years around reforms, the growth is clearly higher than in the years further away from reforms. Reforms tend to increase teacher employment via teacher input per class, and there is a response both before and after the reform year. The development of class size is different. The raw data indicate that class size has an extraordinary increase before the reform year and decreases thereafter. One interpretation is that reforms follow periods with increased average class size, and that the class size is reduced as a consequence of reform. The fact that teacher input per class and class size have opposite effects on teacher employment, imply that teacher employment increases most after reforms. The growth in real teacher wage fluctuates with no clear pattern related to reform periods, and the connection between employment and wage growth looks weak.

Insert Figure 1: Change in school spending components related to reform years

### **III. Theoretical framework**

Legislative school reforms are determined by the national parliament to extend and develop school services. The natural starting point to understand school reform is the demand model for public services applied to the school sector. The demand approach to school spending has been developed in the influential studies of Craig and Inman (1986) and Romer et al. (1992). They both address the static allocation decision. The private income level comes out as the main

determinant of primary school expenditure. We use a conventional demand model here with gross domestic product and demographics as the main economic determinants.<sup>3</sup> The economic demand side is extended with reform and political structure.

While the demand model describes the school spending growth as a continuous process, reforms put the attention to organizational changes that lead to extension of the school system in stages. Reforms are discretionary by design, and explaining reform is about understanding their timing. Growing demand for school services accumulates the demand for expansion of the school system and thereby accumulates the demand for reform. This is the idea in Alesina and Allen (1991), Allen and Grilli (1993) and Velasco (1997). In addition, the timing of the reform is assumed to depend on economic and political circumstances. To capture the main hypothesis of the theoretical literature, macroeconomic conditions influencing the short-run financing of expanded public services are included. However, in our context, the effect of macroeconomic variables is not clear a priori. Economic downturns can induce reforms as part of countercyclical policy. On the other hand, economic upswings make financing easier.

The political economy of school spending is understood similar to the common pool problem described by Weingast, Shepsle and Johnsen (1981). School spending contributes to redistribution and includes central government financing. Benefits are concentrated to the schools and the surrounding municipality, while the costs are shared through general taxation and central government grants. The redistributive aspects are strengthened by the fact that the political representation to the national parliament is based on geography. With this setup, the central government will have a permanent pressure for more school spending, and the ability to handle this pressure will influence the outcome. Political strength is typically assumed to hold down spending with such a spending pressure. Interestingly, in a reform context it is not all that clear how a strong government will work. A strong government may be able to postpone expensive reforms, but may also have the strength to innovate the service production. Only an empirical analysis can tell what political characteristics are more conducive to reform than others. In addition to the structure of decision making, we allow ideological orientation to influence the

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<sup>2</sup> In the figure, each year is identified with the reform closest in time, and years halfway between two reforms are omitted. In order to have at least two observations per data point, the sample is restricted to 8 years before reform to 7 years after reform.

<sup>3</sup> The demand analysis is given a broader presentation in Falch and Rattsø (1996, 1997).

desire for reform. Several studies confirm that socialist are the most eager to develop the welfare state, in particular when redistributive services such as primary education are concerned.

The main variables involved are the following:

$$\text{REFORM} = \begin{cases} 1 & \text{if reform year} \\ 0 & \text{otherwise} \end{cases}$$

EC - vector of variables representing economic conditions

DEM - - vector of variables representing demographic conditions

POL - vector of variables representing political conditions

SSC - vector of school spending components

The analysis of the generation of legislative reforms is based on a reduced form model of the probability of reform:

$$\text{REFORM} = F(\text{EC}, \text{DEM}, \text{POL}) \quad (1)$$

As a benchmark, we treat the development of school spending as an integrated part of the reform. In this case, the reduced form demand includes school spending as an aspect of reform:

$$\text{SSC} = G(\text{EC}, \text{DEM}, \text{POL}) \quad (2)$$

In the Norwegian case, however, school spending is determined in central government bargaining with teacher unions and local government priority of primary school. To capture this separation between legislative reform and spending implications, the analysis treats reform as an independent determinant of school spending. The analytical framework is an extension of the traditional demand model to include reform:

$$\text{SSC} = H(\text{EC}, \text{DEM}, \text{POL}, \text{REFORM}) \quad (3)$$

The attention is put towards the three components of school spending introduced in section II; teacher input per class, class size and real teacher wage. Reforms normally imply an extension of quantity and quality of schooling, and are expected to be most important for teacher employment.

