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Maintenance and building conditions in Norwegian local governments: Economic and political determinants*

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Abstract

The purpose of the paper is to empirically investigate the determinants of maintenance spending and building conditions in Norwegian local governments. In the popular debate there is a concern that low levels of maintenance spending leads to poor building conditions, and in the long run also to excessive costs by reducing the lifetime of the buildings. We take advantage of three different data sources to assess the facility management: i) a comprehensive measure of maintenance spending that includes work conducted by local government employees, ii) survey data for general building conditions, and iii) survey data for school building conditions. The empirical analysis shows that these indicators of facility management are affected by both economic and political factors. Low fiscal capacity, fiscal distress, and a high degree of party fragmentation are associated with low levels of maintenance and poor building conditions.

JEL Classification: H72, H82

Keywords: Maintenance, Building conditions

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1 Introduction

The condition of public buildings has received large attention in the Norwegian public debate in recent years. Several investigations have raised concern about low levels of maintenance and buildings in decay. In 2003 a government commission was appointed to evaluate the facility management in the local public sector in particular. In its final report (NOU, 2004) the commission concluded that buildings in decay were a substantial problem in one third of the local governments, and that the level of maintenance was insufficient in another one third. Aggregate maintenance backlog was estimated to NOK 100 billion (USD 17 billion) or 50 percent of local government revenues. The purpose of this paper is to investigate whether economic and political variables can explain the variation in the performance of the facility management across local governments.

The concerns about low levels of maintenance and poor building conditions are closely related to concerns that are often expressed about low levels of public investment in the international literature. The experiences for the OECD countries during the 1980s has received much attention, and is discussed by Oxley and Martin (1991), De Haan et al. (1996) and Sturm (1998, ch. 3) among others. During the 1980s public investment as share of GDP declined in a majority of the OECD countries, while at the same time total public spending stopped growing as share of GDP. It became a popular claim that public investment is an easy target in periods of fiscal consolidation. Roubini and Sachs (1989, p. 108-109) argue that "in periods of restrictive fiscal policies and fiscal consolidation capital expenditures are the first to be reduced (often drastically) given that they are the least rigid component of expenditures". Based on panel data for a sample of 22 OECD countries, De Haan et al. (1996) and Sturm (1998, ch. 3) find evidence in favor of the hypothesis that public investment is reduced as share of public spending during periods of fiscal stringency. They also find that frequent government changes lead to cuts in investment spending, a result that is interpreted as evidence of myopic behavior.

In the US the same concerns were raised regarding a possible "infrastructure crisis" in state and local governments. Hulten and Peterson (1984) document the decline in capital spending in the 1970s and early 1980s and offer possible explanations. A key issue in the debate was whether the decline was a sensible response to changing economic and demographic

conditions or whether it reflected myopic behavior by state and local politicians. Proponents of the latter explanation (e.g. Inman, 1983) emphasize that capital spending is an easy target when there is a need to balance public budgets because it takes time for the adverse consequences to occur. In a series of papers, Holtz-Eakin and Rosen (1989, 1993) provide more formal tests, and in general they find that the hypothesis of rational forward-looking behavior is an adequate description of municipal capital spending.[1]

While it takes time before the consequences of reduction in public investments become easily observable, new investments may have high visibility. This point is emphasized by Drazen and Eslava (2010) in a study of election cycles in Columbian local governments. They document that local public investments is significantly increased prior to elections, and the effect is strongest in local governments with severe political competition. Moreover, an increase in investments prior to elections pays off in terms of a higher vote share.

Maintenance and investments are similar in the sense that they add to the real capital stock. Maintenance does so indirectly by reducing depreciation and thereby extending the lifetime of the existing capital stock. Most of the studies referred to above emphasize the importance of maintenance, but due to data limitations they are forced to analyze investment spending only. In this paper we take advantage of three novel data sources to assess the facility management in Norwegian local governments: i) a comprehensive measure of maintenance spending that includes work conducted by local government employees, ii) survey data for general building conditions, and iii) survey data for school building conditions. The utilization of these data sources is considered to be a main contribution of the paper, as we are not aware of earlier studies using this type of data. Moreover, building conditions are important for the users of the services as well as the employees.

Our main purpose is to investigate if and how maintenance and building conditions are affected by economic and political determinants. The economic variables measure the fiscal conditions of the local government such as revenues, budget deficit, debt, rainy-day funds, and whether the local government is subject to extended central government control. We will investigate whether fiscal distress leads to poorer building conditions and reduced

[1] A similar examination is carried out by Rattsø (1999) on Norwegian data. As Holtz-Eakin and Rosen (1989, 1993) he cannot reject that local public investments are determined by rational forward looking behavior.

maintenance spending, and in particular whether maintenance is cut relatively more than other expenditures. The main political variable is an indicator of party fragmentation. Earlier studies of Norwegian local governments have documented that a high degree of party fragmentation is associated with large budget deficits (Borge, 2005) and less forward looking spending behavior (Borge and Tovmo, 2009). It is of interest to investigate whether a high degree of party fragmentation is associated with myopic behavior also when it comes to maintenance and building conditions.

The rest of the paper is organized as follows: We start out in Section 2 by presenting a stylized model of maintenance. Section 3 presents the institutional background and the three measures of maintenance and building conditions. The econometric specification and the key explanatory variables are discussed in Section 4, while Section 5 presents the estimation results. The main findings of the paper are briefly summarized in Section 6.

2 A stylized model of maintenance

In this section we develop a simple dynamic model of local government spending behavior. The main purpose is to analyze determinants of maintenance spending. In addition we emphasize the relationship between maintenance and budget deficits. The idea is to show that maintenance spending and budget deficits are determined by the same explanatory variables, and that it makes sense to use a similar econometric model as in the empirical literature on budget deficits. Both high budget deficits and low levels of maintenance mean that "problems" are shuffled ahead, so a first guess is that the exogenous variables will move maintenance and budget deficit in opposite directions.

