The relationship between firm mobility and tax level: Empirical evidence of fiscal competition between local governments*)

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Abstract
Mobility and fiscal competition is a potentially important mechanism of fiscal discipline and economic efficiency. The theory predicts that the intensity of competition, that is the degree of mobility of the tax base, will influence the fiscal outcome. The many theoretical contributions in the area, however, are not matched by empirical evidence. Existing econometric studies address strategic interaction between local governments, but have little to say about variations in mobility conditions. Studies of international capital mobility use very broad measures of openness or capital restrictions, while studies of mobility conditions at the local government level are absent. Based on a dataset covering firm mobility and local government tax level in Norway, we show a systematic relationship between degree of firm mobility and tax level consistent with theory. Local governments experiencing high firm mobility tend to have lower levels of infrastructure fees. The analysis takes into account neighbourhood effects in a spatial model, and the endogeneity of firm mobility conditions is handled with instrumental variables. In an extension of the analysis we show that spending level and spending composition respond accordingly.

Comments welcome
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1. Introduction

The original Tiebout (1956) hypothesis implies efficient provision of local public goods and efficient location of firms. Fischel (1975) extends this model of household mobility to explicit handling of competition for mobile firms in a setting where firms benefit from public services such as infrastructure. Wellich (2000) presents a status and overview of the relevant theoretical models. The efficiency result follows from a tax system where the tax rate reflects the costs of providing public services to the marginal firm. The obvious concern with this literature is that tax systems are not generally in accordance with such marginal cost pricing.

The inefficiencies of tax competition are originally described by Oates (1972) and formalized by Wilson (1986) and Zodrow and Mieszkowski (1986). The standard model assumes benevolent government and economic efficiency when mobility is excluded. Comparing no and perfect mobility, the mobility case implies an equilibrium with underprovision of services and too low taxes because of fiscal externalities. The degree of capital market integration describes the intensity of the tax competition in this model. Bucovetsky (1991) shows how small regions tend to set lower taxes than large regions because of higher capital elasticities (‘asymmetric tax competition’). Following Brennan and Buchanan (1980), recent contributions have left the assumption of benevolent government and show that tax competition may improve welfare by reducing excessive government. These so called Leviathan models also imply that tax competition reduces the size of government.

We agree with Wilson and Wildasin (2001) that empirical researchers have had difficulties ‘in documenting a negative relation between tax revenue and various indicators of tax competition’. Their narrow definition of tax competition says that each government’s tax settings influence the allocation of a mobile tax base among governments. The governments consequently compete over firms, capital, workers, shoppers or else. The definition puts the attention to the mobility of the tax base, but interestingly the empirical literature generally has not applied direct measures of tax base mobility. Studies of tax competition between national governments have focused on globalization, and have investigated the relationship impact on tax structure and level using broad measures of openness or regulations, notably Bretschger and Hettich (2002), Quinn (1997), and Slemrod (2001).
This study investigates the relationship between variations in the tax level and explicit measures of variation in firm mobility at the local government level. The background understanding is that the degree of firm mobility affects the tax decisions of local governments. In an extension we look at the related consequences for spending level and composition. We are not aware of any empirical study testing the effects of variation in firm mobility. Oates (1985) investigates whether decentralization is important for the size of the public sector. The background idea is in the tradition of Brennan and Buchanan (1980) that interjurisdictional mobility works as a constraint on taxation. Oates’ study compares centralization, when mobility is less important, with decentralization, when mobility is important. We concentrate on the horizontal differences in mobility across jurisdictions.

Most empirical analyses of tax competition test for strategic interaction between local governments, that is, whether decisions by one local government are affected by decisions of others. The empirical evidence on fiscal competition and strategic interaction indicates that government decisions are not taken in isolation. But the estimation results are not easily interpreted in terms of mobility. The studies imply that fiscal decisions are affected by other governments, but mobility is not the only factor of potential importance for such interactions, which also may follow from yardstick competition, fiscal externalities, and common shocks.

Case et al. (1993) offer an innovative study of neighbour-effects on state spending making use of spatial econometrics. Neighbourhood in these models is not necessarily geographic proximity. Case et al. find that similarity in demographic composition is the important descriptive when state spending is influenced by the spending of other states. They conclude that state government’s level of per capita expenditure is positively affected by the expenditure levels of similar states, but the authors do not relate this result to mobility. Empirical studies of particular relevance to firm mobility are Brueckner (1998) on growth controls in US municipalities, Hayashi and Boadway (2000) on business taxation in Canadian provinces, and Buettner (2001) on business taxation in Germany.