However, changes in teacher employment have spillover effects to teacher wages, although teacher wages seldom are explicit part of school reform.

Legislative reforms typically include increases in minimum teaching time received by students and the length of the school year. These elements have important consequences at the labor market for teachers. The implementation is influenced by bargaining with national teacher unions. If teacher wages are decided by demand and supply, the effect of reforms on teacher employment will determine the effect on the wages. But with union bargaining, the union evaluation of teacher wage versus employment may give a solution different from the market solution. Preferences over employment can be especially pronounced in the public sector. Since the number of students is exogenously given by demographics, the working effort of each teacher can be reduced if the union is able to raise the number of teachers. If a reform raises employment, the union utility level will go up. The partial effect is a weaker union position in the wage bargaining. But at the same time, the increased demand for teachers means that the union has less to lose from a wage increase. The wage effect of exogenously increased employment is therefore uncertain.

Local governments are responsible for running the primary schools and the implementation of reform necessarily must involve them. The dynamics of the reform consequences will depend on expectations and adjustment costs at the local level. If legislative reform is received by local governments as a 'shock', all the adjustment will be observed after the decision about reform. If local governments expect the reform, they can start the adjustment before the time of implementation. The laws can be revised some time before the date of implementation and the the political process before the legislative decision can take time. In special circumstances, the local level can be the driving force behind reforms. If changes are implemented in many local governments, the central government can be induced to change the law in accordance with practice. In this case rich municipalities are in the driver's seat as innovators, and the central government defends the equity principles of the welfare state by adjusting the school law to include all. The key local decision variable is school structure and thereby class size. Class size is the third cost element analyzed in relation to reform. A few of the reforms have reduced the maximum class size, but since most local governments have had a class size well below the maximum, aggregated class size can have increased as a response to reform.

#### IV. Econometric design

The first part of the analysis estimates determinants of the 10 observed legislative reforms described in Table 1. We are looking for economic and political conditions that systematically contribute to reform. The limited degrees of freedom given by 10 observations of reform years restricts the model formulation. The model is operationalized as:

$$\text{REFORM} = \Phi(\alpha_1 * \text{EC} + \alpha_2 * \text{DEM} + \alpha_3 * \text{POL}) \quad (4)$$

where  $\Phi(\cdot)$  is the standard normal distribution function. All the independent variables are measured as 4 year averages for the 4 years before the reform (including the reform year). They are specified on stationary form. The variables investigated in the reform decision analysis are:

EC:

- Change in log of real GDP per capita
- Deviation from trend in log of real GDP per capita
- Inflation

DEM:

- Change in log of student share of the population
- Change in log of divorce rate

POL:

- Socialist share in the parliament
- Dummy variable for government from liberal or socialist party
- Dummy variable for government with majority in parliament
- Duration of the government in years

In the benchmark case of reduced form simultaneous determination of legislative reform and spending, a more flexible specification of the dynamics of school spending can be applied because of the larger number of observations. The econometric formulation assumes general

error-correction models separating between short run and long run effects. The estimation method is seemingly unrelated regressions. The reduced models including only significant effects developed by Falch and Rattsø (1997) are presented in Appendix Table A1 columns (1a) - (1c). The demand models of school spending components are given the following form:

$$SSC_t = \beta_0 SSC_{t-1} + \sum_{j=0}^4 (\beta_{1j} * EC_{t-j} + \beta_{2j} * DEM_{t-j}) + \beta_3 * POL_{t-1} \quad (5)$$

