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Decentralization with Property Taxation to Improve Incentives: Evidence from Local Governments' Discrete Choice*)

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Abstract

Decentralization of government with property tax financing is the standard recipe for public sector reform. Fiscal competition is assumed to stimulate efficiency and hold down the tax level. Property taxation offers additional incentives for efficiency. We study the incentive mechanisms involved using data for decentralized governments and in a setting where they can choose to have property taxation or not. The empirical analysis addresses whether fiscal competition and political control problems influence the choice of having property taxation. The results indicate that both incentive mechanisms are relevant and consequently support the standard advice. Fiscal competition generates a distinct geographic pattern in local taxation and political fragmentation seems to motivate property taxation to control common pool problems. The main methodological challenge handled concerns spatial interaction with discrete choice.

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Key words: property taxation, fiscal competition, political fragmentation, Bayesian analysis, spatial autoregressive model.

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1. Introduction

Control problems and rigidities in public sector service provision have motivated search for incentive mechanisms to stimulate efficient provision. Decentralization to local governments with property taxation is the standard World Bank - IMF advice to developing and transition economies (re)forming the public sector. De Mello (2004) summarizes the arguments and the cross-country evidence. Recent empirical evidence on the design fiscal decentralization emphasize more conventional economic motivations, notably Arzaghi and Henderson (2005) and Panizza (1999). The empirical research on the effects of decentralization typically addresses the size of government (initiated by Oates, 1985, overview by Rodden, 2003). We offer an alternative empirical investigation into the incentive mechanisms involved in this design, fiscal competition and property value feed-back to control 'Leviathan' government.

Given the incentives involved, we study a key decision of local governments themselves: the choice of having property taxation or not. The situation in Norway facilitates the analysis since local governments can choose to have property taxation given regulated income tax revenue and grants. Our approach is to investigate whether the local choice is affected by fiscal competition and political control problems. If local governments themselves take these factors into account, we can assume that they are important in practice. The results confirm that the use of property taxation reflects fiscal competition and political fragmentation and consequently that incentives matter.

Fiscal competition is the major incentive mechanism of decentralized government. The starting point of the literature on tax competition is the concern that mobility leads to underprovision of public services Tax base mobility implies too low taxes because of fiscal externalities. Later the attention has moved to yardstick competition as an additional channel of fiscal discipline. Wilson and Wildasin (2004) present a recent overview and with discussion of the empirical literature. We read the empirical studies as an overwhelming support of the existence of strategic interaction at the local government level, and that both tax base mobility and information asymmetries may be of importance. We investigate the importance of fiscal competition for the decision to have property taxation utilizing Norwegian data. The analysis implies some econometric challenges of spatial models with discrete dependent variables that are addressed.

Brennan and Buchanan (1978, 1980) introduced the design of tax systems as incentive mechanism. Their main approach is the control of' 'Leviathan' government, but they also discuss incentives of public service provision. In particular they show how governments are stimulated to supply public services when the tax base is complementary to the provision of the public services. The more recent literature on tax incentives have concentrated on property taxation. Oates (2001) summarizes the arguments that property taxes facilitate efficient local fiscal decision-making. When property taxation can help control government officials, property taxation will be more desired the larger the imperfections of the political decision making process. We expect that voters will be more eager to have property taxation when the political system is inefficient. In the tradition of Roubini and Sachs (1989), the main source of fiscal inefficiencies is political fragmentation. Perotti and Kontoupolos (2002) offer an updated evaluation of fragmented government. The stylized fact is that political fragmentation leads to excessive spending and fiscal imbalance. This literature leaves an open question what voters do to overcome the consequences of political fragmentation. Redesign of political institutions is an obvious alternative. But since this is cumbersome and with no easy alternatives, it seems natural to look for alternative mechanisms. We relate the decision to have property tax to the degree of political fragmentation in the local government.

Given the 'Leviathan' government challenge and the favorable characteristics of the property tax, it is of interest to analyze how local governments evaluate property taxation. Our data allow us to study how the local decision to have property taxation is influenced by fiscal competition and political control problems. The approach is inspired by the literature on positive analysis of tax structure. Inman (1989) introduce a political economy model of the local decision to tax. Hettich and Winer (1988) more broadly advocate the understanding of tax structure as a political equilibrium. We include their emphasis on political characteristics, since this is important for the functioning of property taxes as an incentive mechanism to control government. We extend their frameworks by embedding the analysis in a spatial interaction model.

The empirical setting is a large number (434) of local governments supplying public services basically financed by central government grants and regulated income taxes. Property taxes represent a potential additional source of revenue at the margin, and the decision to have residential property taxes is local. The property tax design is specified by national law, but the local governments decide to have it, and they set the tax rate within a band and arrange the assessment of housing values. Local governments are political systems with local councils elected from party lists. The local decision to have the property tax is investigated in this paper.

Section 2 presents the empirical context and the data. The empirical approach is discussed in section 3 and section 4 discusses spatial econometric issues. The discrete choice to have property taxation (probit analysis) is analyzed in section 5, while section 6 expands the analysis to look at the revenue generation (tobit analysis). Section 7 offers concluding remarks.

