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Building Conditions in Norwegian Local Governments: Trends and Determinants

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Abstract

In light of evidence of low levels of maintenance of public buildings, we investigate trends and determinants of public building conditions in Norwegian local governments. On average, the condition of Norwegian local public facilities have improved slightly in the period 2004 - 2016. Survey data suggest substantial fluctuations in building conditions and a negative relationship between building conditions in 2004 and 2016. A driver behind this result is high investments in local governments with poor building conditions in 2004. Further, we find no systematic relationship between the conditions in 2004 and maintenance expenditures in subsequent years. We conclude that if maintenance levels are too low, investment levels may be too high. Generally, our results hint at an unhealthy balance between maintenance spending and public spending. Finally, we find that both political and fiscal factors are important in explaining building conditions.

Keywords: Public building conditions, local governments, maintenance, investments, political fragmentation

[1] We are grateful to Lars Kvamsdal for help with formulating the survey questionnaire. Some of the data are obtained from the Norwegian Social Science Data Services (NSD). All errors and mistakes are our own.

1 Introduction

Public buildings play a vital role in the production of public welfare services, and decaying public facilities give rise to concerns in even some of the most affluent countries in the world. Low levels of maintenance and poor facility management can adversely affect service production through two mechanisms. First, inadequate maintenance means that facilities decay faster than what they would under an appropriate maintenance schedule. Inadequate maintenance thus creates an expenditure backlog that must be covered in the future, either by major renovations of existing facilities, or investment in new. Hence, inadequate maintenance means that the local government shuffles expenditures into the future. As a consequence, the service production in the future must be reduced, since more resources must be spent to keep the local government facilities in operative condition.

In addition to the costs related to cover the maintenance backlog in the future, poor maintenance may have direct consequences for the production of public services. After labor, facilities are probably the most important input in production of local public services. Poor facilities may thus have a negative impact on the quality of public services. The education sector has received particular attention, see, e.g., Green and Turrell (2005), COSLA and the Scottish Government (2009), Lavy and Bilbo (2009), Kristoffersen and Larsen (2010), Hopland (2012; 2013; 2014a), and Hopland and Nyhus (2015).

The conditions of public buildings also cause concern in Norway. A government commission (NOU 2004) that was appointed to evaluate the facility management in the local public sector concluded that buildings in decay or insufficient maintenance were a substantial problem in two thirds of the local governments. Earlier Norwegian studies point to a weak fiscal situation in many local governments and inability or unwillingness among local politicians to give maintenance sufficient priority as the main concerns among facility managers (Econ & Multiconsult, 2001; NOU, 2004; Hopland and Kvamsdal, 2017). Borge and Hopland (2012, 2017) find that economic conditions are not the sole explanation for poor facility management in Norwegian local governments. Rather, they find that weak political leadership is also an important determinant for low levels of maintenance and poor building conditions. They move on to argue that poor conditions of facilities are, to some extent, caused by myopic politicians who are unable to make long-run prioritizations, and thus favor other expenditures that are more visible to voters in the short-run.

Even though Borge and Hopland (2017) is recently published, the survey data they use are quite old, and was collected for the reports by NOU (2004) and Riksrevisjonen (2004-2005). It is thus of great interest to investigate both whether building conditions have improved or declined since these data were collected, and whether the same factors still explain differences in building conditions across local governments.

In this paper, we make use of a survey data set collected during the spring and fall of 2016. The survey was sent to all 428 municipalities in Norway, and the response rate was about 2/3. Respondents were asked to report their overall assessment of the local government's building mass. Given the high response rate, substantially higher than in the NOU (2004) survey, we are certain that the conclusions of the paper are representative for the full population of Norwegian local governments.

Since we have access to the NOU (2004) data as well, we can also investigate how building conditions have developed in the 167 local governments that participated both in that and in our survey. Moreover, we can study whether the building conditions in 2004 have affected maintenance and investments in the years between the surveys – and thus the building conditions in 2016. When comparing the reported building conditions in the 167 local governments that participated both in the 2004 and 2016 surveys, we see that building conditions appear to have improved slightly. Similar as Borge and Hopland (2017), we find that both political and fiscal determinants are important for building conditions.