We use a simple two-period setup where the local government's budget constraints are given by

$$b_1 = (1 + r_0)b_0 + c_1 + m - y_1 \tag{1}$$

$$b_2 = (1 + r_1)b_1 + c_2 - y_2 = 0 \tag{2}$$

where b_t is debt at the end of period t, r_t is interest rate on debt carried over from t to $t+1$, c_t is current spending in period t, m is maintenance spending in period 1, and y_t is revenues in period t. A consolidated budget constraint is obtained by inserting (1) into (2)

$$c_1 + m + \frac{c_2}{1+r_1} = y_1 + \frac{y_2}{1+r_1} - (1+r_0)b_0 \tag{3}$$

The consolidated budget constraint states that the present value of spending equals the present value of revenues minus initial debt. We assume a simple production technology for local public services. Service provision in period 1 (g_1) equals current spending, while service provision in period 2 (g_2) depends on current spending as well as maintenance spending undertaken in period 1

$$g_1 = c_1 \tag{4}$$

$$g_2 = f(c_2, m) \tag{5}$$

In Equation (5) f is a standard production function with constant returns to scale in the two inputs. Although investment and capital stock do not enter explicitly, the underlying idea is that maintenance delays depreciation and thereby increases capital input.

The local decision-making is guided by the following intertemporal utility function

$$U = u(g_1) + \delta u(g_2) \tag{6}$$

where the instantaneous utility function u is strictly concave and $\delta < 1$ is a discount factor. By maximizing the utility function subject to the budget constraint and the production technology, we arrive at the following first order conditions

$$u'(g_1) = (1+r_1)\,\delta u'(g_2)\, f_c \tag{7}$$

$$f_m = (1+r_1)\, f_c \tag{8}$$

Equation (8) is a condition for cost efficient production of the publicly provided good in period 2, while (7) is a condition for optimal allocation of public services across the two periods. The budget constraint (3) and the first order conditions (7) and (8) determine maintenance and provision of public services in the two periods. We are primarily interested in the solutions for maintenance and the budget deficit in period 1 (*d*)

$$m = m(y_1, y_2, b_0, \delta) \qquad (9)$$
$$\quad + \; + \quad - \; +$$

$$d = c_1 + m - y_1 = d(y_1, y_2, b_0, \delta) \qquad (10)$$
$$\quad - \quad + \quad + \; -$$

The intuition for the predicted effects of revenues and initial debt is straightforward.[2] Less initial debt and higher revenues (in any of the two periods) have a positive income effect that contributes to increased service provision in both periods, and thereby to increased maintenance spending in period 1. The budget deficit is reduced if the revenue increase occurs in period 1 (the revenue increase is partly saved to finance higher spending in period 2), and increased if the revenue increase occurs in period 2 (higher budget deficit is a mean to increase spending already in period 1). Lower initial debt will reduce the period 1 deficit since the corresponding spending increase is distributed over both periods.

More myopic behavior (a decrease in the discount factor δ) leads to increased service provision in period 1 at the expense of period 2. Lower service provision in period 2 also means lower maintenance spending in period 1. As for the budget deficit in period 1, there are two opposing effects. Increased service provision in period 1 leads to a larger budget deficit, while lower maintenance spending works in the opposite direction. It can be shown (see Appendix A) that the increase in current expenditures will be larger than the reduction in maintenance, and that more myopic behavior unambiguously increases the budget deficit.

Since high budget deficits and low levels of maintenance mean that "problems" are moved forward in time, one may expect that the explanatory variables have opposite effects on the two variables. It appears that this is the case for initial debt, current revenues, and the degree of myopic behavior. However, an increase in future revenues will move maintenance

[2] The results are formally derived in Appendix A.

spending and the budget deficit in the same direction. This makes sense, since higher revenues in the future will stimulate current spending and maintenance today, and thereby increase the budget deficit.

The stylized model demonstrates substantial analogy between large budget deficits and low levels of maintenance. Our econometric analysis of maintenance spending is motivated by the large empirical literature on budget deficits by focusing on fiscal and political variables. The fiscal variables capture current revenues and fiscal distress, while party fragmentation is the main political variable. Party fragmentation is considered as a proxy for myopic behavior (a low discount factor δ). Low levels of revenue, fiscal distress, and a high degree of party fragmentation are predicted to reduce maintenance.

3 Maintenance and building conditions

As in other Scandinavian countries, Norwegian local governments are important providers of welfare services like child care, primary and lower secondary education, primary health care, and care for the elderly. Other important tasks are culture and infrastructure. After labor, buildings are probably the most important input in production of local public services. Local government buildings amount to 50 m^2 per employee and make up as much as ¼ of all non-residential buildings in Norway. Schools make up nearly half of the total building mass and constitute the most important building type, followed by nursery homes (22 percent), office buildings (11 percent), and child care centers (7 percent).[3]

In the empirical analysis we take advantage of three different data sources of maintenance spending and building conditions. The data for maintenance spending are from local government accounts, while information on building conditions is tapped by the use of surveys. In the following we provide a description of the three data sources.

Until 2008 the local government accounts did not provide an accurate measure of maintenance spending. The problem was that maintenance spending only included materials and labor purchased from external firms, and not the maintenance work conducted by local government employees. Since maintenance spending only was captured to the extent it was

[3] Around half of all child care centers are privately owned and are not included in the figures.

outsourced, maintenance was underestimated and the data were not commensurable across local governments. Since 2008 maintenance work conducted by the local government is included in maintenance spending, and in this study we take advantage of the new and improved spending measure. The spending measure captures maintenance activity for buildings owned by local governments. Maintenance does not include upgrades and major renovations as they are considered as investments.

