Politics and resource use in local government service production

Empirical analyses of administration and long-term care in Norway

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Dr.polit.-avhandling 2003
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ISBN-nummer 82-471-5164-2

Acknowledgements

This thesis is a result of research undertaken at the Department of Economics at the Norwegian University of Science and Technology. The work was supervised by Professor Jørn Rattsø. I would like to thank him for his insightful guidance, patience and support throughout the work. Jørn is co-author of two of the chapters, and has also offered constructive critique and suggestions for improvements of the other chapters. I would also like to thank the staff members at the Department of Economics for providing me with a stimulating work environment.

The funding from the Norwegian University of Science and Technology and the financial support from the Norwegian Research Council to some of the research included in the thesis are gratefully acknowledged. I would also like to thank my present employer SINTEF Unimed Health Services Research for contributing to the completion of the thesis.

The data used in the thesis are provided from Statistics Norway and the Norwegian Social Data Services. None of the institutions are responsible for the analyses of the data and the interpretation of results.

Trondheim, Oktober 2002

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Contents

Chapter 1

Introduction and summary

1. Introduction

This thesis includes five essays studying the performance of local governments in Norway. Four of the essays address variation in resource allocation and efficiency between the local governments, the fifth analyses variation in service levels. The thesis has mainly an empirical orientation. One essay, presented in Chapter 4, provides a theoretical contribution to the study of efficiency variation in public sector service production. The empirical analyses concentrate on two spending components, local government administration and long-term care. Chapter 2 and 3 study variation in the size of local government administration. Administration is a necessary input in both service provision and in the political decision-making process, and administrative spending competes with welfare services for resources. The size of the administrative component determines the amount of resources available for the production of welfare services. Cost efficiency and service levels within long-term care are the topics in Chapter 5 and 6 respectively. Long-term care for elderly and disabled persons is, besides primary education, the major expenditure component of the municipalities.

Two characterizing features of the local government sector have inspired the analyses. First, the local government sector is the major provider of welfare services and represent more than 20 percent of total employment. Given the size and importance of the local government sector, efficient provision of services is an interesting area of study. However, the incentives for efficient resource utilization may be weak. The financing of the local government activities is mainly tax based, through local income tax revenue sharing and intergovernmental grants. Thus the individual welfare services provided are either free of charge or heavily subsidized. There is hardly any competition on the supply side. Furthermore Tiebout competition is likely not to be efficient (Anderson and Carlsen 1997). Second, there are huge differences in per capita spending levels between local governments. This has motivated the investigation of the variation between local governments. The analyses presented here document relatively large differences in resource utilization among the municipalities. The next step of the analysis addresses the question of why the municipalities differ in their economic performance. The common approach in the thesis is the understanding that the local decision-making process is pluralistic and fragmented involving different actors with, at least partly, conflicting interests regarding efficiency and service levels. Hence variation in performance is investigated in relation to characteristics of the political structure of the local governments.

The analytical approach to measuring efficiency is based on the methodology developed for productivity analyses of industries where 'best practice' serves as a reference point. Due to problems of identifying and measuring the administrative output a modification of the production frontier approach is developed for the analysis of resource utilization in local government administration. The concept of a minimum requirement administrative spending frontier is defined, serving as a benchmark for the estimation of administrative overspending. The analysis of efficiency within long-term care is based on the traditional efficiency analysis approach, using the number of client served as an approximation to the long-term care output. Data envelopment Analysis (DEA) is used to establish the ‘best practice’ reference frontier in the analyses in chapters 2, 3 and 5. DEA is a

deterministic, non-parametric method designed to measure relative efficiency of peer group organizations. The advantages of DEA is that it handles multiple inputs and outputs and allows comparison of local government performance without having to specify organizational goals. The disadvantage is that it makes no allowance for statistical noise, implying that all deviation from the frontier is attributed as measured inefficiency. Thus the method is sensitive to error of measurement and outlier observations. However DEA avoid making strong assumptions on functional form and distribution of inefficient units. In chapter 5 different output vectors are specified to check for the sensitivity of results to the chosen output vector. It is important to bear in mind that the indices generated by DEA reflects errors of measurement of the input-output combinations and hence may incorporate factors other than efficiency. The efficiency indices resulting from the frontier analyses serves, in Chapter 3 and 5, as the basis of analyses of the influence of the local political structure on the performance of local governments.

The analyses of variation in local government performance are based on models of the local decision-making process. The approach is inspired by the public choice literature applying the usual assumption of maximizing behavior to the public sector. The conventional approach to the analysis of local governments is the median voter model, concentrating on individual demand functions for public services (Rubinfeld 1987). The median voter approach has serious shortcomings in the case of Norway, since the local governments take decisions in a multidimensional policy space and a well-established party system controls the local council. Instead a community preference model (Wildasin 1986) serves as the benchmark model. The political decision-making is guided by the preferences of the political leadership in the community. Starting with Rattsø (1989) this has become the standard approach in analyses of local governments in Norway. The approach also takes into account the centralized system of financing of the local governments in Norway, constraining the income side of the municipal budget.

The community preference model represents a simplification of the local decision-making process. The model does not address the interaction and the conflicting interests of the participants in the local budget process. The complexity of the decision-making structure is taken into account by expanding the community preference model, incorporating the preferences of the bureaucracy. The understanding is that the budget process involves negotiations between politicians and bureaucrats. The modeling approach lends from theories of bureaucracy in the Niskanen (1971) tradition and from the wage-bargaining literature. The bargaining approach serves as the basis of Chapters 3-5. The main idea behind the empirical analyses in Chapter 3 and 5 is that characteristics of the local political and institutional structure influence the bargaining outcome. Inspired by the literature on political-institutional determinants of public spending and budget deficits, the bargaining power of the political leadership is approximated by measures of political strength. Chapter 5 also investigates whether institutional settings, notably the organization of the budget process, are important for final outcomes.

Chapter 6 departs from the previous chapters both in the unit of analysis and the outcome measure. The essay combines data on individual clients and municipal characteristics to

study whether the type and level of long-term care services offered client with identical attributes varies between local governments. The discussion focuses on the equalizing properties of the centralized system of financing of the local government sector in Norway. A multi-level modeling approach is applied taking into account municipality-specific effects by incorporating random variation at both the individual and municipal level. The study is well suited to illustrate the problem of spurious regression relationship in analysis of data having a natural hierarchical structure, also known as Moulton bias (Moulton 1986), when applying standard OLS or similar regression techniques. Thus the results when applying standard regression techniques are also presented, illustrating the severe biases in standard errors for the variables measured at the municipal level when ignoring the interdependence of clients residing within the same community.

The analysis of variation in resource utilization presented in this thesis does not control for the quality aspect of local government service production. This may represent a potential problem of confusing high quality for low efficiency. In order to control for quality one has to define and measure quality. Both tasks represent major challenges and have been beyond the scope of this thesis.

The next section gives a brief summarization of the essays. The theoretical and methodological approaches, the institutional and political structure of the Norwegian local governments, and finally the data used are outlined in greater detail in the chapters. Section 3 provides some caveats and limitations of the analyses, and points to some issues that are left to be dealt with in future research.

2. Summary of the essays

Chapter 2: Spending and overspending in local government administration: A minimum requirement approach applied to Norway

This chapter provides a cross-sectional analysis of spending variation in local government administration. The definition of administration applied includes 'central administration' and the sectoral administration of the five main services (education, health care/long-term care, social services, culture and infrastructure), representing about 16 percent of total current spending of local governments. Very small, large and extremely rich municipalities are excluded from the analysis. Due to constraints on political and administrative organization the size of the administrative component are very high in the smallest municipalities. The scope and organization of activities and hence the definition of central and sectoral administration of the largest cities is expected to differ from the smaller municipalities. The very rich municipalities are local producers of electric power and are outliers on any dimension of the local government service production.

The paper develops a method of defining and estimating administrative overspending. The point of departure is the community preference model focusing on the final demand

for services. While the central administration, responsible for the overall coordination of the local authority, is assumed to compete with the welfare services for resources, the demand for sectoral administration is derived from the demand for sectoral services. The demand model of administration identifies local factors influencing the per capita administrative spending; the total per capita budget, population size and other socio-demographic factors affecting the composition of services.

The effect of population size is important in relation to the discussion of optimal size of the municipalities and local government consolidations. Estimation of the demand function for administration reveals a scale effect with regard to population size. However the scale effect is found to be declining with size and diseconomies of scale cannot be ruled out for the large municipalities.

The demand model helps define a benchmark for the estimation of administrative overspending. The minimum requirement administration frontier represents the authorities with the lowest per capita resource use in administration correcting for local demand factors. Thus administrative overspending is calculated by comparing the administrative spending of each authority with the spending level of a hypothetical best practice reference authority with similar local characteristics as the municipality under investigation. Administrative overspending can be related both to technical inefficiency in the production of administrative activities and ineffectiveness with regard to the size of the administrative component in relation to service levels.

The result of the best practice frontier analysis implies an estimate of the administrative overspending of 17 percent, using the DEA method to identify the minimum requirement administration frontier. The estimated overspending is higher, 28 percent, using a deterministic parametric method to establish the best practice frontier.

Chapter 3: Political control of administrative spending: The case of local governments in Norway

Chapter 3 takes the analysis of administrative spending a step further and tries to explain some of the variation in the size of local government administration. Here only central administration is examined. To have comparable institutions, we concentrate the analysis to the municipalities with a population size between 5,000-50,000 inhabitants, covering 40 percent of the municipalities. Again a model of the political demand of local services serves as a starting point. The paper expands the model by incorporating the role and interests of the administrators. Given the role of the administration in the local budget process, administrators are expected to be able to influence outcomes. In accordance with theories of bureaucracy initiated by Niskanen (1971), the administration is assumed to prefer higher administrative spending than the political leadership. The budget process is seen as involving negotiations between the administration and the political leadership over the size of administrative spending. The modeling of the bargaining process is kept simple focusing on the concept of relative bargaining strength of the political leadership. The level of administrative spending resulting from the budget process varies inversely

with the bargaining power of the local politicians. The key hypothesis of the study is that a strong political leadership is more capable of resisting bureaucratic pressure.

Two measures of political strength are investigated. The first relates to the basis of the political leadership in the local council, and classifies the political leadership according to two dimensions, minority/majority and coalition/non-coalition. One-party majority represents a strong political leadership, while a minority coalition is seen as a weak political leadership. The second measure of political strength included captures party fragmentation of the local council. Party fragmentation is assumed to increase the complexity of the bargaining situation which the bureaucracy can take advantage of. The analysis also controls for the ideological orientation of the local council. Socialists are assumed to prefer higher administrative spending than non-socialists do.

Two methodological approaches are applied in estimating political determinants of administrative spending. The first estimates the demand function of administrative spending adding political structure. The second takes advantage of the minimum requirement frontier approach developed in chapter 2, and analyses the political determinants of administrative overspending using a Tobit-model.

The bargaining model implies interaction between preferences and relative bargaining strength. We are not able to identify and separate the influence of preferences from the influence of bargaining power in estimating the influence of political strength on administrative spending. The empirical analysis gives us an estimate of the total effect of the political structure variables on administrative spending.

The results confirm the importance of political structure for the size of local government administration. The type of coalition government and ideology affect administrative spending in the hypothesized way. The estimated difference in spending levels between minority coalitions and one party majorities is about the same with the two estimation methods used. However while one party majorities stand out when estimating the expanded demand model, minority coalitions deviates from the other types of political leadership when estimating administrative overspending. Administrative spending is not found to be significantly related to party fragmentation.

Chapter 4: Bargaining over output and effort - a dynamic model of sponsor-bureau interaction

This chapter develops further the bargaining approach to the analysis of the local decision-making process, focusing on the consequences of strong bureaucratic influence and weak political leadership for public sector efficiency and service levels. The interests of the bureaucrats and the modeling of the bargaining game are more elaborated here than in the previous chapter, e.g. introducing efficiency as a parameter in the bureaucratic decision problem and recognizing that the participants in the budget process interact repeatedly. Making the model more formal also implies making stronger assumptions on the basis of bureaucratic influence.

The model is kept quite general, relevant for different public sector services. The paper models the interaction of a sponsor and a public bureau in determining the bureau's budget, level of output and efficiency. Efficiency is related to the level of effort the bureau put into the production of services. Effort plays the same role as slack in the conventional models of bureaucracy assuming that the bureaucrats have preferences for output and slack. The model assumes authority-based bureaucratic influence on outcomes, reflecting the role and responsibilities of the bureaucracy in the decision-making process. The sponsor-bureau interaction is modeled as a bargaining game, introducing bargaining strength as well as preferences as a key variable in the analysis of bureaucratic influence. The model also extends the Niskanen-type bureaucracy models by taking into account that the sponsor and the bureau interact repeatedly. The modeling strategy is inspired by Espinasa and Rhee's (1989) and Strand's (1989) modeling of wage bargaining as a repeated game.

The bargaining context, defined by the organization of the budget process, takes form of a sequential game where the bureau decides the level of effort and the sponsor decides the bureau's budget. Recognizing that the budget process is a reoccurring event opens for other and superior outcomes than the outcome of the one-shot budget game. An implicit bargaining process resulting in the generalized Nash bargaining solution is assumed to describe the bureau-sponsor interaction in the repeated game setting. The players' emphasis on future outcomes is important. Impatience narrows the bargaining space and may constrain the Nash bargaining solution, in which case the Pareto-efficient solution is not attainable. The paper focuses on the effect of a change in the relative bargaining strength of the bureau vis-à-vis the sponsor. In the unconstrained case increased bargaining power of the sponsor increases effort. The effect on production is ambiguous.

The structure of the budget process is important for the outcome of the bargaining game. Two different settings are investigated, a bottom-up type process where the bureau set effort before the sponsor decide the budget and a top-down type process where the sequence of moves are inverted. In the case of a constrained solution of the bargaining game increased bargaining power of the sponsor increases effort and production in the bottom-up case, whereas production is lowered in the top-down case. The effect on effort is indecisive in the top-down case. An increase in effort is more likely the less emphasis the bureau put on future outcomes.

Chapter 5: Political determinants of efficiency variations in municipal service production: An analysis of long-term care in Norway

In this chapter the bargaining approach elaborated in chapter 4 is applied in an analysis of efficiency variation in the municipalities' provision of long-term care. As a simplification, only unconstrained solutions are considered. Thus a negative relationship between the bargaining strength of the bureaucracy and efficiency is expected. As in chapter 3 the main idea is to link the relative bargaining strength of the political leadership vis-à-vis the service department to characteristics of local politics. Political

fragmentation is associated with collective action problems, assumed to weaken the bargaining position of the local political leadership. The impact of institutional arrangements is also analyzed, first and foremost the organization of the annual budget process. A top-down budget process is expected to give the political leadership a better position at the outset of the budget negotiations.

Measuring output represents a challenge in efficiency analysis of public sector service provision. The output of long-term care is associated with concepts such as improved quality of life, or improved capability of managing everyday living, conditions that are hard to measure. This study follows previous efficiency studies of long-term care services relating output to the number of clients served. Output is measured by a vector of recipients of services, disaggregated according to age and mode of care. The concept of efficiency applied here thus relates to the volume of clients served, controlled for client composition, relative to the amount of resources used. This approach implicitly assumes that the quality of care does not vary between the municipalities or is unrelated to resource use per "standardized" client. Norwegian studies of user satisfaction with long-term care services do not find any strong systematic relationship between measures of resource use or efficiency and user satisfaction (Dræge et al. 1997, Erlandsen et al. 1997).

Data envelopment analysis is used to measure relative efficiency. Due to poor quality of the data on personnel use within long-term care operating costs is used as the input measure. Thus in our case the DEA analysis provides us with a measure of relative cost-efficiency rather than technical efficiency. Variation in cost-efficiency is analyzed by use of the Tobit method.

The results of the analysis of efficiency variation are consistent with the hypothesis that political fragmentation improves the bargaining position of the service department. Cost-efficiency in the provision of long-term care is found to be negatively related to political fragmentation. Several measures of political fragmentation are investigated. The number of parties represented in the local council produces the best fit with the data, probably reflecting the consensual properties of the organization of local politics in Norway. Ideology, measured by the party-composition of the local council, also seems to matter. Bourgeois domination in local politics is found to improve cost-efficiency.

The results reveal no direct effect of the organization of the budget process on efficiency within long-term care. However separate analyses of the three types of budget processes identified, indicates that the organization of the early stages of the budget process is important for the impact of party politics, and political and administrative organization, on outcomes. Party politics only seems to matter in a top-down type process with the executive board involved in all stages of the drafting of the budget. With a bottom-up type process, involving the service departments and a corresponding political committee in the early stages of the process, party politics seems to be played down. Finally, when the chief administrative officer controls the initial budget preparation the political influence on outcomes seems to weaken. Instead administrative organization is found to be important in this case.

Tobit estimation is chosen due to the properties of the calculated efficiency indices. The Tobit method is based on the assumption that the underlying distribution is normal. Conditional moments tests indicate that the normality assumption is violated in our case. However, results based on the Generalized Logistic Tobit model, allowing for asymmetry and thicker tails than the normal distribution, show that the estimated effects are quite robust to the altering of the assumption of the underlying distribution.

Chapter 6: Horizontal equity versus local discretion in decentralized public provision systems: An empirical analysis of client care levels within long-term care of elderly in Norway

In Norway there is an ongoing debate on the organization of the responsibilities of the welfare state and the scope of central government regulation of the local government sector. One aspect of the debate is the concern over the stated national goal of equal access to welfare services across the country. This chapter addresses the question of variation in service levels between the local governments, investigating whether the centralized system of financing of the local government sector succeeds in equalizing local economic opportunities.

The study utilizes a unique dataset on local government provision of services to elderly long-term care clients. Two aspects of care is analyzed, the probability of receiving nursing home care and the number of hours of care provided to home care clients. The analyses include two different sets of explanatory variables. A set of client attributes is included to capture individual variation in needs. While a set of variables characterizing the local authority, assumed to affect local priorities, is included to capture variation in local service levels. The dataset is available for 40 of the 435 Norwegian municipalities, covering about 20,000 elderly long-term clients. Since small municipalities are underrepresented in the sample, the analysis is conducted both on the full sample and on a sample excluding the municipalities with less than 3,000 inhabitants.

The community preference model serves as the theoretical framework for the analysis, incorporating the distribution of services among clients as arguments in the preference function. A multilevel modeling approach is applied in the empirical analyses taking into account group specific random effects. The results show that client characteristics are the predominant determinants of individual consumption of publicly provided long-term care. However, we do find that variations in client care levels also are related to characteristics of the local governments. The centralized system of finance does not seem to secure equalization of economic opportunities to provide uniform service levels, the care provided is found to vary systematically with the level of municipal income. The estimated average effect of a 10,000 NOK increase in per capita municipal income (equals 1,3 standard deviations) is to increases the probability of nursing home care by 4 percentage points and the weekly hours of home care per client by 13 percent. The result only applies when including the small municipalities in the sample. There is less variation in municipal income among the larger municipalities. High-income municipalities are typically also small.

Client care levels also varies with sosio-demographic and political characteristics of the local government. The influence of local politics demonstrates the exercise of local discretion in setting standards for care. Variation in service levels related to variation in local priorities challenges the national goal of horizontal equity. This represents a dilemma for the national authorities since more central government control and direct regulation of service standards challenge the foundation of local self-governance.

3. Discussion

The community preference model expanded to incorporate the interest and influence of the local bureaucracy serves as the theoretical point of departure for the analyses presented in this thesis. The thesis does not explore alternative models to the study of variation in local government performance. The results from the empirical analyses may also correspond with hypothesis derived from alternative models. Exploring other approaches, and finding ways of discriminating between alternative models, will deepen our understanding of the nature of the challenges facing the local governments.

The thesis documents the importance of local politics in explaining variation in local government performance. The main idea has been to link poor performance to weak political leadership. The concept of weak political leadership is operationalized by different measures reflecting the composition of the local council. Undeniably there is a big leap from the theoretical model, introducing the concept of the relative bargaining strength of the politician, to the empirical implementation. Even though the leap is thoroughly discussed and motivated in the thesis, the theoretical foundation for the understanding of the functioning of the political system needs further development.

The Norwegian local governments are multi-purpose authorities. The empirical analyses in this thesis are single service analysis and do not address possible interdependencies between the service departments in the local decision process. A multi-service model involving two or more services opens for complex strategic interactions among the service departments, as well as between the service departments and the political leadership. Whether such an analysis would radically alter the conclusions in this thesis remains to be examined.

Exploring the relationship between quality and resource use should be given high priority in future analyses of local government performance. A proper large-scale investigation must await better data. Hopefully the increased public attention in recent years on the quality aspect of public sector service provision will stimulate research on the construction of valid and reliable quality measures for local government services.

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Chapter 2

Spending and overspending in local government administration: A minimum requirement approach applied to Norway.

ELSEVIER

European Journal of Political Economy
Vol. 11 (1995) 239–251

European Journal of
POLITICAL
ECONOMY

Spending and overspending in local government administration: A minimum requirement approach applied to Norway

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Accepted for publication November 1993

Abstract

A demand function for administration is estimated for Norwegian local authorities, emphasizing the per capita total budget, the population size and sociodemographic variables affecting the composition of local services. The demand function forms the basis of an analysis of the variation in the administrative resource use among the authorities. The methodological approach is inspired by productivity studies of manufacturing industries defining a 'best practice' frontier determined by the authorities with the lowest administrative spending per capita given the local characteristics. The minimum required administration serves as a benchmark for the estimation of administrative overspending of approximately 20%.

Keywords: Public administration; Local government; Efficiency

JEL classification: H72

1. Introduction

The size and the growth of the public administration is a concern in many countries. Empirical analyses of the efficiency of resource use in administration are hard to find. The present study investigates the use of resources in Norwegian

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SSDI 0176-2680(94)00063-8

local government administration. The local authorities organize the same kind of welfare services across the country, and the administrative activities are expected to be similar. The analysis of comparable institutions allows us to identify the main determinants of the size of the administration and to study differences in resource use among similar units.

The approach assumes that administration is an input into the production of welfare services in local governments. The starting point is a decision model relating the demand for administration to the final demand for the services. The formulation leads to the concept of administrative intensity (see Pondy 1969), the share of total costs devoted to administration. Two determinants of administration size are focused, the volume and the composition of local public service production and the administrative intensities of the services.

In the literature, administrative intensity is often related to organizational size. In our context, population size is a potentially important factor in explaining local government administration. The standard assumption discussed by Mintzberg (1983) says that large units are more efficient than small – administrative intensity is decreasing with increasing organizational size. Three counter arguments are relevant for local authorities. Blau (1974) argues that complexity and coordination increase with size, inducing bureaucratic rigidity and cost. Oates (1988) introduces the 'zoo effect', here implying that new administrative functions are added in larger authorities. Ott (1980) relates the voter control of local administration and service production to population size, with small municipalities having a possible advantage. A priori, the role of population size is an open question.

Our approach is inspired by standard productivity analysis of private industries where the 'best practice' serves as a reference point. We define the alternative concept of a minimum required administration frontier as a benchmark for comparison of local authorities. The frontier is determined by the authorities with the lowest per capita administrative spending given their local characteristics on the basis of the demand model. The minimum requirement is not necessarily the optimal administration, but it serves as a reference point.

Two methods of establishing the minimum requirement frontier are applied. The first is parametric, based on standard estimation of a Cobb-Douglas expenditure demand model. The other is non-parametric, Data Envelopment Analysis, a programming method.

2. Administrative spending in Norwegian local governments

Local government expenditures on administration amount to about 10 bill. NOK in 1988, or 2.500 NOK per capita (about USD 400), as measured in this study. Administrative costs represent about 16% of total current spending of local governments. By international standards this seems to be on the high side. A

Table 1
Demand function for administration, logarithmic formulation. Estimated coefficients, t-values in parentheses

Constant	ln$Y$	ln$P$	ln$C$	ln$S$	ln$G$
−0.5118	1.0998	−0.1227	−0.3465	0.0125	0.4890
(−0.87)	(21.72)	(−11.37)	(−5.59)	(1.11)	(4.16)
R^2_{adj}	0.8309				
N	407				

recent study by Lane (1987) suggests an administrative share of current spending of about 10% in Swedish local authorities.

The present study defines the administrative activities in terms of the accounts of local governments. According to the accounts, 'central administration' and sectoral administrations of the five main services (education, health care/care for the elderly, social services, culture and infrastructure) can be separated out. The definition does not capture all activities that can be characterized as administration, since some administration is made at the level of each institution (school, home for elderly etc.). On the other hand, some of the activities included may be considered as service production. Despite these shortcomings, the chosen measurement of administration seems to represent an acceptable basis of comparison and is the definition used in government publications.

The per capita administrative spending shows strong variation between the local authorities. In the municipalities studied, the expenditures vary from 1.500 NOK per capita to above 6.000 NOK, and the share of current expenditures devoted to administration varies from about 10% to above 25%. [1] According to the documentation in Table 2 (average per capita spending), population size is clearly involved, and a U-curve is indicated.

3. A demand model of local government administration

The determination of the resource use in administration must be understood in the context of a model of the local decision making process. Since the administrative functions relate to different local services, the final demand of the services must be the starting point. The benchmark model of individual demand functions

[1] 407 of the 448 municipalities are included in the analysis. 34 authorities are excluded because they are small (less than 1.000 inhabitants), big (the few cities with more than 50.000 inhabitants) or extremely rich (total per capita current expenditures excluding health institutions of more than 20.000 NOK). The very rich are local producers of electric power and are outliers on any dimension of the local government service production. Seven authorities are excluded because of lack of data.

for public services is laid out by Inman (1979) and Rubinfeld (1987). By analogy the local government can be treated like a single households maximizing the welfare given a budget constraint. This community preference model is applied here. It does not explicitly address how the political process reaches an outcome that can be described as a result of constrained maximization. As discussed by Wildasin (1986, ch. 3), the approach has been applied successfully in understanding important aspects of local government behaviour.

The model must take into account the Norwegian institutional context, first and for all the fact that the size of the local budget is given exogenously. The national government imposes a budget on each authority by determining the income tax revenue sharing and the general grants. Fees and property taxes amount to less than 10% of the revenues and are regulated by law. It follows that the choice between private consumption and local public services is decided at the national level, and the local public choice process only allocates the given budget between different services. The preference function consequently covers only the local public services. A model along these lines has been developed and implemented by Rattsø (1989).

The reduced form expenditure demand functions (for one authority) can be written on this general form:

$$E_i = f_i(Y, Z) \tag{1}$$

The per capita expenditures demanded for service i, E_i, are determined by the total per capita budget Y and a vector Z of sociodemographic variables. The model puts the attention to two determinants of the local services. First, the per capita total budget varies between local authorities. Poor municipalities are expected to concentrate the service production to necessities, while rich municipalities can afford more of luxuries. Second, the municipalities differ with respect to population size, age composition, settlement pattern etc. that may affect local priorities and cost conditions. No price effects are taken into account.

The next step in the model building relates the resource use in administration to the local services. The administrative expenditures are partly related to the overall coordination of the local authority, central administration, and partly to the sectoral service production. The model assumes that central administration is competing with the services for resources. The demand for sectoral administration is derived from the demand for sectoral services, given the administrative intensities.