2. Local property taxation in Norway

Local governments in Norway can choose to have residential property taxation. The financing of the local governments is highly centralized, and more than 80% of the revenues are generated from central government grants and regulated income taxes. The grants are distributed as block grants and are based on objective criteria, partly as tax equalization and partly as spending equalization. The income tax revenue is shared between local, county and central governments with the maximum income tax rate at the local level set by the central government. All local governments apply the maximum income tax rate and their grants and income tax revenue consequently appear as given from above. Local governments have some discretion in setting fees for infrastructure services and some welfare services, but also the fees are regulated and with the general rule that they can only cover costs. Borge (1995) and Borge and Rattsø (2005) analyze the fee setting, and Carlsen et al. (2005) investigate the role of mobility for the determination of fees for infrastructure services. The choice of having property tax is the key local decision to tax. Borge and Rattsø (2004) analyze determinants of the tax structure, the mix of revenues from property taxation and fees. We will have a closer look at the discrete choice of having property tax.

The property tax is defined by law (of June 6, 1975) and the decision to have the tax is fully in the hands of the local government. The law describes the property that can be taxed, the tax base assessment, and restrictions to the tax rate. Residential property taxation is restricted to urban areas, that is towns and or areas under construction that will appear as towns. This definition of an urban area is not very clear, and there are many court cases where property owners have argued that the area under taxation is not urban.

Local governments in Norway are heterogeneous with respect to population size, with many small municipalities up valleys and along fjords. The median municipality has about 4.500 inhabitants, while the average is a population of 10.000. Since we study the choice of having property tax, we must exclude local governments that cannot have since they have no urban areas. Among the 434 local governments in all, we exclude local governments with less than 2.500 inhabitants and the capital, Oslo. Utilizing data for 2001 this leaves us with a data set consisting of 301 local governments where 105 of them levy residential property taxation.[1] It follows that 3 local governments with property taxation are excluded because of our general criteria to represent the existence of urban areas (see Appendix Table 1).

All local governments have an assessment of house values related to the income tax and the assessment value on average is about 30% of the market value. The locals differ in their assessment, although most of them have assessed values in the area of 15-40% of market value. In addition to differences in the assessment practice, there are also variations in deductions (14 out of 108 local governments use different forms of deductions). The property tax rate is restricted to the interval 0,2% and 0,7% of the assessed housing value. 74 of the 108 local governments with property taxation apply the maximum rate, and the average tax-rate is 0,61%. In addition to the residential property tax about 120 other local governments have a commercial property tax. This is basically a tax on electric power stations and part of a system of distributing the resource rent of electricity based on waterfalls. The commercial property tax is excluded here.

Our main focus is the existence of residential property taxation, but in an extension we will look at the determination of property tax revenue. Based on survey data we calculate how much a standardized household will have to pay in property taxation in all of the 108 local governments that levy residential property taxation in 2001. The standardized house is assumed to be 160 sq. meters with a market value of 1 million Norwegian kroner (USD 160 000). The average effective tax for the standardized house is 1820 NOK (USD 290), varying from 4312 NOK (Sarpsborg) to 130 NOK (Arendal). A majority of the local governments (57 out of 108) levy effective taxes between 1001 and 2000 NOK.

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[1] Data for two local governments are missing.

3. Empirical modelling

We study a situation where local governments can choose to have property taxation or not. Assuming that the property tax is regulated (as the case in Norway), this can be analyzed as a discrete choice between two alternatives: with and without the tax. The dummy-variable dptax is our main dependent variable, and dptax = 1 when the local government has residential property taxation. In an extension we will look at determinants of property tax revenue (ptax).

In the conventional understanding of the role of taxation, the benefits of the increased public services financed by the new tax must be evaluated against the costs of raising the new revenue. No property taxation allows higher private consumption and lower public consumption compared to the alternative with property taxation. Local governments provide services basically financed by grants or lump sum taxes, but with property taxation as a possible marginal source of funds. A standard fiscal demand model of the decision to levy property taxation emphasize two economic determinants, the private income level ($\overline{y}$) and the central government grants (G). The private income level also works as a proxy for the property tax base here, since data about property valuation at the local level are not available. Consistent with the many studies of local public choice in the Scandinavian countries, we include the socialist share of the local council (SOC) as a measure of ideological orientation. Socialist oriented municipalities tend to have higher tax and spending levels. Petterson (2004) have analyzed the importance of socialist orientation in a discontinuity setting.

The first extension of this standard demand understanding is fiscal competition whereby the choice of property taxation takes into account the existence of property taxation in neighboring communities. In general form, yardstick competition implies that the existence of property tax in community i ($dptax_i$) depends on the existence of property taxation in all other N communities and a vector x of other determinants:

$$dptax_i = dptax_i(dptax_1,..,dptax_{i-1},dptax_{i+1},..,dptax_{N,}\mathbf{x}_i)\ , \tag{1}$$

As discussed in the introduction, fiscal competition may result from tax mobility or comparison with neighbors. In the case of property taxation, which is highly politically visible and with low mobility of the tax base, yardstick competition is a potentially important mechanism. Yardstick competition implies that voters make use of information about the political choices in neighboring local governments. The decisions of the neighbors have an information externality, they represent information to evaluate the performance of own government. It follows that voters condition their electoral choices on the relative fiscal performance of their own versus neighboring local governments. The understanding of the mechanism was first developed by Salmon (1987) and formalized by Besley and Case (1995). Bordignon et al. (2003) and Allers and Elhorst (2005) have shown the importance of yardstick competition for property taxation in Italy and in the Netherlands respectively.