This study takes as a starting point the model of Devereux et al. (2002) designed to understand competition between countries over corporate tax rates. They show theoretically how the mobility depends on the variation in relocation costs of industries and estimate tax reaction functions of OECD countries. We explicitly bring variation in mobility conditions between regions in their model to generate a hypothesis that increased mobility will reduce
the taxation of firms. The hypothesis is tested based on local government data. The basic empirical assumption is that firm mobility across regions differs between industries. Compared to local governments in regions with a high share of industries with relatively immobile firms, local governments in regions with a high share of industries with relatively mobile firms have stronger incentives to tailor fiscal decisions according to the needs of local firms. We expect firm mobility to put pressure on local government taxes and fees paid by local firms, i.e. that firm mobility is, ceteris paribus, negatively correlated with local taxes and fees. The financing of local governments in Norway is quite centralized with little local discretion. A key instrument of local tax discretion is a fee for local infrastructure paid by households and firms. Borge (2000) shows that the infrastructure fee works like a source of finance rather than as a benefit tax. Consequently we will analyze the infrastructure fee as a local tax subject to potential tax competition.

Our understanding of firm mobility and taxation of firms is outlined in section 2. Section 3 explains our measures of firm mobility and section 4 presents the data and econometric approach. IV-estimates of the determination of the infrastructure fee with firm mobility are presented in section 5, and the results are checked using spatial econometrics in section 6. Section 7 offers a short analysis of the consequences for spending level and composition, while section 8 gives a short summary.

2. Theoretical framework of firm mobility and taxation of firms

The benchmark Zodrow-Mieszkowski (1986) and Wilson (1986) (ZMW) model studies a set of small identical jurisdictions with immobile labor. A fixed number of identical firms produce output under constant return with labor and mobile capital. Identical households own fixed endowments of capital and supply labour inelastically. Total capital is available in fixed supply, but can costlessly be allocated across jurisdictions. The government purchases the output to transform it into a public good, which is financed by a tax on domestic capital (‘source-based’). The representative household has preferences for private and public goods, and the government is assumed to act in accordance with the representative consumer. Raising the tax rate in one jurisdiction implies a cost in terms of capital outflow, and this fiscal externality is the source of an inefficiently low tax rate and public goods level.
Devereux, Lockwood and Redoano (2002) have modified this benchmark to include the mobility of firms in an analysis of OECD tax competition. We will bring the degree of mobility explicitly into the Devereux et al. model to derive a hypothesis about variation in mobility explaining the local tax level.

A firm produces output with a conventional production function $f(k)$ and capital input $k$. The firm pays tax $\tau (f(k) - rk)$ with statutory tax rate $\tau$ and interest rate $r$. The firm maximizes after-tax profits

$$\pi = (1 - \tau)(f(k) - rk)$$

(1)

to reach the standard first-order condition

$$f'_k(k) = r$$

(2)

It follows that the demand function for capital for a firm is $k = k(r)$ and the profit maximizing profit of the entrepreneur can be written $(1 - \tau)\pi(r)$ with $\pi = -k$.

Capital is perfectly mobile between local governments, but entrepreneurs are only mobile at a cost. An entrepreneur in a municipality can move to another municipality with a relocation cost $c$. The entrepreneurs differ with respect to relocation costs. Different from Devereux et al., we want to focus on the variation in mobility conditions between the tax setting authorities. To handle this heterogeneity, we assume that the relocation costs in a local governments are uniformly distributed on $[0, c]$. The distribution has unit density and the distribution function is $H(c) = c / \bar{c}$. The parameter $\bar{c}$ reflects the local mobility conditions.