Interestingly, we find a weakly negative relationship between building conditions in 2004 and 2016. Further investigations reveal that local governments with buildings in good condition in 2004 had lower investments in the following years. The maintenance expenditures in the same period are not affected by the building conditions in 2004. These findings suggest that we do not necessarily have a "stable ranking" in terms of which local governments that are best at maintaining their buildings. Rather, many seem to follow a cyclical strategy, where they invest in new buildings, maintain them to such low degree that the buildings decay and then invest in new ones once the condition of the old buildings is too poor. Admittedly, some replacement of old buildings that have become outdated is obviously required, but if maintenance budgets suffer in favor of short-term priorities, replacements may become unavoidable earlier than necessary.

2 Related literature

Our study relates to a vast political economy literature on low levels of public investment. For example, the experiences of the OECD countries during the 1980s have received much attention. During the 1980s, public investment as share of GDP declined in a majority of the OECD countries, while total public spending stopped growing as a share of GDP. It became a popular claim that public investment is an easy target in periods of fiscal consolidation. See, (e.g., Roubini and Sachs 1989, p. 108-109). In 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. On the other hand, Sanz (2011) finds that productive spending (spending components assumed to promote long-term growth) is isolated from budgetary cuts in OECD countries. Akitoby et al. (2006) study public spending in 51 developing countries during 1970-2002 and their results support the hypothesis that during economic downturns, investments are cut disproportionately more than other expenditures.

Similar concerns have been raised regarding a possible "infrastructure crisis" in US state and local governments (see, e.g., Hulten and Peterson, 1984). While some argued that low levels of public investments indicate myopic behavior (e.g., Inman, 1983), others claimed that the decline in capital spending was consistent with rational responses to changing economic and demographic conditions (e.g., Holtz-Eakin and Rosen, 1989; 1993).[2]

While it takes time before the consequences of reduction in public investments become easily observable, new investments may have high visibility. Drazen and Eslava (2010) document that local public investments in Columbia increase significantly 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 for the incumbent.

While there exists a vast literature on public investments, the literature on public maintenance is surprisingly scarce. A central point in the academic debate is that postponing maintenance is

[2] Using Norwegian data, Rattsø (1999) reaches similar conclusions as Holtz-Eakin and Rosen (1989, 1993).

essentially the same as running a deficit, in the sense that expenditures are postponed. Borge and Hopland (2012) argue that poor condition of the infrastructure is to some extent due to myopic politicians who are unable to make long-run prioritizations, and thus favor other expenditures that are more visible to voters in the short-run. This argument implies that inadequate maintenance, at least to some extent, is due to irrational behavior from the policy makers. Their theoretical predictions are also backed up by empirical results (Borge and Hopland, 2012; 2017). However, Hopland (2015) argues that local governments can postpone maintenance strategically in order to extract additional funds (bailouts) in the future. He thus argues that decay of public buildings is not necessarily a consequence of myopia or irrationality, but can be due to rational behavior.[3]

Other studies look into the organizational framework, and suggest that differences in organizational structure and competence may determine the successfulness of local government facility management. Haugen (2003) documents that an increasing number of Norwegian local governments centralize their facility management and more services are contracted out to external companies. The driving force behind this development is a wish for a more professional and competent facility management. The importance of competence in the facility management organization is also clear from the analysis by Hopland and Kvamsdal (2016). They show that it is non-trivial to decide how maintenance expenditures are spent most cost-efficiently and to optimize the life-span maintenance schedule of facilities.

Hopland (2014b) looks more closely into the local governments' choice of a centralized or decentralized structure of the facility management. He argues that even though most local governments have chosen to centralize facility management, it is not given that "one size fits all", but that characteristics of the local government will decide which is best. Moreover, his empirical analysis shows that local governments seem to choose the structure of their facility management at least partly based on such characteristics.