The main econometric challenge of estimating the discrete choice of having property taxation is the simultaneous determination of property taxation in all communities that follow from the strategic interaction. The right hand side property tax dummies of the neighbors are endogenously determined. Case et al. (1993) innovated the econometric investigation of this type of strategic interaction in a study of the expenditure levels among US state governments. In addition to the apparent simultaneity problem, we also take into account that the discrete choice is best understood in a latent variable model. This is elaborated in section 4.

The second extension of the fiscal demand model includes local political control problems that may motivate having property taxation as an incentive mechanism. The general Brennan-Buchanan argument is developed in the context of property taxation by Glaeser (1996). It is based on the complementarity between local service provision and tax base via housing values. Gordon and Wilson (2000) and Wilson and Gordon (2003) analyze similar relationships between voters and officials emphasizing government waste (or slack) and in the context of tax competition. Property taxation may reduce waste since the officials will take into account the feedback via property values. Hoxby (1999) provides a theoretical framework to analyze costs and efforts in schools and introduces property taxation as a disciplining device. Property taxation links school quality to school financing and helps control costs and efforts in schools. More broadly Fischel (2001) introduces the concept of 'homevoters', homeowners whose voting is guided by their concern for home values. Since homeowners are locked into the locality, they focus on local government behavior and consequently the housing market disciplines local decisions. Brunner and Sonstelie (2003) supply empirical evidence that homeowners vote to protect their property values (voucher issue in California). The incentive effects of property taxation to hold down costs are shown by Borge and Rattsø

(2003) comparing local governments with and without property tax in Norway. Fiva and Rønning (2005) find favorable incentive effects of property taxation on school efficiency in Norway.

In the empirical part we concentrate on political fragmentation. An extensive literature on fiscal policy outcomes based on Roubini and Sachs (1989) has shown the importance of political fragmentation for fiscal imbalance and the level of spending and taxation. Perotti and Kontopoulos (2002) offer a recent documentation. In the Norwegian local government setting, Kalseth and Rattsø (1998) have shown how fragmentation is associated with higher administrative costs and Borge and Rattsø (2005) show that fragmentation increases the fee level. We hypothesize that local governments with more fragmented political system is more likely to have property taxation.

Political fragmentation is measured by a Herfindahl-index of party fragmentation of the local council. When SH_p is the share of representatives from party p, then the Herfindahl index for party fragmentation (HERF) is given by:

$$\text{HERF} = \sum_{p=1}^{P} \text{SH}_p^2 . \tag{2}$$

The Herfindahl-index is generally given by 1/P, when the representatives are equally divided among P parties. The index has maximum value of 1 when there is only one party in the council. The Herfindahl index ranges from 0.14 to 0.60 in our sample, with a sample mean of 0.24.

The data are documented in Appendix Table 2. As control variables in all regressions we include population size, a measure of the income distribution (ratio of median to mean income), the age distribution of the population (below 5 years of age, 6-15 and 66+), and share of the population in rural areas.

4. Spatial econometric issues

Different approaches for undertaking estimation and inference in linear regression models with spatial effects are well developed. However, spatial models with discrete dependent variables have received little attention in the literature and empirical implementation of such models is an area of active research. Estimation of spatial discrete models yields contrary to linear spatial models a non-spherical variance-covariance matrix. An important consequence of the complex variance-covariance structure is that the error term will be heteroskedastic (Anselin, 2002). This renders standard probit or tobit estimation inconsistent. The underlying problem is the (potential) interdependence in the endogenous variable giving rise to simultaneity. To solve this problem one needs to rely on a spatial latent variable approach.[2] Following Fleming (2004), in econometric form the underlying latent model specification with spatial dependence can be expressed as:

$$\mathbf{dptax^*} = \rho \mathbf{Wdptax^*} + \mathbf{x\beta} + \mathbf{u}, \tag{3}$$

The observed variable, $dptax_i$, is a dummy variable identifying local governments with residential property taxation and $dptax_i^*$ is it's unobserved latent counterpart. The observed $dptax_i$ equals unity when $dptax_i^*>0$ and is zero otherwise. **W** is a symmetric 301x301 weight matrix, with zeros in the diagonal and with elements w_{ij} different from zero if the two local governments are considered to be neighbors. **X** is a matrix of property tax determinants of every local government, **β** is a vector of parameters and **u** is a vector of error terms which we for now assume to be normally distributed with homoscedastic variance:

$$\mathbf{u} \sim N(0, \sigma_u^2). \tag{4}$$

The spatial weights matrix, **W**, is determined apriori and can be considered as part of local government i's basic characteristics. In this analysis we follow the literature on fiscal competition and choose a definition of neighbors as municipalities with a common border. W_{ij} = $1/m_i$ for all municipalities that are contiguous to municipal *i*, where m_i is the number of observations that are contiguous to municipal *i*. Wdptax* is a weighted average of the propensity for neighboring local governments to levy property taxation. ρ captures interaction in the latent variable, the propensity to levy property taxation increases (decreases) as neighbor's propensity to levy property taxation increases (decreases). We expect ρ to come

[2] Other studies which pursue different versions of the spatial latent variable approach include Case (1992), Pinkse and Slade (1998), Holloway et al. (2002) and Klier and Mcmillen (2005).

out positive and statistically significant if fiscal competition is a relevant aspect of the property tax determination.