The administrative intensity of service i, k_i, is defined as the share of the current expenditures devoted to administration:

$$A_i/E_i = k_i \tag{2}$$

A_i is the per capita administrative spending in the sectoral service i. In central administration, all expenditures are administrative (if central administration is sector 1, $k_1 = 1$). The administrative intensity in the service sectors, k_i, may vary

between authorities. Increasing return to scale may allow for reduced administrative intensity with a higher sectoral output. This scale effect is captured by the same variables (population size and other sociodemographic factors) that influence the demand of the services.

The reduced form demand for administrative spending per capita, A, the sum over the n sectors, can be written

$$A = \sum_{i=1}^{n} A_i = \sum_{i=1}^{n} k_i f_i(Y, Z) = f(Y, Z) = \alpha Y^{\beta} Z^{\gamma}. \tag{3}$$

The demand model of administrative resource use identifies local factors influencing the size of the administration and helps define a benchmark for the estimation of overspending.

4. The minimum requirement frontier of administrative spending

The methodology chosen to investigate the variation in the administrative spending is related to standard productivity measurement of industries, where 'best practice' serves as a reference point. Farrell (1957) introduced the method by which the technical efficiency of a micro unit could be measured against an efficiency frontier. A survey of efficiency measurement approaches is provided by Førsund et al. (1980).

Two types of administrative inefficiency can be defined. The first is the technical inefficiency, the authorities are not able to produce the maximum attainable administrative output given the resources used in administration. Clearly this factor may contribute to high administrative spending to run the service production. The other type is ineffectiveness, administration is given too high or too low a priority in the resource allocation compared to the service production. The two types are interlinked. Technical inefficiency may lead to ineffectiveness, since more resources are needed to administer the services properly. Ineffectiveness may stimulate technical inefficiency. More resources put into administration may open up for slack.

Since we are not able to identify and measure the administrative output, we cannot separate the two types of inefficiency. To get around the problem and to describe the variation in administrative spending, a minimum requirement frontier is defined as an alternative to the 'best practice'. The authorities with the lowest per capita spending on administration defines a minimum requirement dependent on local characteristics that others can compare to.

The method is explained by Fig. 1 presenting the relationship between a local characteristic and per capita administrative spending. Five local authorities are shown, A, B, C, D and E. The first four of them are placed on the minimum requirement frontier. They have the lowest per capita administrative spending

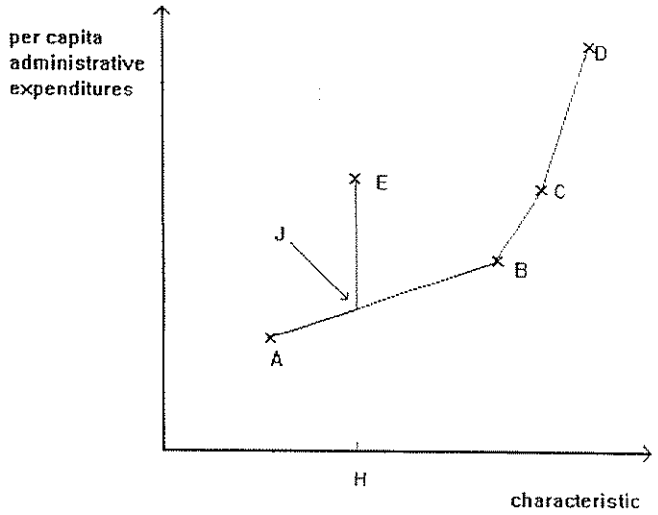

Fig. 1. References frontier and efficiency measurement. Administrative expenditures per capita relative to a local characteristics.

given their local characteristics. Authority E has a larger administration than predicted necessary by the local characteristics. Point J serves as a reference for authority E, the per capita administrative expenditures of the reference frontier given the same local characteristics. The minimum requirement ratio is HJ/HE, the share of the per capita administrative spending in authority E predicted by the local characteristics. The distance JE consequently describes the overspending. A reference unit, such as point J in Fig. 1, is established for every authority.

The strength of the method is that the overspending compared to the minimum requirement can be identified for each authority. The method offers information about excessive spending that the bureaucrats and the politicians of a particular authority can be confronted with. The minimum required administration is not necessarily the best. Needless to say, more administration may improve the political decision making and contribute to cost savings and better quality of services. We cannot say whether the extra resources put into administration represent bureaucratic waste or the priority of the political leadership to achieve cheaper and better services. The minimum requirement and the overspending defined are not without interest, however. Some authorities can make do with the minimum required administration. Even the authorities with the lowest administrative spending have administrative costs above 10% of current expenditures.

5. Estimating the minimum requirement frontier – the parametric method

The first method applied to investigate the variation in the administrative spending makes use of the parametric version of the demand model outlined. The stochastic demand function is estimated by standard OLS. A deterministic refer-

ence frontier is established by adjusting the constant term of the estimated equation so that all authorities have zero or positive residuals. The location of the reference frontier is set by the authority with the lowest per capita administrative spending given the local characteristics (zero residual). Compared to Fig. 1, now in general only one authority is located at the frontier. The method assumes that the functional form of the reference frontier is the same as the average function. The parameters of the reference frontier, e.g. the expenditure elasticity, are the same as for the average function. The procedure is discussed by Førsund et al. (1980).

The demand equation is specified in logarithmic form. Log-linear functional form simplifies the procedure to determine the reference frontier. The coefficients estimated are constant elasticities. The per capita administrative spending (A) is analyzed in relation to the total per capita budget (Y), the population size (P), the age composition of the population (C), the settlement pattern (S) and the population growth rate (G). The sociodemographic variables included represent the main factors expected to influence local public service demand as documented in previous Norwegian studies. The age composition variable C is the share of children attending primary school (age 7 to 15 years) in the population. The settlement pattern S is measured as the average travelling distance (in minutes) to the administration center of the local authority. The data set for 1988 is based on the local government accounts and a databank of sociodemographic characteristics.

The deterministic reference frontier function is specified as (4) (j is observation $j = 1, \ldots, 407$):

$$\ln A_j = h + a_1 \ln Y_j + a_2 \ln P_j + a_3 \ln C_j + a_4 \ln S_j + a_5 \ln G_j + u_j. \tag{4}$$

The residual u_j is a one-sided error term representing overspending. The residual represents the per capita administrative spending in excess of the minimum required as defined by the demand variables. Eq. (4) is equivalent to the following equation to be estimated:

$$\ln A_j = H + a_1 \ln Y_j + a_2 \ln P_j + a_3 \ln C_j + a_4 \ln S_j + a_5 \ln G_j + v_j, \tag{5}$$

where

(i) $H = h + \mu$,

(ii) $v_j = u_j - \mu$.

The residuals u_j are assumed to be independently and identically distributed with mean μ and finite variance, and uncorrelated with the explanatory variables. The error term of Eq. (5) has zero mean, and the ordinary least squares method produces unbiased and consistent estimators for $(h + \mu)$ and the a's, as shown by Richmond (1974) and Schmidt (1985). A consistent estimate of the intercept h of the frontier function is found by correcting the intercept H such that no residual is negative and one is zero, following Green (1980):

$$h = H - |v_{\min}|.$$

Table 2
Minimum requirement ratio, actual spending and overspending[a]

Inhabitants	N	Average min. req. ratio	Average per capita spending	Average per capita overspend.	Total overspend. mill.
1.000– 1.999	59	0.72 (0.09)	4264 (853)	1254 (594)	110
2.000– 2.999	68	0.75 (0.10)	3262 (637)	862 (466)	150
3.000– 4.999	95	0.74 (0.09)	2736 (536)	740 (332)	270
5.000– 6.999	51	0.75 (0.07)	2374 (410)	608 (233)	190
7.000– 9.999	47	0.77 (0.08)	2113 (360)	507 (234)	200
10.000–19.999	64	0.75 (0.10)	2002 (346)	517 (286)	480
20.000–49.999	23	0.67 (0.08)	2184 (391)	734 (281)	490
All	407	0.74 (0.09)	2782 (925)	756 (446)	1900

[a] Parametric reference frontier. Groups of authorities by population size, amounts in NOK. Unweighted averages, standard deviation in parentheses.

$v_{\min}$ is the largest negative residual of the average function estimated, and represents the authority with the lowest per capita administrative spending given the local characteristics.

The expenditure demand model (5) is well established in Norwegian studies of local government resource allocation, as documented by Rattsø (1989) and Borge and Rattsø (1993). The estimates shown in Table 1 are consistent with previous studies and capture a large part of the variation in per capita administrative spending. First and for all the total per capita budget (Y) is important. The expenditure elasticity is 1.10, implying that the administration takes an increasing share of the budget under growth. The elasticity is significantly larger than 1 at the 2,5% level.

The robustness of the demand model is checked by estimation of alternative specifications including other sociodemographic variables describing the age structure and the settlement pattern and by using different combinations of variables. The model also has been estimated for 5 different years. The chosen model is based on the most recent data and has the best fit. Our main findings hold true across the alternative specifications and the different years. Most important, the rank correlation of overspending of the authorities (discussed below) is between 0,96 and 0,99 in the 7 alternatives investigated. The point estimate of the expenditure elasticity is always higher than 1, but not always significantly higher than 1 at the 5% level. Thus, the support for Wagner's Law is weak. Needless to say, the complexities of expanding state activity addressed by Wagner (1883) are not well taken care of in this cross-section study.

The role of population size (P) for administrative spending has been investigated by alternative functional forms to detect a U-curve or a continuous scale effect. The constant elasticity formulation of Table 1 implies that the per capita administrative spending falls with respect to population size. The cost sharing of administration as a collective good seems to dominate. Since the elasticity is

constant, the scale effect is declining with size. It is hard to choose between different specifications of the population size effect, and the alternatives have some influence on the estimated expenditure elasticity because of multicollinearity. The ranking of overspending is robust with respect to different functional forms. It cannot be ruled out that the zoo effect and administrative complexity drive up administrative costs per head for the largest authorities.

The other sociodemographic factors are included to represent demand factors affecting the composition of services. The population growth (G) tends to increase the per capita administrative expenditures, presumably by giving priority to the infrastructure sector that has high administrative intensity (planning etc.). The age composition of the population is a decisive factor in determining the development of local public services. A bias towards many in the school age (C) necessitates a concentration of resources to primary school with low administrative intensity. A high spending share of education may itself represent a scale effect reducing the administrative intensity of the school sector. A decentralized settlement pattern (S) seems not to be an important factor.

The econometric estimates of Table 1 allow the determination of the minimum requirement ratio as explained in Fig. 1, the share of the actual administrative spending in each authority predicted by the minimum requirement frontier. The average minimum requirement ratio of the authorities is 0.74, implying that on average 26% of the expenditures in local government administration are in excess of the predicted minimum, as shown in Table 2.

The sum of the overspending compared to the minimum requirement is 1.9 bill 1988-NOK (about 300 mill 1988-USD) or 650 NOK per capita (about 100 USD). This sum indicates the potential saving if all local governments ran the administration at the minimum required level given their local characteristics, about 28% of the administrative spending in the 407 municipalities. As reported above, the result is robust with respect to both alternative model specifications and different years of estimation.

The method chosen is sensitive to extreme observations. Sensitivity analysis is made by deleting the authorities with the smallest per capita administrative expenditures given their local conditions, since they may represent measurement error. When the 20 authorities with the lowest per capita administrative costs (5% of the observations) are deleted, the expenditures in excess of the minimum required amounts to 1.5 bill NOK or 22% of the administrative expenditures in the remaining 387 authorities. Even when the authorities with the lowest administrative spending are left out, the overspending is significant.

6. Estimating the minimum requirement frontier – the non-parametric method

The robustness of our results are checked by an alternative approach to efficiency estimation – Data Envelopment Analysis. The method determines the

reference frontier by a piecewise linear envelopment of the data without assuming any specific functional form. It is well suited for this type of analysis where a priori knowledge of the relationships is scarce. The DEA method is a generalization of Farrell's efficiency measurement, and was developed by Charnes et al. (1978). Compared to the parametric method, the frontier will be closer to the actual observations.

The starting point is a general relationship between the demand variables and the per capita administrative spending as formulated above. A piecewise linear reference frontier representing the authorities with the lowest administrative spending given their local characteristics is established. In Fig. 1, four authorities (A, B, C and D) define the minimum requirement frontier. The frontier represents reference units that the other authorities can be compared with. Each reference authority (such as J in Fig. 1) is a linear combination of the characteristics of other authorities.

The weight of each authority is determined by a minimization problem: the relationship HJ/HE is minimized for each authority such as E given three main conditions. First, the measure of HJ/HE multiplied by observed per capita administrative spending, that is the administration of the reference unit (point J), must be greater than or equal to a weighted average of the per capita administrative expenditures in the other authorities.

Second, each local characteristic observed must be smaller than or equal to a weighted sum of the same characteristic in other authorities. (The variables are defined so that they all have a positive impact on administrative spending.) This condition implies that the reference unit (point J) must have at least as low spending as the authority observed, i.e. the reference unit does not have a higher per capita expenditure with the same local characteristics than the observed authority (E). Only authorities with the minimum required administration will influence the position of the reference unit (point J), and the set of authorities determining the reference unit will vary dependent on what authority is observed (A and B for E in Fig. 1).

Third, the sum of the weights is 1 by assumption. The intuition of this condition relates to the comparison between authorities. The authorities defining the reference unit are supposed to have similar characteristics as the observed authority. The assumption implies variable return to scale. In our context it is important since local authorities of different population size may have different administrative functions. A general formulation of the method is described by Charnes et al. (1978).

The results of the DEA analysis are reported in Table 3. The average (unweighted) minimum requirement ratio is 0.84, i.e. 84% of the observed per capita administrative spending is predicted by the DEA minimum requirement frontier. The overspending adds up to about 1.2 bill 1988-NOK, as documented in Table 3, representing about 17% of total administrative expenditures in the 407 authorities.

Since the reference frontier is established by envelopment of the units studied,

Table 3
Minimum requirement ratio, actual spending and overspending[a]

Inhabitants	N	Average min. req. ratio	Average per capita spending	Average per capita overspend.	Total overspend. mill.
1.000– 1.999	59	0.91 (0.11)	4264 (853)	379 (495)	40
2.000– 2.999	68	0.82 (0.12)	3262 (637)	632 (531)	110
3.000– 4.999	95	0.81 (0.10)	2736 (536)	551 (355)	200
5.000– 6.999	51	0.81 (0.09)	2374 (410)	480 (264)	150
7.000– 9.999	47	0.85 (0.10)	2113 (360)	339 (254)	130
10.000–19.999	64	0.87 (0.11)	2002 (346)	281 (274)	260
20.000–49.999	23	0.83 (0.10)	2184 (391)	409 (283)	260
All	407	0.84 (0.11)	2782 (925)	456 (397)	1200

[a] Non-parametric reference frontier. Groups of authorities by population size, amounts in NOK. Unweighted averages, standard deviation in parentheses

extreme observations (with respect to per capita administrative expenditures and local characteristics) will be among the minimum requirement units defining the reference frontier. They do not have reference units with similar characteristics to compare with. When a minimum requirement authority is not one of the authorities defining the reference unit of any other authority, it is likely to be an extreme observation. This is the case for 15 authorities (of the 58 minimum requirement authorities identified) in this study. 11 are among the small authorities having less than 2.000 inhabitants. They are extreme observations in the sense that they have different characteristics from others, but they are not necessarily inefficient. The exclusion of the very small, the very large and the very rich municipalities has reduced this problem.

The choice between a parametric and a non-parametric model must be based on the apriori knowledge. The parametric formulation is more restrictive, while the non-parametric may underestimate the overspending of authorities with 'extreme' local characteristics. The predicted minimum requirement ratio differs first and for all for the small and the large authorities. The parametric method may underestimate the diseconomies of scale in the small and overestimate the economies of scale in the large authorities. Broadly the two methods identify the same overspenders, and the simple correlation between the minimum requirement ratios with the two methods is 0.65, while the Spearman rank correlation is 0.64. When authorities with less than 2.000 and more than 20.000 inhabitants are eliminated from the sample, the correlation is about 0.80.

7. Concluding remarks

A demand model of administrative spending is shown to capture the main determinants of local administration size. First and for all the per capita resource

use in administration is affected by the total per capita budget and the population size. But even authorities very similar with respect to the income level, the population size, the age composition of the population etc. have very different resource use in administration. Our analysis throws some light on the variation in administrative spending after taking into account sociodemographic factors influencing local public service demand.

All authorities are compared to a minimum requirement reference frontier representing the authorities with the lowest per capita resource use in administration, correcting for local demand factors. Using two different methods to identify the frontier, a parametric and a non-parametric (DEA), the overspending compared to the minimum requirement is estimated to between 17% and 28% of total administrative expenditures in the 407 local authorities.

The study may be of methodological interest since productivity measurement methods from industry are applied to local government expenditures. The standard product- or cost function is substituted by a demand function representing the relationship between local characteristics and local priorities. The determination of the reference frontier and the calculation of distances from the minimum requirement to the observed expenditures describe the variation of resource use in local administration.

The main weakness with the deterministic method is that it does not allow any statistical noise in the determination of the frontier. The method does not account for measurement errors or omitted variables that may affect the required resource use in administration. This means that all spending in excess of the frontier is regarded as overspending. The strength of the method is that the overspending of each authority can be identified and confronted with the authority in question. The approach offers input to political-economy models that can investigate the sources of the variation of the resource use in administration.

Acknowledgment

The research is funded by the Norwegian Research Council (NRF). We are grateful for comments at the Åsgårdstrand conference on local public finance and in particular to Finn Førsund, Robert Inman, Jan-Erik Lane, Jon Magnussen, Wallace Oates, Rune Sørensen and a referee.

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Chapter 3

Political control of administrative spending: The case of local governments in Norway

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Chapter 4

Bargaining over output and effort- a dynamic model of sponsor-bureau interaction.

Bargaining over output and effort – a dynamic model of sponsor - bureau interaction

Jorid Kalseth*

Abstract

The paper focuses on the interaction of a public bureau and its sponsor in determining the bureau's budget, level of output and efficiency. The bureau is assumed to control effort whilst the sponsor controls the size of the budget. The model takes into account that the sponsor and the bureau interact repeatedly. The bureau-sponsor interaction is modeled as a bargaining game. The relative bargaining strength of the sponsor influences the outcome of the game. The effect on output and efficiency of a weakening of the relative bargaining strength of the sponsor depends on the structure of the budget decision process and the time preferences of the players.

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1. Introduction

Theories of public sector behavior within the public choice tradition have in common that they apply the usual assumption of maximizing behavior to the public sector. Thus in economic models of the behavior of public sector bureaus the bureaucrats are assumed to pursue their own objectives, which, in at least some respects, conflict with the objectives of their financial sponsor, typically a political body. The first to develop a formal model of determination of bureaucratic supply was Niskanen (1968, 1971). The model features a budget-maximizing bureau supplying services in exchange for a budget. The bureau faces a budget constraint; total costs cannot exceed the maximum budget the sponsor is willing to grant for a given level of services. Niskanen's model supports the frequently stated assertion of bureaucratic oversupply.

The critique of Niskanen's model has centered on the assumption of the behavioral motivation of the bureaucrats, and on the modeling of the relation between the bureau and the sponsor. Niskanen depict the bureaucrats as budget-maximizers on the grounds that budget-maximization should be an adequate proxy for utility maximization since variables entering the bureaucrat's utility function, e.g. 'salary, perquisites of the office, public reputation, power, patronage, output of the bureau, ease of making changes, and ease of managing the bureau' (Niskanen 1971, p. 38), are positively associated with the size of the budget[1]. In Niskanen's model budget-maximization is equivalent to maximizing output within the constraint that production costs does not exceed the total budget. The output is however produced at least costs[2], implying that there is no X-inefficiency in the production of services. Migué and Bélanger (1974) criticized the budget-maximization assumption on this account. Cost-efficient production is not consistent with the pursuit of the utility enhancing activities listed by Niskanen. Budget maximization is not necessary equivalent with utility maximization. Later extensions of Niskanen's original model allow for both output and slack, i.e. the difference between total budget and minimum production costs, to enter the bureaucrats utility function (Migué and Bélanger 1974, Niskanen 1975, Miller 1977, Moene 1986).

For divergent preferences to be significant in the sponsor-bureau relationship the bureaucrats must be able to influence outcomes. The source of bureaucratic discretion and the modeling of the relation between the sponsor and the bureau have been a recurring question in the bureaucracy literature (e.g. Breton and Wintrobe 1975, Miller 1977, Miller and Moe 1983, Moene 1986, Chan and Mestelman 1988). Bendor (1988) makes a distinction between two sources of bureaucratic discretion; authority-based and information-based agenda control. In the first case bureaucratic discretion is a result of the institutional structure of the decision making process. Both bureaucrats and politicians have complete and perfect information about production costs and preferences. However the authority granted the parties in the decision making process determines the parties' relative power to influence outcomes. In the latter case bureaucratic discretion stems from asymmetric information concerning production costs and/or preferences. In Niskanen's formal model bureau discretion is a result of authority-based agenda control. The relation between the bureau and its

[1] Niskanen stated that the two last variables are negatively related to the size of the total budget, but positively related to increases in the total budget.

[2] When the solution of the budget maximization problem is cost constrained as pointed out in Miller and Moe (1983).

sponsor is characterized as a bilateral monopoly; the sponsor is dependent on the bureau to supply services and the bureau only receives financial support from the sponsor. As Miller and Moe (1983) points out this is not taken into account in the modeling of the bureau-sponsor relationship. The bureau is given monopoly power while the sponsor is passive, granting whatever budget the bureau request as long as the net benefit to the sponsor is non-negative. However, Niskanen justifies the passive role of the sponsor by arguing that the sponsor lacks the incentive or opportunity to obtain correct information about production costs, i.e. implicitly assuming that the bureaucrat has an information advantage.

Breton and Wintrobe (1975) refute the assumption of a passive sponsor. Governing politicians concerned with reelection will make (optimal) use of control devices (which is available only at some cost) to limit the distortions caused by superior information on part of the bureaucrats. Breton and Wintrobe and later theories of legislative control (e.g. Weingast and Moran 1983, Weingast 1984, McCubbins, Noll and Weingast 1989) treat the issue of bureaucratic discretion as a political control problem. Bureaucratic compliance is ensured by devising mechanisms for ex post or ex ante political control. The politicians hold the upper hand in the bureau-sponsor relation and determine policy outcomes. While Niskanen's model is criticized for assuming a passive sponsor, theories of legislative control can be accused of making just the opposite mistake, i.e. 'overstate legislative power by assuming a strategic legislature and a passive bureau' (Moe 1997, p. 466). Failing to take into account the possibility of strategic behavior on part of either party in the bureau-sponsor relation may be equally misleading. Or as Miller (1977, p. 41-42) puts it: 'Both Niskanen and Breton-Wintrobe fail to consider the more complex possibility that the final result is determined by both the governing political party and the agency head in a bargaining context. One cannot determine the budget outcome just by looking at the preferences of one player or another; the players are engaged in a game'.

This paper follows Miller (1977), Moene (1986) and Chan and Mestelman (1988) in expanding the Niskanen framework by introducing an active sponsor and model the strategic interaction between a bureau and its sponsor. Miller analyses a Cournot-type game where the sponsor decides the bureau's budget and the bureau decides the amount spent on productive purposes. The level of output is determined by the simultaneous decisions taken by the two players. Like Miller we assume that bureaucratic discretion stems from bureau autonomy concerning production decisions. Specifically, following Carlsen (1992, 1994, 1996), we assume that the bureau is in a position to control the level of effort[3]. We also find Miller's notion of bureau-sponsor bargaining appealing. However the formulation of the bargaining game differs from that of Miller. The modeling strategy is inspired by Espinosa and Rhee's (1989) and Strand's (1989) modeling of wage bargaining between a workers union and a firm as a repeated game.

The budget process is an annual happening. Thus the sponsor and the bureau interact repeatedly. Unlike most previous analysis we take into consideration the dynamic aspect of the bureau-sponsor interaction[4]. The bargaining context is a budget process taking the form of a sequential game where the bureau decides the level of effort and

[3] Which is analogous to Miller's assumption that the bureau controls the amount of slack.

[4] E.g. Carlsen and Haugen's (1994) and Carlsen's (1994) analysis of multi-period games between sponsor and bureau provides exceptions.

the sponsor decides the bureau's budget. This stage game is repeated indefinitely. The outcome, i.e. the equilibrium level of output, effort and the budget, may differ from the solution of the stage game when the repeated interaction between the two players is taken into account. Both the sponsor and the bureau may benefit from cooperation in the long run. We propose a solution to the repeated game that is consistent with the constrained generalized Nash bargaining solution, i.e. we implicitly assume a bargaining process where the relative bargaining strength of the players determines the outcome.

The rest of the paper is organized as follows. The model is described in section 2. Section 3 and 4 discusses the solution to the one-shot game, or the stage game, and the repeated game respectively. Moene (1986) and Chan and Mestelman (1988) shows in a static game setting that the outcome of the game depends on the institutional structure of the decision making process. The structure is also important in a repeated game setting. We analyze the consequences of altering the assumption on who makes the first move in the stage game in section 5. Section 6 concludes.

2. The model

We model a situation where a public bureau produces a service (x) financed by a budget appropriation (B) from its sponsoring institution. The relation between the budget and the production level is mediated by the level of effort the bureau puts into the production of services. The bureau's output in period t is given by:

$$x_t = f(L_t, e_t) \qquad f_L > 0,\ f_e > 0,\ f_{LL} < 0,\ f_{ee} < 0 \tag{1}$$

where L is employment and e is the bureau's effort, and there are diminishing return both to employment and effort. The number of workers can thus be substituted for effort in the production of services. Disregarding input of capital and other purchased inputs total spending at time t is equated with total labor costs:

$$B_t = w_t L_t \tag{2}$$

where w is the wage rate. In each period output and effort have to be determined, determining also the number of workers and the total budget (for a given wage level[5]). Both the sponsor and the bureau are in a position to influence outcomes, the sponsor through her control over budget appropriations and the bureau through its control over effort[6], and both behave strategically in their own best interest.

[5] The wage level is assumed to be exogenous. If we think of the sponsor representing a local government then the assumption is in accordance with a system of centralized wage bargaining, i.e. the wage level is determined in national negotiations between worker unions and employer associations, as is the case for local government employees in Norway.

[6] It is reasonable to assume that there are a lower and an upper limit on effort, i.e. $e \in [e^-, e^+]$. The sponsor may react if the effort level set by the bureau is too low, e.g. if the bureau is clearly shirking. Thus there may be a lower limit on effort, $e^- > 0$, triggering negative sanctions from the sponsor if the bureau chooses an effort level below the limit. Similarly, it is reasonable to assume that there is an upper limit on effort, e^+. In the following analysis interior solutions is considered, i.e. $e^- < e < e^+$.