3 Institutional setting

As in other Scandinavian countries, Norwegian local governments are important providers of welfare services such as child care, primary and lower secondary education, primary health

[3] Gauteplass and Hopland (2017) also consider a game-theoretical model where the central government uses tailor-made contracts for different local governments in order to stimulate provision of local government facilities.

care, and care for the elderly. Other important tasks are culture and infrastructure. The local public sector accounts for around 50 percent of government consumption and local public sector revenues make up 18 percent of GDP. After labor, buildings are probably the most important input in production of local public services. Local government buildings amount to 50 square meters per employee and make up as much as about 25 percent of all non-residential buildings in Norway. Schools make up nearly half of the total local public building mass and constitute the most important building type, followed by nursing homes (22 percent), office buildings (11 percent), and childcare centers (7 percent).[4] The main revenue sources for local governments are taxes, grants from the central government and user charges. Whereas the local governments have a large degree of discretion on the expenditure side, revenues are heavily regulated under central standards. The opportunity to influence current revenues is in practice limited to property tax and user charges that are limited to covering costs.

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 elections are held on the same day in all local governments, in September. 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 mayor leads the executive board, and the members of the executive board, including the mayor and the deputy mayor, are elected among the members of the local council.

Prior to each fiscal year, the local council makes decisions regarding current spending, revenue, investment activity and borrowing. The executive board and the chief administrative officer (*rådmannen*) play key roles in the early stages of the budgetary process, and the executive board presents a budget proposal to the local council. The groupings in the local council are free to put forward their own suggestions, either small or large changes to the proposal from the executive board, or different budget proposals. Finally, the local council determines the budget either by voting on alternative budget proposals or issue by issue. The final vote takes place shortly before New Year, around mid-December.

[4] Around half of all childcare centers are privately owned and are not included in the numbers.

4 Data empirical specification

Collection of survey data

The survey was conducted electronically via the survey tool Questback (www.questback.com). An invitation to participate was sent to the main e-mail contact address of each Norwegian municipality. The invitation specified that an adequately informed administrative leader should answer the survey. In a vast majority of cases, the head of the facility management unit answered the survey, while in a few cases it was the chief administrative officer who was the respondent. Hence, we consider the information in the survey to be reliable, accurate, and of the highest possible quality for large-scale surveys. After the initial invitation, periodic e-mail reminders were sent to municipalities that had yet to participate in the survey. The invitation and reminders gave a brief account of the background and motivation for the survey, and further contained a hyperlink to the online survey. The survey was set up such that once one had completed the survey, one could not answer the survey again. If one had only partly answered the survey and followed the hyperlink again, one was offered the opportunity to continue answering the survey from where one left off. Alternatively, one could start from the top, erasing earlier answers.

The survey was open from end of May to early October 2016. We received a total of 282 responses from the population of 428 municipalities, resulting in a 66% response rate. As Table 1 shows, the responding local governments are well distributed throughout the 19 Norwegian counties, thus securing that all parts of the country are well represented. Populous municipalities are somewhat overrepresented. For example, nine out of the ten most populous municipalities are represented. Since there is an overweight of populous municipalities in our data, the sample covers a larger share of the population than municipalities; in fact, the 282 municipalities cover as much as 80% of the population. And because populous municipalities manage more local public facilities, we are confident that our sample gives a very good overview of the facility management in Norwegian municipalities. Since we in this analysis to large extent will rely on the 167 local governments that also participated in the NOU (2004) survey, Table 1 also shows the geographical distribution of these. We see that this smaller sample also gives a good geographical spread across the country.

Table 1: Responses by counties.