The entrepreneur in local government 1 with cost $\hat{c}$ is indifferent between moving to local government 2 or not when

$$\hat{c} = (1 - \tau_2)\pi_2(r) - (1 - \tau_1)\pi_1(r)$$

(3)

The cutoff cost $\hat{c}$ is a function of the tax parameters of the two local governments, and a higher statutory tax rate $\tau_1$ in local government 1 will raise the cutoff cost level as the municipality is less attractive for entrepreneurs.
The local government sets the tax rate to maximize the welfare of the residents, and the government can only tax the \( 1 - \frac{\hat{c}}{c} \) resident entrepreneurs. The government finances local public goods \( g \) with these taxes, and the budget constraint can be written:

\[
g_1 = \left[ 1 - \frac{\hat{c}}{c} \right] \tau_1 \pi_1
\]  

(4)

The objective of the local government is to maximize the welfare of agents resident in the municipality:

\[
W_1 = r k + \gamma g_1 + \left[ 1 - \frac{\hat{c}}{c} \right] \left[ (1 - \tau_1) \pi_1 + \gamma g_1 \right]
\]  

(5)

The consumption of the private good is equal to the respective agents after-tax income, equal to \( r k \) for the capitalist and \( (1 - \tau_1) \pi_1 \) for the entrepreneurs. In addition we assume that both types of agents have linear utility from the public good (parameter \( \gamma \)).

Assuming that local government 1 takes the tax level in 2 as given, the first order condition for optimal taxation is

\[
\left( 2 - \frac{\hat{c}}{c} \right) \left( 1 - \frac{\hat{c}}{c} \right) \gamma \pi_1 - \left( 1 - \frac{\hat{c}}{c} \right) \pi_1 + \frac{dW_1}{d\hat{c}} \frac{d\hat{c}}{d\tau_1} = 0
\]  

(6)

Using (4) and (5), we have

\[
\frac{dW}{d\hat{c}} = -\left[ (1 - \tau_1) + \gamma \tau_1 \left( 3 - 2 \frac{\hat{c}}{c} \right) \right] \frac{1}{c} \pi_1
\]  

(7)

We reach the following reaction function for local government 1:

\[
\left( 2 - \frac{\hat{c}}{c} \right) \left( 1 - \frac{\hat{c}}{c} \right) \gamma - \left( 1 - \frac{\hat{c}}{c} \right) \left[ (1 - \tau_1) + \gamma \tau_1 \left( 3 - 2 \frac{\hat{c}}{c} \right) \right] \frac{1}{c} \pi_1 = 0
\]  

(8)

The marginal gain of increasing the tax is more public services (first term), and this must be traded off against the marginal cost represented by less consumption (second term) and less
entrepreneurs (third term). In the symmetric Nash equilibrium, the tax rates of the two jurisdictions are equal, the profits $\pi$ are equal, and $\hat{c} = 0$, so that:

$$2\gamma - 1 - (1 - \tau_1) \pi \frac{1}{\bar{c}} - 3\gamma \tau_1 \pi \frac{1}{\bar{c}} = 0$$

(9)

The distribution function chosen makes the common tax rate $\tau_1$ explicitly dependent on the local cost conditions $\bar{c}$:

$$\tau_1 = \frac{(2\gamma - 1)\bar{c} - \pi}{(3\gamma - 1)\pi}$$

(10)

The tax rate has an interior solution when $\frac{\bar{c}}{2\bar{c} - 3\pi} > \gamma > \frac{\pi + \bar{c}}{2\bar{c}}$, and there is a positive relationship between $\tau_1$ and $\bar{c}$ when $\gamma > 1/2$. Higher relocation costs $\bar{c}$ in a municipality affect the location of entrepreneurs and therefore both tax revenues and benefits of spending, as identified in (9). When more entrepreneurs are held back in the municipality, the tax rate will be increased if their benefit from public services is not too small. Given the conditions above we hypothesize that higher expected relocation costs, less mobility, leads to a higher tax level as the marginal costs of increasing taxes are lower.

In the standard ZMW-model there is no variation in the mobility of capital across jurisdictions. But the size of the externality depends on the number of competing jurisdictions. With many jurisdictions, the elasticity of the capital supply from a jurisdiction with respect to the tax rate is small. Hoyt (1991) has shown the equilibrium tax rate and public goods provision falls when the number of jurisdictions rises. This can be interpreted as intensified competition for capital. As mentioned in the introduction, Bucovetsky (1991) studies the case of asymmetric competition with two regions of different size competing for internationally mobile capital. He shows that the small country will have lower tax rate because of the more elastic tax base.