According to Statistics Norway, the aggregate local government maintenance spending amounted to NOK 375 (USD 68) per capita or NOK 86 (USD 16) per m^2 in 2008. In January 2009 a maintenance grant to local governments was implemented as part of the fiscal stimulus package to counteract the impacts of the global financial crisis. The grant was earmarked for new maintenance projects that were not included in the adopted budget for 2009. The grant was paid out as a flat amount per capita. [4] The grant contributed to an increase in maintenance spending to NOK 117 per m^2. After the grant was abolished in 2010, maintenance per m^2 dropped back to NOK 96.[5]

Since the new and more proper definition of maintenance was introduced as recently as in 2008, the reliability of the data varies substantially across local governments. The approach taken in this study is to consider very low or very high maintenance spending per m^2 as signals of low data reliability. As a baseline we exclude observations with maintenance spending per m^2 below NOK 25 and above NOK 400. This means that nearly 20 percent of the observations are excluded, of which roughly a half is below the lower cut-off and the other half above the upper cut-off. The baseline sample is representative in the sense that the mean values are very close to the national means discussed above. However, since it is not obvious how to define the cut-offs, we will investigate whether the results are robust to variations in the cut-off values.

[4] The scope of the maintenance grant was broader than the spending concept used in this study. The grant could be used for local government infrastructure (not only buildings), for private organizations receiving financial support from the local government, and also for renovation and upgrading.

[5] The figures for 2009 and 2010 are in fixed 2008 prices.

Table 1: Descriptive statistics for the dependent variables

Variable	Mean	p10	p25	p50	p75	p90
Maintenance spending per m^2 (NOK)						
2008 (N=318)	83	30	40	56	85	130
2009 (N=369)	112	38	51	83	132	169
2010 (N=362)	92	33	40	60	94	147
Maintenance spending per capita (NOK)						
2010 (N=362)	420	178	235	349	587	921
Maintenance as share of total exp. (%)						
2010 (N=362)	0.76	0.30	0.38	0.58	0.84	1.22
General building conditions 2004 (N=239)	3.1	2	2	3	4	5
School building conditions 2004 (N=106)	1.4	0.7	1.0	1.3	1.8	2.1

Maintenance spending per m^2 and per capita are in fixed 2008 prices. The means for the maintenance indicators are weighted. N is the number of observations.

We use three indicators of maintenance spending; per m^2, per capita, and as share of total current expenditures. Descriptive statistics for the three indicators are reported in Table 1. It appears that the maintenance variables show substantial variation even after the exclusion of extreme observations. The ratios between the 90th and the 10th percentiles are in the order of 4-5, and the 75th percentiles are more than twice as large as the 25th percentiles.

Maintenance spending per m^2 is the best indicator with respect to evaluating whether maintenance is sufficient. According to norms for good maintenance, maintenance spending per m^2 should be NOK 110-145.[6] It appears that the maintenance spending was far below the norm in 2008. And even in 2009, with the extraordinary maintenance grant in place, maintenance spending was in the lower end of the norm. A majority of the local governments still had maintenance spending below the norm.

In addition to maintenance spending, we make use of information on building conditions from two different sources. The first source is a government commission (NOU, 2004) that was set up to evaluate the facility management in the local public sector. The commission conducted a survey on building conditions, maintenance, and organization of the facility management. The survey was mailed to all local governments and achieved a response rate of 55 percent. Small local governments (population size below 5,000) are underrepresented in the sample.

[6] The norm is taken from FOBE (2006). We have adjusted their original figures for inflation from 2004 to 2008/2009.

The questionnaire was designed to be filled out by the top administrative management. In most cases it was done by the facility manager.

As part of the survey, the respondents were asked to state to which extent the building mass in general is well maintained. The answer was imposed to be on a 1-6 scale, where 1 is "to very little extent" and 6 "to very large extent". A total of 239 local governments answered this question. The response was 1 in 5 percent of the cases, 2 in 25 percent of the cases, 3 in 35 percent of the cases, 4 in 25 percent of the cases, 5 in 9 percent of the cases, and 6 in 1 percent of the cases, yielding the descriptive statistics reported in Table 1. Except for the description of the end points, the respondents were not given much guidance on how to interpret the 1-6 scale. However, if the response was 4 or lower, the respondents would also answer questions regarding explanations for insufficient maintenance. This indicates that 90 percent of the local governments expressed that their buildings are insufficiently maintained. If we extend the definition of sufficient maintenance to include a 4, the share of local governments with insufficient maintenance is reduced to 65 percent.

The Auditor General of Norway (*Riksrevisjonen*) is the second source of information on building conditions. In 2004 the Auditor General conducted a survey on school building conditions in a sample of local governments (Riksrevisjonen, 2004-2005). This is an important building type that makes up around half of the total local government building mass. The questionnaire was mailed to the department responsible for school buildings in 129 local governments. All large local governments (population size above 20,000) were included. For the rest a stratified random sample was drawn, with stratification based on population size and local government revenue. The response rate was as high as 85 percent, i.e. 109 local governments returned the questionnaire. By design, large local governments are overrepresented in the sample.

Information on building conditions was tapped in a very different way compared to the commission that was set up to evaluate the facility management. First, it was emphasized that the respondents should have a common reference for the evaluation. The chosen reference

was the Norwegian Standard 3424 Building Condition Analysis, where buildings are evaluated according to the following 0-3 scale:[7]

3 A building in very good conditions with no defects and only minor wear and tear compared to new buildings.

2 A building in good, satisfactory condition where all legal regulations are obeyed. Some wear and tear compared to new buildings.

1 A building with some defects that need corrective maintenance and/or where legal regulations are not obeyed.

0 A building with extensive damage and defects, considerable need for corrective maintenance, and much wear and tear. Legal regulations are not obeyed.

The scale does not come with a clear definition of acceptable condition. A reasonable interpretation is that a building with grade 2 is clearly acceptable, while a building with grade 1 is not sufficiently maintained. For a local government with several schools, the cut-off for the average condition would be somewhere between 1 and 2.