The preferences of the sponsor are represented by the per period net benefit function:

$$NV_t = v(x_t) - q(B_t), \qquad v_x > 0,\ q_B > 0,\ v_{xx} < 0,\ q_{BB} > 0 \tag{3}$$

The sponsor benefits from the bureau's provision of services. However budget appropriations necessary to finance the production of services carries an opportunity cost. Equation (1) and (2) defines implicit the budget, and thus the sponsor's net benefit as function of output and effort (and the wage level, which is suppressed in (3')):

$$NV_t = nv(x_t, e_t), \qquad nv_e = q_B \frac{w_t}{f_L} f_e > 0, \quad nv_x = v_x - q_B \frac{w_t}{f_L} \lessgtr 0 \tag{3'}$$

The sponsor's net benefit is strictly increasing in effort. Higher effort allows a reduction in the budget allocated to the bureau without lowering production. The effect of higher output on the other hand is ambiguous. Higher production increases the utility of the sponsor (v_x>0). However, for a given level of effort, higher production also requires a higher number of workers, and thus an increase in the budget allocated to the bureau, which contributes to a lowering of the sponsor's net benefit ($q_b(w/f_L)$>0). Since the net benefit function is strictly quasi-concave in output and effort the effect on net benefit of increased production is positive for low production levels and negative when production is high, as illustrated in Figure 1. We return to the interpretation of the nv_x=0 curve in the discussion of the solution of the one-shot game below.

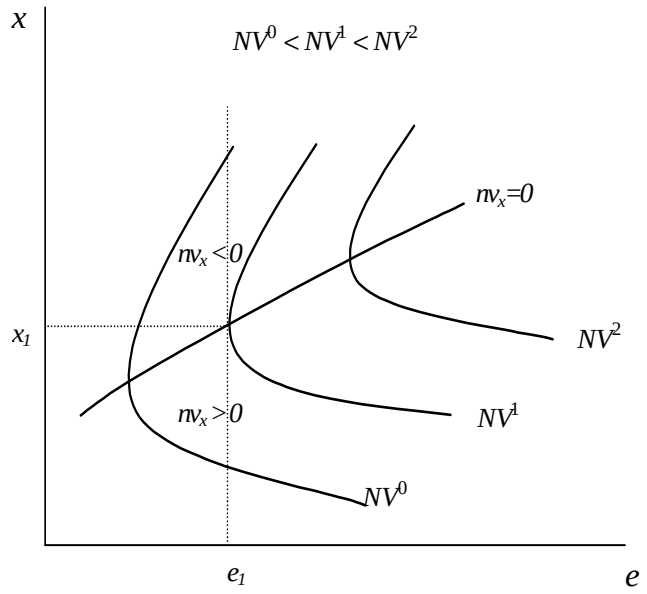

Figure 1

The preferences of the bureau are represented by the following strictly quasi-concave per period utility function:

$$U_t = u(x_t, e_t) \qquad u_x > 0, u_e < 0 \tag{4}$$

The bureau is assumed to gain utility from output and disutility from effort. There is thus a trade-off between production and effort in the welfare of the bureau in each period *t*. Effort plays here the same role as slack in Migué and Belangér (1974), Miller (1977) and Moene (1986). A lowering of effort raises production costs by lowering productivity.

Most previous analyses of determination of bureaucratic supply only consider the sponsor-bureau relation in a static context, i.e. one-shot games. We propose a dynamic model in which the strategic interaction between a bureau and its financial sponsor take form of a repeated game with an infinite horizon[7]. In infinitely repeated games equilibrium outcomes may emerge which would not be attainable if the game is played only once (Fudenberg and Tirole 1991, ch. 5). We model a solution to the repeated game consistent with an implicit bargaining process taking place. The bargaining context is as follows. At each time period *t* a budget process takes place determining the bureau's budget, the level of effort and the quantity of services produced. The stage game played in each period is a sequential game where the bureau moves first setting effort, and the sponsor decides the bureau's budget after observing the level of effort chosen by the bureau. Carlsen (1992) discusses why this may be a reasonable description of the sponsor-bureau interaction. The consequences of altering the sequence of moves are investigated in section 5. One possible equilibrium outcome of the repeated game is the equilibrium outcome if the game is played only once. This will be the outcome if the players are perfectly myopic. We start by solving the one-shot sequential game.

3. The stage game

In each period the bureau moves first announcing and committing to an effort level. This may be thought of as the bureau presenting a budget proposal committing it to a cost schedule announcing the total cost (the amount of labor input) associated with deliverance of different levels of services. The sponsor then responds by deciding the bureau's budget. The backward induction outcome, or the Stackelberg equilibrium, is the subgame-perfect Nash equilibrium of this game. Thus we start by finding the sponsor's best response in stage two of the game. The sponsor set the budget to maximize net benefits (equation (3)) taken into account the production function (1), the cost constraint (2) and the effort level set by the bureau. This amounts to finding the optimal level of output (and hence the optimal level of labor input) for a given effort level, i.e. maximize (3') with respect to *x*. The first-order condition for this maximization problem is:

[7] This does not necessarily imply that the game goes on forever. The infinite horizon case also describes situations where there is a chance that the game may terminate some time in the future. The requirement is that the players believe that the game will continue with high enough probability (Fudenberg and Tirole 1991, chapter 5).

$$nv_x = 0 \qquad (5)$$

The solution to the sponsor's decision problem can be illustrated by use of Figure 1. For a given effort level e_1 the sponsor get the highest net benefit by choosing a budget that will produce the output level x_1, i.e. the level of output balancing the marginal benefit of increased output (v_x) against the increased cost incurred ($q_B(w/f_L)$).

From (5) we derive the sponsor's best budget response function $B^*(e)$ and the output response curve, $x^*(e)$ (again suppressing w), represented by the zero marginal net benefit of output (nv_x=0) curve in Figure 1. The sign of the budget response, $\partial B^*/\partial e$, is indecisive if the cross-partial derivative of the production function f_{Le} is positive[8]. Increased effort increases output and thus lowers the marginal utility of output and hence the marginal net benefit of the budget. This effect pulls in the direction of lowering the budget. However if an increase in effort increases the marginal productivity of employment the cost to the sponsor of increasing output is reduced. This effect contributes to an increase of the marginal net benefit of the budget, and thus pulls in the direction of increasing the budget. The slope of the output response curve $\partial x^*/\partial e$ is positive if effort is a normal factor of production[9]. If $\partial B^*/\partial e<0$ this contributes to a lowering of output. However the initial increase in output caused by the increase in effort dominates when effort is a normal factor of production.

In stage one of the game the bureau chooses the effort level e to maximize (4) taken into account the best response function of the sponsor, which gives us the following first-order condition:

$$-\frac{u_e}{u_x} = \frac{\partial x^*}{\partial e} \qquad \left[= \frac{f_L}{w}\frac{\partial B^*}{\partial e} + f_e \right] \qquad (6)$$

The optimal effort level yielding the highest attainable utility for the bureau is found in the tangency between the output response curve of the sponsor and the indifference curve of the bureau, as illustrated in Figure 2, balancing the marginal costs and benefits of reducing effort.

As discussed above the cost to the bureau of reducing effort in terms of forgone output can be separated into two effects. The first, direct effect comes via the production function. The second indirect effect comes via the effect on budget appropriations. The budget effect dampens the direct production effect, i.e. lowers the cost of reducing effort, if $\partial B^*/\partial e<0$.

The equilibrium outcome of the one-shot game is thus $(e^*, x^*(e))$ yielding a net benefit of $NV^*=nv(x^*,e^*)$ for the sponsor and a utility level of $U^*=u(x^*,e^*)$ for the bureau.

[8] See equation (A.1) in the appendix.
[9] See equation (A.2) in the appendix.

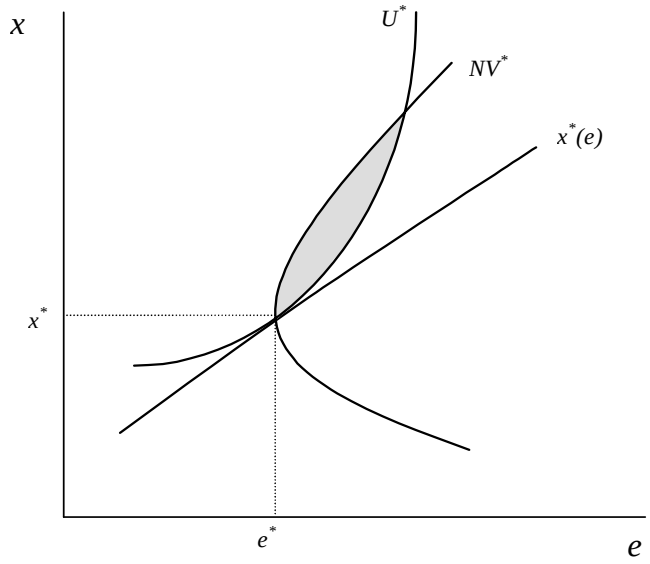

Figure 2

The solution of the one-shot game is not efficient. All the points within the shaded area in Figure 2, yielding higher effort and output levels, are preferred by both the sponsor and the bureau to the equilibrium outcome (e^*,x^*). However these are not attainable in the one-shot game. Knowing the net benefit function of the sponsor, the bureau foresees that if it sets a higher effort level than e^* the sponsor rationally will respond by picking a point along the reaction curve yielding a lower utility level for the bureau. A promise from the sponsor to pick a point within the shaded area as a response to the bureau setting $e > e^*$ is not credible in the one-shot game since this is not an optimal strategy for the sponsor once the bureau has set the effort level. A pareto improvement can not be enforced in the one-shot game without the use of binding contracts.

4. The solution of the repeated game

Taking the repeated nature of the game into account the loss of noncooperation may be substantial depending on how the players emphasize future outcomes. The increased loss of noncooperation as time passes provides incentives to implicitly cooperate to reach an outcome superior to the one-shot Nash equilibrium. The modeling of the repeated game follows Espinosa and Rhee (1989) (see also De la Rica and Espinosa 1997 and Bandyopadhyay 1997).

A cooperative solution may be attainable in an infinitely repeated game if the parties adopt a strategy in which deviations from an agreed-upon outcome are punished; i.e. defection is deterred by threats of severe punishment of noncooperation. We assume that the players use classic trigger strategies where deviations are followed by a punitive action that lasts forever, i.e. the player cooperates as long as the other player cooperate and defection triggers a switch to noncooperation forever. Here the punishment scheme is assumed to be a reversion to the one-shot Nash equilibrium

forever after. Then the so-called 'Nash-threats' folk theorem applies; for any payoff vector *v* yielding a higher payoff for both players than the static Nash equilibrium there is a subgame-perfect Nash equilibrium of the infinitely repeated game with payoffs *v* provided a high enough discount factor (Fudenberg and Tirole 1991, ch. 5). We consider stationary paths where the level of effort and output are constant over time, i.e. $(e_t,x_t)=(e,x)$ for all *t*. Stationary paths sustainable in a subgame-perfect equilibrium must satisfy the two following conditions:

$$u(e,x) \geq U^* \tag{7}$$

$$[1/(1-\delta)]nv(x,e) \geq nv(x^*(e),e) + [\delta/(1-\delta)]NV^* \tag{8}$$

where U^* and NV^* are the one-shot Nash equilibrium levels of utility for the bureau and sponsor respectively, $x^*(e)$ is the output level on the reaction curve of the sponsor and δ is the discount factor of the sponsor. δ may reflect both pure time preferences of the sponsor and the probability that the game will end (Fudenberg and Tirole 1991, ch. 5). Thus we can get some cooperation even if there is a chance that the game will not continue[10].

The sequential nature of the stage game implies that the sponsor can punish defection on part of the bureau immediately, which means that it does not pay for the bureau to unilaterally deviate from the cooperative outcome. A cooperative outcome that gives the bureau a higher utility than the noncooperative Nash equilibrium is thus sustainable from the bureau's point of view. This is captured in inequality (7). If, on the other hand, the sponsor defects the punishment will be effectuated only at the beginning of the next period. Thus the sponsor may profit from deviation. If the discounted value of the cooperative solution is greater than the value of an optimal one-shot deviation and then reversion to the noncooperative solution in all following periods the sponsor will have no incentive to deviate. The incentive compatible condition for the sponsor is stated in inequality (8).

To be able to single out one among the multiple sustainable equilibrium combinations of effort and output we have to make a further assumption on how the equilibrium is reached. We assume that the mechanism the sponsor and the bureau use to choose among the multiple equilibria is an implicit bargaining process resulting in the generalized Nash bargaining solution. The level of effort and the budget sequentially announced by the bureau and sponsor then solves the following maximization problem:

$$\underset{x,e}{Max} \prod(x,e,\alpha) = \left[u(x,e) - U^*\right]^{\alpha} \left[nv(x,e) - NV^*\right]^{(1-\alpha)} \tag{9}$$

subject to

$$g(x,e) = U^* - u(x,e) \leq 0 \tag{7'}$$

$$h(x,e,\delta) = \delta NV^* + (1-\delta)nv(x^*(e),e) - nv(x,e) \leq 0 \tag{8'}$$

[10] See also footnote 7.

rewriting constraint (7) and (8) as (7') and (8') respectively. We allow for asymmetric Nash bargaining solutions, where α and $(1-\alpha)$ are interpreted as the relative bargaining strength of the bureau and the sponsor respectively. Thus α represents asymmetries in the bargaining power not captured in preferences and the disagreement, or threat points (Binmore et al., 1986). The set of feasible outcomes of the repeated game is constrained to the area above the U^*-curve the and below the curve representing $h(x,e,\delta)=0$[11], as illustrated in Figure 3.

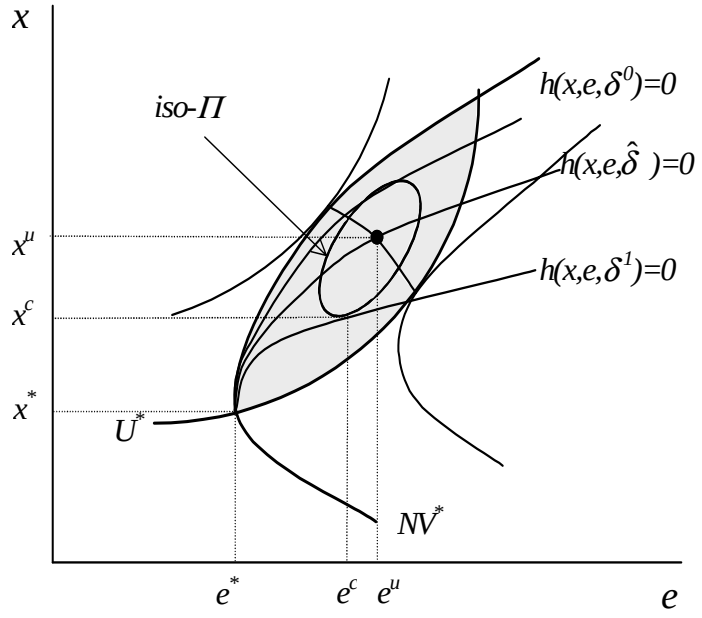

Figure 3

The one-shot Nash equilibrium is represented by the point (e^*,x^*), and it will be the solution of the repeated game if the sponsor does not discount future outcomes, i.e. $\delta=0$. For δ close enough to 1 ($\delta \geq \hat{\delta}$, e.g. δ^0 in Figure 3) the Nash bargaining solution will be unconstrained, and hence a point (e^u,x^u) on the contract curve[12]. Thus assuming a generalized Nash bargaining solution assures that the chosen equilibrium combination of output and effort is fully efficient given a high enough discount factor. Constraint (7') is never binding unless $\alpha=0$ and/or $\delta=0$. For $0<\delta<\hat{\delta}$ (e.g. δ^1 in Figure 3) constraint (8') is binding and the solution (e^c,x^c) is characterized by the tangency between the $h(x,e,\delta)=0$ curve and an iso-Π curve, and lies between the one-shot Nash equilibrium and the fully efficient solution[13].

[11] When $\delta=0$ the $h(x,e,\delta)=0$ curve collapses to a single point, the noncooperative Nash equilibrium. When δ increases the location of the $h(x,e,\delta)=0$ curve moves in the north-west direction, and it collapses with the NV^* curve when δ equals 1.

[12] $\hat{\delta}$ is thus the minimum value of δ for which constraint (8') is not binding. The contract curve represents the fully efficient solutions characterized by the tangency between the indifference curves of the bureau and the sponsor. See equations (A.3) in the appendix.

[13] See equations (A.5) in the appendix.

Changes in the discount factor will not affect the equilibrium (e,x) path as long as the discount factor is sufficiently high ($\delta \geq \hat{\delta}$) (in accordance with the assumption of independence of irrelevant alternatives (Nash 1950, 1953)). However when constraint (8') is binding a reduction of δ implies that the gain to the sponsor from cheating increases and the $h(x,e,\delta)=0$ curve moves down in the south-east direction, shrinking the set of sustainable (e,x) paths. Given reasonable assumptions on the shape of the Π- and h-function, a lower discount factor gives lower effort and output levels in the constrained solution[14].

For a given discount factor the outcome of the repeated game is determined by the relative bargaining strength of the sponsor and the bureau (α). The relative bargaining strength affects the shape of the Π-function. When the sponsor is in a position to dictate the outcome of the bargain, i.e. $\alpha=0$, constraint (7') is always binding (the bureau must at least get the utility obtained in the one-shot solution) and the Nash bargaining problem reduces to the sponsor maximizing her net benefit subject to $g(x,e)=0$, and $h(x,e,\delta)=0$ when constraint (8') is binding[15]. When the bureau is in the position to dictate the outcome of the bargain, i.e. when $\alpha=1$, constraint (8') is always binding and the Nash bargaining problem reduces to the bureau maximizing its utility subject to $h(x,e,\delta)=0$. The outcome is then found in the tangency between the $h(x,e,\delta)=0$ curve and an indifference curve of the bureau.

In the intermediate case, i.e. $0<\alpha<1$, both players have power to influence the outcome of the bargain. When δ is high enough, such that constraint (8') is not binding, the relative bargaining strength determine the location of the solution on the contract curve. The sign of the marginal effect on output and effort of an increase in the relative bargaining strength of the bureau along the contract curve is indecisive[16], depending on the shape of the indifference curves of the bureau and the sponsor. Given reasonable assumptions, increased bargaining power of the bureau reduces effort[17]. In Figure 3 we have shown the case where in addition output is increasing in α. However this can not be the result in the constrained case.

Constraint (8') will sooner or later become binding as α increases. When the Nash bargaining solution is constrained the solution has to be a point along the $h(x,e,\delta)=0$ curve. At any point along the $h(x,e,\delta)=0$ curve the sponsor is indifferent to upholding the cooperative agreement and cheating by deviating to the best response curve (by reducing the budget and thus the output level), i.e. the one period gain of cheating $\{nv(x^*(e),e)-nv(x,e)\}$ is just equal to the present value of the loss incurred by reverting to the noncooperative solution in all following periods $\{(\delta/(1-\delta))[nv(x,e)-nv(x^*e^*)]\}$. Thus if the bureau reduces effort this will lower the value of the agreement for the sponsor and thus violating (8'). This means that when the Nash bargaining solution is constrained output has to be reduced (since the net marginal benefit of output (nv_x) is negative) if the bureau wishes to reduce effort. The bureau yields a higher utility moving downwards along the $h(x,e,\delta)=0$ curve, i.e. moving towards the outcome that results when the bureau has all the bargaining power. Thus when the Nash bargaining

[14] See equation (A.6) in the appendix.
[15] In this case is constraint (8') binding when the curve representing $h(x,e,\delta)=0$ crosses the U^* curve to the left of the intersection between the contract curve and the U^* curve.
[16] See equations (A.4) in the appendix.
[17] See equations (A.4') in the appendix.

solution is constrained a strengthening of the bargaining power of the bureau reduces both effort and output[18].

To sum up, a weakening of the relative bargaining power of the sponsor contributes to a reduction in both the level of effort and output when the Nash bargaining solution is constrained. In the unconstrained case the prediction on output is indecisive.

5. The sponsor moves first

In the previous sections the bureau is assumed to move first, determining effort before the sponsor decides on the budget. Here we investigate the consequences of altering the sequence of moves. Now the sponsor is assumed to decide on the budget before the bureau set effort. Again, the static Nash equilibrium is found by backward induction. Once the budget is determined by the sponsor, the optimal response from the bureau is to set effort to equate the marginal benefit of reduced effort and the marginal cost in terms of reduced output.

$$-\frac{u_e}{u_x} = f_e \tag{10}$$

The optimal effort level is thus found in the tangency between the production function for a given budget level and an indifference curve as shown in Figure 4. The optimal effort response to changes in the budget, $\partial e^*(B)/\partial B$, can be decomposed into a pure income effect and a relative-price effect[19]. The pure income effect is the effect of increased budget holding relative prices of effort and output, here the marginal productivity of effort, constant. Provided effort is a normal good for the bureau the pure income effect contributes to a lowering of effort when the budget increases. The relative-price effect hinges on the sign of the cross-partial derivative of the production function (f_{eL}). If the cross-partial derivative is positive, the marginal cost of reducing effort in terms of foregone output increases and the relative price effect pulls in the direction of increased effort. Assuming that the pure income effect dominates when f_{eL} is positive, the effort response curve is downward sloping, $\partial e^*/\partial B<0$, as shown in Figure 4[20].

The sponsor set the budget to maximize net benefit taking into account the effort response of the bureau. The first order condition of the maximization problem is:

$$v_x\left(\frac{f_L}{w} + f_e\frac{\partial e^*}{\partial B}\right) = q_B \tag{11}$$

The optimal size of the budget for the sponsor equates the marginal benefit and marginal cost of the last dollar spent. When the bureau's effort response to increases in the budget is negative this contributes to a lowering of the marginal benefit of

[18] See equations (A.7) in the appendix.
[19] See equation (B.1) in the appendix.
[20] The sign of the slope of the effort response curve in the effort-output diagram is the same as of $\partial e^*/\partial B$. See equation (B.2) in the appendix.

increasing the budget for the sponsor. The first order condition can also be expressed as follows:

$$\frac{-q_B \frac{f_L}{w} f_e}{v_x - q_B \frac{w}{f_L}} = \frac{f_L}{w} \frac{1}{\frac{\partial e^*}{\partial B}} + f_e \quad \Leftrightarrow \quad -\frac{nv_e}{nv_x} = \left.\frac{dx}{de}\right|_{\frac{-u_e}{u_x} = f_e} \tag{11'}$$

Thus the first order condition of the maximization problem for the sponsor implies that the solution to the one-shot game is found in the tangency between an iso-net benefit curve and the effort response curve. If $\partial e^*/\partial B<0$ the tangency of the iso-net benefit curve and the effort response curve is found in the downward sloping part of the iso-net benefit curve as illustrated in Figure 4. Thus if $\partial e^*/\partial B<0$ the marginal net benefit of output (nv_x) for the sponsor must be positive if (11') is to be fulfilled.

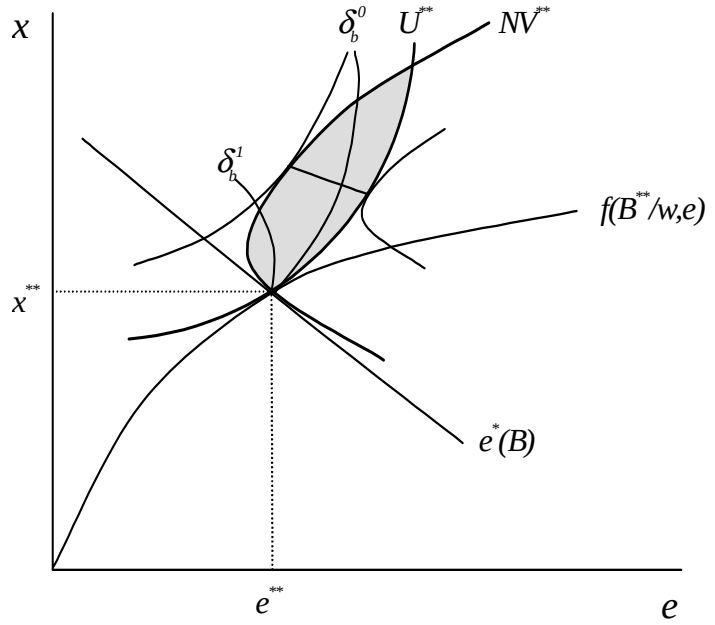

Figure 4

Again, the Nash equilibrium of the one-shot game (e^{**},x^{**}) is not efficient. Both the sponsor and the bureau would be better off if they were to agree on an effort-output combination within the shaded area in Figure 4. Such a combination may be attainable in the infinitely repeated game as discussed in section 4. When the sponsor moves first the bureau can punish defection on part of the sponsor immediately whereas the sponsor can punish defection on part of the bureau only at the beginning of the next period. Thus the incentive compatible conditions now becomes:

$$g(x,e,\delta_b) = \delta_b U^{**} + (1-\delta_b)u(x^*(B),e^*(B)) - u(x,e) \le 0 \quad (12)$$

$$h(x,e) = NV^{**} - nv(x,e) \le 0 \quad (13)$$

where U^{**} and NV^{**} are the one-shot Nash equilibrium levels of utility for the bureau and sponsor respectively, $x^*(B)$ and $e^*(B)$ is the level of output and effort on the reaction curve of the bureau and δ_b is the discount factor of the bureau. Thus the set of feasible outcomes of the repeated game now is constrained to the area below the NV^*-curve and above the curve representing $g(x,e,\delta_b)=0$[21] in Figure 4. As in section 4 the equilibrium effort-output combination of the repeated game is assumed to be consistent with the generalized Nash bargaining solution. Constraint (12) and (13) replaces (7') and (8') in the maximization problem and the disagreement points (i.e. the utility/net benefit obtained in the one-shot game) changes when the sequence of moves in the stage game alters. The outcome of the repeated game is determined by the discount factor of the bureau and the relative bargaining strength of the two players. Again we characterize the solution by looking on what happens when the relative bargaining strength changes.

When the sponsor has the upper hand in the bargain (α=0) constraint (12) will always be binding no matter the discount factor of the bureau. The Nash bargaining problem reduces to the sponsor maximizing her net benefit subject to $g(x,e,\delta_b)=0$ and the outcome is found in the tangency between the $g(x,e,\delta_b)=0$ curve and an iso-net benefit curve of the sponsor. When constraint (12) is binding changes in the relative bargaining strength imply a movement along the $g(x,e,\delta_b)=0$ curve[22]. In Figure 4 the curve is drawn for two different discount factors ($\delta_b^0 > \delta_b^1$). The $g(x,e,\delta_b)=0$ curve is more likely to be positively sloped (i.e. $g_x<0$) when δ_b is relatively high than when δ_b is relatively low. And further more for a given δ_b the $g(x,e,\delta_b)=0$ curve is more likely to be positively sloped when output is relatively low than when output is relatively high. Increased bargaining strength of the bureau will lead to an increase in the equilibrium level of output whatever the slope of the constraint. The effect on effort on the other hand depends on which of the two regimes prevails. A strengthening of the bargaining power of the bureau will give a higher equilibrium level of effort when the constraint is positively sloped. The opposite is true when the constraint is negatively sloped.