The literature has addressed many variants of the Zodrow-Mieszkowski model, including an extension to several tax instruments. Bucovetsky and Wilson (1991) include tax on labor with the source-based capital tax. In a situation of many small jurisdictions, the jurisdictions will tax only the immobile labor. When jurisdictions are large enough to influence the after-tax
return on capital, they choose a mix of labor and capital taxation. The general lesson is that the fiscal externalities created by capital taxation leads to inefficient tax mix, and that tax competition leads to reduced taxation of mobile relative to immobile factors. The model is also extended to handle expenditure composition. Keen and Marchand (1997) separate between public inputs and public goods, and identify a source of bias towards public inputs to attract capital inflow.

The key hypothesis derived from the theoretical literature is that increased mobility of the tax base leads to lower capital taxation. Associated with this is a possible shift in the tax structure from mobile to immobile tax bases and a possible shift in the expenditure composition from services directed towards immobile factors to services directed towards mobile factors. In the empirical analysis below we concentrate on the key relationship between firm mobility and tax level, but we also address the effects for spending level and composition.

3. Measuring variation of firm mobility

The general lesson from theory is that the intensity of the competition varies with tax base mobility and affects the fiscal decisions of governments. In practice the mobility concerns of governments relate to the location of firms. In our empirical context, discretionary firms in various industries choose to invest in one or more out of many municipalities. The elasticity of the tax base cannot be measured by a simple parameter in this situation of heterogenous firms.

The main contribution of this analysis is to introduce explicit measures of mobility. As direct information about relocation of firms across municipality borders is not available, we compute two indirect measures of firm mobility at the regional level. Our definition of a region is the travel-to-work area. Statistics Norway has constructed 90 travel-to-work areas on the basis of data about commuting between all 435 municipalities. A travel-to-work area consequently comprises on average 4.8 municipalities.

Geographical mobility of firms depends on the specificity of human and physical capital, that is, the costs of hiring and replacing workers and the costs of moving production facilities. Human capital specificity is typically measured as the rate of job reallocation (Davis and Haltiwanger, 1992), defined as the sum of job creation and job destruction scaled by total
jobs. Job reallocation rates have been applied by Alt et al. (1999) to study of the relation between factor specificity and the political behaviour of firms in Norway. Statistics Norway has computed the average job reallocation rate during 1977-86 for 29 three-digit manufacturing industries. Our first measure of firm mobility at the regional level, denoted job turnover (JOB-TURNOVER), is the weighted average job reallocation rate of the manufacturing industries of the region, with employment shares in 1990 as weights.

To obtain a measure of physical capital specificity, we examine variation in the return to capital across municipalities. High profit variability indicates that there are substantial costs of moving production facilities. For each of nine two-digit manufacturing industries and each municipality, we compute an estimate of the return to capital in 1990 (using three-digit industries generate too few observations). Estimates of the value of each type of capital (buildings, vehicles and equipment) are computed from investment data 1972-90 for each industry and municipality using the perpetual inventory method. Return to capital is defined as value added at factor prices less wage costs scaled by the total value of capital. The standard deviation of return to capital across municipalities (RETURNVAR) is a proxy for firm mobility at the industry level. Our second measure of firm mobility at the regional level, denoted profit variability (PROFIT-VARIABILITY), is the weighted average value of RETURNVAR with the 1990 capital shares of the industries of the region as weights. Higher values of PROFIT-VARIABILITY are associated with lower firm mobility. Summary statistics for the two mobility variables as well as variable definitions and summary statistics for the dependent variable and the other explanatory variables are presented in the appendix Table 1.

4. Data and empirical specification

When we take the theoretical hypothesis of section 2 to data, we will assume that mobility conditions measured by \( \bar{c} \) differ between regions, but are equal for local governments within a region. It follows that the expected value of the relocation costs of entrepreneurs differ between regions, reflecting different degrees of mobility. According to the model, in equilibrium the tax level will be similar among local governments in a region, but differ between regions. Regions with high mobility and therefore low relocation costs will have lower tax level. This is the main hypothesis to be tested below.
The analysis is designed to identify the relationship between the degree of mobility of firms and the local tax level measured by the size of the infrastructure fee. We have access to unique data about the infrastructure fee level that is related to a standardized house. Our measure of infrastructure fees (FEE INFRA) is average annual fees on utilities paid by owners of a standard apartment (140 m²). The variable is available since 1996. The measure indirectly represents a standardization of the fee paid by firms. The geographic pattern of the infrastructure fee fits the assumption made above. When we run a regression of the fee level of the about 400 local governments in the data against dummies for the 90 regions, significant regional differences in fee levels are identified.