County	Total number of local governments	Number of respondents, full sample (%)	Number of respondents, overlapping sample (%)
Østfold	18	12 (66.67)	9 (50.00)
Akershus	22	15 (68.18)	14 (63.64)
Oslo*	1	1 (100)	0 (0.00)
Hedmark	22	14 (63.64)	9 (40.91)
Oppland	26	21 (80.77)	13 (50.00)
Buskerud	21	14 (66.67)	5 (23.81)
Vestfold	14	9 (64.29)	7 (50.00)
Telemark	18	16 (88.89)	8 (44.44)
Aust-Agder	15	7 (46.67)	5 (33.33)
Vest-Agder	15	9 (60.00)	8 (53.33)
Rogaland	26	18 (69.23)	11 (42.31)
Hordaland	33	25 (75.76)	15 (45.45)
Sogn og Fjordane	26	16 (61.54)	10 (38.46)
Møre og Romsdal	36	22 (61.11)	9 (25.00)
Sør-Trøndelag	25	20 (80.00)	12 (48.00)
Nord-Trøndelag	23	15 (65.22)	7 (30.43)
Nordland	44	23 (52.27)	13 (29.55)
Troms	24	14 (58.33)	5 (20.83)
Finnmark	19	12 (63.16)	7 (36.84)
Total	428	283 (66.12)	167 (39.02)

*The county Oslo only covers the capital city Oslo, which is also a local government.

Variables

Our main dependent variable is extracted from one of the questions in the survey discussed above. Respondents were asked to report their overall assessment of the local government's building mass on a 1-5 scale, where 1 indicates very poor overall condition while 5 means that the buildings are in very good condition.

Our first explanatory variable is the reported building condition from 2004. A positive coefficient indicates that for a municipality with above average building conditions in 2004, we expect building conditions to also be above average in 2016, and vice versa. That is, that there is a fairly stable ranking of municipalities with respect to overall building condition. A negative coefficient indicates the opposite, if the overall building condition was above average in 2004, we expect overall building condition to be below average in 2016, and vice versa. That is, a ranking of municipalities with respect to overall building condition is not stable over time.

In addition to data from the two surveys, we merge data on several important local government characteristics. First, we use information about the local councils to construct political variables. As Borge and Hopland (2017), we use political fragmentation, measured as the familiar Herfindahl-Hirschman index *(HHI)* as a proxy for myopic policymaking.

$$HH = \sum_{p=1}^{P} SH_p^2 \qquad (1)$$

where SH_p is the share of representatives from party *p* and P is the total number of parties in the council. The *HH*-index captures the number of parties in the local council and the distribution of seats among them. The index can be interpreted as the probability that two randomly drawn members of the council belong to the same party. The value of the index is reduced (fragmentation increases) when the number of parties increases and when the seats become more equally divided among a given number of parties. Since the index is inversely related to political fragmentation, we expect it to come out with a positive coefficient in the regression analyses. An increase in the *HH*-index (a lower degree of political fragmentation) is expected to be associated with better building conditions and a higher share of schools in good condition.

In the Norwegian context the socialist camp is dominated by the Labour Party, while the nonsocialist camp comprises more equally sized parties. Consequently, there is strong correlation between political fragmentation and political ideology. It is important to control for ideology in order to rule out that our measure of fragmentation picks up the effect of ideology. In most specifications we use the share of socialist in the local council (*SOC*) as indicator of ideology. The correlation between the *HH*-index and *SOC* is around 0.35.

Our main variable for the fiscal capacity of the local governments is local government revenues (*Revenue*). It may be easier for local governments with high revenues to allocate sufficient resources to maintenance, to rehabilitate older buildings, and to invest in new buildings. We thus expect revenues to come out with a positive coefficient.

The revenue measure requires some explanation. Compared to most other countries, the Norwegian system of financing is quite centralized. Most local taxes are of the revenue sharing type where effective tax limits have been in place since the late 1970s. We use a measure of revenue published annually by the Ministry of Local Government. The starting point is the sum of local taxes and general purpose grants, both measured per capita. But since high per capita revenue to some extent is compensation for unfavorable cost conditions, the revenues must be "deflated" in order to capture the real differences across local governments. The cost index 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 the local taxes are of the revenue sharing type (where all local governments use the same tax rate set by the central government), the real revenue measure can be interpreted as an indicator of fiscal capacity. Differences in fiscal capacity reflect differences in tax bases and the design of the grant system. In addition to revenues, we also include the net operating surplus (*Surplus*), measured in percent of revenues. We also expect this variable to come out with a positive coefficient.