Second, each local government was instructed to evaluate up to 10 schools that were built prior to 1985. The intention was not to measure the conditions of all school buildings, but rather the conditions of schools that are 20 years or older. Older schools were chosen in order to facilitate the identification of insufficient maintenance. Moreover, to secure a random sample of schools, local governments with more than 10 schools were instructed to pick schools in alphabetical order. A total of 671 schools were evaluated as part of the survey.[8] Of these 11 percent were given grade 3, 31 percent grade 2, 44 percent grade 1, and 14 percent grade 0. This implies that nearly 60 percent of the schools are insufficiently maintained. Moreover, in nearly 90 percent of the local governments at least one of the investigated schools received grade 1 or 0.

Since our analyses of the determinants of maintenance will be carried out at the local government level, it is the average grade for each local government that is as dependent variable. Descriptive statistics for these figures are reported in the bottom row of Table 1. It

[7] In the original scale 0 is the best grade and 3 the worst. We have reversed the scale so that the indicator of school building conditions has the same ordering as the two other indicators.

[8] This is a bit more than 20 percent of all schools.

appears that the average school building condition among the 106 local governments in our sample is 1.4. This is slightly better than "a building with some defects that need corrective maintenance and/or where legal regulations are not obeyed". If the cut-off for acceptable condition is set at 1.5, 57 percent of the local governments come out with insufficient maintenance on average.

Table 2: The correlation between the indicators of maintenance spending and building quality

	Maintenance per m^2	Maintenance per capita	Maintenance as share of tot. exp.	General building cond.	School building cond.
Maintenance per m^2	1.000				
	(N=362)				
Maintenance per capita	0.728***	1.000			
	(N=362)	(N=369)			
Maintenance as share of	0.911***	0.846	1.000		
total expenditures	(N=362)	(N=369)	(N=369)		
General building conditions	0.098	0.169**	0.130*	1.000	
	(N=208)	(N=208)	(N=208)	(N=239)	
School building conditions	0.109	0.155	0.118	0.359***	1.000
	(N=98)	(N=98)	(N=98)	(N=66)	(N=106)

N is the number of observations that the correlation is based on. Data for maintenance is from 2010.

*** p<0.01, ** p<0.05, * p<0.1.

Table 2 reports the correlation between the indicators of maintenance spending and building conditions. It appears that the two indicators of building condition are positively and significantly correlated. Given the very different design of the surveys, we think the positive correlation yields credibility to both indicators. Not surprisingly, also the three indicators of maintenance spending are highly correlated. It is less clear what to expect for the correlations between building conditions (in 2004) and maintenance spending (in 2010). On the one hand, local governments that over time have had high levels of maintenance spending will tend to have buildings that are in good condition. On the other hand, and in particular because of the time lag, high levels of maintenance spending may be a response to poor building conditions. It turns out that there is a weak positive correlation between maintenance and building conditions, so in the raw data there is no sign that high maintenance spending is a response to poor building conditions.

All three data sets described in this section indicate that, on average, the local government building mass is insufficiently maintained. But the average figures mask large differences across local governments. While a majority is characterized by low maintenance spending and

poor building conditions, there is also a sizeable minority with a well-functioning facility management. It is of great interest to seek explanations for these differences.

4 Econometric specification

The empirical analyses are based on the following econometric model

$$y = \beta_0 + \beta_1 \text{Fiscal} + \beta_2 \text{Political} + \beta_3 \text{Controls} + u \tag{11}$$

where the dependent variable y is either maintenance spending or building conditions, Fiscal is a vector of fiscal variables, Political is a vector of political variables, Controls a vector of control variables, and u a stochastic error term. The dependent variables were discussed in detail in Section 2. In the following we discuss the operationalization of the explanatory variables. Descriptive statistics for the explanatory variables are reported in Appendix 2.

The main fiscal variable is local government revenue. We use a measure of real per capita revenue published by the Ministry of Local Government, which is widely accepted as the most reliable indicator of fiscal capacity. The measure is an index where the weighted average for all local governments is set equal to 100 each year. The starting point is the sum of general purpose grants and local tax revenues. Most taxes are of the revenue sharing type, and the tax revenues comprise income and wealth tax from individuals, as well as the property tax. Since the grant system provides compensation for high spending needs, the revenues must be "deflated" in order to capture the real differences across local governments. An index of spending needs from the spending needs equalization system is used as deflator. It captures unfavorable cost conditions related to population size, settlement pattern, the age composition of the population, and social factors. Since most taxes are of the revenue sharing type, the revenue measure can be interpreted as an indicator of fiscal capacity. The substantial variation in fiscal capacity reflects differences in tax bases and the design of the grant system. Revenues are measured according to an index where the average for each local government is set equal to 100 each year.

In addition to per capita revenues as indicator of fiscal capacity, we include a number of indicators of fiscal distress. Fiscal distress is broadly defined as actual fiscal performance in relation to the balanced-budget-rule (BBR). The main requirement in the Norwegian BBR is

operational budget balance. In the budget (or ex ante), current revenues must be sufficient to cover current expenditures (wages and materials) and debt servicing costs (net interest payment and net installment on debt). Actual deficits can be carried over, but have to be covered within two years.[9] On average (over time and across local governments) the net operating surplus amounts to 2-3 percent of revenues and contributes to ⅓ of investment financing.

The net operating surplus[10] in the previous year is our first indicator of fiscal distress. Local governments with low or negative net operating surplus may need to tighten their budgetary policy. But since the budget can be balanced by use of rainy-day-funds, the need to tighten the budgetary policy will be less for local governments with large funds. Available rainy-day-funds by the end of the previous year constitute our second indicator. It is inversely related to fiscal stress. The third indicator is net debt. Net operating surplus, funds, and net debt are all measured in percent of current revenues.