It should be noticed that the strategic interaction in (3) technically implies that it is the neighbor's latent variable (Wdptax*) that matters for local government i, and not neighbors' observed decisions (Wdptax). The straightforward formulation of the interaction is that the observed existence of property taxation depends on the observed property taxation of the neighbors ($\mathbf{dptax} = \rho\mathbf{Wdptax} + \mathbf{x\beta} + \mathbf{u}$), while a formulation where the propensity to levy property taxation depends on the observed property taxation of the neighbors is an intermediate case ($\mathbf{dptax^*} = \rho\mathbf{Wdptax} + \mathbf{x\beta} + \mathbf{u}$). We estimate the standard probit model with an exogenous spatial lag as an alternative to the latent variable model. As will come clear, the strength of the interaction estimated is seriously affected by the formulation applied. As Klier and McMillen (2005:8) point out, only the latent model represents algebraically consistent handling of the endogeneity problem.

Our spatial autoregressive probit model (SARP) given by (3) yields correlation between Wdptax* and the disturbances, even when the latter are iid. The endogeneity problem can easily be seen from writing (3) on reduced form (assuming that $(\mathbf{I}\text{-}\rho\mathbf{W})$ is invertible):

$$\mathbf{dptax^*}=(\mathbf{I}\text{-}\rho\mathbf{W})^{-1}\mathbf{x\beta} + (\mathbf{I}\text{-}\rho\mathbf{W})^{-1}\mathbf{u}\,, \tag{5}$$

implying that

$$E((\mathbf{Wdptax^*})\mathbf{u'}) = \mathbf{W}(\mathbf{I}\text{-}\rho\mathbf{W})^{-1}\sigma_u^2 \neq \mathbf{0}\,. \tag{6}$$

Non-spatial probit estimation yields in this case biased and inconsistent estimators. Note that contrary to the linear case, it is complicated to utilize standard Maximum Likelihood (ML) estimation of ρ because the SARP specification given by (3) introduces a non-spherical variance-covariance matrix given by:

$$\mathbf{Cov(u)} = \left[(\mathbf{I} - \rho\mathbf{W})(\mathbf{I} - \rho\mathbf{W})'\right]^{-1}\sigma_u^2\,. \tag{7}$$

The error terms will consequently be homoscedastic only if ρ=0. Contrary to models with continuous dependent variables, the discrete dependent model with heteroscedastic error terms yields inconsistent estimates. There are basically two potential remedies to this problem. Some authors, such as Case (1992) and Pinkse and Slade (1998), have proposed to ignore the off-diagonal elements of the variance-covariance matrix and focus on the heteroskedasticity induced by spatial dependence. This method yields consistent, but not fully efficient estimates of the spatial probit model. To obtain consistent and fully efficient estimators, one has to deal with multidimensional integrals (Anselin, 2002). Fleming (2004) presents a survey of different simulation techniques available for solving this problem. He concludes that the Bayesian approach based on Lesage (2000) is the most flexible method. We follow the Bayesian approach when empirically analyzing fiscal competition in section 5 and 6.[3]

The Bayesian approach is a Markov Chain Monte Carlo (MCMC) method based on the Gibbs Sampler. This is a data augmenting procedure which provides the linkage between the discrete dependent variable and it's latent continuous counterpart. We refer the reader to Lesage (2000) and Fleming (2004) for a complete presentation of the method. A general introduction to the Gibbs sampler can be found in Casella and George (1992). The Gibbs sampler introduces a conditional distribution for the censored variable conditional on all other parameters in the model. This distribution is used to produce a random draw for each value of the dependent variable in the probit specification. Once a sample for the unobserved latent dependent variable is established, the problem reduces to the linear spatial auto-regressive model which can be estimated with traditional ML methods. The Bayesian approach allows for heteroskedastic error terms even after controlling for spatial dependence, ensuring that parameter inconsistency is not driven by heteroskedastic influences (Fleming 2004: 156). This allows (4) to be generalized as:

$$\mathbf{u} \sim N(0, \sigma_u^2 \mathbf{V}),\ \mathbf{V} = diag(v_1, v_2, ..., v_n)\,. \tag{8}$$

Technically the Gibbs sampler proceeds as follows:

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[3] The analysis is carried out using James Lesage's spatial econometric toolbox in the Matlab environment and Tim Thomas' corrected scripts (Lesage, 2003 and Thomas, 2005).

1. Start with arbitrary initial values for the parameter vector: $\left(\sigma_u^2, \rho, \beta_1, \beta_2, ..., \beta_k, v_1, v_2, ..., v_n\right)$.
2. Estimate σ_u^2 given all other parameters and the data.
3. Estimate $(\beta_1, \beta_2, ..., \beta_k)$ given all other parameters and the data.
4. Estimate $\left(v_1, v_2, ..., v_n\right)$ given all other parameters and the data.
5. Estimate ρ given all other parameters and the data.
6. Sample the conditional distribution for the latent variable (dptax*) given all parameter values.

This completes one pass of the Gibbs sampler process.[4] The Gibbs sampler process is then repeated a large number of times to derive conditional distributions for all the parameters. The mean of the conditional distribution is the final parameter estimate and the standard deviation of the distribution is used for inference. All MCMC sampling procedures reported below are based on 10000 draws with the first 2000 draws omitted. The first draws are omitted to allow the sampler to achieve a steady-state (the so called 'burn-in period'). Note that estimates based on 1000 draws with the first 200 draws omitted were close to identical to the reported estimates, suggesting that one need not carry out an excessive number of draws in practice. Note that we need to fix one of the unknown parameters in order to identify the other unknowns in the model (Holloway et al. 2002:394). We adopt the usual practice and fix σ_u^2 equal to unity.