The vector of controls ($\boldsymbol{x_i}$) include variables that are common to include in empirical studies of local government spending behavior as well as variables that are specifically relevant for building conditions. We first control for several demographic factors. We expect relative population growth to come out as positive, since local governments experiencing population decline may find it optimal to let some buildings fall into decay as they may not need them in the future. We thus expect population growth to come out with a positive coefficient in the regressions. In addition, we include population size, the settlement pattern as percentage of the population living in rural areas, and the age composition of the population. We split the age composition into three categories, the percentage of the population 0-5 years, 6-15 years, and 80 years and above. The three age groups capture demand for respectively child care, primary and lower secondary education, and care for the elderly. We have now clear a priori expectation of the signs of the coefficients for population size, settlement pattern, and age composition.

We also include two control variables that aim to take geographic and climatic variation into account. First, we include a dummy equal to one if the local government has a coastline, as areas close to the coast are in general wetter and have milder winters than the inland areas. Further, we include county dummies in order to capture any other systematic geographical differences.[5]

The final control variable is also from the survey. We asked the local governments to provide information on whether the responsibility for facility management is decentralized to individual institutions (school, nursing homes, etc) or is handled at the local government level (centralized). We control for organization of the facility management by a dummy variable that equals 1 if the facility management is handled at the local government level.

When it comes to operationalization of the remaining explanatory variables, it is important to take account of the fact that building conditions are affected by maintenance activity during several years and that the explanatory variables must be measured over a longer period. In the empirical analyses we thus use averages that cover the period 2008-2015 for all variables that vary over time (i.e., political variables, fiscal conditions, and demographics).[6] Descriptive statistics for the explanatory variables are reported in the table in the Appendix.

Empirical specification

The baseline empirical analyses are based on various versions of the following linear regression model

$$BC2016_i = \beta_0 + \beta_1 BC2004_i + \beta_2 HH_i + \beta_3 Revenue_i + \beta_4 Surplus_i + \boldsymbol{x_i'}\boldsymbol{\beta_C} + u_i \qquad (2)$$

where the dependent variable $BC2016_i$ is the building conditions in local government *i* as reported in the 2016 survey, and $BC2004_i$ is the building condition from the 2004 survey. u_i is an error term. Since the building conditions on a categorical scale, we will report results using both OLS and ordered probit.

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[5] There are 19 counties in Norway with an average of 23 local governments.

[6] The political variables are measured as averages over the two elections covering this period, i.e. the elections held in 2007 and 2011.

5 Results

Descriptive statistics

Table 2 presents descriptive statistics for the building conditions both in the full sample of 2016 participants and the 2016 conditions for the local governments that also participated in the NOU (2004) survey. We first observe that the descriptive statistics are almost identical for the two groups. This indicates that the smaller sample (59.2% of the total sample) is also quite representative.

Table 2: Descriptive statistics for the dependent variable, overall building conditions in 2016.

Variable	Mean (st.dev.)	p10	p25	p50	p75	p90
Full sample, N=282	3.22 (0.72)	2	3	3	4	4
Overlapping sample with NOU (2004), N=167	3.20 (0.71)	2	3	3	4	4

It is not obvious where we should place the cut-off for “good” building conditions in the survey, but a labelling where we define 1 and 2 as “poor”, 3 as “fair” and 4 and 5 as “good”, seems quite reasonable. We then have that 37 (13.1%), 148 (52.5%), and 97 (34.4%) report that buildings are in poor, fair, and good conditions in the full sample. In the overlapping sample we have that 24 (14.3%), 88 (52.6%), and 97 (32.9%) report that buildings are in poor, fair, and good conditions. We thus again see that the full sample and overlapping sample are very similar.