The final indicator of fiscal distress is a dummy variable capturing whether the local government is included in the Register for State Review and Approval of Financial Obligations (Robek). The register lists local governments that have violated the BBR by passing a budget with a net operating deficit or have been unable to cover an actual deficit within two years. The far most common reason for being in the register is that a deficit is not covered on time. The consequence of being in the register is that the budget and resolutions to raise new loans must be approved by the county governor, the central government's representative in the county. Local governments in the register are subject to stronger central government control, and must tighten their budgetary policy in order to be removed from the register.

Three of the indicators of fiscal distress are significantly correlated with fiscal capacity. Local governments with high per capita revenue tend to have high net operating surplus, large funds, and low debt. The correlations are in the range 0.3-0.4. On the other hand, there is no systematic relationship between per capita revenue and the likelihood of being in the Robek

[9] An actual deficit is covered when future surpluses are at least as large as the deficit.

[10] The net operating surplus is current revenue less current expenditures and debt servicing costs.

register. Local governments with low per capita revenue are more likely to experience a deficit, but they are also more likely to cover the deficit on time.

The political system at the local government level is a representative democracy where the members of the local council are elected every fourth year. The national parties are important players, and the national struggle between the socialist and non-socialist camps is mirrored at the local level. Compared to national politics, a main difference is that the majority coalition does not form a cabinet. The typical organization is an alderman model with an executive board with proportional representation from all major parties. The executive board is led by the mayor, and the members of the executive board, including the mayor and the deputy mayor, are elected among the members of the local council.

Several studies of Norwegian local governments have emphasized the impact of political strength. Political strength is shown to reduce administrative spending (Kalseth and Rattsø 1998), to increase efficiency (Borge et al., 2008 among others), and to reduce the budget deficit (Borge, 2005). A traditional Herfindahl-Hirschman index has been the most widely used indicator of political strength. It is a measure of the party fragmentation in the local council, and is calculated as

$$HHI = \sum_{p=1}^{P} SH_p^2 \tag{12}$$

where SH_p is the share of representatives from party p. The index takes the maximum value of 1 when a single party holds all the seats in the local council, while the minimum value of $1/P$ is attained when the seats are equally divided among the P parties. The index can be interpreted as the probability that two randomly drawn members of the council belong to the same party. Alternatively, we can say that it captures the number of parties in the local council and the distribution of seats among them. The value of the index is reduced (fragmentation increases) when the number of parties increases and when the number of seats are more equally divided among a given number of parties. In this paper we use the inverse of the Herfindahl-Hirschman index as indicator of political strength. This indicator can be interpreted as the effective number of parties. In our sample, the effective number of parties varies from 1.5 to nearly 7, with an average just above 4.

In Norway, the socialist camp is dominated by the Labor party, while the non-socialist camp is more fragmented. As a consequence, there is a negative correlation between party fragmentation and the share of socialists in the local council.[11] Since we cannot rule out that socialist influence has an impact on maintenance and building conditions, we will control for the share of socialists to get an unbiased estimate of the efficient number of parties. Socialist parties are defined as the social democrats (The Labor Party) and all parties to its left.

In analyses of local government tax and spending behavior it is usual to control for socioeconomic variables such as population size, population growth, age composition of the population, and settlement pattern. We conducted some preliminary analyses to detect the most relevant socioeconomic determinants of maintenance and building conditions. It turned out that population size is a significant determinant of maintenance spending, while population growth is important for building conditions. Neither age composition nor settlement pattern came out as significant in these preliminary regressions, and they are not included in the regressions to be reported in the proceeding section. In addition to population size, we control for the share of rented building mass in the equations for maintenance per capita and as share of total expenditures. The reason is that maintenance of rented buildings is not included in the measure of maintenance spending.[12]

The datasets for maintenance and building conditions are slightly different. For maintenance we have a panel with 3 years of data. However, the time series dimension is too short to estimate a fixed effects model. We report results from pooled OLS that also utilizes the cross section variation in the data. It is well known that pooled regressions may underestimate the standard errors and thereby overestimate the t-values. We deal with problem by reporting t-values based on clustered standard errors taking into account that the error terms from the same local government are correlated, see Wooldridge (2003).

[11] The correlation between the effective number of parties and the share of socialists is -0.37.

[12] The denominator in maintenance per m^2 only includes buildings owned by the local government.

For building conditions we have two cross sectional datasets, and we mainly report results from OLS regressions with robust standard errors. However, since the data for general building conditions are on an ordinal 1-6 scale, results from ordered probit are also reported.[13]

Building conditions are affected by maintenance activity during several years. In the empirical analysis this is taken into account by measuring the explanatory variables over a longer period. The length of the periods differs somewhat due to data availability. Most fiscal indicators are averages for the period 1998-2003. The only exception is the variable capturing whether the local government is listed in the Robek register. This variable is measured as the fraction of months the local government was in the register during the three year period 2001-2003 (the register was first established in 2001). The political variables are averages based on the local elections held in 1995, 1999, and 2003. Finally, population growth is measured as the growth rate during 1988-2003.

5 Estimation results

Estimation results from a baseline specification with the three maintenance indicators as dependent variables are reported in Table 3, Columns (A)-(C). The baseline specification includes local government revenue as indicator of fiscal capacity, but has no indicator of fiscal distress. The reason is that we consider local government revenue as the most exogenous of the fiscal variables. Local government revenue comes out highly significant with a positive sign, indicating that high fiscal capacity stimulates maintenance spending. The positive impact in the case where maintenances is measured as share of total expenditures means that maintenance spending is more elastic with respect to revenues than other current expenditures. In periods where local government revenues decrease (increase), maintenance spending decreases (increases) relatively more than other current expenditures. The high elasticity is confirmed by the per capita equation which yields an elasticity above 2.