Introducing firm mobility implies that the tax base of the local government is endogenized. Local governments must take into account the consequences for the tax base when they decide on tax and spending policy. The degree of tax base response will vary across local governments dependent on local mobility conditions. High mobility of firms implies that the tax base response is an important consideration in the setting of fees. The empirical issue is to settle whether mobility conditions add information of relevance to the understanding of local government fee setting.

The analytical starting point is the standard workhorse demand model of fiscal policy emphasizing income and tax price effects, also typically including demography and cost factors. Since taxation involves distribution concerns, the positive analyses of taxation address the role of the political structure. Influential contributions rationalize the aggregate preference function within a probabilistic voting model, where the political system takes into account marginal effects on voting when the budget package is decided (Hettich and Winer, 1984), or within an interest group model, where a kind of bargaining compromise between interest groups is reached (Inman, 1989). We do not address the political decision making explicitly, but include ideology and party fragmentation as controls in accordance with the existing studies of Norwegian local governments (see Kalseth and Rattsø, 1998).

In the demand model setting it is important to capture the relevant budget constraint. Local government financing is mainly under centralized control with regulated income taxes and grants dominating, and the infrastructure fee is the main discretionary local revenue source. Local governments set a fee for infrastructure that is paid by households and firms. The fee is set given some central government regulation (cover infrastructure costs at most), but the fee
level, the cost share covered by the fee and the cost level varies significantly between local
governments. Borge (2000) estimates a demand model to analyze how the fee varies
systematically with economic and political conditions. The analysis below extends Borge’s
analysis to include mobility aspects.

The set of demand control variables are taken from available empirical analyses of Norwegian
local government behaviour (see Borge and Rattsø, 1995) and in accordance with the broad
international literature. Grants, including regulated income tax revenue sharing, dominate
local government revenues and are expected to reduce all use of revenue instruments. Private
income is here mainly an indicator of private demand for local government services. When
services are allocated to specific age groups (day care, primary education and care for the
elderly), the size of the age groups are expected to influence the composition of service
spending. Local cost conditions are represented by the settlement pattern, the population size
and the wage level.

GRANTS include both central government grants and local income and wealth taxes with tax
rates regulated by the state. On average these exogenous sources of revenue represent about
80 percent of the total. Private income (PINCOME) is measured as ordinary income after tax
per capita. The population shares of the main user groups of municipal services – children
(CHILD), young people (YOUNG) and the elderly (OLDCARE) – are included as
DEMOGRAPHICS to control for variation in age structure, whereas population density
(TRAVEL) and the wage level (WAGE LEVEL) are proxy variables for the COSTS of
producing municipal services. TRAVEL is an index that measures average travel distance to
the nearest local centre. TRAVEL is computed by the Norwegian Institute of Transport
Economics from detailed information about the population pattern in each municipality and is
considered the best indicator of population density. WAGE LEVEL is computed from a large
micro data set that comprises most workers in the municipal sector during the period covered
by this study. Technically, WAGE LEVEL is the estimated fixed effects in annual regressions
explaining municipal wages as a function of personal characteristics and municipal fixed
effects. The variable is scaled by the county average. Party fragmentation of the municipal
council (HERF) is of interest in a multi-party system where coalition formation is difficult.
This is of particular importance in the case of redistributive services. Other controls such as
the population size representing costs, and share of socialist representatives in the municipal
council representing election outcome and thereby the ideological preferences of the electorate, have been investigated, but are excluded below because of insignificant effects.