If, and when the $g(x,e,\delta_b)=0$ curve crosses the contract curve the solution of the Nash bargain becomes unconstrained as the bargaining power of the bureau increases. In this case the discussion in section 4 applies. When the bureau is in the position to dictate the outcome of the bargain, i.e. α=1, constraint (13) is always binding (the sponsor must at least get the net benefit obtained in the one-shot solution) and the Nash bargaining problem reduces to the bureau maximizing its utility subject to $h(x,e)=0$, and $g(x,e,\delta_b)=0$ when constraint (12) is binding.

Thus when the sponsor moves first a strengthening of the bargaining power of the bureau will increase the equilibrium level of output when the Nash bargaining

[21] When δ_b=0 the $g(x,e,\delta_b)=0$ curve collapses to a single point, the noncooperative Nash equilibrium. When δ_b increases the location of the $g(x,e,\delta_b)=0$ curve moves in the north-east direction, and it collapses with the U^{**} curve when δ_b equals 1.

[22] See equations (B.4) in the appendix.

solution is constrained. The prediction on effort however is indecisive. A reduction in effort is more likely the lower the discount factor of the bureau. In the unconstrained case a strengthening of the bargaining power of the bureau will lower effort while the prediction on output is indecisive.

6. Conclusion

The interaction between a bureau and a sponsor is analyzed in a model where the bureau controls effort whilst the sponsor controls the size of the budget. The annual budget process is modeled as a sequential game. The outcome of the one-period game depends on the sequence of moves. When the bureau is the Stackelberg leader and the sponsor's budget response to the bureau setting a higher effort level is negative the bureau will have an incentive to lower effort in order to induce the sponsor to grant a higher budget. When the sponsor is the Stackelberg leader she will hold back on the budget to force the bureau to increase effort when the effort response of the bureau to an increase in the budget is negative. Thus effort will be lower and the budget higher when the bureau moves first compared to the case when the sponsor moves first. The equilibrium level of output may be higher or lower. The outcome of a one period game is not efficient. Both the bureau and the sponsor would be better off with a change in the output/budget-effort combination. Thus there is room for the bureau and sponsor to bargain to reach a mutually beneficiary outcome. However an efficiency improving agreement is not enforceable in a one-period game without the use of binding contracts since the optimal strategy of the player making the last move is to defect once the other player has made her move.

The budget process is repeated every year. Recognizing that the bureau and the sponsor interact repeatedly opens for the possibility of efficiency improving cooperative outcomes. The outcome of the repeated game is assumed to be consistent with a generalized Nash bargaining solution. The bargaining space is delimited by the players' valuation of future outcomes. The less the players emphasis future outcomes the narrower the bargaining range and the lower the equilibrium effort and output level, i.e. the closer is the equilibrium outcome of the repeated game to the outcome of a one-shot game. When the sponsor moves first in the annual budget process the equilibrium level of effort may in fact be lower in the cooperative solution than in the one-shot game. The outcome of the repeated game is fully efficient if the discount factor is high enough such that the constraints stating that the players shall have no incentives to deviate are not binding.

The generalized Nash bargaining solution allows for unequal bargaining strength of the bureau and the sponsor. The effect on the equilibrium level of output and effort of changes in the relative bargaining strength depends on the structure of the budget process and whether the bargaining solution is constrained or not. Given reasonable assumptions, increased bargaining strength of the bureau will always, except for some special cases, reduce the equilibrium level of effort. Increased bargaining strength of the bureau may lead to higher effort when the sponsor is the Stackelberg leader in the budget process and an increase in output increases the bureau's payoff from the cooperative outcome compared to the payoff of defection. This may be the case if the discount factor of the bureau is high and the relative bargaining strength of the bureau is low such that the incentive compatible constraint of the bureau is binding. The

effect on the equilibrium level of output of increased relative bargaining strength of the bureau is indecisive when the Nash bargaining solution is unconstrained. When the solution is constrained the effect on output differs in the two institutional settings analyzed. Output falls as the bargaining power of the bureau increases when the bureau is the Stackelberg leader. The opposite is true when the sponsor is the Stackelberg leader. A constrained solution is more likely when the bargaining power of the bureau is high in the first case and when the bargaining strength of the bureau is low in the latter case.

Even though a fully efficient outcome is attainable in the repeated game the outcome may still be undesirable from the societies point of view. If the sponsor represents the voters any outcome that does not fully reflect the preferences of the sponsor may be deemed undesirable.

As long as the bureaucrats have some discretion they will be in a position to influence the outcomes of public sector decision making. However, the above analysis shows that relying on one-period models of bureau-sponsor interaction may give a too pessimistic view on public sector performance. Taking into account the repeated nature of the play the decision process may yield outcomes judged more favorable by the sponsor.

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Appendix

The reaction curve of the sponsor

The first order condition of the one-shot maximization problem of the sponsor defines $B^*(e,w)$ and $x^*(e,w)$. Differentiating the first order condition with respect to e and solving for $\partial B^*/\partial e$ gives us the slope of the budget reaction curve:

$$\frac{\partial B^*}{\partial e} = \frac{-[v_{xx} f_e f_L + v_x f_{Le}]}{D_1} \tag{A.1}$$

where $D_1 = v_{xx} \frac{(f_L)^2}{w} + v_x \frac{f_{LL}}{w} - q_{BB} w \quad < 0$ follows from the second order condition of the maximization problem.

$$\frac{\partial x^*}{\partial e} = \frac{f_L}{w} \frac{\partial B^*}{\partial e} + f_e = \frac{\frac{v_x}{w}[f_{LL} f_e - f_{Le} f_L] - q_{BB} w f_e}{D_1} \tag{A.2}$$

$\frac{\partial x^*}{\partial e} > 0$ if $[f_{LL} f_e - f_{Le} f_L] < 0$.

The unconstrained solution of the Nash bargaining problem

We assume that the $\Pi(x,e,w,\alpha)$ function in the Nash bargaining problem is strictly concave in *e* and *x*. Maximizing $\Lambda(x,e,w,\alpha)=\ln\Pi(x,e,w,\alpha)$ gives us the same solution as the original maximization problem. The first order condition of the unconstrained Nash bargaining solution can thus be expressed as:

$$\Lambda_e(x,e,w,\alpha) = \alpha\left[u(x,e) - U^*\right]^{-1} u_e + (1-\alpha)\left[nv(x,e,w) - NV^*\right]^{-1} nv_e = 0 \qquad \text{(A.3.1)}$$

$$\Lambda_x(x,e,w,\alpha) = \alpha\left[u(x,e) - U^*\right]^{-1} u_x + (1-\alpha)\left[nv(x,e,w) - NV^*\right]^{-1} nv_x = 0 \qquad \text{(A.3.2)}$$

(A.3) reduces to $\frac{u_e}{u_x} = \frac{nv_e}{nv_x}$.

(A.3) applies when $\delta \geq \hat{\delta}$ and implicitly defines the equilibrium levels of effort and output as functions of α and *w*. Differentiating (A.3) with respect to α and solving for $\partial e/\partial\alpha$ and $\partial x/\partial\alpha$ yields:

$$\frac{\partial e}{\partial \alpha} = \frac{-\Lambda_{e\alpha}\Lambda_{xx} + \Lambda_{x\alpha}\Lambda_{ex}}{D_2}, \qquad \frac{\partial x}{\partial \alpha} = \frac{-\Lambda_{x\alpha}\Lambda_{ee} + \Lambda_{e\alpha}\Lambda_{xe}}{D_2} \qquad \text{(A4)}$$

where $\Lambda_{ee}<0$, $\Lambda_{xx}<0$ and $D_2 = \Lambda_{ee}\Lambda_{xx} - (\Lambda_{ex})^2 > 0$ follows from the 2. order condition of the maximization problem. $\Lambda_{e\alpha} = \left[u(x,e) - U^*\right]^{-1} u_e - \left[nv(x,e,w) - NV^*\right]^{-1} nv_e < 0$ and $\Lambda_{x\alpha} = \left[u(x,e) - U^*\right]^{-1} u_x - \left[nv(x,e,w) - NV^*\right]^{-1} nv_x > 0$. (A4) can alternatively be written as:

$$\frac{\partial e}{\partial \alpha} = \frac{1}{D_2}\left[\frac{-\alpha}{1-\alpha}\frac{\left(u_e u_{xx} - u_x u_{ex}\right)}{\left(U - U^*\right)^2} + \frac{1-\alpha}{\alpha}\frac{\left(nv_e nv_{xx} - nv_x nv_{ex}\right)}{\left(NV - NV^*\right)^2}\right]$$

$$\frac{\partial x}{\partial \alpha} = \frac{1}{D_2}\left[\frac{-\alpha}{1-\alpha}\frac{\left(u_x u_{ee} - u_e u_{ex}\right)}{\left(U - U^*\right)^2} + \frac{1-\alpha}{\alpha}\frac{\left(nv_x nv_{ee} - nv_e nv_{ex}\right)}{\left(NV - NV^*\right)^2}\right] \qquad \text{(A4')}$$

If *e* and *x* are 'normal' goods, i.e. $\left(u_e u_{xx} - u_x u_{ex}\right) > 0$, $\left(u_x u_{ee} - u_e u_{ex}\right) < 0$, $\left(nv_e nv_{xx} - nv_x nv_{ex}\right) < 0$ and $\left(nv_x nv_{ee} - nv_e nv_{ex}\right) < 0$ then $\frac{\partial e}{\partial \alpha} < 0$ and $\frac{\partial x}{\partial \alpha} \lessgtr 0$.

The constrained solution of the Nash bargaining problem

Let A be the set of (e,x) such that $u(x,e)\geq U^*$ and $nv(x,e)\geq \mathrm{NV}^*$. We assume that the function $h(x,e,w,\delta)$ is quasi-convex in A. When constraint (8') is binding ($\delta < \hat{\delta}$) the first order condition of the Nash bargaining problem becomes:

$$\Lambda_e(x,e,w,\alpha) - \lambda h_e(x,e,w,\delta) = 0 \quad \text{(A.5.1)}$$
$$\Lambda_x(x,e,w,\alpha) - \lambda h_x(x,e,w,\delta) = 0 \quad \text{(A.5.2)}$$
$$h(x,e,w,\delta) = 0 \quad \text{(A.5.3)}$$
$$\lambda > 0 \quad \text{(A.5.4)}$$

where λ is the Lagrangean coefficient of the maximization problem. (A.5) implies that in optimum $\frac{\Lambda_e}{\Lambda_x} = \frac{h_e}{h_x}$, also implying $\frac{\Pi_e}{\Pi_x} = \frac{h_e}{h_x}$.

(A.5) implicitly defines the equilibrium level of effort and output (when $\delta < \hat{\delta}$) as functions of δ, α and w. Differentiating (A.5) with respect to δ and solving for $\partial e/\partial\delta$ and $\partial x/\partial\delta$, and with respect to α and solving for $\partial e/\partial\alpha$ and $\partial x/\partial\alpha$ we get:

$$\frac{\partial e}{\partial \delta} = \frac{\lambda\left(h_{x\delta}h_e h_x - (h_x)^2 h_{e\delta}\right) + h_\delta\left[h_e(\Lambda_{xx} - \lambda h_{xx}) - h_x(\Lambda_{ex} - \lambda h_{ex})\right]}{D_3}$$
$$\frac{\partial x}{\partial \delta} = \frac{\lambda\left(h_{e\delta}h_e h_x - (h_e)^2 h_{x\delta}\right) + h_\delta\left[h_x(\Lambda_{ee} - \lambda h_{ee}) - h_e(\Lambda_{xe} - \lambda h_{xe})\right]}{D_3} \quad \text{(A.6)}$$

$$\frac{\partial e}{\partial \alpha} = \frac{h_x\left[h_x\Lambda_{e\alpha} - h_e\Lambda_{x\alpha}\right]}{D_3}, \quad \frac{\partial x}{\partial \alpha} = \frac{-h_e\left[h_x\Lambda_{e\alpha} - h_e\Lambda_{x\alpha}\right]}{D_3} \quad \text{(A.7)}$$

where D_3 is the determinant of the bordered Hessian. $D_3>0$ is required by the 2. order condition of the maximization problem, and

$$h_e = (1-\delta)\frac{\partial nv\left(x^*(e),e\right)}{\partial e} - \frac{\partial nv(x,e)}{\partial e} = (1-\delta)v_x\left(x^*(e),e\right)f_e\left(L^*(e),e\right) - q_B w\frac{f_e}{f_L} < 0,$$
$$h_x = -\frac{\partial nv(x,e)}{\partial x} = -\left[v_x - q_B\frac{w}{f_L}\right] > 0,$$
$$h_\delta = NV^* - nv\left(x^*(e),e\right) \leq 0,$$

$h_{e\delta} = -v_x\left(x^*(e),e\right)f_e\left(L^*(e),e\right) < 0$, $h_{x\delta} = 0$, in the set A.

If $[h_e(\Lambda_{xx} - \lambda h_{xx}) - h_x(\Lambda_{ex} - \lambda h_{ex})]<0$ and $[h_x(\Lambda_{ee} - \lambda h_{ee}) - h_e(\Lambda_{xe} - \lambda h_{xe})]<0$ which is the same as requiring that $\frac{d}{dx}\left[\frac{\Lambda_e}{\Lambda_x}\right] > \frac{d}{dx}\left[\frac{h_e}{h_x}\right]$ and $\frac{d}{de}\left[\frac{\Lambda_e}{\Lambda_x}\right] < \frac{d}{de}\left[\frac{h_e}{h_x}\right]$ respectively, then

$\frac{\partial e}{\partial \delta} > 0, \frac{\partial x}{\partial \delta} > 0$. Assuming $[h_x \Lambda_{e\alpha} - h_e \Lambda_{x\alpha}]$, i.e. $\frac{d}{d\alpha}\left[\frac{\Lambda_e}{\Lambda_x}\right] < 0$, which implies that reduction of effort becomes socially less costly when the bargaining strength of the bureaucrat increases, then $\frac{\partial e}{\partial \alpha} < 0, \frac{\partial x}{\partial \alpha} < 0$.

The reaction curve of the bureau when the sponsor moves first

The first order condition of the one-shot maximization problem of the bureau defines $e^*(B,w)$. Differentiating the first order condition with respect to B and solving for $\frac{\partial e^*}{\partial B}$ gives us the slope of the reaction curve of the bureau:

$$\frac{\partial e^*}{\partial B} = \frac{\frac{f_L}{w u_x}\left[\left(u_{xx}u_e - u_{ex}u_x\right) - \frac{(u_x)^2}{f_L} f_{eL}\right]}{D_4} \qquad \text{(B.1)}$$

where $D_4 = \frac{1}{(u_x)^2}\left[u_{xx}(u_e)^2 - 2u_{ex}u_e u_x + u_{ee}(u_x)^2 + (u_x)^3 f_{ee}\right] < 0$ follows from the second order condition of the maximization problem of the bureau. The first term in the numerator is positive when effort is a normal good in the utility of the bureau.

In order to portray the reaction curve in the effort-output diagram we calculate $\frac{dx}{de}$ given that the first order condition of the maximization problem of the bureau is fulfilled:

$$\left.\frac{dx}{de}\right|_{\frac{-u_e}{u_x} = f_e} = \frac{\left(u_{ee}u_x - u_{ex}u_e\right) + \frac{(u_x)^2}{f_L}\left(f_{ee} f_L - f_{eL} f_e\right)}{\left(u_{xx}u_e - u_{ex}u_x\right) - \frac{(u_x)^2}{f_L} f_{eL}} \quad \left[= \frac{f_L}{w}\frac{1}{\frac{\partial e^*}{\partial B}} + f_e\right] \qquad \text{(B.2)}$$

The two terms in the numerator are negative when output is a normal good in the utility of the bureau and employment is a normal factor of production. The denominator is positive when $\frac{\partial e^*}{\partial B} < 0$. Thus given reasonable assumptions the sign of the reaction curve in the effort-output diagram is the same as the sign of $\frac{\partial e^*}{\partial B}$.

The constrained Nash bargaining solution when the sponsor moves first

The calculation and description of the unconstrained solution in this case is analogous to the case where the bureau moves first, the difference being different threat points.

Only the comparative static for a change in the discount factor (δ_b) and the relative bargaining power of the bureau (α) in the constrained case is therefore shown here.

$$\frac{\partial e}{\partial \delta_b} = \frac{\mu\left(g_{x\delta} g_e g_x - (g_x)^2 g_{e\delta}\right) + g_\delta [g_e(\Lambda_{xx} - \mu g_{xx}) - g_x(\Lambda_{ex} - \mu h_{ex})]}{D_5}$$

$$\frac{\partial x}{\partial \delta_b} = \frac{\mu\left(g_{e\delta} g_e g_x - (g_e)^2 g_{x\delta}\right) + g_\delta [g_x(\Lambda_{ee} - \mu g_{ee}) - g_e(\Lambda_{xe} - \mu g_{xe})]}{D_5} \quad \text{(B.3)}$$

$$\frac{\partial e}{\partial \alpha} = \frac{g_x[g_x \Lambda_{e\alpha} - g_e \Lambda_{x\alpha}]}{D_5}, \quad \frac{\partial x}{\partial \alpha} = \frac{-g_e[g_x \Lambda_{e\alpha} - g_e \Lambda_{x\alpha}]}{D_5} \quad \text{(B4)}$$

where $\mu>0$ is the Lagrangean coefficient of the maximization problem with $g(x,e,w,\delta_b)=0$ as the binding constraint. $D_5 >0$ is required by the 2. order condition of the maximization problem, and

$$g_e = (1-\delta_b)\frac{\partial u\left(x^*(B), e^*(B)\right)}{\partial e} - \frac{\partial u(x,e)}{\partial e} > 0,$$

$$g_x = (1-\delta_b)\frac{\partial u\left(x^*(B), e^*(B)\right)}{\partial x} - \frac{\partial u(x,e)}{\partial x} \lesseqgtr 0$$

$$g_{\delta_b} = U^{**} - u\left(x^*(B), e^*(B)\right) \leq 0,$$

$$g_{e\delta_b} = -u_e\left(x^*(B), e^*(B)\right) > 0,$$

$g_{x\delta_b} = -u_x\left(x^*(B), e^*(B)\right) < 0$, in the set of (e,x) such that $u(x,e) \geq U^{**}$ and $nv(x,e) \geq NV^{**}$.

Given that $\frac{u_e(x^*(B), e^*(B))}{u_x(x^*(B), e^*(B))} > \frac{u_e(x,e)}{u_x(x,e)}$ then if $[g_e(\Lambda_{xx} - \mu g_{xx}) - g_x(\Lambda_{ex} - \mu g_{ex})] < 0$ and $[g_x(\Lambda_{ee} - \mu g_{ee}) - g_e(\Lambda_{xe} - \mu g_{xe})] < 0$, i.e. $\frac{d}{dx}\left[\frac{\Lambda_e}{\Lambda_x}\right] > \frac{d}{dx}\left[\frac{g_e}{g_x}\right]$ and $\frac{d}{de}\left[\frac{\Lambda_e}{\Lambda_x}\right] < \frac{d}{de}\left[\frac{g_e}{g_x}\right]$ respectively, then $\frac{\partial x}{\partial \delta_b} > 0$ and $\frac{\partial e}{\partial \delta_b} \lesseqgtr 0$.

Assuming $[g_x \Lambda_{e\alpha} - g_e \Lambda_{x\alpha}] < 0$, i.e. $\frac{d}{d\alpha}\left[\frac{\Lambda_e}{\Lambda_x}\right] < 0$, $\frac{\partial x}{\partial \alpha} > 0$ and $\frac{\partial e}{\partial \alpha} \lesseqgtr 0$.

Chapter 5

Political determinants of efficiency variation in municipal service production: An analysis of long-term care in Norway.

Political determinants of efficiency variation in municipal service production: An analysis of long-term care in Norway

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Abstract

This paper addresses the implication of collective action problems of political decision making for bureaucratic discretion and provides an empirical analysis linking cost-efficiency of municipal service provision to political structure and institutions. The theoretical approach focuses on the interaction of the politicians and the bureaucrats in the budget process. The budget process is modeled as a bargaining game between the politicians and the bureaucracy determining the level of efficiency and output. The relative bargaining strength of the politicians influences the outcome of the game. A weakening of the relative bargaining power of the politicians reduces efficiency. In the empirical analysis the relative bargaining strength of the politicians is approximated by measures of the party fragmentation of the local council. Local politics is shown to have significant impact on the efficiency of the long-term care services in the Norwegian municipalities. Politically fragmented authorities are relatively less efficient than authorities where the political responsibility is concentrated to few parties. Efficiency variations are also related to political and administrative organization. However the influence of party politics and political and administrative organization is found to depend on the organization of the annual budget process.

1 Introduction

The public sector plays an important role in the provision of welfare services in most countries. The efficiency of public sector provision has been a recurring issue in the literature for a long time. Monopoly provision and lack of profit motive is seen to weaken the incentives to control costs resulting in inferior performance of public providers as compared to private market provision. While the public versus private provision distinction has shown to be important in explaining differences in production- or cost-efficiency in markets where both types of providers operate (Mueller 1989, ch. 14, Vining and Boardman 1992) the approach is insufficient to explain apparent differences in performance among public providers.

Public sector provision is characterized by agency relations. Politicians are elected to represent voter interests while public sector bureaucrats are responsible of implementing the decisions taken by the politicians. Inefficiency can be linked to imperfect representation of interests. Starting with the seminal contribution of Niskanen (1971) an extensive, mainly theoretical, literature on bureaucratic behavior has emerged. In Niskanen's original model the sponsor's role in the public decision process was played down with the power to control outcomes in the hands of the bureaucracy. Later extensions have incorporated an active role for the sponsoring institution. Even though the collective nature of the political decision making process sometimes is recognized (e.g. Miller and Moe 1983), the collective action problems facing the legislature are mostly ignored in the bureaucracy literature in the Niskanen tradition[1]. This paper addresses the implication of collective action problems of political decision making for bureaucratic discretion and provides an empirical analysis linking cost-efficiency of public service provision to political structure and institutions. The analysis also relates to the growing literature on politico-institutional determinants of public spending and budget deficits, linking loose fiscal policy to fragmented political and budgetary institutions (see e.g. Poterba and von Hagen 1999).

The characteristic feature of public sector provision is that spending and production decisions are taken within a political process involving negotiations between different political parties as well as between politicians and bureaucrats. If addressed, the notion of bargaining between bureaucrats and politicians is only made implicit in most models of bureaucratic supply. Here, the bargaining approach is made explicit. The budget process is modeled as a bargaining game between the politicians and the bureaucracy determining

[1] The collective action problems are addressed in the spatial voting literature, see e.g Hill (1985) and Steunenberg (1996).

the level of efficiency and output. The approach is based on Kalseth (2000). The advantage of the bargaining approach is that it allows bureaucratic influence on outcomes to vary, depending on the relative bargaining strength of the politicians vis-à-vis the bureaucracy. The main idea behind the paper is to link the relative bargaining strength of the politicians to collective action problems associated with political fragmentation. Political fragmentation is seen to weaken the bargaining position of the politicians. The outcome of the bargaining game is also influenced by the institutional setting in which the political and bureaucratic negotiations take place. A 'bottom-up' type budget process gives the bureaucracy a first-mover advantage in the budgetary game, the reverse is true with a 'top-down' type organization of the budget process.

Empirical analyses of public sector efficiency based on models of bureaucratic supply are scarce, perhaps reflecting the limited focus on variation among public providers in the theoretical literature. Duncombe and Miner (1997) and Hayes et al. (1998) represent recent empirically oriented contributions on local government efficiency. This paper provides an empirical analysis of municipal service provision focusing on political determinants of efficiency variation. The service under study is long-term care of elderly and disabled people. Kalseth and Rattsø (1998) provides an analysis of administrative overspending based on a similar approach to the one taken here. Long-term care comprises a range of services, from limited home based care to full-scale institutional care. The bulk of studies assessing the efficiency of long-term care services (typically US studies) are concentrated on specific services, such as nursing homes (e.g. Ozcan et al. 1998), area agencies on aging (Ozcan and Cotter 1994) and deinstitutionalized care of developmentally disabled (Dusansky and Wilson 1995), reflecting the (US) separate organization of supply. In Norway the provision of long-term care is a public sector responsibility, decentralized to the 435 municipalities. Thus the Norwegian setting allows for an analysis of comparable institutions responsible of providing the full range of long-term care services.

The reminder of the paper is organized as follows. In the next section the bargaining approach is elaborated. The adaptation to the empirical analysis of efficiency variation within long-term care is discussed in section 3. The analysis of the effect of political fragmentation on efficiency is presented in section 4, while the influence of institutional arrangements is discussed in section 5. In section 6 a test of the normality assumption underlying the econometric model is presented. And finally section 7 concludes.

2 The bargaining model

The decision to spend on long-term care is ultimately taken by elected politicians in the local council. The Norwegian municipalities are multi-purpose authorities. Hence, the preferences of the political leadership can generally be defined over the range of services provided by the municipality (long-term care, primary education, kindergartens etc.)[2]. The income side of the municipal budget is constrained by the central government control of the major local revenue sources, grants and income tax revenue sharing. Thus the decision problem facing the local decision-makers is to allocate the exogenous revenues among the different services. For a fixed total municipal budget the benefit of increased spending on long-term care must be weighted against the cost associated with the accompanying reduction in spending on other services. To simplify the exposition we formulate the objective function of the political leadership, or the political net benefit of long-term care, as follows:

$$NV = v(X) - q(B), \qquad v_X > 0, v_{XX} < 0, q_B > 0, q_{BB} > 0 \tag{1}$$

where X is the level of long-term care services produced and B is spending on long-term care. The politicians benefit from production of long-term care services ($v_X > 0$). However budget appropriations necessary to finance the production of services carry an opportunity cost, capturing the trade-off between spending on long-term care and spending on other services and the cost of raising additional funds[3] ($q_B > 0$). Higher exogenous municipal revenue reduces the political cost of spending on long-term care.

Production responsibilities are decentralized to a service department. In theories of bureaucracy in the Niskanen (1971) tradition public sector bureaucrats are assumed to pursue their own goals, which, in at least some respects, conflict with the goals of their superiors. In Niskanen's original model the bureaucrats are assumed to act as budget-maximizers exploiting their role as service producers to extract consumer surplus. The budget maximization hypothesis implies that output is produced at minimum costs when the solution to the budget maximization problem is cost constrained. Cost-minimization is not consistent with the pursuit of many of the utility enhancing activities the bureaucrat is assumed to be engaged in. Following later extensions of the

[2]Due to the multi-dimensional nature of the local decision problem the link between voter preferences and policy outcomes is blurred. In order not to complicate things too much in the discussion of the bargaining set-up the political demand for services is assumed to mirror the preferences of the political leadership (dominating party or the dominating coalitions of parties) in the local council as in the dominant party model discussed by Inman (1979).

[3]Reducing surpluses or increasing deficits is an option in the short run.

Niskanen model the bureaucracy is assumed to have preferences for output and slack, i.e. above minimum production costs (Migué and Bélanger 1974, Niskanen 1975):

$$U = u(X, S), \qquad u_X > 0, u_{XX} < 0, u_S > 0, u_{SS} < 0 \tag{2}$$

Migué and Bélanger (1974) defined slack as the discretionary budget, i.e. the difference between the total budget and minimum production costs: $B - C(X)$, where $C(X)$ is the minimum cost function. We define slack (S) as the ratio of the budget to minimum production costs, i.e. $S = \frac{B}{C(X)}$, which comes closer to the concept of inefficiency to be analyzed empirically below. This implies that the bureaucracy is concerned not with the absolute level of discretionary resources available but rather the amount of discretionary resources relative to the level of activity. If discretionary resources are not exclusively consumed by the bureau head but also enjoyed by subordinates this is a plausible assumption[4].