As expected, a high degree of party fragmentation is associated with lower levels of maintenance spending. This is consistent with the hypothesis that fragmented local governments are more myopic. The estimated effects are highly significant when maintenance

[13] School building conditions are measured on an ordinal 0-3 scale for individual schools. But since the regression analysis is conducted at the local government level with average school building conditions as dependent variable, ordered probit cannot be used in this case.

is measured per capita or as share of total expenditures and marginally significant when it is measured per m^2. The point estimates also indicate that a high share of socialists in the local council is associated with low levels of maintenance, but the impact is weak in terms of statistical significance.

Table 3: The determinants of maintenance spending

	Per m^2	Per capita	Share of total expenditures (%)				
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Local government revenue	0.337 (3.64)	9.03 (6.48)	0.0040 (3.76)	0.0038 (3.33)	0.0033 (2.71)	0.0037 (3.16)	0.0040 (3.72)
Previous surplus (% of revenues)				0.0036 (1.35)			
Rainy-day-funds (% of revenues)					0.0062 (1.85)		
Net debt (% of revenues)						-0.0011 (-1.43)	
Central government control (Robek)							-0.095 (-2.03)
Effective number of parties	-3.37 (-1.65)	-42.3 (-2.06)	-0.043 (-2.23)	-0.043 (-2.24)	-0.040 (-2.04)	-0.040 (-2.02)	-0.040 (-2.09)
Share of socialists in the local council (%)	-0.179 (-1.17)	-1.91 (-1.75)	-0.0021 (-1.49)	-0.0020 (-1.46)	-0.0014 (-1.00)	-0.0018 (-1.32)	-0.0020 (-1.46)
Rented buildings (%)		-4.93 (-2.99)	-0.0051 (-2.08)	-0.0051 (-2.05)	0.0044 (-1.77)	-0.0052 (-2.12)	-0.0044 (-1.74)
Population size (in 10,000)	5.33 (2.96)	5.62 (1.01)	0.026 (1.95)	0.026 (2.02)	0.026 (2.02)	0.026 (1.86)	0.025 (1.86)
Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Number of observations	1,035	1,035	1,035	1,035	1,035	1,034	1,035
R^2	0.104	0.263	0.095	0.097	0.104	0.099	0.099

The t-values in parentheses are based on clustered standard errors. Time dummies and a constant term (not reported) are included in all equations.

The share of the building mass that is rented comes out with a negative sign when included (maintenance per capita and as share of total expenditures). In addition maintenance spending tends to increase with population size. The impact is significant when maintenance is measured per m^2 or as share of total expenditures.

As discussed in Section 3, it is not obvious how to define the cut-offs for respectively high and low maintenance spending. In Appendix 2 we report sensitivity analyses with two alternative cut-off definitions. The first alternative, with a lower cut-off of NOK 20 per m^2 and a higher cut-off of NOK 500 per m^2, is less strict than the baseline. The second alternative is stricter than the baseline, and has a lower cut-off of NOK 30 and an upper cut-off of NOK

300. The first alternative expands the sample by 59 observations, while the second alternative reduces the sample by 64 observations. It appears that the results are quite robust to the alternative cut-offs. The largest changes are observed for the share of socialists in the local council. In both alternatives the effect of the share of socialists becomes stronger than with the baseline cut-off.

The indicators of fiscal distress are included one by one in Columns (D)-(G). Only regressions with maintenance as share of total expenditures as dependent variable are presented since we are particularly interested in whether maintenance is affected relatively more by fiscal distress than current expenditures in general. The four indicators of fiscal distress all come out with the expected sign, but only rainy-day funds and the dummy variable for whether the local government is listed in the Robek register are statistically significant. It appears that the effects of local government revenue and party fragmentation are very robust to the inclusion of variables capturing fiscal distress.

Table 4: The determinants of general building conditions

	(A)	(B)	(C)	(D)	(E)	(F)
Local government revenue	0.0062	0.0061	0.0014	-0.0009	0.0032	0.0055
	(2.26)	(2.25)	(0.41)	(-0.23)	(1.09)	(2.11)
Previous surplus			0.0765			
(% of revenues)			(2.55)			
Rainy-day-funds				0.0397		
(% of revenues)				(2.44)		
Net debt					-0.0058	
(% of revenues)					(-2.22)	
Central government						-0.468
control (Robek)						(-2.20)
Effective number of	-0.292	-0.294	-0.251	-0.254	-0.255	-0.248
parties	(-3.47)	(-3.39)	(-2.87)	(-2.82)	(-2.83)	(-2.88)
Share of socialists in the	-0.0120	-0.0118	-0.0092	-0.0082	-0.0079	-0.0104
local council (%)	(-2.12)	(-2.09)	(-1.52)	(-1.32)	(-1.26)	(-1.82)
Population growth	0.0181	0.0184	0.0146	0.00122	0.0158	0.0156
1988-2003 (%)	(3.01)	(3.01)	(2.32)	(1.84)	(2.48)	(2.56)
Method	OLS	Ordered probit	OLS	OLS	OLS	OLS
Number of observations	239	239	236	231	232	239
R^2	0.073		0.092	0.087	0.080	0.088

The t-values in parentheses are based on robust standard errors. A constant term (not reported) is included in all equations.

Table 4 reports the results from the regressions with general building conditions as dependent variable. Again, the point of departure is a specification (Column (A)) with local government

revenue as the only fiscal variable. Local government revenue comes out with a positive and significant impact on general building conditions. Both political variables are statistically significant. Increases in the effective number of parties and the share of socialists in the local council contribute to poorer building conditions. Finally, rapid population growth is associated with better building conditions, probably reflecting a larger share of new buildings and a larger need to maintain older buildings. Column (B) reveals that these results are almost identical when the estimation method is ordered probit.

Columns (C)-(F) includes the four indicators of fiscal distress one by one, and they all come out as significant and with the expected signs. Previous operating surpluses and large funds are associated with better building conditions, while high debt and listing in the Robek register are associated with poorer building conditions. The impact of party fragmentation, both the quantitative effect and its significance, is very robust to the inclusion of variables capturing fiscal distress. The impacts of local government revenue and the share of socialists are more fragile, and they are both insignificant in Columns (C), (D), and (E).