There is a potential endogeneity of firm mobility since firms are expected to sort themselves according to local fiscal conditions. Recent or current mobility descriptions are potentially endogenous because local budget priorities change slowly and local spending and revenue decisions affect local mobility conditions. We use demographic and industrial descriptive variables dated about 20 years before the variables describing the local fiscal performance as instruments.¹

The estimated benchmark model is then (time subscripts suppressed):

\[
\begin{align*}
\text{FEEINFRA}_i &= \beta_0 + \alpha_{i1.2}\text{MOBILITY}_i + \beta_3\text{GRANTS}_i + \beta_4\text{PINCOME}_i + \beta_{3.4.5}\text{DEMOGRAPHICS}_i + \\
& \quad + \beta_{6.7.8}\text{COSTS}_i + \beta_{9.10}\text{HERF}_i + \beta_{11.12}\text{TIMEDUMMY}_i + u_i
\end{align*}
\]

(11)

5. Estimation results: firm mobility and infrastructure fee level

The estimates of the benchmark model are reported in Table 1. The results shown in column 1 imply that job turnover and profit variability both have the expected signs (negative for job turnover and positive for profit variability). Both measures indicate that increased regional mobility is associated with lower local government fee level, and both effects are significant. The results support the prediction of the theoretical model of section 2, that local governments with different mobility conditions choose different tax levels affecting firms.

Table 1 about here

The elasticity of the infrastructure fees with respect to job turnover and profit variability are -0.26 and 0.53 respectively. Higher firm mobility as measured by one standard deviation (= 13.8 percentage points) reduction in profit variability reduces the annual infrastructure fee per standard apartment by NOK 210, or about 15%, whereas a one standard deviation (= 1.5

¹ Instrumental variables: Population shares in five years intervals from 20-24, ...60-64, to 65-66, population shares with high-school (two levels) and university degree (two levels), employment shares for 29 industrial sectors, and population share in municipality relative to region. All variables are registered in 1970, and all – except the latter – are at both municipal and regional level.
percentage points) increase in job turnover reduces annual infrastructure fees by NOK 45 (= 3.4%).

The economic and political determinants of the fee level, included as controls here, are consistent with other Norwegian studies (Borge, 2000). The exogenous revenues of local governments, GRANTS, are the major determinant of the fee level. Higher exogenous revenue is associated with lower fees. Demographics are also important. The interpretation of the negative coefficients of CHILD and YOUNG is that local governments with age structure biased towards children and youth have less emphasis on infrastructure.

The three other columns in Table 1 documents that the estimated effects of the firm mobility variables are stable over years. Profit variability is highly significant all years, but job turnover is only significant for the last year.

6. Spatial specification and reaction functions

So far we have concentrated on the equilibrium prediction of the modified Devereux et al. model of section 2. Implicitly the model defines reaction functions of the local governments, and outside equilibrium the fee setting of a local government is affected by others. To investigate the existence of strategic interdependence, we expand the model to include neighbours tax decision in a spatial lag formulation. As mentioned in the introduction, the estimation of reaction functions is now the standard procedure in empirical studies of tax competition. Also the Devereux et al. (2002) model is applied to analyze reaction functions among counties.

The benchmark model in (11) is expanded with the following term:

\[ + \rho \sum_{j \neq i} w_{ij} FEEINFRA_j \]  

(12)

where \( w_{ij} \) are weights that relate the neighbours to each other, and the parameter \( \rho \) measures the strength of this relationship; that is, whether decision by one local government is affected by decisions of others. The weights are determined a priori, and the reported estimates are based on a definition of neighbours as municipalities with a common border. An expanded matrix that also includes neighbours belonging to the same economic region have been tested, and tith basically the same results as below. The neighbourhood matrix is row-standardized,
and the neighbourhood variable is the mean value of the neighbour’s infrastructure fee. The spatial lag model is estimated using a ML estimation procedure that takes into account the non-linearity in the problem, and with an IV-method suggested by Kelejian and Robinson (1993) using spatial lagged exogenous variables as instruments.

But a spatial lag is not the only source of a spatial pattern. If we have omitted variables that are spatially dependent, we might have a pattern of spatial error dependence of the form

$$u_i = \lambda \sum_{j \neq i} w_{ij} u_j + \epsilon_i$$

(13)

where $\lambda$ is the unknown spatial autocorrelation parameter. Reasons for such patterns are often connected to topological characteristics not included in the model, and ignoring spatial error dependence can give false proof for the spatial lag model. The neighbour matrix may not be the same as in the spatial lag formulation, but it is assumed to be the first order contiguity matrix also here.

The results from the spatial model are reported in Table 2. In the first two columns we report ML-estimates of the spatial lag model without, and with, the mobility variables. In column three we report the alternative IV-estimation that also gives consistent, but not necessarily efficient, estimators for the spatial lag model.