Legislative reforms are implemented in bargaining and local politics. Since the central government does not decide on school spending directly, legislative reform is introduced as independent variables in the spending equations. We add dummy variables representing reform and allow for a flexible dynamic response to reform by assuming separate effects for each year before and after reforms. The reform year in addition to four years lag and lead are included, denoted  $REFORM_{t,i}$ ,  $i \in [-4, 4]$ , where  $t$  is year and  $i$  is number of lags or leads:<sup>4</sup>

$$SSC_t = \beta_0 SSC_{t-1} + \sum_{j=0}^4 (\beta_{1j} * EC_{t-j} + \beta_{2j} * DEM_{t-j}) + \beta_3 * POL_{t-1} + \sum_{i=-4}^4 \beta_{4i} * REFORM_{t-i} \quad (6)$$

## V. The determination of legislative school reform

We have identified 10 different years of legislative school reform during a 110 year period. Is there any systematic pattern of factors generating reform in these particular years? Because of the limited number of reform observations, we have experimented with different combinations of the independent variables, and the results of the probit estimation reported in Table 3 seem to be robust: Economic conditions are generally unimportant, but the political constellation prevailing is a good predictor of reform.

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<sup>4</sup> A flexible lag structure is limited when reforms follow within a short time period. When there is less than eight years between reforms, we associate each year with the nearest reform. The effects of years that are halfway between two reforms closer than eight years are identified with specific dummy variables in the regressions. This procedure gives us the following number of cases where  $REFORM_{t,i}$  is equal to 1; 10 observations for  $i = 0$ ; 9 observations for  $i = 1$  and  $-1$ ; 7 observations for  $i = 2$  and  $-2$ ; 6 observations for  $i = 3, -3$  and  $-4$ ; and 4 observations for  $i = 4$ .

The economic conditions for reform are represented by three descriptives of the macroeconomic environment - change in GDP, deviation from GDP trend as a measure of unemployment, and inflation. Only when the economic and demographic variables are the sole determinants of reform, model (1) Table 3, inflation has a significant effect at 10 % level. When other factors are included, and their significance implies that they should, no economic factors are important. School reforms cannot be predicted by looking at the macroeconomic situation.

Demographic and social conditions may motivate reforms of public services. The divorce rate represents social factors and has been shown to influence the school spending (Falch and Rattsø, 1997). But changes in the divorce rate are not related to legislative reform. More students mean that schools are more important, and school reform is more likely.

Insert Table 3 : Determinants of legislative school reforms

Models (2) - (5) include political variables. The main conclusion is that political structure is important for reform. The qualitative results are independent of whether the duration of the government is measured as total duration of the government in office or the accumulated duration up till the actual year. However, the significance is reduced when the latter measure is used. In the specifications with total duration, all political variables are significant at 10% level. Reforms take place under specific political constellations. Legislative school reform is more likely under the following circumstances:

- high socialist share of representatives in the parliament
- liberal or socialist government
- government is based on a majority in the parliament
- government is of limited duration

The first two political variables represent our measures of ideology and are consistent with our expectations about socialist orientation. The last two political factors describe the strength of government. Majority control means decisive control of the parliament and ability to implement the desired reform. Strength measured in this way is conducive to reform. Interestingly, short-lived governments mark themselves by implementing reforms. Long-lasting governments may have less incentive to promote reform and in the end they may lack the energy to get reform going.

The estimated models can be used to predict the probability of reform, which is reported in Figure 2. Our preferred model, model (4), predicts all the actual reforms with relatively high probability. In particular the intensive reform period before 1920 and the period with introduction of a compulsory secondary school around 1970 show a high probability of reform, both related to majority government with limited duration. Even though it is hard to predict the exact reform year, the estimated probability of reform is low in the periods without reforms.

Insert Figure 2: Estimated probability of legislative reform

Because of the limited number of observations and the heterogeneity of types of reform, it is important to check the robustness of our results. Two alternative model formulations are investigated. The first investigates the stability of the model. Regression results for different time periods are reported in Table 4. The effects of the political variables are remarkably stable when the sample period is extended from the 1936-reform. By comparing the pre-WW2 period and the post-WW2 period (model (1) and (7) in Table 4), it seems like the socialist share of the parliament only was important during the period the share increased, 1904 - 1946. However, there is little variation in the socialist share in the post-WW2 period. In spite of the fact that all liberal governments took place before 1935 and all socialist governments thereafter, the mean probability derivative of the dummy variable for liberal and socialist government is between 0.34 and 0.51 in all specifications.