Table 5: The determinants of school building conditions

	(A)	(B)	(C)	(D)	(E)
Local government revenue	0.0067	0.0034	0.0053	0.0112	0.0065
	(1.23)	(0.60)	(1.00)	(2.23)	(1.18)
Previous surplus		0.0427			
(% of revenues)		(1.67)			
Rainy-day-funds			-0.0027		
(% of revenues)			(-1.35)		
Net debt				-0.0015	
(% of revenues)				(-1.35)	
Central government					-0.500
control (Robek)					(-2.33)
Effective number of	-0.178	-0.157	-0.177	-0.194	-0.138
parties	(-2.86)	(-2.50)	(-2.80)	(-3.19)	(-2.16)
Share of socialists in the	-0.0060	-0.0054	-0.0052	-0.0093	-0.0052
local council (%)	(-1.50)	(-1.35)	(-1.13)	(-2.28)	(-1.32)
Population growth	0.0173	0.0135	0.0150	0.0193	0.0140
1998-2003 (%)	(3.05)	(2.31)	(2.56)	(3.30)	(2.44)
Method	OLS	OLS	OLS	OLS	OLS
Number of observations	104	103	102	102	104
R^2	0.147	0.168	0.167	0.170	0.173

OLS estimates with t-values (based on robust standard errors) in parentheses. A constant term (not reported) is included in all equations.

The estimation results with school building conditions as dependent variable are reported in Table 5. Party fragmentation and population growth are the only variables that come out as

significant in Column (A). As for general building conditions, an increase in the effective number of parties will lead to poorer building conditions, while rapid population growth contributes to better building conditions. Local government revenue and the share of socialists in the local council come out as insignificant. The insignificant effect of local government revenue may reflect that the variation in revenues across municipalities is smaller in this sample where larger municipalities are overrepresented. In Columns (B)-(E) the four indicators of fiscal stress are included one by one. Previous net operating surplus and the Robek dummy are the only indicators that come out as significant, both with their expected signs. The impact of party fragmentation is very robust to the inclusion of the indicators of fiscal distress.

Our most robust finding is that a high degree of party fragmentation comes out with a significantly negative effect on maintenance and building conditions. However, it may be objected that reverse causality may be a problem. Good building conditions may increase the support for the ruling parties, and thereby the degree of party fragmentation. We investigate this issue utilizing the surveys on building conditions (from 2004) and the outcome of the local elections held in 2007. Reverse causality is a problem for our analysis if local governments with good building conditions experience a reduction in the number of effective parties relative to local governments with poor building conditions. It turns out that there indeed is a negative correlation between building conditions and the change in the number of effective parties. However, the correlations are very low (-0.02 for general building conditions and -0.06 for school building conditions) and they are far from being statistically significant. We take this as suggestive evidence that reverse causality is not a severe problem in our case.

The analyses show that economic and political variables are relevant determinants of maintenance spending and building conditions. However, the quantitative effects are modest. An increase in the effective number of parties by one (equal to one standard deviation) is predicted to reduce maintenance spending by 0.04 percentage points (when measured as share of total expenditures), to reduce the general building conditions by 0.25-0.30, and to reduce school building conditions by 0.15-0.20. An increase in local government revenue by 25 (roughly one standard deviation) is predicted to increase maintenance spending by up to 0.1 percentage points and to improve general building conditions by up to 0.15. The quantitative effect of being listed in Robek is to reduce maintenance spending by 0.1 percentage points. An increase in the fraction of months (during 2001-2003) in Robek by ½ is predicted to

reduce building conditions by 0.25. It is fair to say that these effects are small in relation to the variation in the explanatory variables discussed in Section 2.

6 Concluding remarks

The purpose of the paper has been to investigate the determinants of maintenance spending and building conditions in Norwegian local governments by taking advantage of three different data sources to assess the facility management. The most robust result is that a high degree of party fragmentation is associated with low levels of maintenance and poor building conditions. We interpret this finding as evidence of myopic behavior where "problems" are shuffled ahead. Maintenance and building conditions are also affected by fiscal variables. The response to lower revenues is to reduce maintenance relatively more than current expenditures in general. Local governments in fiscal distress due to violation of the balanced-budget-rule come out with low levels of maintenance and poor building conditions. The impacts of the fiscal variables indicate the maintenance is an easy target in periods of fiscal consolidation that also results in poorer building conditions.

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Appendix 1 Comparative statics

This appendix derives the comparative static results used in Section 2 more formally. The point of departure is the first order conditions (7)-(8) and the consolidated budget constraint (3). Differentiation with respect to period 1 revenues yields the following results

$$\frac{\partial c_1}{\partial y_1} = \frac{\delta u''(g_2) f_m^2}{u''(g_1) + \delta u''(g_2) f_m^2} > 0 \tag{A1}$$

$$\frac{\partial m}{\partial y_1} = -\frac{u''(g_1)}{D f_c}(f_{cc} f_m - f_{cm} f_c) > 0 \tag{A2}$$

$$\frac{\partial c_2}{\partial y_1} = -\frac{u''(g_1)}{D f_c}(f_{mm} f_c - f_m f_{cm}) > 0 \tag{A3}$$

where $D = -\left[\frac{u''(g_1)}{f_c f_m} + \frac{f_m}{f_c}\delta u''(g_2)\right](f_{cc} f_m^2 - 2 f_{cm} f_c f_m + f_{mm} f_c^2)$ is negative from the second order condition. The terms within the parentheses on the right hand sides of (A1) and (A2) are negative given that maintenance and current spending are normal factors of production. Then $\frac{\partial m}{\partial y_1} > 0$ and $\frac{\partial c_2}{\partial y_1} > 0$ follows. By differentiating the expression for the budget deficit and utilizing (3) we arrive at

$$\frac{\partial d}{\partial y_1} = \frac{\partial c_1}{\partial y_1} + \frac{\partial m}{\partial y_1} - 1 = -\frac{1}{1 + r_1}\frac{\partial c_2}{\partial y_1} < 0 \tag{A4}$$