An observed spatial pattern in property taxation is not necessarily due to competition among local governments. Also common shocks and unobserved correlates will appear as spatial auto-correlation. In empirical work it is a challenge to separate the spatial auto-regressive probit (SARP) model from the spatial error probit model. With spatially correlated omitted variables, we have a pattern of spatial error of the form:

$$\mathbf{u} = \boldsymbol{\lambda}\mathbf{M}\mathbf{u} + \boldsymbol{\varepsilon}, \tag{9}$$

[4] Lesage (2000) has derived all the conditional distributions for the limited dependent Bayesian spatial models and it is this sampling procedure that is used to obtain parameter estimates.

where ε is a well behaved error term and M is a neighbor matrix. Estimating the SARP model introduced above can in principle lead to a false conclusion of fiscal competition (ρ>0) when ρ=0 holds in the true model. The ability to separate spatial lag from spatial error depends on the quality of the other explanatory variables in (3).[5]

The error structure offers some information about the type of fiscal competition at work. If yardstick competition is the driving force behind spatial auto-correlation, an error structure like (9) may appear if voters have a reasonable knowledge of the deterministic factors affecting taxation in neighboring local governments. Bordignon et al. (2003) argue that yardstick competition is likely to show up as spatial error because the spatial lag model implicitly assumes that tax rates are spatially correlated *independently* of the levels of the Xs, while the spatial error model tests for correlation of the tax rates which cannot be explained by the other Xs. In section 5 we estimate both the spatial lag and the spatial error model and compare which model which best fit the data.

In section 6 we present an extension of the spatial probit analysis and have a look at the determination of the property tax revenue. The endogenous variable here is the annual property tax payment for a standard house (ptax). The latent spatial tobit specification is given by:

$$\mathbf{ptax^*} = \rho \mathbf{Wptax^*} + \mathbf{x\beta} + \boldsymbol{\varepsilon}\,. \qquad (10)$$

The observed dependent variable, $ptax_i$, is equal to $ptax_i^*$ if $ptax_i^*>0$ and 0 otherwise. In section 6 we present results for both the non-spatial and the Bayesian spatial tobit model (both lag and error specification).

5. The discrete choice of having property taxes

The benchmark analysis looks at characteristics of the local governments important to explain the existence of the property tax, ignoring the spatial dimension. Specification A in Table 1 presents the results for the standard non-spatial probit model. The fiscal demand variables

[5] Anselin et al. (1996) have proposed some LM tests to separate spatial error from spatial lag, but these are not implementable in the discrete endogenous variable case.

included are private income level and central government grants. The likelihood of having property tax decreases with the level of private income. The effect is statistically significant and quantitatively important. Evaluated at the mean of the explanatory variables, one standard deviation increase in private income reduces the probability of levying property tax with approximately 20 percentage points. Since private income represents both a demand effect and is an indicator of the local tax base, the negative coefficient shows that the tax base effect dominates. In the demand framework, higher private income is expected to lead to higher demand for local public services and having property tax is a way of arranging additional revenue. Central government grants have no statistically significant effect.

Political fragmentation (measured by the Herfindahl index, HERF) is also shown to influence the choice of property taxation. Higher value of the index means less party fragmentation of the local council. The negative coefficient implies that increased party fragmentation is associated with higher likelihood of having property taxation. The quantitative effect is of political importance. Evaluated at the mean, one standard deviation increase in party fragmentation increases the likelihood of having property tax by about 5.7 percentage points. In our setting the result is consistent with the understanding that political fragmentation motivates property taxation. The party fragmentation of the local council motivates the introduction of property taxation to improve the incentives of the officials of the local government.

Table 1 about here

The positive relationship between political fragmentation and likelihood of having property taxation may be interpreted in a different context. The studies of political fragmentation and fiscal policy innovated by Roubini and Sachs (1989) emphasize political fragmentation as a source of fiscal inefficiency. Perotti and Kontopoulos (2002) argue that political fragmentation may lead to excessive government and consequently a high tax level. In the Norwegian context, Kalseth and Rattsø (1998) were the first to show that political fragmentation in local governments has economic effects, in their data they found excessive administrative spending in fragmented councils. Borge (1995) find that political fragmentation is associated with higher level of user charges. In this understanding our relationship between fragmentation and property taxation may reflect 'political strength'. A strong political leadership may be better able to hold down the tax (and spending) level. The separation between these two explanations is addressed below.

The choice of property taxation also seems to be an ideological issue. The share of socialists in the local council is an important predictor of property taxation. More socialists increase the likelihood of having property taxation. The size of the effect is quite large. When the share of socialists increase by 10 percentage points, the likelihood of having property tax increases by 14 percentage points. The average socialist share is 37%, and one standard deviation increase raises the likelihood by about 18 percentage points. The result is consistent with the results of Borge and Rattsø (2004), who study the socialist influence in a model focused on the role of income distribution for the tax structure. Petterson (2004) has shown a similar effect of socialist orientation on the tax level in a Swedish study using the discontinuity method to compare local governments close to 50% socialists.