Insert Table 4: Stability of the legislative reform model

The other robustness check addresses the problem of identifying the exact timing of the effects of the independent variables on reform and is reported in Table 5. In our main analysis, the independent variables are represented by 4 year averages before the reform. In Table 5, the independent variables are measured by averages covering from 1 and up till 6 years before reform. As can be seen, the fit of the model and the size the coefficients are highest in our preferred specification. The specification with 4 year averages implies a clear dynamic pattern of reform decisions. The qualitative results, however, are independent of the model specification.

Insert Table 5: Robustness of the legislative reform model specification

## **VI. Reduced form analysis of school spending: the benchmark case**

Broadly speaking, school reform involves both legislative action and spending decisions. In the first analysis of spending, we treat school spending as an aspect of reform. In this reduced form, we apply the same economic and political variables that serve as determinants of legislative reform. Since more observations are available for spending components compared to legislative reform, more variables are included in the spending model.

The long data set available for school spending is utilized by a flexible dynamic formulation. The general error correction models are reduced to models which only include significant variables at 10% level. These models are reported as Equations (1a) - (1c) in Appendix Table A1. Table 6 summarizes the long run effects in the models.

Primary school is income elastic since in particular teacher input per class is responsive to GDP growth. The elasticities of teacher wage and teachers per class add up to above 2, implying a strong support of Wagner's law. As discussed by Falch and Rattsø (1997), this result is in strong contrast with cross-sectional analyses with an overwhelming evidence of income-inelastic educational services (see Craig and Inman, 1986, and Romer et al., 1992). In a dynamic study, we capture the growth of important cost elements.

Insert Table 6: Economic and political determinants of school spending components

A higher share of students in the population is expected to increase class size. We find that class size goes up with higher student share, and also that the number of teachers increases. The positive relationship between the share of students of the population and the teacher real wage documented in Table 6 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. 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. The share of elderly is positively associated with class size. This is

consistent with the understanding that local politics is a battle of resources between age groups dividing a given pie.

The analysis shows that characteristics of the political system must be taken into account to understand school spending growth. Both long duration of government and little fragmentation of parliament 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.

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.

## **VII. Separation of legislative reform and implementation, analysis of the consequences of legislative school reforms**

The analysis in section VI assumes that legislative reform and school spending is simultaneously determined. Since the implementation of reform involves bargaining with teacher unions and local government priorities, we argue that legislative reform can be investigated as an independent determinant of school spending. In this section we estimate and test this assumption.

The effects of legislative reforms are described by the deviation from mean in the school expenditure components in Figures 3a - 3c (deviations are shown as the fat lines). They indicate that reforms tend to influence school expenditure mainly via an increase in teacher input per class. The response can be identified both before and after the actual reform year. To reach more robust conclusions, we need to look at a broad model including the demand variables influencing

school spending. The particular pattern of expenditure growth around the school reforms can be explained by background factors such as economic growth or changing age composition of the population. If the timing of reforms is correlated with other potential explanatory variables, the implications of reforms drawn from raw data are spurious.

We use the model described in the previous section as the starting point. Given the economic and demographic demand model determining the components of school spending, the consequences of reform must appear as a systematic pattern of the residuals from the demand models. The mean values of the residuals in connection with reforms are also presented in Figures 3a - 3c. As expected, the economic and demographic variables explain some of the adjustment observed before, during and after reform. But the development of the demand determinants cannot fully explain the pattern. Teacher input per class shows systematically strong positive residuals. Only for class size, the demand model seems to explain all the reduction observed in the raw data.