It is evident from Equation (3) that increased revenues in period 2 has the same qualitative effect on current spending and maintenance as increased revenues in period 1 ($\frac{\partial c_1}{\partial y_2} > 0$, $\frac{\partial m}{\partial y_2} > 0$ and $\frac{\partial c_2}{\partial y_2} > 0$), while higher initial debt has the opposite effect ($\frac{\partial c_1}{\partial b_0} < 0$, $\frac{\partial m}{\partial b_0} < 0$ and $\frac{\partial c_2}{\partial b_0} < 0$). Then $\frac{\partial d}{\partial y_2} > 0$ and $\frac{\partial d}{\partial b_0} < 0$ follows from the expression for the budget constraint.

Differentiation of equations (3) and (7)-(8) with respect to the discount factor yields the following results

$$\frac{\partial c_1}{\partial \delta} = \frac{u'(g_2) f_m}{u''(g_1) + \delta u''(g_2) f_m^2} < 0 \tag{A5}$$

$$\frac{\partial m}{\partial \delta} = \frac{u'(g_2) f_m}{D f_c} (f_{cc} f_m - f_{cm} f_c) > 0 \tag{A6}$$

$$\frac{\partial c_2}{\partial \delta} = \frac{u'(g_2) f_m}{D f_c} (f_{mm} f_c - f_{cm} f_m) > 0 \tag{A7}$$

Moreover, by differentiating the expression for the budget deficit and utilizing (3) we arrive at

$$\frac{\partial d}{\partial \delta} = \frac{\partial c_1}{\partial \delta} + \frac{\partial m}{\partial \delta} = -\frac{1}{1 + r_1} \frac{\partial c_2}{\partial \delta} < 0 \tag{A8}$$

Appendix 2 Descriptive statistics for the explanatory variables

Table A1: Descriptive statistics for the explanatory variables, maintenance regressions

Variable	Description	Mean (st.dev)
Local government revenue	The sum of local taxes and lump-sum grants from the central government. Measured per capita and adjusted for spending needs. Normalized such that the weighted average (for all local governments) equals 100 each year.	108.1 (24.8)
Previous surplus	The net operating surplus the previous year. Measured in percent of current revenues.	1.74 (6.5)
Rainy-day-funds	Available funds by the end of the previous fiscal year. Measured in percent of current revenues.	6.1 (7.6)
Net debt	Gross debt minus financial wealth by the end of the previous year. Measured in percent of current revenues.	61.1 (26.5)
Central government control (Robek)	A dummy variable set equal to one if the local government is listed in the Register of State Review and Approval of Financial Obligations.	0.10 (0.31)
Effective number of parties	An indicator of party fragmentation in the local council. Based on the election held in 2007.	4.1 (1.1)
Share of socialists in the local council	The share of socialists in the local council, percent. Based on the election held in 2007.	35.2 (14.8)
Rented buildings	The fraction of the building mass that is rented, percent.	3.0 (6.8)
Population size	The number of inhabitants January 1, in ten thousandths.	1.13 (3.4)

Table A2: Descriptive statistics for the explanatory variables, building conditions regressions

Variable	Description	Mean (st.dev)	
		Buildings in general	School buildings
Local government revenue	The sum of local taxes and lump-sum grants from the central government. Measured per capita and adjusted for spending needs. Normalized such that the weighted average (for all local governments) equals 100 each year. Average 1998-2003.	103.8 (23.3)	102.1 (15.9)
Previous surplus	The net operating surplus measured in percent of current revenues. Average 1998-2003.	1.64 (2.5)	1.42 (2.4)
Rainy-day-funds	Available funds measured in percent of current revenues. Average 1998-2003.	4.1 (5.9)	4.2 (7.9)
Net debt	Gross debt minus financial wealth measured in percent of current revenues. Average 1998-2003.	32.0 (27.4)	28.8 (30.3)
Central government control (Robek)	The fraction of months listed in the Register of State Review and Approval of Financial Obligations during 2001-2003.	0.166 (0.292)	0.179 (0.300)
Effective number of parties	An indicator of party fragmentation in the local council. Average for the elections held in 1995, 1999, and 2003.	4.1 (1.0)	4.1 (1.0)
Share of socialists in the local council	The share of socialists in the local council, percent. Average for the elections held in 1995, 1999, and 2003.	38.2 (13.3)	36.7 (14.0)
Population growth	The percentage growth in population size from January 1, 1988 to January 1, 2003.	2.0 (12.1)	4.1 (12.6)

Appendix 3 Sensitivity analysis for varying cut-offs

Table A.3: The determinants of maintenance spending as share of total expenditures (%), varying cut-offs

	(A)	(B)	(C)
Local government revenue	0.0040	0.0040	0.0036
	(3.78)	(3.76)	(3.54)
Effective number of parties	-0.038	-0.043	-0.048
	(-1.86)	(-2.23)	(-2.39)
Share of socialists in the local council	-0.0024	-0.0021	-0.0023
(%)	(-1.73)	(-1.49)	(-1.66)
Rented buildings (%)	-0.0052	-0.0051	-0.0070
	(-2.16)	(-2.08)	(-3.05)
Population size	0.028	0.026	0.022
(in 10,000)	(2.02)	(1.95)	(1.82)
Method	OLS	OLS	OLS
Lower cut-off	20	25	30
Upper cut-off	500	400	300
Number of observations	1,094	1,035	971
R^2	0.100	0.095	0.091

The t-values in parentheses are based on clustered standard errors. Time dummies (not reported) are included in all equations.