The model is extended to include the existence of property taxation in neighboring communities. The geographical distribution of the use of residential property taxation as a local tax shows a clear pattern. The distribution follows to some extent the rural-urban dimension. But we also find significant differences across counties that hardly can be explained by rurality. As an example we note that none of the municipalities in Vestfold or Akershus counties levy residential property taxation (see Appendix Table 2). The counties are close to Oslo and most of the local governments have a high private income level.

To take into account strategic interaction among neighboring governments we extend model A to include a spatially lagged dependent variable. The extended formulations are shown in models B and C in Table 1. Model B is a straightforward Probit estimation, ignoring simultaneity, while model C is based on the Markov Chain Monte Carlo (MCMC) technique outlined in section 4. We find that fiscal competition certainly is important to explain the existence of property taxation. The statistical effect is solid in both model B and C. The marginal effect of fiscal competition is overstated when we ignore the inherent simultaneity problem, comparing models B and C. While the naïve Probit estimation finds an estimated reaction function coefficient ($\hat{\rho}$) of 1.72, the MCMC technique estimate is 0.22. The marginal effects are 0.56 and 0.07, respectively, evaluated at the sample averages for the explanatory variables.

While the fiscal competition is clearly confirmed in both specifications, the difference in economic impact between the two is substantial. The simultaneous latent formulation indicates that the likelihood that a local government will levy property taxation increases with 2 percentage points if one additional neighbor starts levying property taxation (assuming 4 neighbors). This is hardly of economic importance. The corresponding effect for the naïve probit is 13.5 percentage points, which must be considered to be economically relevant. The difference is expected on methodological grounds. In the naïve model B it is assumed that local governments take into account the observed property taxation of the neighbors, with a stark difference between those with and those without property taxation. In the latent model C formulation, the local governments take into account the predicted likelihood of having property taxation of the neighbors. This likelihood will show much less variation between local governments, and consequently the interaction effect will be much smaller. When the fiscal competition is a marginal effect, the endogeneity problem is not expected to seriously bias the estimates, and the model B estimate may be the best estimate of the interaction. A more conservative approach is to consider $\hat{\rho}_{MCMC}$ to be a lower bound and the $\hat{\rho}_{ML}$ to be an upper bound of the true ρ.[6]

For completeness we also estimate the spatial error model, reported as specification D in Table 1. Again we find evidence of a geographic pattern in the property taxation decision. According to the Pseudo-R^2, the fit of the model is somewhat lower when we rely on the spatial error rather than spatial lag specification.

Different econometric strategies have been used in previous studies to disentangle spatial auto-correlation driven by tax base mobility and yardstick competition. All studies point to the latter as the most likely source of observed tax mimicking. Besley and Case (1995) find that the probability for a US state governor to be re-elected decreases as state taxes rise, and increases with the tax rises in neighboring states. While Bordignon et al (2003) find that property tax rate interdependence in Italy is present only when mayors can run for reelection and are not backed by strong majorities. Finally, Allers and Elhorst (2005) study strategic interaction in property tax setting in Dutch municipalities and find that interaction is weaker when the electoral margin is high. If tax base mobility was the driving force behind spatial

[6] Allers and Elhorst (2005) summarize the previous research on tax mimicking and conclude that the estimated neighborhood effect typically ranges from 0.2 to 0.6. All of these studies rely on continuous dependent variables.

autocorrelation, we would observe this irrespective of term limits and electoral margins. We conclude that with limited mobility of the property tax base in Norway an observed spatial pattern is likely to be due to yardstick competition. We cannot rule out that omitted spatially correlated variables are an important part of the spatial auto-correlation, but our set of control variables do include the factors shown to be of importance in other studies of local taxation in Norway.

Ignoring spatial dependence generally leads non-spatial models to attribute spatial autocorrelation in the dependent variable to explanatory variables rather than assign this variation to spatial dependence. This can potentially yield seriously biased effects in non-spatial models. We find that this is not the case for the discrete choice of property taxation. Comparing model A to model C we find that all coefficient are only slightly underestimated in the non-spatial probit model.[7]

6. The determinants of property tax revenue

It is of interest to investigate whether the fiscal competition influences the level of property taxation in the local governments. As a starting point we have had a look at the demand determinants of the standardized property tax revenue in a simple OLS among the 103 local governments with property taxation (not reported). Central government grants come out as the main determinant of the property tax revenue. Higher grants induce local governments to reduce the property tax level given that they have property taxation. This revenue substitution is the standard result in this kind of studies (see Borge and Rattsø, 2004). The private income level has a negative effect on the property tax level. We interpret this as the effect of higher property tax base associated with higher personal income. No political variables have any statistically significant effect on the property tax level given that they have property taxation. It seems that only economic variables influence the size of the property tax revenue given property taxation.

[7] The marginal effects do not vary greatly between the spatial and the non-spatial probit. A one standard deviation increase in the Herfindahl index is in specification C is estimated to reduce the probability of property taxation with approximately 0.07, while a one standard deviation increase in the socialist share increases the probability with 0.22.

In the combined tobit analysis of the propensity to have property taxation and the level of property tax revenue both economic and political determinants are important. The benchmark tobit analysis without spatial interaction is reported as model E in Table 2. Political fragmentation is shown to be an important determinant of the property tax revenue. The property tax level goes down when the local council is less fragmented. Since political fragmentation has no effect in an OLS estimation among local governments with property taxation, but has statistically significant effect in the tobit formulation, we conclude that political fragmentation first and for all is important for the choice to have property taxation or not. This is consistent with the interpretation that political fragmentation motivates having property taxation as an incentive mechanism. We also find statistically significant effects of political ideology and private income level.