Table 2 about here

In all the tree spatial lag specifications, the neighbour-effects in infrastructure fees are large, positive and strongly significant. The reaction curves are upward sloping. Reduced infrastructure fees by neighbours lead to reduced infrastructure fee in the municipality. The direct effects of the other parameters are reduced, but both profit variability and grants are still significant. When we take into account the long run effect, the effect of profit variability is still high, with elasticities of 0.59 in the maximum likelihood estimation, and elasticity of 0.81, but not as significant, in the instrument variable estimation.

In the last column we report the results from the spatial error model formulation. The autocorrelation coefficient is highly significant. But the change in model specification seems not to affect the parameters of our mobility variable - the effect of profit variability is still strong, significant and stable compared to the earlier results.
In the spatial model results reported, we have not instrumented the mobility variables. To check for stability we therefore obtained fitted values for the two mobility variables by running regressions on the mobility indexes with 1970 data describing the population and industrial structure of the municipality and the other municipalities in the municipality’s region as regressors. Using these fitted values as our mobility variables gave a drop in magnitude and significance of the job-turnover variable in the ML-lag model. All other results, and profit variability estimates especially, are very stable. For details, see appendix Table 2.

7. Firm mobility and spending composition

In an extension of the analysis we study the relationship between firm mobility and the expenditure side. The spending is separated out for seven service categories; central administration, education, health and social services, housing and environment policy, church and culture, technical services and transport and communication. As documented at the bottom of Table 3, most of the spending measured in NOK per capita is concentrated to education and health and social services, that is care for the elderly. We assume that transport and communication are of most relevance to firms, and that increased firm mobility accordingly will shift resources from welfare services (education and health and social services) towards transport and communication. The estimation apply the same demand model variables and instrument variable method explained above.

Table 3 about here

As suggested by Keen and Marchand (1997) and others, fiscal competition is expected to involve all fiscal instruments and not only taxes, in particular the spending level and the spending competition. We expect the tax aspects of the competition to put pressure on local government budgets, thereby affecting the spending level. And the composition of spending will be a potentially important instrument in the competition for firms. Table 3 reports the effect of mobility on current spending by the seven main budget chapters in the municipality.

For all spending categories job-turnover is associated with a negative effect on spending levels. The size of the effect is large and clearly significant for the main welfare services
education and health care and social services. The effect for transport and communication, the category of most relevance to business, is not significant. It follows that this measure of firm mobility represents a negative effect of mobility on the spending level and a shift of the composition of the services towards firms. The other measure of firm mobility, profit variability, is only significant for health care and social services and for transport and communications, for both service categories with the expected sign. Higher firm mobility - measured by lower profit variability - is associated with lower expenditure level in health care and social services and higher expenditure level in transport and communication. Given the size of the coefficients and the spending levels involved, the total spending level is reduced with higher firm mobility.

7. Concluding remarks

The paper reports results of econometric analyses of local government behaviour including measures of variation in mobility conditions. We suggest an approach where the effects of mobility conditions for local government behaviour are investigated directly. A data set for Norway allows two alternative measures of firm mobility, and they are related to local government taxation and spending. The results confirm that firm mobility influences taxation. Local governments in regions experiencing high firm mobility tend to have lower levels of infrastructure fees. In an extension of the analysis, we show that increased firm mobility is associated with lower spending level and a shift in the spending composition towards services relevant for firms. The analysis includes instrumental variables for mobility and variables representing neighbourhood effects.

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Table 1

Effect of firm mobility on infrastructure fee, IV-estimates (variables in levels)