Insert Figures 3a - 3c: The change in school spending components  $\pm 4$  years around reform

Investigation of the residuals in order to conclude about consequences of reform has two main weaknesses. First, we cannot say anything about significance. Second, if specific adjustment processes are at work during reform periods, the estimates of the economic model can be seriously biased. To take this criticism into account, we re-estimate the model and include dummy variables representing the years around reforms. The coefficients of the dummy variables are presented in Figures 3a - 3c and Table 7.

Insert Table 7: The effects of legislative reform

All dummy variables in the model for teacher input per class are positive, and all except  $REFORM_{t-4}$  and  $REFORM_{t+1}$  are significant at 10% level. A hypothesis of jointly no effect of the reform dummy variables is strongly rejected by an F-test. Reforms drive up teacher employment via teacher input per class. The higher teacher-class ratio is related to both increased annual school year for the students, reduced working time for the teachers and new teacher intensive subjects.

Given the effect of reforms on teacher input per class, how do the local governments react? The main local determinant, the class size, tends to go up with reform. This is true even though many reforms specify reduced maximum allowable class size. Eight of nine dummy variables in the class size model are positive, and five of them are significant at 10% level. One possible interpretation is that increased class size is a cost saving strategy by the local governments. The size of the coefficients implies that teacher employment increases every year except  $REFORM_{t+1}$ . Both class size and teacher input per class increase before the reform years, an indication that the reforms are expected. When local governments expect reform, they start raising teacher input per class by implementing some of the elements of the reform before the actual reform decision of the central government. Notice, however, that the dummy variables in the class size model are not jointly significant at 10% level.

If teacher wage is decided by supply and demand, the increased teacher employment in connection with legislative reforms will drive up the wage level. This is not the case. The wage level is negatively related to reforms, but the effect is significant in only two years. The results support a hypothesis of union influence. Due to increased employment, the union utility may increase even though the wage decreases.

To be able to draw clearer conclusions, the next step is a search for a more general pattern of the reaction to reforms. The jointly insignificant result of the reform dummy variables on class size and real teacher wage can be the result of too many variables included in the models. The first step gives each year a number. We construct a variable, REF, with the value five in the reform year, the value four one year away from reform, and so on until the value one four years away from reform. We allow for different effects of the post-reform years, REFPOST, and the reform year,  $REFORM_t$ . We start by regressing the quadratic relationship

$$SSC_t = \beta_0 SSC_{t-1} + \sum_{j=0}^4 (\beta_{1j} * EC_{t-j} + \beta_{2j} * DEM_{t-j}) + \beta_3 * POL_{t-1} + \beta_4 * REF_t \quad (7)$$

$$+ \beta_5 * REF_t^2 + \beta_6 * REFPOST_t + \beta_7 * REFPOST_t^2 + \beta_8 * REFORM_t$$

and put restrictions on the structure documented in Table 8. The reform periods have significant effect on all components with this specification. Figure 4 illustrates the adjustment. The reaction is strongest 2-3 years before and after the reform years. Surprisingly, the responses to reform are

small very close to the reform year. If the reform was expected by local governments, we would expect an increasing reaction up till the reform, and a high reaction the first years thereafter. Instead we find that the response is decreasing before the reform, and is high only from 2 years after the reform.

Insert Table 8: Quadratic functional form of legislative reform effects

Insert Figure 4: Quadratic functional form of legislative reform effects

Some generalizations can be drawn regarding the size of the adjustments to reform. The reform effect on teachers input per class implies an additional growth of approximately 0.7 percentage point up to the reforms, and an additional 1.5% from two years after reform. Compared to the sample mean growth of 1.3 %, the quantitative effect is of economic importance. The sample mean growth in real teacher wage is 2%, and the extraordinary effect of reform implies a reduction to 1% yearly growth around the reform year. The spending consequences of the change in class size are smaller, but they can be important because the mean growth is equal to zero.

Figure 4 also illustrates how reforms may be financed. Even though teacher employment increases, the wage level is reduced by a similar percentage. It seems like reforms do not increase total school spending. This is surprising. The reason can be that the union is willing to trade off wage for employment.