The politicians are granted the power of making the final budget appropriations. This does not however deny bureaucratic influence on the outcomes of the local decision making process. It is common to separate between two sources of bureaucratic discretion, authority-based and information-based agenda control. The bureaucracy is responsible of preparing and providing documentation serving as the foundation of political decision making. Furthermore, the politicians depend on the bureaucracy to carry out politics. Authority is delegated to the bureaucracy in both instances. Bureaucratic expertise and complex working environments give the bureaucracy an information advantage vis-à-vis the politicians. Taking into account the strategic interaction of bureaucrats and politicians there is a wide range of possible policy outcomes depending on the institutional setting in which the budgetary game takes place (Miller and Moe 1983, Moene 1986, and Chan and Mestelman 1988).

Taking as the point of departure that the budget process involves negotiations between the political leadership and the bureaucracy, and not imposing pre-eminence of either of the parties at the outset, we assume that the local decision making process can be described as a bargaining game. The bargaining approach to the modeling of the relationship of politicians and bureaucrats is applied earlier in e.g. Carroll (1993), Kalseth and Rattsø (1998), Fuest (2000) and Kalseth (2000). We further assume that the outcome of the

[4]In Kalseth (2000) the production of the bureau's services is assumed to be a function of labor input and effort and the preferences of the bureau are defined over output and effort. The definition of slack applied here is wider, including the notion of slack due to low effort levels.

bargaining game is consistent with the asymmetric Nash bargaining solution. In our case the Nash maximand reads:

$$\Pi = \alpha \log \left[u(X,S) - U_0\right] + (1-\alpha) \log \left[v(X) - q(S \cdot C(X)) - NV_0\right] \qquad (3)$$

The bargaining formulation is flexible in that it opens for the complete dominance of either the political leadership or the bureaucracy as special cases. The parameter $\alpha \in [0,1]$ is interpreted as the relative bargaining strength of the bureaucracy. U_0 and NV_0 represent the reservation utility levels of the bureaucracy and the political leadership respectively, i.e. the utility each of the parties obtain in case the negotiations break down.

Maximization of (3) with respect to S and X gives us the following first order condition of the Nash bargaining game:

$$\begin{aligned} \alpha U_X \left[NV - NV_0\right] + (1-\alpha) NV_X \left[U - U_0\right] &= 0 \\ \alpha U_S \left[NV - NV_0\right] + (1-\alpha) NV_S \left[U - U_0\right] &= 0 \end{aligned} \qquad (4)$$

We see from equation (4) that in the Niskanen type case with all the bargaining power in the hands of the bureaucracy ($\alpha = 1$) the political net benefit is set at its reservation level which in Niskanen's model equals zero. Likewise if the politicians fully determine policy outcomes ($\alpha = 0$) they will set output and slack such that the utility of the bureaucracy is just high enough for continued cooperation. We also see that in the intermediate case the marginal political net benefit of output is negative[5]. It is also evident that the solution will be a point along the contract locus. The location on the contract curve is determined by the relative bargaining strength of the political leadership and the bureaucracy. The effect on policy outcomes of increased bargaining power of the bureaucracy is found by differentiating (4) with respect to α:

$$\begin{aligned} \frac{dS}{d\alpha} &= \frac{1}{D}\left[-\Pi_{S\alpha}\Pi_{XX} + \Pi_{X\alpha}\Pi_{SX}\right] \\ \frac{dX}{d\alpha} &= \frac{1}{D}\left[-\Pi_{X\alpha}\Pi_{SS} + \Pi_{S\alpha}\Pi_{SX}\right] \end{aligned} \qquad (5)$$

where $\Pi_{S\alpha} = U_S \left[U - U_0\right]^{-1} - NV_S \left[NV - NV_0\right]^{-1} > 0$, $\Pi_{X\alpha} = U_X \left[U - U_0\right]^{-1} - NV_X \left[NV - NV_0\right]^{-1} > 0$, and $\Pi_{SS} < 0$, $\Pi_{XX} < 0$ and $D = \Pi_{SS}\Pi_{XX} - (\Pi_{SX})^2 > 0$ follows from the 2. order condition of the maximization problem. The sign of $\frac{dS}{d\alpha}$ and $\frac{dX}{d\alpha}$ is generally ambiguous depending on the relative emphasis on slack and output on part of the bureaucracy and the relative

[5] $NV_X = v_X - q_B \cdot C_X \cdot S$ and $NV_S = -q_B \cdot C\left(X\right)$.

cost of increasing slack and output to the politicians. If e.g. the bureaucrat is a pure slack-maximizer ($U = u(S)$) as is sometimes assumed (e.g. Hayes et al. 1998, Fuest 2000) then the prediction is clear: slack is increased at the expense of reduced output as the bargaining strength of the bureaucracy increases. However in the more general case the bureaucracy may use a strengthening of its bargaining power to push up both slack and output. Rewriting (5) we get:

$$\begin{aligned}
\frac{dS}{d\alpha} &= \frac{1}{D}\left[\frac{-\alpha}{1-\alpha}\frac{(U_S U_{XX} - U_X U_{SX})}{(U-U_0)^2} + \frac{1-\alpha}{\alpha}\frac{(NV_S NV_{XX} - NV_X NV_{SX})}{(NV-NV_0)^2}\right] \\
\frac{dX}{d\alpha} &= \frac{1}{D}\left[\frac{-\alpha}{1-\alpha}\frac{(U_X U_{SS} - U_S U_{SX})}{(U-U_0)^2} + \frac{1-\alpha}{\alpha}\frac{(NV_X NV_{SS} - NV_S NV_{SX})}{(NV-NV_0)^2}\right]
\end{aligned}$$

In the normal case both $(U_S U_{XX} - U_X U_{SX})$ and $(U_X U_{SS} - U_S U_{SX})$ is negative. The term $(NV_X NV_{SS} - NV_S NV_{SX}) = -v_X q_{BB} C(X)^2 - q_B^2 C(X) C_X$ is negative. Then it follows from the quasiconcavity of the net benefit function of the politicians that $(NV_S NV_{XX} - NV_X NV_{SX})$ is positive. Thus in the normal case a strengthening of the bargaining power of the bureaucracy implies increased slack. The effect on output is however uncertain.

The reservation, or disagreement, utility levels may be thought of as representing the Nash equilibrium of the non-cooperative game implied by the structure of the annual budgetary process as in Kalseth (2000), and as suggested in Chan and Mestelman (1988, p. 102). The organization of the budgetary process imposes a certain structure on the bureau-sponsor relation. This can be represented as a non-cooperative game. Cooperation will generally lead to outcomes preferred by both parties compared to the outcome of playing the non-cooperative game[6]. If the political leadership and the bureaucrat are unable to reach a negotiated agreement on the distribution of the benefits of cooperation then the solution to the budgetary game is the one implied by the structure of the budget process. The non-cooperative level of slack will typically be higher in a 'bottom-up' type budget process, i.e. when the budget process is initiated by the bureaucracy announcing the cost schedule before the politicians decide on the budget, than if the budget process is organized as a 'top-down' process granting the politicians the first-mover advantage (Kalseth 2000). The latter type budget process gives the politicians a better position at the outset of the negotiations.

[6] The modeling in Kalseth (2000) takes into account the repeated nature of the bureau-sponsor relation. The time preferences of the players constrain the Nash bargaining solution. Here we simplify by neglecting the time aspect, which is consistent with the players fully discounting future outcomes.

3 Empirical analysis of efficiency variation in local government provision of long-term care services

The bargaining model outlined above serves as the point of departure for the empirical analysis of efficiency variations in local government provision of long-term care services in Norway. The relative bargaining strength of the politicians is linked to characteristics of the political system, notably political fragmentation. The negotiation between the political leadership and the service department takes place within varying institutional settings. The influence of institutional arrangements on outcomes is also analyzed.

The municipalities' performance within long-term care is assessed by use of Data Envelopment Analysis (DEA). The DEA method provides efficiency indices for each municipality based on relative performance compared to an efficiency frontier defined by best-practice municipalities. Each municipality is given an efficiency score in the range (0,1]. An efficiency score of e.g. 0.9 indicates that the municipality in question can reduce its production costs by 10 percent without reducing the level of output produced. A score of 1 indicates that the municipality is located at the best practice frontier. Efficiency scores based on four different output vectors are calculated (EffScore1-EffScore4). The evaluation of relative performance will generally be affected by the way production is operationalized (Magnussen 1994). Thus experimenting with different ways of measuring output contributes to a check of the robustness of the results. The data are obtained from the 1997 Nursing and care statistics collected by Statistics Norway. The output and efficiency measures are discussed in more detail in appendix A.

The efficiency scores resulting from the DEA analysis provide us with an inverse proxy for slack. The bargaining model gives the efficiency level as function of the relative bargaining strength of the political leadership vis-à-vis the service department and factors affecting the reservation utility levels of the politicians and the bureaucracy as well as factors influencing the political demand for long-term care and the preferences of the bureaucracy. In order to reduce omitted variable biases in the analysis of observed efficiency variation a set of control variables supposed to capture local preferences and cost conditions is included along with the variables capturing the effect of political structure and institutions. The variables are documented in appendix B.

A considerable share of the observations on the efficiency variables, the best practice municipalities, are clustered at the value 1. And furthermore, we measure observed relative efficiency rather than actual efficiency. Thus, the actual efficiency of the best practice municipalities is censored. This

speaks in favor of using regression techniques handling censored data rather than ordinary least square (OLS). Efficiency is estimated using the Tobit method (Green 1993, chapter 22). The Tobit model with upper censoring is defined as follows: $y_i^* = \beta' x_i + u_i$, $u_i \sim N[0,1]$, where $y_i = 1$ if $y_i^* \geq 1$ and $y_i = y_i^*$ if $y_i^* < 1$, and y_i is the observed variable and y_i^* is the latent or censored variable.

The bargaining model opens for complex relationships between bargaining strength, institutional arrangements and the set of control variables. A simple linear approximation is used as the base line model. Alternative specifications are investigated. In section 5 the model is estimated allowing the effect of the variables to vary according to the type of budget process in place.

The analysis is conducted in two rounds. First, three alternative measures of bargaining strength are examined in section 4. Of the 397 municipalities for which efficiency scores are calculated six have missing data on one or more control variables and are excluded from the analysis, leaving us with a sample of 391 municipalities in the first round of estimations. Next, in section 5, the effect of institutional arrangements is investigated. Due to lack of information on the organizational variables for 94 of the municipalities included in the original sample the analyses of political and administrative organization cover only 297 municipalities.

4 Political fragmentation

The Norwegian local political system is characterized by multi-party representation. After the 1995 election the number of parties (and non-party groups) represented in the local council ranged from two to 10 with an average of six parties. Local politics is organized according to the 'Board of Aldermen' model. That is, an executive board is elected by and from the local council with proportional representation of the parties. Thus no party or coalition of parties holds a formal ruling position, in contrast to a parliamentary political system.

Majority-rule decision making by a political body characterized by multi-party representation, heterogeneous policy platforms and a multi-dimensional policy space entails collective action problems (Ordeshook 1997). As long as no party holds a majority of the seats in the local council 'chaos', i.e. voting cycles, is to be expected. Institutional constraints, logrolling, political bargaining and coalition building may help to overcome the collective action problems and create stable outcomes (Mueller 1989 ch. 5, Stratmann 1997). The usual prediction of coalition theory is that minimum winning coalitions

will be formed. However minimum winning coalitions are vulnerable to defection. Oversized coalitions will produce more stable coalitions (Groseclose and Snyder 1996). In the limit this amounts to the norm of universalism (Weingast 1979, Tullock 1981).

The obstacles to political bargaining, coordination and commitment caused by problems of collective action leave space open for bureaucratic maneuvering. According to Moe (1997) the downside of legislative power is: "the transaction costs and collective action problems that make it difficult for legislatures to take strong action on their own behalf and render them vulnerable to exploitation by others" (p. 480). Thus the bargaining power of the politicians vis-à-vis the bureaucracy can be linked to the severity of the collective action problem.

The severity of collective action problems within a voting body is likely to be positively correlated with the number of decision makers. Coordinating politics and agreeing on policy alternatives will typically be more demanding the higher the number of decision makers, especially if there is a strive for consensus as prescribed by the norm of universalism, in which case every decision maker is a potential veto player. An increase in the number of veto players reduces the ability of political action or change (Tsebelis 1999) and increase agency discretion (Steunenberg 1996). The problem of free-riding also increases with the number of decision makers. As long as policy decisions are taken by, potentially shifting, coalitions the responsibility of policy outcomes cannot be attributed to single decision makers[7]. The incentive to control the bureaucracy weakens.

The system of joint rule embedded in the 'Board of Aldermen' system is intended to enhance the division of power and responsibility between the political parties, tending towards a norm of consensus. We expect the bargaining power of the politicians vis-à-vis the bureaucracy to be weaker the higher the number of parties, i.e. the more politically fragmented the local council. Thus our measure of the relative bargaining strength is the number of parties holding seat in the local council (NOP). The measure relates to Perotti and Kontopoulos' (1998) notion of size fragmentation.

Two alternative, but related, measures of political fragmentation are also examined. The effective number of parties ($ENOP$) takes into account that the relative size of the party groups vary. If large party groups are more influential in the political negotiations than small party groups, then the effective number of parties may be a better representation of size fragmentation than

[7]Leyden and Borrelli (1995) found that the incumbent gubernatorial party was more severely punished for bad economic conditions by the voters in gubernatorial elections when the governor's party controlled the state legislature than in the case of divided government. See also the discussion in Roubini and Sachs (1989, p. 925-926).

the actual number of parties. The effective number of parties is calculated as the inverse of the Herfindahl index:

$$ENOP = \left[\sum_{p=1}^{P} SH_p^2\right]^{-1} \tag{6}$$

where SH is the share of the seats held by party p. The Herfindahl index was used to measure party fragmentation in Kalseth and Rattsø (1998).

If a single party holds a majority of the seats in the local council the decision problem stemming from unstable majority constellations disappears. A majority party is in a position to control, or dictate, policy decisions. Thus one party majority is expected to represent a strong political leadership and thus a strong bargaining position vis-à-vis the bureaucracy. The second measure of political strength applied by Kalseth and Rattsø (1998) is a classification of the political leadership, represented by the party of the mayor and deputy mayor, according to the two dimensions majority/minority and coalition/non-coalition leadership[8]:

$COAL$ 1- Minority coalition
$COAL$ 2- One party minority
$COAL$ 3- Majority coalition
$COAL$ 4- One party majority

The classification is inspired by the power dispersion, or 'strength-of-government', index adopted by Roubini and Sachs (1989). The Roubini and Sachs index ranks the government according to coalition size, from one party majority government being the strongest type of government via coalition governments to a minority government representing the weakest type of government. A dummy variable formulation is used to allow for non-linearity of the effect of strength measured this way, taking into account the criticism of the power dispersion index by Edin and Ohlsson (1991).

The results for the political strength variables are documented in table 1. Political fragmentation is clearly important in explaining variation in efficiency in the provision of long-term care. Efficiency is negatively related to the number of parties represented in the local council. The result is consistent with our hypothesis that political fragmentation improves the bargaining position of the bureaucracy. The bureaucracy exploits the collective action problem facing the political leadership to increase slack. The estimates on the effect of NOP imply that one additional party being represented in the local council reduces efficiency by 2-3 percentage points.

[8] See appendix B for more details.

The two alternative measures of bargaining strength are also significantly related to efficiency variations. A Wald test of the type of coalition variables all being equal to zero is rejected at the 10 % level for three of the four efficiency score variables. However, contrary to what we expected there are no significant differences between one party majority and the rest. Rather minority coalitions seem to stand out. For EffScore1 and 2 a significant difference between two-party majority and two party minority coalitions is found. For EffScore3 and 4 minority coalitions have significantly lower efficiency levels than both two party majorities and one party minorities.

Table 1 Estimation results. Three measures of political strength[1].

Model		EffScore1[2]	EffScore2[2]	EffScore3[2]	EffScore4[2]
I	NOP	-2.009	-3.121	-2.658	-3.312
		(-2.94)	(-4.29)	(-3.35)	(-4.05)
II	ENOP	-1.650	-2.174	-1.859	-2.153
		(-1.76)	(-2.17)	(-1.71)	(-1.91)
III	COAL1[3]	-2.872	-3.785	-2.405	-3.325
		(-1.07)	(-1.31)	(-0.78)	(-1.04)
	COAL2[3]	-0.385	-0.875	1.892	1.312
		(-0.14)	(-0.30)	(0.612)	(0.41)
	COAL3[3]	1.193	0.258	2.229	1.208
		(0.44)	(0.09)	(0.71)	(0.374)
	Wald[4]	0.10	0.13	0.07	0.09

1 Results from three separate estimations for each EffScore measure. The results for the full set of variables using NOP as the political strength variable is documented in table A4 in appendix C. t-values in parentheses.

2 Efficiency score * 100.

3 One party majority serves as the reference group.

4 Wald test: COAL1=COAL2=COAL3=0. P-value reported.

The result is in line with the findings in Kalseth and Rattsø (1998). Municipalities with minority coalitions are found to have higher administrative overspending than other municipalities. The municipalities having minority coalitions are on average more politically fragmented than the other municipalities. Further, neither the mayor nor the deputy mayor belong to the largest party in more than 50 % of the minority coalition cases as opposed to roughly 10 percent or less for the rest.

In case of one party majorities there may be a problem of separating strength from ideology. The Labor Party is the majority party in 70 percent of the cases. The Centre Party is the majority party in seven of the remaining 10 one party majority cases. There are close connections between the

Labor party and labor organizations in Norway. The Centre Party has also been one of the strongest defenders of the public sector in debates on public sector performance in recent years[9]. The Labor Party and perhaps also the Centre Party may be more willing to trade efficiency for the loyalty of the bureaucracy e.g. as voters.

The three measures of bargaining strength are interrelated. The number of parties in the local council shows the strongest relationship with measured efficiency[10]. This is in line with the norm of consensus associated with the 'Board of Aldermen' model allowing even minor parties to take part in the policy formulation, however at the cost of profound collective action problems making way for increased bureaucratic influence.

Similar measures of political fragmentation are applied in studies of the efficiency of Belgian municipalities. Vanden-Eeckaut et al. (1993) groups the municipalities according to three types of political majorities; strong (basically one party majority), dual (two party majority) and multiple majority. They find that the share of inefficient municipalities is lowest in the group of strong majority and highest in the group of multiple majority. De Borger et al. (1994) find a negative, however insignificant, effect of the number of parties in the municipal coalition[11].

Two additional aspects of the composition of the local council are included in the analysis. The share of seat of bourgeois parties (political centre and right) ($BOURG$) is included to control for possible ideology effects. While the share of female representatives ($WOMAN$) is included to capture other aspects of representation than party affiliation. The importance of ideology (party color) for local government spending decisions is well documented in the Norwegian case (Rattsø 1998). Kalseth and Rattsø (1998) find a positive relationship between share of socialist in the local council and administrative overspending. Traditionally the political right wing has been most concerned with the level of efficiency within public sector service provision, prone to be skeptical to public provision on ideological grounds. The share of seats of bourgeois parties is found to have a significant positive effect on efficiency within long-term care when the Centre Party is not counted among

[9] In a recent survey the local politicians were asked to rank the challenges facing the local governments. Only among the politicians from the Centre Party and a small left wing party did efficiency not rank at the top of the list.

[10] When entering ENOP along with NOP in the estimation only NOP remains significant. The same goes for the coalition type variables.

[11] The studies of the Belgian municipalities differ from the one presented here in that they evaluates the efficiency of the local governments as a whole implying that they must rely on even more aggregated and imprecise measures of output than single service studies typically do.

the bourgeois camp, se table A4 in appendix C. This contrasts the findings of De Borger et al. (1994). They find that municipalities dominated by liberals tend to have a lower overall level of efficiency. However the results are not readily comparable since they use a dummy variable for the presence of liberals in the ruling coalition while we use the share of seats of the bourgeois parties in the local council. The latter approach seems to be more appropriate in our case since the local political system in Norway enables parties outside the ruling coalition to influence outcomes. The bourgeois dominated councils are typically politically fragmented[12]. Thus the gain in efficiency from bourgeois dominance tend to be offset by collective action problems worsening the bargaining position vis-à-vis the bureaucracy. No effect of the share of female representatives in the local council is found.

The results for the other control variables are quite robust over the four alternative efficiency scores. However the results indicate that the output vector used to calculate EffScore4 probably best capture variation in caseloads between the municipalities[13]. Thus in the proceeding only results based on EffScore4 are reported.

5 Institutional arrangements

The bargaining between politicians and the bureaucracy takes place within the context defined by institutional arrangements, first and foremost the organization of the annual budget process. The Local Government Act requires that the final overall budget proposal, which is to be presented to and decided upon by the local council, is prepared by the executive board. There are however few restrictions on the organization of the early stages of the budget process. Three models of organization of the annual budgetary process can be identified from the database on municipal organization from which information on institutional arrangements is collected: i) decentralized process, ii) centralized administrative process, and iii) centralized political process. In the decentralized process the annual budget process starts with the service departments preparing a budget proposal for their respective departments. The proposal is reviewed by the corresponding political committee. In the next stage the chief administrative officer coordinates the proposals from the committees and prepares a consolidated budget proposal which serves as the starting point for the discussion in the executive board. In the centralized administrative process the political committees are not involved in the first

[12] The correlation between bourgeois share and number of parties in the local council is 0.52.

[13] EffScore4 is less correlated with variables assumed to capture variation in caseloads.

stages of the budget preparation. The chief administrative officer, in collaboration with the service departments, produces an overall budget proposal which is submitted to the standing committees. The process then continues with the executive board preparing the final budget proposal. Finally, in the centralized political process the executive board initiates and directs the process. The executive board prepares the budget proposal in collaboration with the municipal administration through the chief administrative officer. The final proposal is submitted to the standing committees and the local council for final discussions and decision.

The decentralized process comes closest to a 'bottom-up' process and the centralized political process resembles a 'top-down' process, as discussed in section 2. The centralized administrative process looks like a compromise between the decentralized and the centralized political process. We expect the centralized political budget process to be associated with higher efficiency levels than the centralized administrative and the decentralized process. Two dummy variables $ABUD$ and $DBUD$ for centralized administrative and decentralized process respectively are constructed to capture the effect of type of budget process on efficiency.

The nature of the budgetary bargains, and hence final outcomes, is likely to be influenced by the political and administrative organization in general. Two additional characteristics of political and administrative organization are investigated. The first is the organization of the standing committees. The second relates to the organization of the administrative leadership.

Case preparation, proposition making and even decision authority is to a large, however varying, extent decentralized to the executive board and to different standing committees. An important aspect of political decentralization concerns who occupies the seats of the committees. We expect fragmentation of decision-making to be higher the less overlap in membership there is between the different political bodies. Decision making is likely to be more coordinated when the members of the executive board also hold seats in the committees. Fragmented political organization is expected to strengthen the bargaining position of the bureaucracy. An ordinal variable ($COMMEMB$) ranging from 1 (all members of the executive board hold seats in a committee) to 5 (non of the members of the executive board hold seats in a committee) is included to capture the effect of concentration of decision making power[14]. The local governments have chosen different models concerning the nature of the authority delegated to the committees. The effect of membership overlap may depend on the type of model in place. Two types of standing committees are identified in the database on municipal or-

[14]See appendix B for more details.

ganization. The first type has authority to make final decisions on matters delegated to the committee. The committee may also be granted the right to make proposals to the executive board and/or the local council. The second type of committee resembles parliamentary committees and is delegated authority to prepare and make proposals on cases, which are to be handled by the local council. A dummy variable ($COMTYPE$) is constructed taking the value of one if the committee system is said to be of the latter type.

Finally, we also include a variable reflecting the organization of the administrative leadership. The variable ($ADMTEAM$) takes on a value of one if the chief administrative officer and the heads of the service departments constitute an administration team acting in concert. The motivation for including the variable is that both the preferences and the bargaining position of the heads of the service departments may be affected by operating within a management team. We expect administration teams to be associated with higher efficiency levels.

The analysis of the impact of organization on efficiency is not unproblematic due to potential endogeneity biases. An instrumental variable approach is preferable. However proper instruments are hard to find. Factors affecting the choice of institutional arrangements are also likely to influence efficiency. The control for political structure (NOP, $BOURG$, $WOMAN$) and other control variables possibly correlated with both organization and efficiency probably reduces the problem of endogeneity biases. Table 2 below reports the results for the organizational variables analyzed.

Table 2 Estimation results.
Political and administrative organization[1].

DBUD[2]	-0.901	(-0.41)
ABUD[2]	-1.901	(-0.90)
COMTYPE	-13.741	(-2.55)
COMMEMB	-1.28	(-1.95)
TYPE*MEMB	4.061	(2.71)
ADMTEAM	1.185	(0.66)

1 EffScore4*100. N=297. Full model not reported.

t-values in parentheses.

2 Centralized political budget process serves as the reference group.

The results reveal no significant relationship between type of budget process and the level of efficiency. Nor is efficiency found to be related to our measure of the organization of the administrative leadership. The organization of the standing committees seems to matter when we allow for interaction effect between $COMTYPE$ and $COMMEMB$. The effect of the

degree of overlap in membership of the executive board and the committees is conditional on the type of committee system in place. For municipalities having delegated decision making authority to the standing committees a lowering of the share of the members of the executive board holding seat in a standing committee reduces efficiency as suggested above. However this is not the case when the committees are of the type of parliamentary committees. Having a parliamentary type committee system seems to imply lower efficiency than a committee system with decentralized decision making authority, however only when the members of the executive board also take part in the work of the committees. The interaction term is positive suggesting that non-overlap in membership in the executive board and the committees contributes to improve efficiency for municipalities having adopted a parliamentary type model. Since there are relatively few municipalities having the latter type of committee system the estimates are less reliable.

Table 3 Estimation results by type of budget process.[1]

	Centralized pol	Centralized adm	Decentralized
BOURG	0.183	0.083	0.102
	(1.70)	(0.69)	(0.99)
WOMAN	0.057	0.071	0.403
	(0.29)	(0.39)	(2.62)
NOP	-5.779	-1.109	0.868
	(-3.39)	(-0.68)	(0.74)
COMTYPE	-14.59	0.221	-19.26
	(-2.01)	(0.02)	(-0.91)
COMMEMB	-1.056	-1.742	-1.007
	(-1.01)	(-1.51)	(-1.28)
TYPE*MEMB	4.961	0.350	5.517
	(2.39)	(0.12)	(1.07)
ADMTEAM	-1.786	9.171	-3.098
	(-0.61)	(3.04)	(-1.15)
# obs	133	86	78

1 EffScore4*100. Full model not reported. t-values in parentheses.

Even though the results reveal no significant differences in the level of efficiency related to the structure of the budget process the budget procedure may still be of importance since it alters the roles of the participants in the budgetary game. Thus the effect of the other explanatory variables may be conditional on the budgetary procedure. Table 3 reports the results of separate estimations for municipalities having a decentralized process, centralized administrative process and centralized political budget process respectively.