We next look at the development in building conditions over time. Since our survey used a 1-5 scale, while the NOU (2004) survey used a 1-6 scale, we must conduct a standardization procedure in order to make them directly comparable. We thus use the proportion of maximum scaling (POMS) which transforms each scale to a measure between 0 (minimum and 1 (maximum) and allow us to compare them (Little, 2013). The formula is

$$POMS = \frac{observed\ value - minimum\ value}{maximum\ value - minimum\ value} \quad (3)$$

This procedure yields a POMS score of 0.43 for the 2004 data and 0.55 in 2016 for the 167 local governments that participated in both surveys (0.56 in the full 2016 sample). Since a 5-step scale offers the possibility to choose a “neutral” category (i.e., 3), while the 6-step scale does not, we should keep in mind that respondents may react differently to them. However, we do observe the same tendency when looking more closely at the distribution of answers on the NOU (2004) survey. If we categorize 1 and 2 as "poor", 3 and 4 as "fair" and 5 and 6 as "good", we have in the total sample that 50 (29.9%), 99 (59.3%), and 18 (10.8%) report that buildings are in poor, fair, and good conditions. We thus see that whereas the number of local governments that define their building conditions as "fair" is quite similar, many more local governments report that their buildings are "good" now than what was the case in the NOU (2004) survey, and, hence, many fewer report their buildings to be in "poor" condition.

It is interesting to note that the building conditions from our survey and the NOU (2004) survey are only very weakly correlated (p-value 0.81), and that the correlation is actually marginally negative, at -0.019. This finding suggests that we do not necessarily have a "stable ranking" in terms of which local governments that are best at maintaining their buildings. In order to investigate this further, we turn to the formal regression analysis.

Main results

Table 3 reports our main results. In Columns (A)-(D) we include the building conditions from NOU (2004) as an explanatory variable, and thus restrict the analysis to the overlapping data set. In Column (E), we exclude this variable and use the full 2016 data set. We see that the weakly negative correlation between building conditions in 2004 and 2016 persists, even as several variables are added to the equation, and that the coefficient remains quite stable across the three linear regressions [(A), (B), and (D)] where it is included (the ordered probit coefficient cannot be compared directly to the linear regression coefficients). Actually, the negative relationship becomes a bit stronger the more variables that are included, and the coefficient is even significant at the 10% significance level in the most general model (D).

Similar as Borge and Hopland (2017), we find that strong political leadership, here captured by a higher Herfindahl-Hirschman index, is associated with better building conditions. Also similar to Borge and Hopland, we see that political ideology does not seem to play a central role in determining building conditions, although a higher share of socialists consistently comes out with a positive sign. Further, we see that high revenues and strong population growth are associated with good building conditions. This is also consistent with Borge and Hopland's (2017) findings.

Table 3: Determinants for overall building conditions in 2016.

	(A)	(B)	(C)	(D)	(E)
Building conditions in 2004	-0.0652 (0.0538)	-0.0762 (0.0534)	-0.140 (0.0922)	-0.0963* (0.0515)	
Herfindahl-Hirschman index	2.212*** (0.671)	2.138*** (0.777)	3.874*** (1.421)	1.878** (0.802)	1.536** (0.679)
Share of socialists (%)	0.00707 (0.00469)	0.00774 (0.00469)	0.0144* (0.00814)	0.00736 (0.00456)	0.00617 (0.00383)
Local government revenue		0.00716** (0.00328)	0.0143** (0.00617)	0.00735** (0.00330)	0.00676** (0.00290)
Net operating surplus		-0.00294 (0.0331)	-0.00641 (0.0566)	0.0187 (0.0349)	0.0235 (0.0244)
Population growth (%)		0.0209* (0.0116)	0.00376* (0.0200)	0.0132 (0.0157)	0.0215* (0.0117)
Population size (in 10,000)				0.0218 (0.0243)	0.0260 (0.0210)
Percentage of pop. aged 0-5 years				-0.0182 (0.0949)	0.0223 (0.0712)
Percentage of pop. aged 6-15 years				0.0322 (0.0822)	0.0889* (0.0526)
Percentage of pop. aged ≥ 80 years				-0.0355 (0.0665)	0.0715 (0.0528)
Coast dummy				0.285* (0.152)	0.235* (0.126)
Centralized facility management dummy				0.647** (0.287)	0.234 (0.211)
Observations	167	167	167	165	277
R^2/Pseudo R^2	0.221	0.256	0.139	0.330	0.178
Method	OLS	OLS	Ordered probit	OLS	OLS
Sample	Overlap	Overlap	Overlapping	Overlapping	Full 2016 sample

County dummies and a constant term (not reported) are included in all regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The remaining variables seem to be of less importance, although there are some indications that age distribution, geography and organization of the facility management has an impact on the building conditions.