When estimating the demand model, teacher input per class is assumed determined by national bargaining factors. If the bargaining factors are related to reforms, we would expect the effects of the demand variables to change when the reform specific variables are included. As can be seen from Appendix Table A1 Equations (2a) - (2c), this is not the case.<sup>5</sup> We conclude that the legislative reforms can be analyzed as independent determinants of the bargaining outcome. Macroeconomic variables such as inflation and deviation from trend in GDP influence the bargaining between central government and teacher union. The working conditions of teachers are adjusted as part of the bargaining, although larger changes are part of reforms.

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<sup>5</sup> Compared to the previous model (Equations (1a) - (1c) Appendix Table A1), there are very small changes in the estimates except for the constant terms. There is an additional interesting change. The long run elasticity of the socialist share of the parliament with respect to teacher input per class reduces from 0.10 to 0.03 and is no longer significant at 10% level. This is not surprising given the fact that the socialist share is positively related to the probability of legislative reform. The socialist parties seem to increase school spending via their higher propensity to reform the school sector together with an independent effect on teacher wages.

If legislative reform and spending are determined simultaneously, we would also expect the estimated effects of reform from ordinary least square to vary over time. In addition, parameters may change if the legislative reforms differ and the conditions for reform vary in many aspects. The Chow test for parameter stability with WW2 as break point cannot reject parameter constancy of the models, see Appendix Table A1. In order to investigate parameter stability specifically for the reform effects, we re-estimate the last models (the models in Table 8 and Equations (3a) - (3c) in Appendix Table A1) with recursive ordinary least square. The general impression of the results is that the parameters are fairly constant for the post-WW2 period, see Figures 5a - 5c. For the teacher input per class model, there is some variation in the estimates, but the parameters are almost identical in the cases when the model is estimated only for the period up to 1950 and for the whole period. The class size model is of specific interest because all reforms including reduced maximum class size take place before WW2. The estimated parameters are somewhat reduced when the sample period is extended, and the size of the parameters imply that, if anything, the effect on the class size was highest in the pre-WW2 period. For the wage equation, there is no indication of changed effects.

Insert Figures 5a - 5c: Recursive estimates for the spending components

## **VII. Conclusion**

We have analyzed the generation legislative of school reforms and school spending. The extension of primary school over time is understood as the result of growing demand for school services related to higher income level and more students. The demand model is extended to include the role of political structure, ideology and strength.

Political structure is the main explanatory factor of reform. While the literature on economic reform tends to emphasize the importance of economic distress to motivate changes, economic conditions have no systematic effects on legislative school reform. Legislative school reform is more likely under the following circumstances:

- high socialist share of representatives in the parliament
- liberal or socialist government

- government is based on a majority in the parliament
- government is of limited duration

Political structure also is important for school spending. School spending is disaggregated to capture different aspects of the school system - teachers per class, class size and teacher wage. School spending growth is driven by income-elastic decisions about teacher wages and teaching requirements at the national level. The local public sector, determining the class size, has inelastic response to the national cost factors and thereby local governments are not able to hold down the spending growth. Stable governments and low fragmentation of parliament hold back teacher employment. Socialist oriented governments increase both teacher employment and teacher wages.

In Norway, decision making about legislative reform is different from decisions about school spending, since spending involves bargaining with teacher unions and local government priorities. Compared to conventional school spending studies emphasizing the impact of continuous demand factors, we have introduced legislative school reforms as an intermediate variable between demand and expenditure. The explicit handling of legislative reforms offers new insight into the determinants of school spending. While demand factors explain the spending growth over time, political constellations conducive to reform must be taken into account to understand the dynamics of the spending.

Reforms drive up teacher employment via teacher input per class. The reforms imply changes in both the length of the school year for the students, reduced working time for the teachers and new teacher intensive subjects that influence teacher demand. Our results indicate that the local governments react by increasing the class size. Increased class size is a cost saving strategy when reforms raise their costs. In addition, the growth in real teacher wage goes down around reform years. Reforms do not raise spending because of this wage effect, it seems like unions are willing to trade off wage for employment.

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