The results reveal an interesting pattern. Party politics, measured by party color and party fragmentation, and political organization contribute significantly to efficiency variations in the centralized political process but not in the centralized administrative and the decentralized process. The administrative organization variable has a strong positive effect in the centralized administrative process. While a higher share of female representatives is associated with higher efficiency with the decentralized budget process.

The observed pattern is consistent with an interpretation stressing the importance of the early stages of the budgetary process. In the decentralized process the first stages of the budget process involve the service departments and the political committees. The politicians are often said to be elected to the committees on basis of special knowledge or field of interest, or they develop special knowledge and interest as a consequence of committee membership. If so, then characteristics other than party affiliation, such as sex[15], may be important in explaining behavior. The variation in the political organization variables is too limited to get precise estimates in the decentralized case. The political level is not involved in the early stages of the budget preparation in the centralized administrative process. This may hamper or weaken political influence on outcomes. Rather administrative organization becomes important. The effect of having an integrated administrative leader team is to increase efficiency by almost 10 percentage points. Political structure and party politics become important when the budget process is initiated and coordinated by the executive board. The effect of political fragmentation is substantial. If one additional party is represented in the local council the efficiency is reduced by nearly six percentage points.

The results reported in table 2 and 3 indicate that the potential advantages of political control of the budget process are lost due to political fragmentation. The chief administrative officer and service-oriented politicians may represent stronger opponents in the bargaining with the service department than a fragmented executive board.

6 Test of the normality assumption

The results reported so far indicate that political structure and institutions do play a significant role in determining the level of efficiency within municipal service production. The results are obtained by use of the Tobit model. The consistency of the Tobit estimator preconditions that the underlying distribution is normal. The assumption of normally distributed disturbances

[15] Sex is seen as a proxy for other underlying factors, such as position in the labor market, influencing preferences.

is tested by use of the conditional moments test described in Green (1993, ch. 22). The test is carried out by running a linear regression of the third and fourth moment on the first order conditions and a constant term to test for symmetry (skewness) and the degree of excess (kurtosis) respectively. The null of normally distributed residuals is rejected if a t test of the constant terms being zero is rejected. Table 4 reports the results from the test.

Table 4 Conditional moment test of normality[1].

	All	Centralized pol	Centralized adm	Decentralized
Skewness	-5.631	-4.140	-2.430	-3.887
	(0.000)	(0.000)	(0.018)	(0.000)
Kurtosis	-4.804	-3.140	-4.236	-0.921
	(0.000)	(0.002)	(0.000)	(0.362)
# obs	297	133	86	78

1 EffScore4. t-values. P-values in parentheses.

The symmetry assumption is clearly rejected both for the full sample and when the municipalities are separated according to type of budget process. Further zero excess is rejected except for the sample of municipalities having a decentralized budget process. The normality assumption thus seem to be violated in our case.

Table 5 Estimation results.
Generalized Logistic Tobit model[1].

BOURG	0.166	(2.30)
WOMAN	0.013	(0.14)
NOP	-2.139	(-2.52)
DBUD	4.347	(2.11)
ABUD	-0.157	(-0.08)
COMTYPE	-8.594	(-1.65)
COMMEMB	-1.202	(-1.96)
TYPE*MEMB	2.170	(1.45)
ADMTEAM	0.303	(0.17)
Theta	6.106	(3.06)
Wald[2]	0.01	

1 EffScore4*100. N=297. Full model not reported.
t-values in parentheses.
2 Wald test for symmetry: Theta=1. P-value reported.

In order to assess the robustness of our results to alternative distributions we reestimated the model using a Generalized Logistic Tobit model as described in Green (1998, p. 690). The Logistic distribution allows for thicker

tails than the Normal distribution. The Generalized Logistic distribution also allows for asymmetry. The number of observations is too small to get reliable results for the three subsamples. Thus the check of results is performed for the model with dummy variables for the type of budget process[16]. The results are documented in table 5. The rejection of the symmetry assumption is confirmed in the Generalized Logistic Tobit model as can be seen from the reported p-value of the Wald statistic. The estimated effects are quite robust to the altering of the assumption of the underlying distribution. The exception is the effect of having a decentralized budgetary process. In the Generalized Logistic Tobit model the estimated effect of decentralization is to increase efficiency.

7 Concluding remarks

Local politics is shown to have significant impact on efficiency within long-term care in the Norwegian municipalities. Politically fragmented authorities are relatively less efficient than authorities where the political responsibility is divided among few parties. We interpret this result as fragmented local councils being in a weaker bargaining position towards the bureaucracy. Efficiency variations are also found to be related to political and administrative organization.

However the influence of party politics and political and administrative organization depend on the organization of the annual budget process. Party politics, i.e. ideology and party fragmentation, only seem to matter when the executive board is involved in all stages of the drafting of the municipal budget. When the budget process starts at the level of each service department, with the service department and the corresponding political committee preparing the first draft of the department's budget, party politics seems to be played down. The third model of organization of the budget process excludes political participation in the early stages of the process. The initial budget preparation is controlled by the chief administrative officer. This seems to weaken the political influence on outcomes. Administrative organization on the other hand is found to be important in this case.

[16] An ordered probit estimation of the model, where the observations are grouped according to the level of efficiency, is also tried. The ordered probit estimation reproduces the results of the Tobit model for the full sample. The effect of committee type weakens and becomes insignificant in the analysis of the centralized political budget process. This is also the case for the share of female representatives in the analysis of the decentralized budget process. Otherwise the results hold using ordered probit estimation for the three subsamples.

Appendix A: Measuring output and efficiency

In order to evaluate the municipalities' performance within long-term care we need a measure of output. Measuring output within long-term care is not straightforward. The output may be conceptualized as improved health status, improved capability of managing every day living or improved quality of life. Conditions which all are hard to measure. If quality of services are constant and the recipients are homogenous in needs, one possible approximation to long-term care production is the number of people served. In most studies of nursing home efficiency output is measured as the number of patients or the number of patient days for different groups of patients that are supposed to be relatively homogenous. The output measure in this study is also based on the number of recipients. The users of long-term care are however highly heterogeneous. If this is not taken into account the output measure will be biased, favoring authorities with a light caseload. Heterogeneity can be taken into account by allowing multiple outputs. However some sort of aggregation is necessary if the number of outputs is to be manageable. Thus, quality aside, the problem lies in defining a vector of outputs that capture differences in case-mix between the municipalities, and that at the same time comprise a manageable number of outputs.

Four output vectors are defined. The first (Output1) aggregates the total number of users according to age and mode of care into five output categories; three groups according to age for home care (age 0-66, age 67-79, and age 80 years and more) and two groups according to age for institutionalized care (age 0-79, and age 80 years and more)[17]. The second output vector (Output2) includes the same output categories as Output1 however adding the number of users of home care receiving an amount of help equivalent to a full man-year or more. This output variable is added to capture the high costs faced by the municipalities with a relative high share of users of home care demanding very high levels of care. The users receiving such high levels of care are typically persons with severe physical or mental disabilities[18]. The third output vector (Output3) utilizes the information on the type of services that the users of home care receive. The users of home care are divided into three groups; those receiving (only) home nursing, those receiving (only)

[17] Young users and users living in institutions receive considerably more help than old users and users receiving home care respectively (Kalseth and Magnussen 1995).

[18] In 1991 the primary responsibility for providing long-term care services to mentally challenged persons with comprehensive needs was transferred from the counties to the municipalities. After the reform the clients was to be transferred back to the municipality where they where born. However, about 50 percent of the clients that were living in the former institutions continued to live in the municipality where the institution was located (the 'host-municipality') after the reform (St.prp. nr. 1 (1995-96)).

practical assistance[19] and those receiving both types of services. In order to keep the number of outputs down we only operate with two age categories for each of the three groups; 0-66 and above 66 years of age, giving us a total of 8 user groups. And again the last output vector (Output4) is identical to Output3 except for the addition of the number of users demanding very high levels of home care[20].

Unfortunately, we do not have any information on the quality of the services produced. Thus if increasing the quality of care is costly, there may be a danger present of confusing variation in quality with variation in efficiency. However studies of user satisfaction with the municipalities' long-term care services do not indicate any strong systematic relationship between user satisfaction and indicators of resource use (Dræge el al. 1997) or efficiency (Erlandsen et al. 1997)[21].

The municipalities' performance within long-term care are assessed by use of Data Envelopment Analysis (DEA). DEA is a non-parametric linear programming technique that can be employed to assess relative efficiency among decision-making units (DMUs). The method is based on the work of Charnes et al. (1978) generalizing the measure of technical efficiency proposed by Farrell (1957). The DEA method handles easily multi-output/multi-input production, which is often the case in public service production and it does not require any assumptions about functional form. An underlying assumption in the DEA analysis is that all observations are part of the production possibility set implying that the boundary of the production possibility set is deterministic. The DEA method establishes a reference frontier consisting of best practice observations to which all the other DMUs are compared. The performance of each unit is assessed by comparison with other similar units. The reference frontier is established by a linear piecewise envelopment of the observations. Furthermore the production possibility set is convex, i.e. convex combinations of observed input-output combinations are attainable. The identification of efficient DMUs depends on the assumption of technology applied. Here we assume variable return to scale technology. Each municipality is given an efficiency score in the range (0,1]. An efficiency score of e.g. 0.9

[19] Assistance and training in managing activities of daily living.

[20] The disaggregation of the users according to the criteria discussed above is an attempt to reduce biases stemming from differences in caseloads. Since our treatment of the heterogeneity problem is quite rough substantial biases may still be present. In the analysis of efficiency variations we therefore include several variables that are supposed to capture differences in caseloads.

[21] We have access to measures of uncovered needs for a small subset of the municipalities included in the efficiency analysis. The data reveal no systematic relationship between uncovered needs and the calculated efficiency scores for these municipalities.

indicates that the municipality in question can reduce its factor-input use by 10 percent without reducing the level of output produced. A score of 1 indicates that the municipality in question is located at the best practice frontier. The performance is thus evaluated according to the input-saving potential. See e.g. Seiford and Thrall (1990) for a review of the DEA approach.

Due to poor quality of the data on personnel use within long-term care we apply the dual to technical input efficiency viz. cost efficiency (Färe and Primont 1988, 1996). Thus a cost efficient reference frontier is established defined by the municipalities having the lowest costs given their output levels[22]. This approach is also taken in previous studies evaluating the performance of local governments, e.g. Vanden-Eeckaut et al. (1993) for Belgian municipalities and Athanassopoulos and Triantis (1998) for Greek municipalities. About 10 percent of the municipalities are excluded from the analysis due to poor data quality on the users of long-tern care[23]. The results from the DEA analysis is documented in table A1.

Table A1 Efficiency scores using DEA analysis[1]. N=397.

	Mean	Std. dev.	Minimum	Maximum	% Eff=1
EffScore1	0.754	0.141	0.430	1.000	8.1
EffScore2	0.793	0.134	0.460	1.000	12.1
EffScore3	0.805	0.140	0.472	1.000	17.1
EffScore4	0.837	0.132	0.475	1.000	21.7

1 EffScore$i$ is based on output vector Output$i$, i=1,..,4.

The average efficiency score is in the range of 0.75 to 0.84, implying that on average the municipalities can reduce their costs by 15 to 25 percent without any reduction in activity. An increase in the number of dimensions (here number of outputs) typically increases the average efficiency score since it increases the heterogeneity among the municipalities. The share of the municipalities classified as efficient increases from 8 percent with output vector 1 to 22 percent with output vector 4. The wide variation in measured cost-

[22]Production costs are defined as the sum of net salaries and social expenses; other running expenses; net transfers to counties and 'others'; and net internal transfers. Source: Municipal accounts. Norwegian social science data services.

[23]In addition to municipalities with incomplete data we have excluded municipalities where the number of users changed with more than 30 percent from the previous year (1996). Large changes in the number of users can to a large extent be explained by poor routines in reporting data to Statistics Norway. Even though the large change in the number of users is real it may create problem in the efficiency analysis if the changes occurred late in the year. This because the output data is based on a counting of the numbers of user receiving services at the end of the year while the input measure reflects resource use throughout the entire year.

efficiency between the municipalities is likely to reflect problems in capturing variations in caseloads adequately.

Table A2 Correlation matrix of the efficiency scores. Spearman's rho.

	EffScore1	EffScore2	EffScore3	EffScore4
EffScore1	1.000			
EffScore2	0.856	1.000		
EffScore3	0.894	0.809	1.000	
EffScore4	0.746	0.900	0.885	1.000

The rank correlation coefficient, see table A2, indicates that even though the four output vectors do rank the municipalities roughly in the same way, which output vector is used affects the evaluation of some of the municipalities.

Appendix B: Documentation of the variables

Description of the variables.

Variable	Description
NOP	Number of parties (and non-party groups).
ENOP	Effective number of parties (See eq. 6).
COAL1	Minority coalition - the mayor and deputy mayor represent different parties and the two parties together hold less than 50 % of the seats in the local council.
COAL2	One party minority - the mayor and deputy mayor represent the same party and this party hold less than 50 % of the seats in the local council.
COAL3	Majority coalition - the mayor and deputy mayor represent different parties and the two parties together hold more than 50 % of the seats in the local council.
COAL4	One party majority - the mayor and deputy mayor represent the same party and this party hold more than 50 % of the seats in the local council.
BOURG	Percentage of the representatives from the Progress party (Fremskrittspartiet), the Conservative party (Høyre), The Left (Venstre), and the Christian democratic party (Kristelig Folkeparti).
WOMEN	Percentage of female representatives in the local council.
DBUD	Dummy equal 1 if decentralized budget process (see section 5).
ABUD	Dummy equal 1 if centralized administrative budget process (see section 5).
COMMEMB	The share of the members of the executive board being member of a standing committee. 1=all ,2=more than 75 %, 3=25-75 %, 4=1-25 %, 5=none.
COMTYPE	Dummy equal 1 if the standing committees mainly is of the form of parliamentary committees (see section 5).
TYPE*MEMB	COMTYPE*COMMEMB
ADMTEAM	Dummy equal 1 if the chief administrator and the heads of the service departments constitute an integrated administration team (see section 5).

Continued.

Description of the variables continued.

Variable	Description
MunicInc	Tax revenues and grants per capita (In 1000 NOK).
PrivInc	After-tax income per capita (In 1000 NOK).
Unempl	Unemployment rate. Percentage in population 16-66 years.
Singlepar	Percentage of families receiving child benefits being single parent families.
Child	Percentage of population aged 0-6 years.
Young	Percentage of population aged 7-15 years.
Elderly	Percentage of population aged 67 years or more.
Old	Percentage of elderly population aged 80 years or more.
Mortalily	Mortality per 100 000 inhabitant, yearly average 1990-1994. Standardized for the age- and sex composition of the population.
Disabled	Percentage of population 16-67 years being disabled.
Alone	Percentage of population above 79 years non-married, divorced or widowed.
FemWork	Female work participation rate. Percentage of female population 20-66 years.
MentChall	Percentage of population being mentally challenged.
HostMunic	Municipalities hosting institutions for mentally challenged persons prior to the reform in 1991.
Distance	Average traveling distance (in minutes) to the center of the municipality.
Rural	Percentage of population living in rural areas with less than 200 inhabitants.
Mono	Indeks of centricity. Mono=$\sum_k (\frac{F_k}{F})^2$, F=total number of people living in population centers with more than 200 inhabitants, F_k=number of people living in population centre k. Mono ϵ $[0, 1]$
Pop	Population size (/1000).

Table A3 Descriptive statistics. N=391.

Variable	Mean	Std.dev	Min	Max
NOP	6.1	1.5	3	10
ENOP	4.0	1.0	1.8	7.1
COAL1	0.44	0.50	0	1
COAL2	0.21	0.41	0	1
COAL3	0.26	0.44	0	1
COAL4	0.09	0.28	0	1
BOURG	31.8	17.8	0	79.3
WOMAN	32.3	8.1	10.5	56.5
DBUD (N=297)	0.26	0.44	0	1
ABUD (N=297)	0.29	0.45	0	1
COMMEMB (N=297)	2.66	1.52	1	5
COMTYPE (N=297)	0.17	0.38	0	1
TYPE*MEMB (N=297)	0.56	1.40	0	5
ADMTEAM (N=297)	0.51	0.50	0	1
MunicInc	22.4	7.1	14.8	79.0
PrivInc	97.0	13.5	68.8	166.0
Unempl	3.3	1.5	0.6	10.7
Singlepar	15.3	4.8	2.7	36.2
Child	9.4	1.2	6.8	14.0
Young	11.8	1.4	8.8	15.9
Elderly	15.8	3.6	6.6	29.8
Old	30.4	4.5	17.8	49.0
Mortalily	929.3	128.3	494	1490
Disabled	9.0	2.6	3.4	18.7
Alone	71.1	4.9	51.4	88.1
FemWork	63.2	5.0	48.5	81.7
MentChall	0.5	0.3	0	4.0
HostMunic	0.08	0.27	0	1
Rural	55.5	28.7	0.6	100.0
Distance	13.9	11.0	0.9	106.8
Mono	0.63	0.35	0	1
Pop	9.0	16.9	0.6	224.3

The DEA analysis covers 397 of the 435 Norwegian municipalities (1997). Six municipalities included in the DEA analysis (see Appendix A) is excluded due to missing data on the control variables. Further 94 municipalities lack data on some or all of the variables describing institutional arrangements. Data Sources: Statistics Norway and Norwegian Social Science Data Services' (NSD) databank of social, economic, demographic and political variables

describing each municipality. Data on the users of nursing and care services is also collected from this databank. The data on political and administrative organization is also provided by NSD. NSD is not responsible for the analysis of the data used or the interpretations made.

Appendix C: Selected estimation results

A4 Estimation results. N=391. t-values in parentheses.

	EffScore1[1]	EffScore2[1]	EffScore3[1]	EffScore4[1]
MunicInc	-0.332	-0.357	-0.284	-0.296
	(-2.37)	(-2.41)	(-1.77)	(-1.79)
PrivInc	-0.109	-0.044	-0.144	0.096
	(-1.30)	(-0.49)	(-1.49)	(-0.97)
Unempl	1.212	1.695	1.335	1.503
	(1.68)	(2.21)	(1.60)	(1.74)
Singlepar	-0.410	-0.319	-0.363	-0.295
	(-1.73)	(-1.27)	(-1.33)	(-1.05)
Child	-0.201	-0.527	-0.965	-1.321
	(-0.23)	(-0.58)	(-0.98)	(-1.30)
Young	-0.906	-1.023	-0.444	-0.811
	(-1.23)	(-1.31)	(-0.53)	(-0.93)
Elderly	0.457	0.215	-0.052	-0.285
	(1.15)	(0.51)	(-0.11)	(-0.61)
Old	0.654	0.669	0.608	0.503
	(3.10)	(2.99)	(2.50)	(2.01)
Mortality	0.017	0.015	0.011	0.010
	(2.33)	(1.96)	(1.33)	(1.18)
Disabled	-0.088	-0.092	0.043	0.050
	(-0.22)	(-0.22)	(0.09)	(0.11)
Alone	0.211	0.071	0.225	0.065
	(1.48)	(0.47)	(1.38)	(0.70)
FemWork	-0.083	-0.0005	-0.134	-0.043
	(-0.42)	(-0.00)	(-0.60)	(-0.19)
MentChall	-12.072	-2.524	-9.031	-1.087
	(-4.89)	(-0.95)	(-3.18)	(-0.36)
HostMunic	-2.503	2.153	-0.761	5.155
	(-0.85)	(0.68)	(-0.22)	(1.44)
Rural	-0.011	-0.005	0.00005	0.019
	(-0.23)	(-0.11)	(0.00)	(0.34)
Distance	0.132	0.152	0.217	0.209
	(1.85)	(2.01)	(2.50)	(2.29)
Mono	-3.817	0.649	1.000	4.794
	(-1.51)	(0.24)	(0.33)	(1.50)
Pop	0.786	0.973	1.487	1.580
	(2.91)	(3.26)	(3.78)	(3.76)

Continued

	EffScore1[1]	EffScore2[1]	EffScore3[1]	EffScore4[1]
Rural*Pop	0.005	0.011	0.002	0.005
	(0.86)	(1.83)	(0.34)	(0.67)
Distance*Pop	-0.015	-0.019	-0.020	-0.017
	(-1.59)	(-1.99)	(-1.47)	(-1.16)
Mono*Pop	-0.194	-0.348	-0.819	-0.981
	(-0.80)	(-1.29)	(-2.31)	(-2.58)
BOURG	0.10	0.134	0.127	0.152
	(1.90)	(2.41)	(2.10)	(2.44)
WOMAN	0.79	0.021	0.075	0.017
	(0.92)	(0.23)	(0.76)	(0.17)
NOP	-2.009	-3.121	-2.658	-3.312
	(-2.94)	(-4.29)	(-3.35)	(-4.05))
Constant	65.765	72.593	86.206	101.219
	(2.11)	(2.20)	(2.40)	(2.75)
σ	12.541	13.226	14.301	14.591
	(26.41)	(25.52)	(24.57)	(23.68)
Log-L	-1462.603	-1429.843	-1399.404	-1344.495

1 EffScore*100

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Chapter 6

Horizontal equity versus local discretion in decentralized public provision systems: An empirical analysis of client care levels within long-term care of elderly in Norway

Horizontal equity versus local discretion in decentralized public provision systems: An empirical analysis of client care levels within long-term care of elderly in Norway

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Abstract

Decentralization of important welfare services to the local government sector introduces a tension between local discretion to adjust to voter preferences and central government concern for horizontal equity. This paper takes advantage of a unique dataset for the Norwegian long-term care services to study whether the local governments differ in their choice of service standards. The discussion focuses on the equalizing properties of the centralized system of financing of the local government sector in Norway. Restriction of local taxation and the system of intergovernmental grants are intended to secure equalization of 'economic opportunities' and enable the local governments to provide uniform service levels. A multilevel modeling approach is applied in the empirical analysis. The results show a positive relationship between municipal income and client care levels, indicating that the centralized system of financing fails to achieve full tax and expenditure needs equalization. The results also indicate varying local priorities with regard to service levels within long-term care.

1 Introduction

A characterizing feature of the Norwegian welfare state is decentralization of responsibilities to the local government sector. Major welfare services such as schooling, health care and care of the elderly and the disabled are taken care of at the local level. About 60 percent of total public consumption is found within the counties and the municipalities (NOU 1997: 8). The economic rationale for decentralization of public responsibilities to local governments is to secure efficient allocation of resources as summarized in the decentralization theorem (Oates 1972). Decentralization allows local governments to adjust to local costs and preferences, which may produce welfare gains compared to standardized national solutions. However the variation in service levels between the local governments following full local freedom to tax and spend may come at odds with the distributional goals of the welfare state. This has been a recurring issue in the Norwegian debate of local government autonomy. Decentralization of important welfare services introduces a tension between local discretion to adjust to voter preferences and central government concern for horizontal equity (Borge and Rattsø 1998).

Decentralization gains are achieved by allowing variation in local spending levels. Variation in the local governments' per capita spending within a given service sector can be decomposed according to source of variation: demand, coverage, production costs and service standards[1]. The demand for services is related to socio-demographics such as the age-composition of the population and is generally exogenous to the local government. Production costs are also partly outside the local government control. Population size and settlement pattern affect production costs through scale economics and constrains put on organization of activities. Cost-efficiency, coverage and service standards on the other hand are subject to local government discretion. Local discretion is exercised within the limits set by the local financial capacity and central government regulations.

From the central government's point of view there is an important distinction between variation in service levels due to varying local conditions and variation due to differences in local priorities. If the central government's aim is to achieve equalization of service levels across the country, then variation

[1] Per capita spending can be decomposed as follows: $\frac{SPENDING_j}{POP} = \frac{POP_j}{POP} \times \frac{USERS_j}{POP_j} \times \frac{SPENDING_j}{SERVICES_j} \times \frac{SERVICES_j}{USERS_j}$, where $SPENDING_j$ is total spending within service sector j, POP is population size, POP_j is the size of the target population of service j, $USERS_j$ is the number of peoples served, and $SERVICES_j$ is the level of services produced. Then the first term on the right hand side expresses the demand for service j, the second term is the coverage ratio, the third term captures unit costs, and the last term gives the (average) service standard.

in local conditions can be equalized by use of different financial instruments, while varying local priorities demand central regulation of service levels. The latter is, in the extreme, equivalent to centralization of responsibilities.

The Norwegian central government uses several instruments to constrain local government discretion, including various regulations on service standards and accessibility[2]. On the financial side the local governments are heavily restricted in their autonomy in taxation[3]. Due to variation in tax bases and socio-demographic conditions, constraining local discretion to tax is not sufficient to enable the local governments to offer uniform service levels. Thus the central government co-finance the local governments through a grant system. The grant system is intended to secure equalization of 'economic opportunities' and combines tax equalization with expenditure needs equalization based on objective criteria. The expenditure need equalization part of the grant system is said to fully compensate for variation in demand and involuntary cost factors[4].

Even though the centralized system of financing curtails local autonomy on the revenue side the local authorities still have discretion in setting priorities regarding the composition of services. Furthermore the grant system does not fully equalize tax revenue differences between the local authorities. Thus, despite the equalization ambitions of the central government, there are relatively huge differences in local spending patterns. To illustrate, the budget share of primary education varied from 0,18 to 0,44 and the budget share of primary health care, social services and long-term care varied from 0,21 to 0,60 in 1996 (NOS C 475).

Previous Norwegian studies in the field of local public finance (e.g. Rattsø 1989, Borge and Rattsø 1995) have analyzed determinants of variation in per capita spending and budget shares of different services between the municipalities, relating spending variation to differences in local economic and structural conditions. The importance of municipal income (per capita grants and tax revenues) in explaining variation in spending patterns is well documented. Increased municipal income generally increases the spending levels in all service sectors. However, the income elasticities vary considerably. Borge and Rattsø (1995) reports long-run Engel elasticities in the range of 0,7 for primary education to 1,9 for childcare.

[2] E.g. primary education is compulsory, and everybody is entitled to secondary education.

[3] Income tax and wealth tax are the major tax revenue sources. The local discretion in setting tax rates are limited to a narrow band and all municipalities uses the maximum rate.

[4] This of course depends on how well the criteria used to calculate expenditure needs reflects actual demand and cost conditions.

Due to the compounding sources of variation in per capita spending, differences in spending levels between the local governments do not necessarily imply differences in service levels offered to clients with identical needs. This paper takes advantage of a unique dataset for the Norwegian long-term care services to study whether the local governments differ in their choice of service standards. The impact of the centralized system of financing of the local government sector in Norway is analyzed by the effect of municipal income on client care levels.