Building conditions vary over time, and in Table 4 we take a closer look at the relationship between reported overall building conditions in 2004 and 2016. We sort the 2016 data into ‘poor’ (1-2), ‘fair’ (3) and ‘good’ (4-5) categories as above. The 2004 data are sorted as follows: ‘Poor’ (1-2), ‘fair’ (3-4), and ‘good’ (5-6). The table lists, in the first column, the number of observations that were in the ‘poor’ category in 2004, and how these are distributed in the different categories in 2016, and similarly for the subsequent columns. We make two key observations: There seem to be considerable ‘dynamics’ in building conditions, in line with our interpretation of the negative coefficient for 2004-condition in table 3 that there is no stable ranking of municipalities with respect ot overall building condition. Further, the distribution over the different categories in 2016 seem hardly related to the 2004 categories.

Table 4: Development over time.

	Poor condition in 2004	Fair condition in 2004	Good condition in 2004
Poor condition in 2016	7	15	2
Fair condition in 2016	27	50	11
Good condition in 2016	16	34	5

Further analysis: maintenance and investment

The negative relationship between building conditions in 2004 and 2016 is somewhat surprising and calls for further investigations. We thus proceed by analyzing how the building conditions in 2004 affected investment and maintenance in the following years. Since we do not have high-quality data for maintenance and investment prior to 2008 (see Borge and Hopland 2012 for more details), we study average maintenance and investment in the period 2008-2015. We measure maintenance as expenditures per square meter, since this is the measure most closely related to maintenance needs available. Investment is measured in 1,000 NOK per capita. Both are in fixed 2008 prices, and descriptive statistics are reported in the appendix.

We report results for regressions with maintenance expenditures [Column (A)] and investments [Column (B)] in Table 5. We see that the building conditions have no statistically significant effect on the maintenance expenditures in the years ahead. Actually, almost none of the included variables explain average maintenance expenditures in this period. For our purposes, the main take-away is that local governments with poor and good building conditions in 2004 seem to maintain their facilities to the same extent.

The picture is a bit different when looking at investments. Here we see that for each step on the Likert scale one goes up, average investment per capita drops by 420 NOK, a full 9% of the sample mean for average investments in the period. It thus seems that the negative relationship we found in our main analysis arises because the local governments that had poor buildings in 2004 invested more heavily in new (or substantial renovation of existing) facilities than those that had good facilities already. These findings suggest that we do not necessarily have a “stable ranking” in terms of which local governments that are best at maintaining their buildings. Rather, many seem to follow a cyclical strategy, where they invest in new buildings, maintain them to such low degree that the buildings decay and then invest in new ones once the condition of the old buildings is too poor.

Table 5: Determinants for average maintenance per m^2 and investment per capita 2008-2015.

	(A) Maintenance per m^2	(B) Investment per capita
Building conditions in 2004	3.158	-0.420**
	(4.406)	(0.206)
Herfindahl-Hirschman index	45.52	12.66
	(54.63)	(8.104)
Share of socialists (%)	-0.0743	-0.0617
	(0.306)	(0.0414)
Local government revenue	0.226	0.0578*
	(0.245)	(0.0314)
Net operating surplus	-1.166	0.222
	(2.028)	(0.201)
Population growth (%)	-1.303	-0.106
	(1.140)	(0.0984)
Population size (in 10,000)	3.023**	0.0306
	(1.409)	(0.0559)
Percentage of pop. aged 0-5 years	9.537	0.454
	(6.955)	(0.581)
Percentage of pop. aged 6-15 years	-10.38	0.0399
	(6.293)	(0.398)
Percentage of pop. aged ≥ 80 years	-2.670	-0.179
	(4.674)	(0.412)
Coast dummy	-5.511	-0.00248
	(10.85)	(0.660)
Centralized facility management dummy	-23.34*	-0.368
	(13.15)	(0.932)
Observations	163	165
R^2	0.181	0.411
Method	OLS	OLS
Sample	Overlap	Overlap