Moving on to the spatial tobit specifications we find that property tax revenue certainly is affected by fiscal competition. The average property tax revenue is about NOK 1000 (USD 150) per standardized house. The estimated neighborhood effects in models F, G and H in Table 2, are statistically and economically significant. Again, we find as expected that ignoring simultaneity yields an upward bias in the estimated strategic interaction. Based on the MCMC technique we find an interaction coefficient based on the spatial lag specification of 0.22. The spatial error specification suggests an interaction coefficient of 0.32. The estimates implies that when neighboring local governments increase their property taxation with NOK 1000 per house, then the local government under study increases the property taxation with NOK 220 or 320 according to model formulation. This is an estimated reaction function coefficient of the same magnitude as other European studies of property tax interaction have found. Utilizing a spatial error model Bordignon et al (2003) find a coefficient of 0.30 on Italian data while Allers and Elhorst (2005) hinging on the spatial lag specification and find a coefficient of 0.35 on Dutch data. Both these studies analyze property tax decisions in a continuous setting. We interpret the highly statistical significant evidence of spatial auto-correlation provided in table 2 as evidence that local governments look to their geographic neighbors when making property tax decisions. As in the probit case, we find that the estimated effects of the other Xs are not sensitive to controlling for spatial auto-correlation.

Table 2 about here

7. Concluding remarks

The starting point of the paper is the recent interest in decentralization with property taxation as an incentive mechanism to stimulate efficient resource use in the public sector. Local governments in Norway can choose to have residential property tax, and their choice can inform us about the importance of the incentives involved – fiscal competition and property value feedback. The standard demand model assumes that property taxes are determined based on the economic tradeoff between the benefit of more services and the cost of higher taxes. Two additional aspects of the discrete choice of having property taxation are investigated, the roles of fiscal competition and political fragmentation. We test the hypothesis that fragmentation and competition influence the decision to have property taxation. Econometric challenges of spatial models with discrete dependent variables are addressed.

The empirical results indicate that fiscal competition generates a distinct geographic pattern in local taxation and that fragmentation motivates property taxation to control the associated common pool problems. The fiscal competition is consistent with the strategic interaction expected with yardstick competition. In an extension of the analysis we show that fiscal competition and fragmentation also is important for the property tax level. More fragmented local councils in an area where many local governments have property taxation contribute to higher property tax level. The quantitative effect of the fiscal interaction depends on model formulation, and it is a challenge for future research to discriminate between alternative econometric representations of fiscal competition with discrete dependent variable.

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Table 1: Probit analysis of fiscal competition in property taxation

	A			B			C			D		
Dependent variable	*dptax*			*dptax*			*dptax**			*dptax**		
	Coeff	t-prob	Marginal effect	Coeff	t-prob	Marginal effect	Coeff	p-value	Marginal effect	Coeff	p-value	Marginal effect
SPATIAL LAG (ρ)				1.72	0.00	0.56	0.22	0.00	0.07			
SPATIAL ERROR (λ)										0.32	0.01	0.10
HERF	-2.93	0.10	-0.96	-2.98	0.11	-0.97	-3.69	0.04	-1.20	-4.13	0.05	-1.35
$\overline{y}$	-0.03	0.00	-0.01	-0.02	0.01	-0.01	-0.03	0.00	-0.01	-0.03	0.00	-0.01
G	0.05	0.19	0.01	0.00	0.91	0.00	0.05	0.13	0.01	0.03	0.31	0.01
SOC	4.34	0.00	1.41	3.78	0.00	1.23	5.16	0.00	1.69	5.20	0.00	1.70
$\frac{y_m}{\overline{y}}$	-2.70	0.39	-0.88	-2.47	0.46	-0.81	-3.37	0.20	-1.10	-2.69	0.28	-0.88
POPULATION	0.01	0.22	0.00	0.01	0.29	0.00	0.01	0.06	0.00	0.01	0.06	0.00
CH	24.94	0.10	8.14	38.49	0.02	12.56	37.53	0.02	12.25	28.47	0.08	9.29
YO	-12.78	0.24	-4.17	-17.34	0.12	-5.66	-14.73	0.14	-4.81	-18.04	0.12	-5.89
EL	6.56	0.23	2.14	9.38	0.10	3.06	11.61	0.05	3.79	6.15	0.22	2.01
RURAL	-3.47	0.00	-1.13	-3.85	0.00	-1.26	-4.47	0.00	-1.46	-4.54	0.00	-1.48
McFadden R^2	0.29			0.35								
Pseudo R^2							0.66			0.65		
Log likelihood	-138.13			-126.41								
Model	Probit			Spatial lag probit			Spatial lag probit			Spatial error probit		
Estimation method	ML			ML, exogenous lag			MCMC, endogenous lag			MCMC, endogenous error		
Number of draws							10000			10000		
Number of draws omitted							2000			2000		
# obs.	301			301			301			301		
# positive obs.	105			105			105			105		

Note: A constant term is included in all regressions (not reported). Marginal effects are evaluated at sample averages of the explanatory variables.