The responsibility of providing long-term care services lies within the 435 municipalities. They are charged with offering the full range of services, from home based care, such as home-help and home-nursing, to full scale institutionalized care in nursing homes. The municipalities are multi-purpose authorities. Besides long-term care the municipalities also organize primary education, kindergartens, primary health care, social services, culture and infrastructure. Long-term care accounted for 1/4 of total current expenditures in 1996[5]. The municipalities' expenditures within the long-term care services amounted to 6,900 NOK per capita, adding up to a total of 30 billion NOK. This is about the same amount as the total outlay on specialized health care, for which the 19 counties is responsible. The elderly constitute the major user group, 4 out of 5 persons receiving long-term care services are 67 years or more[6]. The per capita expenditure is about 50,000 NOK measured relative to the number of people aged 67+. The care offered is either free of charge or heavily subsidized. User charges cover only a small share of total expenditures to long-term care, less than 10 percent in 1993 (NOU 1997:17).

Even though user charges may to some degree regulate the demand for long-term care, the type and level of care offered is determined by the local government. The latent conflict between central and local authorities resulting from the decentralization of responsibilities of the welfare-state also pertains to long-term care. The main goal for the long-term care services as expressed in central government documents is that 'everybody in need of long-term care is entitled to a satisfactory and, as much as possible, equivalent supply of care independent of where they live, their level of income and their social status' (St meld nr 50 (1996-97)).

This paper aims at investigating variation between the municipalities in the type and level of care offered each client. A simple demand model framework provides a theoretical point of departure for the analysis of the local government decision on individual care levels. The empirical analysis is based on data on individual consumption of publicly provided care and incorpo-

[5]Local government accounts. Statistics Norway.

[6]Nursing and care statistics. Statistics Norway.

rates both client needs characteristics and economic, structural and political characteristics of the local government. Two features of the care offered is analyzed, the probability of being offered institutionalized care in a nursing home, and the number of hours of care provided for those receiving home care.

The paper also addresses the problem of spurious regression relationships in analysis of data having a natural hierarchical structure. Micro-econometrical analyses tend to ignore the possible interdependence among lower level units (individuals) nested within higher level units (here: municipalities). The Norwegian long-term care system provides a setting well suited to address the potentially severe biases in estimation results, also known as Moulton bias (Moulton 1986), when applying OLS or similar regression techniques when the data have this kind of grouped structure. Neglecting the potential problem of random group effects is especially problematic if the analysis incorporates higher level explanatory variables since the bias in OLS estimates may be particularly severe for variables that do not vary within groups. A multilevel modeling approach incorporating random variation at both the individual and municipal level is applied in the empirical analysis. Standard regression analyses ignoring random group effects are also performed serving as a basis for comparison. The potential grouping effect is overlooked in most studies of individual demand for long-term care (e.g. Ettner 1994, Hoerger et al. 1996, Reschovsky 1996, 1998). Even though the problem need not be as apparent as in our case, intra-group error correlation is likely to be present in long-term care systems where the provider of services or third-party payers play an important role in determining the access to and the level and composition of services offered, e.g. as is the case with public fee-for-service financing where the shaping of the financial system may vary between responsible authorities and perhaps even more so in managed care systems (Degenholtz et al. 1999, Carey 2000).

The theoretical approach to the local government decision on client care levels is developed in section 2. The data and the empirical specification of the allotment functions are discussed in section 3, while the econometric results are presented and discussed in section 4. Section 5 provides some concluding remarks.

2 Theoretical approach

The dominating approach to the analysis of local government provision in the literature is the median-voter model (Inman 1979, Rubinfeld 1987). The median voter theorem states that with majority voting the chosen level of

public provision corresponds to the level preferred by the voter with median demand (Mueller 1989). Thus local government provision is identified by the demand function of the median voter. The median-voter approach focuses on the determination of the aggregate level of public provision. However, the demand framework can be modified to incorporate the distributional aspect of public provision as in e.g. Behrman and Craig's (1987) analysis of distribution of police protection among neighborhoods.

The demand framework modeling local public decisions as a result of constrained maximization serves as the startingpoint also for the analysis of the determination of individual long-term care service levels. However, due to the well-known shortcomings of the median voter approach in case of multidimensionality, the voting mechanism is played down focusing instead on the local authority's decision-making process. The modeling of the local decision process follows previous studies of the local governments' spending decisions in Norway, starting with Rattsø (1989). The centralized system of financing limits the municipalities' ability to influence the income side of the budget. Hence the municipal revenue is assumed to be fixed. The local decision making is modeled 'as if' a community preference function (Wildasin 1986) is maximized subject to the exogenous budget constraint. For sake of simplicity we ignore the allocation of other municipal services than long-term care on households and merge all other services into a composite good. The preference function then include long-term care services (Y) and the composite good (X):

$$V(Y, X; D, Z, I) \tag{1}$$

The local decision-makers are concerned about the distribution of long-term care services among recipients. Thus Y is a vector of individual service levels $(y_1, .., y_N)$, where N is the total population being served. The municipality is assumed to put unequal weight on clients with unequal needs and the preferences are conditional on client specific characteristics represented by the vector D=(d_1,d_2,...,d_N). Furthermore local preferences are assumed to be conditional on other structural characteristics of the municipality (Z) influencing the desired service composition. I represent per capita private consumption and is included to allow for the marginal rate of substitution between local public services to depend on the level of private consumption. The local authority is assumed to have perfect information about the long-term care needs of their elderly population, and the final consumption pattern reflects the local government's allotment decisions. Theisen (1997) discusses the distributional implications of uncertainty concerning the assessment of individual needs within a theoretical framework similar to the one adopted

here. The local decision problem reduces to:

$$\underset{y_1,..,y_N,X}{Max} V(y_1,..,y_N,X;D,Z,I) \qquad s.t \qquad \begin{aligned} \sum_{i=1}^{N} p_y y_k + p_x X &\leq R \\ y_i &\geq 0, \\ i &= 1,..,N \end{aligned} \tag{2}$$

p_y and p_x represent the unit price of long-term care and the composite good respectively, and R is the total per capita exogenous revenue. The optimization process defines the individual allotment functions:

$$y_i = g_i(p_y, p_x, R; D, Z, I) \tag{3}$$

The distribution of long-term care services on clients depends on unit costs of services, municipal income, local structural characteristics, private consumption, and individual need characteristics. Client care levels are expected to decrease with unit cost of long-term care and increase with the level of municipal revenues. Individual service levels also depend on the composition of long-term care service needs in the population. The variables measured by Z can be seen as indicators of aggregate demand for municipal services captured by the composite service X, influencing the local government's preferred budget allocation. The major municipal services are targeted toward different age groups. Hence the age-composition of the population is an important determinant of aggregate demand for services, i.e. an increase in the number of children in school age is expected to increase the demand for primary education and to have a negative impact on long-term care budgets and hence on individual care levels.

3 Data and empirical specification

The empirical analysis of individual care levels is based on data from an information and management system called Gerix which is developed for the Norwegian long-term care services. The Gerix data provides comprehensive information on individual clients including variables capturing needs and variables describing the type and amount of services received. The Gerix data covers all users of long-term care services within the municipality. The users are highly heterogeneous with respect both to age and type of disabilities and needs. We concentrate on the major user group, the elderly aged 67 years or more, excluding mentally challenged users and young and middle-aged persons with chronic psychiatric or physical illnesses and disabilities.

The number of weekly hours of direct care received provides an approximate measure of individual care levels provided by the municipality. The reported weekly hours of care is said to be of poor quality for the clients receiving institutional care[7]. To get around the problem the analysis of individual care levels is performed in two rounds. First, the fact that a client receives institutional care is in itself an indication of the care level received since the average nursing home client receives much higher numbers of weekly hours of care than the average home care client[8]. Furthermore, institutional care differs from home care since the former implies 24-hours access to qualified care and supervision. A discrete choice approach is chosen for the analysis of the allotment of nursing home care. The dependent variable is a dichotomous variable ($Inst$) taking on the value of one if the individual receives nursing home care and zero otherwise. Next, the amount of care offered persons receiving home care is analyzed separately. The dependent variable ($Home$) is the natural logarithm of the total number of hours of care provided per week in the form of help with (1) activities of daily living (ADL) and (2) instrumental activities of daily living (IADL), (3) rehabilitation of ADL functions, (4) rehabilitation of IADL functions, (5) home nursing and (6) activities directed towards strengthening psychological and social functioning. Other care and services provided, i.e. in form of supervision or meals-on-wheels and safety-alarms, are not included[9]. The logarithmic formulation prohibits the possibility of negative estimates on hours of home care received.

The allotment functions derived in the previous section specify the individual care levels as function of two set of explanatory variables, client needs characteristics measured at the level of each client and local government characteristics measured at the municipal level. Table A1 in the appendix provides a description of the variables used in the empirical analysis.

The primary client needs characteristic included is the variable capturing functional status ($Func$), i.e. disabilities related to ADL and IADL functions, and cognitive and emotional problems. Functional status is found in US studies (e.g. Ettner 1994, Reschovsky 1996, 1998) to be a major determinant of the demand for long-term care. Functional status is also likely to be an important factor in the municipal assessment of needs. Age and sex are

[7] E.g. based on nurses evaluation in a survey conducted by the national union of trained nurses in 1995.

[8] In our data the average number of weekly hours of care for nursing home clients and home care clients are 28 and 5 respectively.

[9] A few clients receives only the kind of services not included in the registration of weekly hours of care and hence are registered with zero hours of care. These clients drop out from the analysis since the natural logarithm of hours of care is used as the dependent variable.

also previously shown to influence the demand for long-term care. Dummy variables indicating marital status and household status (whether the person lives alone), and a variable capturing the access to informal (unpaid) care are included as indicators of the amount of social support available to the elderly, which may at least to some extent be a substitute for formal care. Household status and access to informal care are only included in the home care analysis[10]. The allotment functions define individual care levels as function of a vector of client characteristics. This specification cannot be estimated. Thus the empirical specification only include the client's own characteristics. The influence of other clients' characteristics is represented by socio-demographic variables measured at the municipal level reflecting aggregate demand.

The purpose of the empirical analysis is to investigate differences in care levels between local governments. Client characteristics function as control variables. The variable of primary interest is municipal income, measured by the total per capita tax revenues and general grants ($MunicInc$). The estimated effect of municipal income on individual service levels relates to the discussion of the distributional properties of the grant system. The purpose of the grant system is to equalize tax revenues and expenditure needs and thus enable the local governments to provide uniform services levels. If long-term care service levels is found to be significantly related to the level of municipal income then the centralized system of finance fails to eliminate differences in client care levels due to varying local economic conditions.

Previous studies of Norwegian local authorities, e.g. Rattsø (1989) and Borge and Rattsø (1995), have shown that the overall service composition is influenced by local socio-demographic characteristics representing measures of aggregate demand. Within an exogenous budget constraint there is a struggle between different user-groups, first and foremost different age groups, for resources. An increase in the population share of children in school age increases the demand for primary education, while an increase in the elderly population increases the budget share of long-term care. The share of children ($\%Child$), youth ($\%Youth$), and elderly ($\%Elderly$) in the population, and the share of the old amongst the elderly ($\%Old$) are included to capture the political influence of different age-groups. A second set of variables assumed to influence the aggregate demand for long-term care services

[10]For nursing home residents household status reflects their situation after entering the nursing home, i.e. if they live in a single-bed room or shared room. There may be a general simultaneity problem related to the informal care variable, i.e. feedback effects from municipal care to informal care. The problem is likely to be more severe for institutional care than for home care, since nursing home care implies that the elderly is removed from their home and local community into an environment that provides 24-hours access to supervision and care.

is also included. High mortality rates ($Mortality$) and a high share of the old population living alone ($\%Alone$) is assumed to increase the demand for long-term care services amongst the elderly. While an increased population share of mentally challenged persons ($\%MentChall$) and non-senior disabled persons ($\%Disabled$) may imply a tougher competition for long-term care services. The analysis also include a dummy variable ($HostMunic$) indicating whether the municipality is a former 'host-municipality' for a specialized institution for severally mentally challenged persons[11]. Traditionally women have been the primary suppliers of informal (unpaid) care to their elderly relatives. The female work-participation rate ($FemWork$) is included to capture the possible lower capacity for informal care in municipalities with a high work-participation rate for women. The level of private consumption, assumed to influence the desired composition of local public services, is represented by the per capita private after-tax income ($PrivInc$).

Data on relative prices of municipal services are not available. However, population size (Pop) and settlement pattern, here represented by the average traveling time to the center of the municipality ($Distance$), are expected to affect relative prices and are included to represent local cost conditions. The grant system includes a special grant for the municipalities in Northern-Norway. The argument for the extra grant to Northern-Norway is special climatic and structural conditions not captured by the criteria used in the grant system. The grant is also motivated by regional political considerations (NOU 1996:1). We control for the potential cost-disadvantage of being located in the north of Norway by entering a dummy for the municipalities in Northern-Norway ($North$).

Finally, we include a set of variables describing local politics. The Norwegian municipalities are formally run by the local council. The representatives holding seats in the local council are elected on basis of party affiliation. The municipalities differ a lot, both in the size and number of parties represented and with regard to the political orientation (color) of the parties dominating local politics. The importance of the political system in understanding the behavior of the local public sector is evident from previous Norwegian studies, e.g. Kalseth and Rattsø (1998). The results in Kalseth (2000) document the significance of ideological orientation and political fragmentation for efficiency variations within the long-term care services. It is of interest to investigate whether political factors also affect the service level offered indi-

[11] In 1991 the responsibility of providing long-term care to mentally challenged persons with comprehensive needs was transferred from the counties to the municipalities. The municipalities where the specialized institutions were located prior to the reform (the 'host-municipalities') have a relatively high share of mentally challenged persons demanding high service levels.

vidual clients. The influence of local politics on service levels demonstrates the operation of local discretion in setting priorities. The share of socialist representatives (Soc) and the number of parties represented in the local council (NOP) are included to capture the effect of political orientation and party fragmentation respectively. The share of female representatives ($FemRepr$) is included to capture other aspects of representation than party color.

The data have a nested, or grouped, structure; individual clients are nested within provider units, i.e. municipalities. In such a setting group specific effects are to be expected. With higher level variables to be estimated fixed effect, or least square dummy variable, models are not feasible. Assuming random group effects the individual error terms will be composed by both client specific and municipal specific components. The composite error term will be correlated for clients living within the same municipality violating the standard assumptions of independence and common variance. Ignoring the 'intra-class correlation' and applying standard regression approaches such as ordinary least squares (OLS) give downward biased estimates of standard errors and the significance levels of parameters will be misleading (overestimated). In the empirical analysis a multilevel regression model is applied which incorporates random parameters both at the individual and municipal level (Goldstein 1999). When involving only random intercepts the model is equivalent to the error component, or random effects, model of the panel data literature (Maddala, chapter 14). When group sizes are large, as in our case, multilevel analysis provides consistent estimates also in the case when the random group effects are correlated with the regressors (Blundell and Windmeijer 1997).

The multilevel specification for the linear regression model in the case of a single explanatory variable at each level is illustrated in equation (4):

$$y_{il} = \beta_0 + \beta_1 d_{il} + \gamma_0 z_l + u_l + e_{il} \tag{4}$$

The dependent variable y_{il} is in our case the natural logarithm of the number of hours help per week received by individual i ($i = 1, .., N_l$) in municipality l ($l = 1, .., L$), and d_{il} and z_l are the explanatory variables measured at the individual and municipal level respectively. The random part of the model is represented by the composite error term $u_l + e_{il}$, where e_{il} is the random error term for the ith user within the lth municipality and u_l represent unmeasured variation at the municipal level, and both random errors are assumed to be normally distributed with zero mean and constant variance, σ_e^2 and σ_u^2 respectively. Furthermore, we assume that the random disturbances at the individual and municipality level are uncorrelated, i.e. $\text{cov}(e_{il}, u_l)$=0. Thus the conditional variance of y_{il} equals $\sigma_e^2 + \sigma_u^2$. There is

a positive covariance between any two users within the same municipality, equaling $\text{cov}(u_l, u_l)=\sigma_u^2$ since the error terms associated with the individual level are assumed to be independent. The 'intra-group correlation coefficient' $\rho = \sigma_u^2(\sigma_u^2 + \sigma_e^2)^{-1}$ provides a measure of the strength of the grouping effect (Goldstein 1999).

For the discrete choice model let π_{jl} be the probability that user j in municipality l receives institutionalized care. Assuming a logistic distribution for the expected probability (using the same general variable notation as for the linear model for simplicity) we have:

$$\text{Prob}(y_{jl} = 1) = \pi_{jl} = [1 + e^{-(\beta_0+\beta_1 d_{jl}+\gamma_0 z_l+u_l)}]^{-1} \tag{5}$$

where the random disturbance at the municipal level u_l again is assumed to be normally distributed with zero mean and constant variance σ_u^2. The response variable y_{jl} , equaling 1 if the user receives nursing home care and 0 otherwise, is assumed distributed as Binomial$(1, \pi_{jl})$. The conditional variance of y_{jl} $\text{var}(y_{jl}|\pi_{jl})=\pi_{jl}(1 - \pi_{jl})$. The model can now be written as in equation (6):

$$y_{jl} = \pi_{jl} + e_{jl}w_{jl} \tag{6}$$

where $w_{jl} = \sqrt{\pi_{jl}(1 - \pi_{jl})}$ and $\sigma_e^2 = 1$.

The linear regression model is estimated using the restricted iterative generalized leased square (RIGLS) method. Starting with reasonable estimates of the parameters of the deterministic part of the model the iterative GLS procedure (IGLS) alternates between estimation of the fixed and random parameters until convergence. The maximum likelihood estimates produced by applying IGLS under the assumption of multivariate normality will generally be biased. The RIGLS procedure adjusts for the sampling variation of the fixed parameters. The discrete choice model is estimated using the 2nd order predictive quasilikelihood (PQL) procedure. The model is linearized using a Taylor series expansion using the first derivatives of the nonlinear function for the fixed part and the first and second derivatives for the random part. With the PQL the Taylor series is expanded around the predicted value of the current iteration of the RIGLS algorithm, i.e. using the current estimate of both the fixed and random parameters. Goldstein (1999) provides thorough description of the estimation procedures. The estimation is performed by use of the MLWin software package (Rasbash et al. 2000).

The development of the Gerix system started around 1990 and by 1996, the year of study, 48 municipalities have taken the system into active use[12].

[12]The current official long-term care statistics in Norway does not provide information on individual users, only aggregate measures on the level and composition of services.

Our sample covers 40 municipalities excluding those that do not provide complete data for their long-term care services. Users with missing values on variables used in the analysis are excluded[13]. The resulting sample covers 19,234 elderly users of long-term care services residing in the 40 municipalities. The number of elderly users per municipality ranges from 56 to 2,550.

If the municipalities using the Gerix system differ from the non-users in relevant aspects it may represent a potential selection-bias problem. Small municipalities, in terms of population size, are clearly underrepresented in the sample, see table A2 in the appendix. Since the sample may be less representative for the small municipalities results both for the full sample and for a reduced sample excluding municipalities with less than 3,000 inhabitants is presented. Excluding the municipalities with less than 3,000 inhabitants reduces the sample to 36 municipalities covering 18,824 persons.

Table A2 provides sample means for the full sample and for the municipalities with less than 3,000 inhabitants. Separate figures for individual characteristics for home care clients are shown. For the municipal characteristics national means are also shown. The majority of the long-term care clients, 74 percent, receive home care. The elderly offered nursing home care are on average more functionally impaired and somewhat older than the average home care client. On average the home care client receives 5.1 hours of care per week. A majority, 74 percent, of the elderly receiving home care lives alone and 57 percent have access to less than six hours of informal care per week. The elderly users living in the four municipalities with less than 3,000 inhabitants are somewhat less disabled, are more often married and male, are less likely to live alone, and have more access to informal care. The average number of hours of home care is somewhat higher for the small municipalities, but the proportion of users receiving institutionalized care do not differ from the larger municipalities.

The municipalities included in the sample clearly differs from the rest of the municipalities in two respects. They are larger, are more often 'host-municipalities'. Further, larger municipalities tend to have lower municipal income, a younger population and be more politically fragmented.

4 Results

The results for the discrete choice of institutionalization are presented in table 1 and the results from the analysis of hours of care offered clients receiving home care are presented in table 2.

[13] All the users in one municipality have missing value on marital status. To avoid excluding the municipality, missing values on marital status are imputed.

Table 1 Logit estimation of probability of institutionalization[a].

	Full sample		Pop > 3000	
	'Standard' Logit	Multilevel	'Standard' Logit	Multilevel
Cons	-6.784 (-44.46)**	-7.013 (-29.60)**	-7.287 (-36.49)**	-7.451 (-17.89)**
Individual characteristics				
Func	4.655 (18.63)**	4.694 (17.81)**	4.642 (18.41)**	4.663 (17.50)**
$Func^2$	-0.382 (-7.87)**	-0.362 (-7.09)**	-0.379 (-7.74)**	-0.358 (-6.93)**
Age	0.0495 (13.37)**	0.053 (13.92)**	0.050 (13.35)**	0.053 (13.79)**
Male	0.000 (0.00)	-0.008 (-0.13)	0.003 (0.05)	-0.010 (-0.16)
Non-married	0.517 (8.07)**	0.547 (8.32)**	0.517 (7.98)**	0.540 (8.14)**
Municipal charactristics				
MunicInc	0.064 (7.07)**	0.052 (2.26)**	-0.021 (-0.83)	-0.017 (-0.23)
PrivInc	0.0107 (2,93)**	0.005 (0.29)	0.024 (4.64)**	0.022 (0.96)
%Child	-0.486 (-6.72)**	-0.034 (-0.17)	-0.562 (-6.84)**	-0.204 (-0.81)
%Youth	-0.192 (-2.96)**	-0.261 (-1.31)	-0.100 (-1.40)	-0.120 (-0.54)
%Elderly	-0.181 (-5.49)**	-0.047 (-0.52)	-0.163 (-4.26)**	-0.060 (-0.54)
%Old	0.003 (0.13)	-0.022 (-0.32)	-0.019 (-0.85)	0.009 (0.13)
%MentChall	-0.430 (-3.86)**	-0.403 (-1.24)	0.045 (0.27)	-0.065 (-0.13)
HostMunic	0.748 (6.89)**	0.862 (2.22)**	0.840 (7.60)**	1.018 (2.57)**
Mortality	-0.001 (-1.46)	0.001 (0.37)	-0.002 (-2.54)**	0.000 (0.04)
%Disabled	-0.006 (-0.17)	-0.057 (-0.54)	-0.043 (-1.18)	0.004 (0.04)
%Alone	-0.049 (-3.46)**	-0.048 (-1.32)	-0.037 (-1.90)*	-0.035 (-0.61)
FemWork	-0.071 (-4.76)**	-0.094 (-2.18)**	-0.071 (-4.62)**	-0.094 (-2.10)**
Distance	0.014 (2.78)**	0.027 (1.79)*	0.024 (4.01)**	0.034 (1.92)*
Pop	-0.000 (-0.10)	0.002 (0.31)	-0.003 (-1.68)*	0.005 (0.72)
North	0.271 (2.09)**	0.055 (0.14)	0.734 (4.78)**	0.0551 (1.14)
FemRepr	-0.015 (-3.03)**	-0.027 (-1.59)	-0.010 (-2.08)**	-0.019 (-1.08)
Soc	-0.020 (-3.98)**	-0.018 (-1.18)	-0.012 (-2.17)**	-0.007 (-0.39)
NOP	0.046 (0.97)	-0.007 (-0.05)	0.004 (0.08)	-0.038 (-0.26)
Random effects (standard errors in parentheses)				
σ_u^2		0.336 (0.086)		0.321 (0.086)

[a] t-values in parentheses. * and ** denotes significance at 10% and 5% level respectively.

Table 2 Regression of hours of home care received[a].

	Full sample		Pop > 3000	
	OLS	Multilevel	OLS	Multilevel
Cons	-0.062 (-1.78)*	-0.071 (-1.31)	-0.088 (-1.85)*	-0.110 (-1.16)
Individual characteristics				
Func	2.121 (27.09)**	2.101 (26.85)**	2.090 (26.52)**	2.077 (26.36)**
$Func^2$	-0.220 (-11.79)**	-0.217 (-11.60)**	-0.213 (-11.36)**	-0.211 (-11.25)**
Age	0.004 (3.70)**	0.004 (3.40)**	0.004 (3.69)**	0.004 (3.31)**
Male	-0.081 (-4.58)**	-0.081 (-4.62)**	-0.076 (-4.24)**	-0.075 (-4.23)**
Non-married	-0.006 (-0.20)	-0.003 (-0.12)	0.007 (0.26)	0.007 (0.26)
Alone	0.311 (11.69)**	0.307 (11.55)**	0.296 (10.97)**	0.295 (10.96)**
Inf. care-Little	-0.024 (-1.15)	-0.012 (-0.54)	-0.023 (-1.09)	-0.012 (-0.57)
Inf. care-Some	-0.070 (-3.32)**	-0.053 (-2.48)**	-0.066 (-3.10)**	-0.053 (-2.44)**
Inf. care-Much	-0.193 (-7.44)**	-0.179 (-6.81)**	-0.186 (-7.07)**	-0.173 (-6.50)**
Municipal characteristics				
MunicInc	0.013 (4.59)**	0.013 (2.14)**	0.007 (1.07)	0.004 (0.21)
PrivInc	-0.007 (-6.06)**	-0.008 (-1.81)*	-0.005 (-3.10)**	-0.004 (-0.67)
%Child	0.111 (5.26)**	0.058 (1.09)	0.144 (6.08)**	0.083 (1.40)
%Youth	0.033 (1.72)*	0.032 (0.64)	0.016 (0.76)	0.015 (0.28)
%Elderly	0.023 (2.36)**	0.011 (0.46)	0.021 (1.91)*	0.006 (0.22)
%Old	-0.017 (-2.59)**	-0.010 (-0.56)	-0.012 (-1.77)*	0.004 (0.21)
%MentChall	-0.026 (-0.79)	-0.025 (-0.30)	-0.012 (-0.26)	-0.011 (-0.09)
HostMunic	-0.012 (-0.36)	-0.003 (-0.03)	-0.027 (-0.81)	-0.001 (-0.01)
Mortality	0.0007 (3.95)**	0.0009 (1.74)*	0.0004 (2.18)**	0.0003 (0.61)
%Disabled	-0.023 (-2.39)**	-0.021 (-0.80)	-0.009 (-0.90)	0.003 (0.11)
%Alone	-0.018 (-4.39)**	-0.024 (-2.61)**	-0.008 (-1.49)	-0.014 (-1.05)
FemWork	-0.018 (-4.27)**	-0.012 (-1.13)	-0.016 (-3.81)**	-0.010 (-1.00)
Distance	0.004 (2.61)**	0.003 (0.89)	0.006 (3.30)**	0.006 (1.43)
Pop	-0.0043 (-8.42)**	-0.0043 (-2.39)**	-0.0045 (-8.26)**	-0.0041 (-2.49)**
North	-0.374 (-9.96)**	-0.369 (-3.71)**	-0.364 (-8.29)**	-0.328 (-2.91)**
FemRepr	0.013 (8.69)**	0.016 (3.58)**	0.012 (7.79)**	0.015 (3.47)**
Soc	-0.001 (0.67)	-0.003 (-0.69)	0.000 (0.22)	-0.001 (-0.13)
NOP	0.071 (4.98)**	0.082 (2.35)**	0.062 (3.98)**	0.057 (1.66)*
Random effects (standard errors in parentheses)				
σ_e^2	0.779 (0.009)	0.772 (0.009)	0.776 (0.010)	0.770 (0.009)
σ_u^2		0.021 (0.006)		0.017 (0.005)
Intra-group corr (ρ)		0.026		0.021
-2Logl	35014	34959	34198	34163
-2Logl (null)	41810	41291	40867	40382

[a] t-values in parentheses. * and ** denotes significance at 10% and 5% level respectively.