County dummies and a constant term (not reported) are included in all regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

6 Concluding remarks

Public facilities and maintenance of these represent substantial expenditures for local governments. That maintenance of public facilities is underfinanced and not prioritized is more or less a stylized fact (Borge and Hopland 2012, 2017). A possible factor in this lack of priority is that maintenance returns – in terms of long-run facilities conditions – and what constitutes an appropriate or optimal maintenance schedule is not well understood (Hopland and Kvamsdal 2016). By studying determinants of the condition of local public facilities, and how conditions vary over time, we contribute to this understanding.

Norwegian local public facilities were reportedly in better condition in 2016 than in 2004 on average. For a given facility, we expect a general downward trend in condition because (i) it presumably is in a good condition as new, (ii) to invest in its condition (that is, maintain) towards the end of its time of service makes little sense, and (iii) inevitably, it becomes outdated even under comprehensive maintenance. An outdated and run down facility may be replaced with a new and up-to-date facility. Thus, in a portfolio of facilities, the overall condition will vary with time.

Our finding that facility conditions over time (from 2004 to 2016) are negatively correlated may thus be explained by a natural replacement cycle in the portfolio of facilities. We do worry, however, that the cycle is more rapid than necessary. A more rapid cycle means that costly investments in new facilities occur more frequently, and we hypothesize that if better maintenance could postpone these investments, that is, if the replacement cycle was slower, it would lower overall costs. We see in table 4 that there is considerable dynamics in the conditions of Norwegian local public facilities. Facilities remain in use for a long time, several decades is typical, and in comparison, our study covers a relatively small time window of 12 years. Thus, we do worry about the negative relationship between facility conditions in 2004 and 2016, and whether it indicates a too rapid replacement cycle. Further, maintenance expenditures seem uncorrelated with facility conditions, maybe generally at a too low level, while investments in new facilities is clearly higher where facilities are in poor conditions.

We need more research in this area. Theory could be developed to form empirically testable hypotheses regarding the level of maintenance, replacement cycles, and inherent tradeoffs. A relevant question is how the length of replacement cycles and an appropriate maintenance scheme relate to total expenditures. Further, more detailed empirical studies are necessary to document how systematic these cycles are, and whether they are part of a larger management plan or merely an unintended consequence of shortsighted political priorities. Panel data type studies, perhaps on specific types of facilities, could be of interest here. Ultimately, modern building materials is meant to reduce maintenance needs, but usually require a larger, initial investment. It is of interest to study how this claim holds up, both in theory and in practice.

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Appendix

Table A1: Descriptive statistics.

Variable	Mean (standard deviation)
Building conditions in 2004	3.12 (1.06)
Herfindahl-Hirschman index	0.26 (0.08)
Share of socialists (%)	37.00 (12.98)
Local government revenue	105.93 (21.02)
Net operating surplus (% of revenues)	2.26 (2.15)
Population growth (%)	4.99 (6.51)
Population size (in 10,000)	1.44 (2.84)
Percentage of population 0-5 years	6.81 (1.12)
Percentage of population 6-15 years	12.73 (1.15)
Percentage of population ≥80 years	5.06 (1.44)
Coast dummy	0.61 (0.49)
Centralized facility management unit dummy	0.95 (0.23)

Based on the sample from column (D) in Table 3, N=165.

In light of evidence of low levels of maintenance of public buildings, we investigate trends and determinants of public building conditions in Norwegian local governments. On average, the condition of Norwegian local public facilities have improved slightly in the period 2004–2016. Survey data suggest substantial fluctuations in building conditions and a negative relationship between building conditions in 2004 and 2016. A driver behind this result is high investments in local governments with poor building conditions in 2004. Further, we find no systematic relationship between the conditions in 2004 and maintenance expenditures in subsequent years. We conclude that if maintenance levels are too low, investment levels may be too high. Generally, our results hint at an unhealthy balance between maintenance spending and public spending. Finally, we find that both political and fiscal factors are important in explaining building conditions.

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