Table 2: Tobit analysis of fiscal competition in property taxation

	E		F		G		H	
Dependent variable	*ptax*		*ptax*		*ptax**		*ptax**	
	Coeff	**p-level**	**Coeff**	**p-level**	**Coeff**	**p-level**	**Coeff**	**p-level**
SPATIAL LAG (ρ)			0.69	0.03	0.22	0.01		
SPATIAL ERROR (λ)							0.32	0.00
HERF	-4913.05	0.06	-4561.97	0.08	-5062.22	0.03	-5582.28	0.03
$\overline{y}$	-46.51	0.00	-40.73	0.00	-47.47	0.00	-49.07	0.00
G	9.92	0.84	5.60	0.91	-3.60	0.47	-26.39	0.35
SOC	6882.03	0.00	6195.67	0.00	6903.96	0.00	6741.48	0.00
$\frac{y_m}{\overline{y}}$	-6408.41	0.18	-4431.92	0.36	-8301.06	0.07	-7642.19	0.11
POPULATION	7.87	0.24	7.58	0.25	9.18	0.10	7.18	0.15
CH	34667.99	0.14	46806.54	0.05	49889.68	0.02	43711.70	0.05
YO	-17859.71	0.28	-20570.20	0.21	-25998.32	0.08	-35610.17	0.04
EL	7689.52	0.36	9823.67	0.24	9620.42	0.14	2064.66	0.42
RURAL	-5252.45	0.00	-5297.45	0.00	-5894.90	0.00	-6175.61	0.00
McFadden R^2								
Pseudo R^2					0.544		0.548	
Log likelihood	-1016.73		-1014.43					
Model	Tobit		Spatial lag tobit		Spatial lag tobit		Spatial error tobit	
Estimation method	ML		ML, exogenous lag		MCMC, endogenous lag		MCMC, endogenous error	
Number of draws					10000		10000	
Number of draws omitted					2000		2000	
# obs.	301		301		301		301	
# positive obs.	105		105		105		105	

Note: A constant term is included in all regressions (not reported).

Appendix Table 1

Population size	Share of municipalities with dptax = 1	Number of municipalities	Average ptax	Average ptax for dtpax=1
<2500	0.02	130	43	2150
>2500 & <5000	0.23	112	355	1543
>5000 & <10000	0.39	90	679	1741
>10000	0.44	99	911	2070
Overall	0.25	431	456	1824

Note: 108 out of 431 observations levy residential property taxation. Only 3 out of 130 municipalities with a population size below 2500 levy residential property taxation.

Appendix Table 2: Data description and descriptive statistics – Mean and standard deviations

Variable	Description	Mean	St.dev	Min	Max
PTAX	Annual property tax payment for a standard house, NOK.	634.88	991.84	0.00	4312.00
DPTAX	Dummy taking the value 1 for local governments levying residential property tax	0.35	0.48	0.00	1.00
W_DPTAX	Spatially lagged DPTAX, interpreted as the share of neighbors with residential property taxation.	0.26	0.22	0.00	1.00
HERF	Herfindahl-index measuring political fragmentation of the local council.	0.24	0.06	0.14	0.60
Y	Average before tax income for every person 17 years and older, measured in 1000 NOK.	224.26	24.14	170.00	341.60
G	The sum of lump-sum grants from the central government and regulated income and wealth taxes, measured in 1000 NOK per capita.	23.88	3.32	18.64	35.44
SOC	The share of socialist representatives in the local council. A socialist is defined as a representative belonging to one of the following parties: NKP, RV, SV and AP.	0.37	0.13	0.05	0.72
POPULATION	Total population in thousands (1st of January).	12.56	20.19	2.52	230.95
CH	The share of the population 0-5 years (1st of January).	0.08	0.01	0.05	0.11
YO	The share of the population 6-15 years (1st of January).	0.14	0.01	0.10	0.19
EL	The share of the population 67 years and above (1st of January).	0.14	0.03	0.07	0.23
$\frac{y_m}{\overline{y}}$	Income distribution measured as the ratio of median to mean income, based on before tax income.	0.90	0.04	0.73	1.00
RURAL	The share of the population living in rural areas (3rd of November)	0.41	0.23	0.01	1.00

Data description is based on the local governments with population>2500 (N=301).

Documentation of the variables: The data used in this analysis are provided by Norwegian Social Science Data Services, Statistics Norway and Arne Sauar. None of them are responsible for the analyses conducted or for the conclusions drawn.

Appendix Table 3 – Frequency of property taxation on county level

County	Overall			Population>2500		
	Municipalities with ptax	Municipalities without ptax	Average ptax	Municipalities with ptax	Municipalities without ptax	Average ptax
Østfold	4	14	566	4	12	637
Akershus	0	22	0	0	22	0
Hedmark	10	12	782	9	7	988
Oppland	13	13	914	13	8	1132
Buskerud	4	17	179	4	13	221
Vestfold	0	14	0	0	13	0
Telemark	10	8	1212	10	3	1677
Aust-Agder	2	13	249	2	6	466
Vest-Agder	2	13	280	2	8	420
Rogaland	9	17	561	9	12	695
Hordaland	6	27	299	6	19	407
Sogn og Fjordane	6	20	355	5	13	379
Møre og Romsdal	6	30	336	6	22	413
Sør-Trøndelag	5	20	332	5	14	437
Nord-Trøndelag	5	19	578	5	8	1067
Nordland	11	34	494	11	8	1171
Troms	7	18	402	7	5	838
Finnmark	8	11	629	7	3	1020
Overall	**108**	**323**	**458**	**105**	**196**	**635**