The average predicted probability of receiving nursing home care is 0.26, i.e. equal to the actual share of nursing home users. The model increases the proportion of correctly predicted cases, using a probability cutoff of 0.50, compared to a naive guess[14] from 0.61 to 0.87. The null of the estimates for all the variables equaling zero in the home care equation is clearly rejected using a likelihood ratio (LR) test [15].

4.1 Random group effects

The estimates on the intra-municipality variance indicate the presence of random group effects in our data. An LR test of the null of no random group effect in the analysis of hours of home care received is clearly rejected (55.2 with 1 d.f.). However the intra-group variation is small relative to the total variation. The intra-group correlation is only 0.026. Figure 1 and 2 show the estimated residuals associated with the municipal level for the nursing home and home care analysis respectively. The residuals are ranked in order of the size of the estimate. In order to assess differences between the municipalities the confidence intervals shown are constructed such that the significance level for judging non-overlap between any pair of residuals on average is 5 %. These are given by ± 1.39 standard errors of the estimate (Goldstein 1999). For most pair of municipalities the intervals do overlap. However, we see that the interval at each end of the ranking do not overlap. Thus there evidently are differences in care levels among municipalities.

Comparison of the results from the 'standard' Logit and OLS estimation and the Multilevel estimation show the severe biases in estimation results for the variables measured at the municipal level resulting from ignoring the intra-group error correlation among individuals receiving care from the same public provider. The downward bias in standard errors implies an increased probability of type I error, i.e. incorrectly rejecting the null hypothesis. Based on the results from the 'standard' Logit and OLS estimation a majority of the municipal characteristics appears to be significant. However only a few variables are significant at the 10 percent level when allowing random group effects. The estimation results for the individual characteristics are not affected much by the choice of estimation method.

Generally the biases will be larger the higher the average group size, the

[14] The naive model is based on a binomial random number generation given a probability of institutionalization of 0.261.

[15] The likelihood ratio statistic -2[Logl (restricted) - Logl (unrestricted)]=6332 for the full sample, which is distributed as χ^2 with 26 degree of freedom. The approximation of the log likelihood for nonlinear models is not reliable when the response is binary (Goldstein 1999).

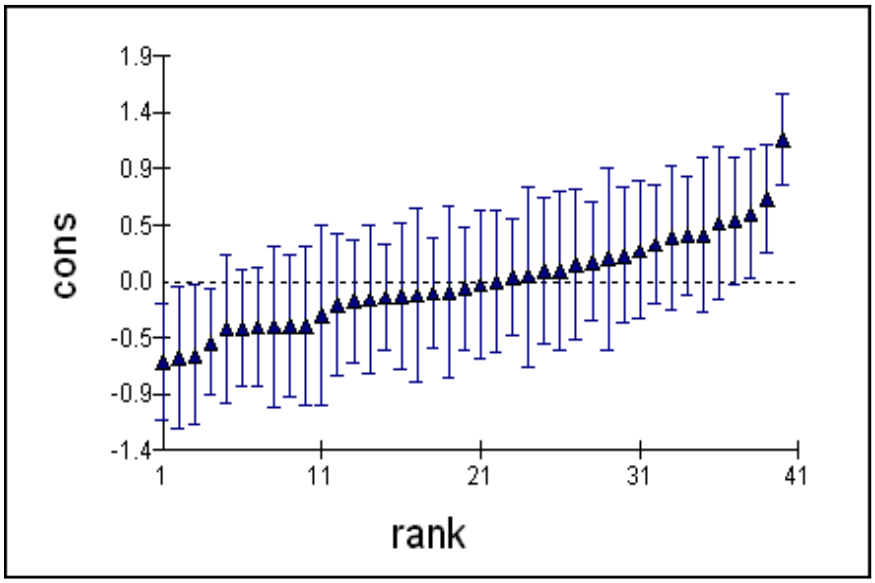

Figure 1: Simultaneous confidence intervals for the estimated municipality residuals. Probability of institutionalization.

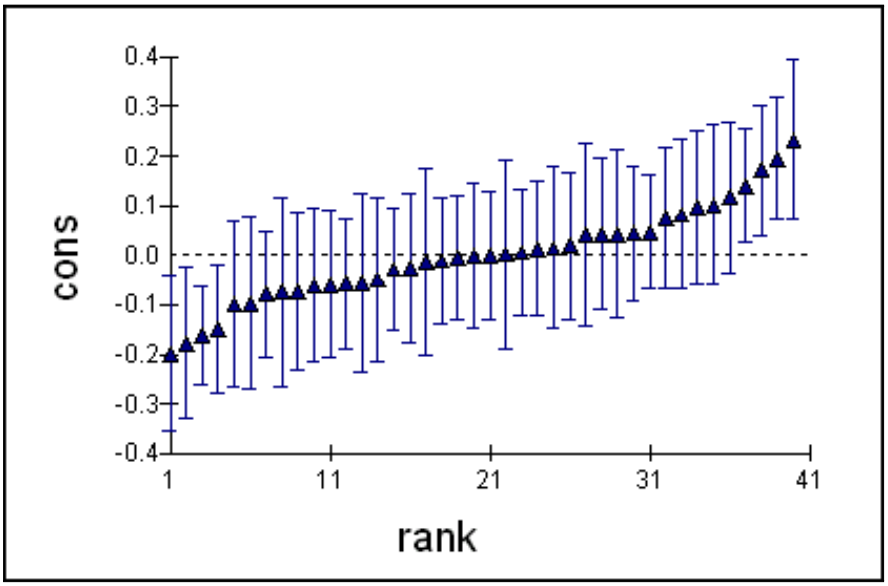

Figure 2: Simultaneous confidence intervals for the estimated municipality residuals. Natural logarithm of weekly hours of home care.

larger the variation in group size, the higher the intra-group error correlation and the higher the intra-group correlation of the regressors (Moulton 1986). Our dataset fulfills the first two conditions, the average number of users and the variation in the number of users per municipality is high. Given the structure of the dataset even a small intra-group error correlation may cause relatively large estimation biases if the intra-group correlation of the regressors is large enough. The municipal characteristics do not vary between individuals residing within the same municipality, i.e. the intra-class correlation equals unity. The bias will therefore be particularly large for this set of variables. The intra-group correlation of the individual characteristics, on the other hand, is low contributing to minor biases in the estimates for these variables.

4.2 Variation in municipal care levels

Client need characteristics are the major determinants of local governments' decision on individual service levels within long-term care of the elderly. The single most important variable, both concerning the probability of being offered nursing home care and for the service level received when being offered home care, is functional disability. Age and sex also influence the care offered. Furthermore, the municipalities take into account the living situation and the amount of social support available to the elderly in setting care levels.

The municipalities' decisions on the allotment of care to clients are taken under varying local conditions influencing the choice on the type and level of care offered. Firstly, there do seem to be an income effect. Elderly long-term care clients living in high-income municipalities are more likely to receive nursing home care than elderly with similar individual characteristics living in less affluent municipalities. Service levels for home care clients are also significantly positively related to municipal income. The effects are non-negligible. On average, the estimated effect of an 10,000 NOK increase in the per capita municipal income (equals 1,3 standard deviations) is to increase the probability of nursing home care by 4 percentage points[16] and the weekly hour of home care per client by 13 percent.

[16] In the logit model the marginal effects are given by $\Lambda(\beta' x)\left[1-\Lambda(\beta' x)\right]\beta$, where $\Lambda(\cdot)$ indicates the logistic cumulative distribution function (Green 1997, ch. 19) and x includes higher level variables. The scale factor, $\Lambda(\beta' x)\left[1-\Lambda(\beta' x)\right]$, is first evaluated at every observation then the sample average for the individual scale factors (0.083) is used. Thus the average marginal effect is calculated as $0.083^{*}\beta$. In a multilevel model the estimated probabilities is group specific. In the discussion of the results zero group effect is assumed.

Table 3 Interaction effects between functional status and municipal income[a].

	Full sample		Pop > 3000	
	I	II	I	II
Nursing home care				
MunicInc	0.030 (1.14)	0.0120(0.27)	-0.061 (-0.76)	-0.161 (-1.73)*
MunicInc*Func	0.020 (1.77)*	0.080 (1.30)	0.025 (1.59)	0.245 (2.50)**
MunicInc*Func^2		-0.012 (1.01)		-0.041 (2.33)**
Home care				
MunicInc	0.013 (1.98)**	0.006 (0.83)	0.005 (0.28)	0.001 (0.07)
MunicInc*Func	0.0008 (0.23)	0.051 (2.70)**	-0.002 (-0.44)	0.024 (0.99)
MunicInc*Func^2		-0.013 (2.70)**		-0.006 (-1.07)

[a] t-values in parentheses. * and ** denotes significance at 10% and 5% level respectively.

In the analysis the effect of municipal income is assumed to be equal for all users. However, the assessment of individual needs may systematically differ between different types of municipalities. In order to investigate whether 'rich' and 'poor' municipalities differ in their assessment of needs the model is reestimated including interaction terms between functional disability and municipal income. The results are reported in table 3. There is a tendency for the marginal effect of functional disability on the probability of institutionalization to be higher for high income municipalities than for low income municipalities[17]. The effect of municipal income on service levels for the home care clients also varies with functional status. The results reveal a $\cap$-shaped relationship. The marginal effect of municipal income is declining for clients with functional disability somewhat above the mean for home care clients, and is negative for high levels of functional disability. The latter result applies for less than two percent of the home care clients and is driven by the fit to the model for the 'lighter' clients. Adding a third degree term to the model is statistical significant (not reported) and captures a positive marginal effect of municipal income for clients with very high scores on the disability variable. Thus the difference in home care levels between high-income municipalities and low-income municipalities seem to be largest for clients with moderate needs.

The per capita private consumption does not seem to influence the local government decision on nursing home placement. There is however a tendency for the service level of home care clients to be negatively related to per capita private consumption. Hence, private consumption may be a substitute for publicly provided home care. The per capita municipal income is

[17] The effect is stronger assuming no direct effect of municipal income (not reported).

negatively correlated with the per capita private income. The grant system tends to translate private 'poverty' to public 'wealth' and vice versa.

Ignoring random group effects, the majority of the structural variables included to capture variation in aggregate demand and cost conditions appear to be significantly related to long-term care service levels of the elderly. However for most variables this is spurious regression relationship. The results for the multi-level analyses reveal no systematic relationships between e.g. the age composition of the population, which is the important determinant of the aggregate service composition, and client care levels. Some of the aggregate demand variables included are however found to be significantly related to client care levels. Firstly, elderly living in a former 'host-municipality' have a higher probability of receiving institutionalized care than others[18]. Next, the female work participation rate is found to have a negative impact on the probability of institutionalization. Assuming that the overall access to informal care is negatively correlated with the female work participation rate the estimated effect probably represent an aggregate demand effect, i.e. higher demand for services induces a substitution of home care for nursing home care. The female work participation rate may alternatively capture differences in local preferences on institutionalization. Finally, mortality rates and the share of single-person households among the elderly above 80 years of age seem to influence service levels of home care clients. High mortality rates are associated with higher service levels, while the share of single person households amongst the old is found to contribute to a lowering of the number of hours of care offered home care clients. The latter result probably reflects that the municipalities respond to an increase in the aggregate demand for home care services by reducing the amount of care offered each client. The opposite result for the mortality rate may indicate that the variable captures unmeasured variation at the individual level. The variables included to capture local cost conditions are also found to contribute to variation in service levels. Municipalities with a dispersed settlement in terms of high average traveling distance to the municipal center seem to be more prone to provide nursing home care to their elderly long-term care users. One possi-

[18]The dummy for 'host-municipalities', i.e. municipalities that were hosting specialized institutions for mentally challenged persons prior to the reform in 1991, was included to capture the high demand for long-term care services of mentally challenged persons in these municipalities, supposed to affect care levels of the elderly negatively. However the opposite effect is found. The intention of the reform in 1991 was to de-institutionalize the mentally challenged. Thus the municipalities were given the responsibility of providing long-term services in home like environments. Hence the reform implied that a considerable institutional capacity became free for alternative use. This is probably what is captured by the 'host-municipality' effect.

ble interpretation of the result is that it reflects a relative price effect. The cost of home care compared to institutionalized care is likely to be higher in municipalities with long traveling distances. Population size contributes to variation in home care service levels between the municipalities. Large municipalities offer less hours of home care than the smaller ones. This may also represent a price effect. Or it may indicate that the grant system does not fully capture the expenditure needs of the large municipalities as is sometimes claimed. We also find a strong negative effect on home care service levels of the dummy variable for Northern-Norway.

The results also demonstrate that local politics matter for individual care levels. There is a strong positive relationship between home care service levels and the share of female representatives in the local council. The estimated effect implies that a ten percentage point increase in the share of female representatives increases the weekly hours of care offered home care clients by about 15 percent. Client care levels are also found to be positively related to the number of parties represented in the local council.

The results discussed so far relate to the analyses based on the full sample. Not all the results carry over to the analysis of the sample excluding the small municipalities. Many of the municipal characteristics are correlated with population size contributing to unstable estimates. The effect of municipal income is sensitive to the exclusion of the smallest municipalities from the sample. The small municipalities are mostly found among the high-income municipalities. This has partly to do with the fact that population size is used as a criterion in the grant system, favoring the small municipalities. An income effect is not found for the larger municipalities, indicating a more successful income-equalization policy with regard to client care levels among the larger municipalities. However, the results in table 3 reveal an interaction effect between municipal income and functional disabilities for the probability of institutionalization also in the reduced sample. Excluding the small municipalities, the marginal effect of income becomes negative. The $\cap$-shaped relationship detected implies that differences due to income is largest for clients at each end of the disability scale. The high and low income municipalities are equally likely to offer institutionalized care to clients with average disability score for nursing home clients. The result for the high needers is moderated when allowing a more flexible specification of the interaction effect (not reported). There is a trend towards de-institutionalization within long-term care. Giving the elderly in need of long-term care the choice of independent living is a stated goal of the central government (St meld nr 50 (1996-97)). If the larger, high-income municipalities are in front of the development this may explain the above results. The results reveal no interaction effects for home care service levels among the larger municipalities.

4.3 Discussion

The analyses only cover elderly receiving care from the municipality. This may bias the results. The local governments may differ, not only in the amount of care consumed for those being offered municipal care, but also in the threshold for receiving care. Table A3 in the appendix shows the results of an analysis of long-term care coverage among elderly aged 67 years or more[19], covering a sample of 394 municipalities using data on elderly long-term care users from the Nursing and care statistics of Statistics Norway.

Variation in service levels due to varying local economic, structural and political conditions show up both in service standards and coverage ratios. The long-term care coverage ratio is positively related to per capita municipal income. Thus municipal income affects both client care levels and the threshold for receiving care. The coverage ratio is negatively related to per capita after tax private income again indicating that private consumption is a substitute for public provision of long-term care. The results reveal a negative relationship between coverage and the share of elderly in the population. Thus the struggle between the age groups for resources appears to show up in accessibility rather than service levels of those receiving care. The results confirm that the share of single-person households among the elderly above 80 years of age and the female work-participation rate are positively related to aggregate demand for long-term care services. Traveling distances within the municipality do not only affect the probability of receiving nursing home care. Municipalities with a dispersed settlement also have higher coverage ratios than municipalities with shorter average traveling time to the center of the municipality. Finally, the municipalities in Northern-Norway seem to trade-off service standards of home care clients for higher coverage among the elderly. Political fragmentation seems to have the opposite effect.

The centralized system of finance and mandatory spending does not constrain local discretion to the extent that we observe uniform service levels across the country. Variation in municipal income contributes to variation both in accessibility and services standards within the long-term care services. The grant system does not secure full equalization. The results of the analyses may indicate that the grant system in fact contributes to differences in service levels across municipalities by 'overcompensating' for cost-disadvantages due to (low) population size and (high) traveling distances. The municipalities with high expenditure needs ends up with the best service supply. The influence of local politics on client care levels demonstrates the exercise of local discretion in setting priorities.

[19] The coverage ratio is calculated as: $\frac{\text{Users aged 67+}}{\text{Elderly aged 67+}} * 100$.

The theoretical framework motivating the empirical analysis focuses exclusively on the municipal allocation process. This is a reasonable simplification as long as the services are free of charge or user charges are set so low that individual demand always exceeds municipal supply. Then the consumption pattern reflects the municipalities' assessment of individual needs. As a simplification user charges are not introduced in the model. The municipal decision on user charges is complex involving both the revenue effect and community welfare effects. The assumption of the individual consumption being supply constrained is likely not to hold for all elderly clients, in which case individual consumption reflects both client and municipal decisions. The results of the empirical analyses can be viewed as reduced form estimates. The Gerix data do not provide information on clients' income or other economic variables that may affect individual demand. Client income may also influence the municipal decision on allocation of care, e.g. the municipalities may adopt a discriminatory policy in the decision on which clients is to be offered nursing home care since high income individuals pays a higher price than low income individuals. The absence of client income in the econometric analysis may bias the result of the other variables.

The present analysis represents a first attempt to investigate variation in individual long-term care levels within a decentralized public provision system focusing on differences between the local governments. Hopefully, data on long-term care clients will be available for a larger number of municipalities in the future. More observations at the municipal level will give more precise estimates on variation among the municipalities in individual care levels. Future research should look more closely into the assumption of supplied constrained consumption of care and be directed towards disentangling provider decisions from individual demand effects.

The study demonstrates the importance of taking into account the grouping effects in micro-econometrical analyses of data having a hierarchical structure. Ignoring the possibility of random group effects implies that we assume that there are as many independent observations as there are individuals in the dataset. Given the fact that the municipality makes the decision on the amount and type of care offered it is not likely that the assumption will hold. Comparison of multi-level modeling results with the results from using standard regression techniques reveals the considerable spurious regression relationships found when applying the latter.

5 Conclusion

Client characteristics are the predominant determinants of individual consumption of long-term care in the decentralized public long-term care system in Norway. The municipalities allocate their long-term care budgets based on assessment of individual needs. There are however significant provider effects on individual care levels after controlling for client attributes, i.e. the care levels offered clients with identical attributes varies between the municipalities.

The decentralization of responsibilities of important welfare services such as long-term care challenges the central government concern for horizontal equity. The local governments face different economic and structural conditions constraining their choice set. The centralized system of finance is designed to prevent large differences in service levels across the country due to varying local conditions. However, the grant system does not fully equalize the 'economic opportunities' of the local governments. In fact the grant system seems to introduce inequalities. The revision of the grant system in 1997 was an attempt to improve the distributional profile of the system (NOU 1996:1).

Income and expenditure needs equalization is not sufficient to secure equalization in service levels. Decentralization of responsibilities implies local freedom in setting priorities. It is evident that differences in local priorities contribute to variation in service levels. The central government can, and do, limit undesirable inequalities due to variation in local preferences by imposing restrictions on service standards and accessibility. However, extensive regulation implies de facto centralization of responsibilities.

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Appendix

Table A1 Description of variables.

Variable	Description
Dependent variables	
Inst	=1 if person resides in a nursing home or old age home, =0 otherwise.
Home	The natural logarithm of hours of home care per week (sum help with (1) activitis of daily living (ADL) and (2) instrumental activities of dalily living (IADL), (3) rehabilitation of ADL and (4) IADL functions, (5) home health care and (6) activities directed towards strengthening psycological and social functioning.
Individual characteristics	
Func	Average score on 17 variables representing ADL and IADL disabilities and limitations in psychological and social functioning[a]. The score on each variables ranges from 1 (need no help/represent no problem) to 4 (entierly dependent on help to perform the activity/severly reduced functioning). The average score is rescaled such that the values range from 0 to 3.
$Func^2$	Average disability score (range 1-4) squared. The variable is rescaled such that the values ranges from 0-15.
Age	Age minus 67.
Male	=1 if male, =0 if female.
Non-Married	=0 if married or co-habitee, =1 otherwise.
Alone	=1 if persons lives alone, =0 otherwise.
Informal care	Reference cathegory=no access to informal care.
Little	=1 if acces to less than 5 hours a week, =0 otherwise.
Some	=1 if access to 6-10 hours a week, =0 otherwise.
Much	=1 if access to more than 10 hours a week, =0 otherwise.

Table A1 continued.

Variable	Description
Municipal charactristics[b]	
MunicInc	Tax revenues and grants per capita (in 1000 NOK).
PrivInc	After-tax income per capita (in 1000 NOK).
%Child	Precentage of population aged 0-6 years.
%Youth	Precentage of population aged 7-15 years.
%Elderly	Precentage of population aged 67 years or more.
%Old	Precentage of elderly population aged 80 years or more.
%MentChall	Percentage of population being mentally challenged.
HostMunic	=1 if the municipality were hosting an institution for mentaly challenged persons prior to the reform in 1991, =0 otherwise.
Mortality	Standardized mortality per 100 000 inhabitant, yearly average 1990-1994.
%Disabled	Percentage of population aged 16-66 receiving disablement benefits.
%Alone	Percentage of population above 79 years non-married, divorced or widowed.
FemWork	Female work partisipation rate. Percentage of female population 20-66 years of age.
Distance	Average traveling distance (in minutes) to the center of the municipality.
Pop	Population size(/1000).
North	=1 if the municipality lies in Northern-Norway (Nordland, Troms and Finnmark county), =0 otherwise.
FemRepr	Precentage of female representatives in the local council.
Soc	Precentage of socialist representatives in the local council (left-wing parties including the Labor party).
NOP	Number of parties (and non-party groups) in the local council.

[a] The 17 activities and conditions are; eating, dressing, toileting, bathing, getting aroung inside, getting around outside, preparing meals, doing laundry or housework, shopping for groceries, medical self-care, memory and concentration, insight in own situation, feeling of security, ability to make contact with others (create and maintain a social network), ability to take inititatives, ability to take responibility for everyday living and ability to communicate with others.

[b] The variables are measured as deviation from the national mean in the analyses.

Table A2 Descriptive statistics[a].

Variable	All users		Home care	
	Full sample	Excluded	Full sample	Excluded
#	19234	410	14167	302
Dependent variables				
Inst	0.26 (0.44)	0.26 (0.44)		
Home[b]			5.1 (8.4)	5.9 (6.7)
Individual characteristics				
Func (1-4)	2.03 (0.84)	1.91 (0.76)	1.68 (0.57)	1.58 (0.47)
Age	81.6 (6.8)	81.1 (6.8)	80.7 (6.6)	80.2 (6.4)
Male	0.26 (0.44)	0.37 (0.48)	0.26 (0.44)	0.38 (0.49)
Non-Married[c]	0.77 (0.42)	0.74 (0.44)	0.77 (0.42)	0.71 (0.44)
Alone			0.74 (0.44)	0.63 (0.48)
Informal care				
No			0.32 (0.47)	0.23 (0.43)
Little			0.25 (0.44)	0.16 (0.37)
Some			0.27 (0.45)	0.41 (0.49)
Much			0.14 (0.35)	0.19 (0.39)

Table A2 continued.

Variable	Norway[d]	Full sample	Norway, pop < 3,000	Sample, pop < 3,000
# municipalities	434	40	155	4
Municipal charactheristics[e]				
MunicInc	20,971 (7,505)	19,705 (8,589)	26,520 (9,054)	33,611 (18,618)
PricInc	89,862 (11,597)	93,794 (12,317)	83,389 (8,992)	88,284 (9,783)
&Child	9,4 (1,2)	9,6 (1,2)	9,1 (1,2)	9,3 (2,0)
%Youth	11.7 (1.5)	11.8 (1.4)	11.6 (1.5)	12.1 (1.3)
%Elderly	15.9 (3.8)	15.1 (3.0)	18.1 (3.2)	18.2 (3.2)
%Old	29.6 (4.4)	28.5 (2.5)	31.6 (4.9)	29.4 (2.0)
%MentChall	0.5 (0.3)	0.6 (0.6)	0.5 (0.3)	0.4 (0.2)
HostMunic	0.08 (0.27)	0.23 (0.42)	0.01 (0.11)	0
Mortalityrate[f]	932 (127)	918 (91)	949 (159)	886 (93)
%Disabled[g]	9.0 (2.6)	9.3 (2.5)	9.5 (3.0)	8.5 (3.2)
%Alone	71.1 (4.9)	70.9 (4.5)	71.3 (6.3)	65.5 (6.2)
FemWork	63.2 (5.1)	63.4 (4.4)	62.4 (5.9)	65.2 (6.2)
Distance	13.7 (10.6)	14.4 (9.8)	15.0 (14.0)	15.6 (4.6)
Pop	8,943 (16,811)	17,465 (26,538)	1,817 (689)	2,186 (573)
North	0.21 (0.40)	0.18 (0.38)	0.32 (0.47)	0.25 (0.50)
FemRepr	32.2 (8.2)	34.0 (8.8)	31.4 (10.0)	34.8 (13.3)
Soc	37.3 (14.3)	36.9 (12.5)	35.4 (15.0)	30.1 (12.9)
NOP	6.0 (1.5)	6.9 (1.4)	4.8 (1.1)	4.7 (0.5)

[a] Variable means, standard errors in parentheses.

[b] The actual number of hours of home care per week (not the natural logarithm).

[c] Excluding persons with missing value on the variable.

[d] Oslo, which also is a county government, is not included.

[e] The variables are measured as deviation from the national mean in the analyses.

[f] 6 municipalities (all pop < 3,000) have missing value on the variable. Non of these are represented in the sample.

[g] 2 municipalities (both pop < 3,000) have missing value on the variable. Non of these are represented in the sample.

Data Sources: Statistics Norway and Norwegian Social Science Data Services' (NSD) databank of social, economic, demographic and political variables describing each municipality. Statistics Norway and NSD are not responsible for the analysis of the data used or the interpretations made.

Table A3 OLS estimation of the coverage ratio[a].

Cons	11.57 (1.14)
MunicInc	0.191 (4.30)**
PrivInc	-0.110 (-3,16)**
%Child	-0.108 (-0.35)
%Youth	-0.205 (-0.79)
%Elderly	-0.249 (-1.97)**
%Old	0.274 (3.55)**
%MentChall	-0.765 (-0.72)
HostMunic	-1.046 (-0.97)
Mortalityrate	0.003 (1.17)
%Disabled	0.040 (0.27)
%Alone	0.182 (3.36)**
FemWork	0.126 (1.86)*
Distance	0.061 (2.55)**
Pop	-0.016 (-0.65)
North	2.101 (2.60)**
FemRepr	0.038 (1.21)
Soc	-0.028 (-1.31)
NOP	-0.652 (-2.91)**
R^2_{adj}	0.31

[a] N=394, t-values in parentheses.

* and ** denotes significance at 10% and 5% level respectively.