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<tr>
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<tbody>
<tr>
<td>JOB TURNOVER</td>
<td>-0.031**</td>
<td>-0.021</td>
<td>-0.021</td>
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<tr>
<td></td>
<td>(0.015)</td>
<td>(0.024)</td>
<td>(0.026)</td>
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<tr>
<td>PROFIT VARIABILITY</td>
<td>0.015***</td>
<td>0.015***</td>
<td>0.014***</td>
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<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.003)</td>
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<tr>
<td>GRANTS</td>
<td>-0.042***</td>
<td>-0.045***</td>
<td>-0.043***</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.006)</td>
<td>(0.006)</td>
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<tr>
<td>PINCOME</td>
<td>-0.007**</td>
<td>-0.008</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.006)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>CHILD</td>
<td>-0.128***</td>
<td>-0.130***</td>
<td>-0.139***</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.036)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>YOUNG</td>
<td>-0.116***</td>
<td>-0.131***</td>
<td>-0.101***</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.027)</td>
<td>(0.031)</td>
</tr>
<tr>
<td>OLD</td>
<td>-0.045**</td>
<td>-0.040***</td>
<td>-0.041***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.010)</td>
<td>(0.014)</td>
</tr>
<tr>
<td>TRAVEL</td>
<td>-0.037***</td>
<td>-0.038***</td>
<td>-0.030</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.011)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>W. LEVEL</td>
<td>0.037***</td>
<td>0.047**</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.015)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>HERF</td>
<td>0.009***</td>
<td>0.005</td>
<td>0.012**</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.005)</td>
</tr>
</tbody>
</table>

Notes: Standard errors in parentheses. * = p < 0.1, ** = p < 0.05, *** = p < 0.01.
### Table 2

**Effect of firm mobility on infrastructure fee, spatial model 1998, 414 observations**

<table>
<thead>
<tr>
<th>Variable</th>
<th>ML-lag</th>
<th>ML-lag</th>
<th>IV-lag (robust)</th>
<th>ML-error</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOB TURNOVER</td>
<td>-0.041** (0.021)</td>
<td>-0.030 (0.020)</td>
<td>-0.065** (0.025)</td>
<td></td>
</tr>
<tr>
<td>PROFIT VARIABILITY</td>
<td>0.009*** (0.003)</td>
<td>0.004* (0.003)</td>
<td>0.014*** (0.003)</td>
<td></td>
</tr>
<tr>
<td>GRANTS</td>
<td>-0.028*** (0.006)</td>
<td>-0.014** (0.006)</td>
<td>-0.023*** (0.007)</td>
<td></td>
</tr>
<tr>
<td>PINCOME</td>
<td>-0.011** (0.005)</td>
<td>-0.013** (0.005)</td>
<td>-0.016** (0.006)</td>
<td></td>
</tr>
<tr>
<td>CHILD</td>
<td>-0.080** (0.036)</td>
<td>-0.063* (0.036)</td>
<td>-0.077** (0.037)</td>
<td></td>
</tr>
<tr>
<td>YOUNG</td>
<td>-0.059** (0.029)</td>
<td>-0.079*** (0.029)</td>
<td>-0.079** (0.033)</td>
<td></td>
</tr>
<tr>
<td>OLD</td>
<td>-0.034** (0.014)</td>
<td>-0.038*** (0.014)</td>
<td>-0.044*** (0.016)</td>
<td></td>
</tr>
<tr>
<td>TRAVEL</td>
<td>-0.026 (0.021)</td>
<td>-0.016 (0.021)</td>
<td>0.001 (0.018)</td>
<td>-0.023 (0.021)</td>
</tr>
<tr>
<td>W. LEVEL</td>
<td>0.049** (0.024)</td>
<td>0.042** (0.023)</td>
<td>0.036 (0.023)</td>
<td>0.040* (0.023)</td>
</tr>
<tr>
<td>HERF</td>
<td>0.004 (0.005)</td>
<td>0.004 (0.005)</td>
<td>-0.002 (0.004)</td>
<td>0.002 (0.057)</td>
</tr>
<tr>
<td>spatial lag (neighbours fee)</td>
<td>0.510*** (0.051)</td>
<td>0.456*** (0.054)</td>
<td>0.826*** (0.098)</td>
<td></td>
</tr>
<tr>
<td>spatial error ($\lambda$)</td>
<td>0.476*** (0.057)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: standard errors in parentheses. * = $p < 0.1$, ** = $p < 0.05$, *** = $p < 0.01$. 

Long run effect

| JOB TURNOVER | -0.075 | -0.172 |
| PROF VARIABILITY | 0.017 | 0.023 |
Table 3
Effect of firm mobility on budget-priorities, IV-estimates (variables in levels)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Central administration</th>
<th>Education</th>
<th>Health, social services</th>
<th>Housing, environment</th>
<th>Church, culture</th>
<th>Technical services</th>
<th>Transport, communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOB TURNOVER</td>
<td>-0.053*** (0.018)</td>
<td>-0.083*** (0.032)</td>
<td>-0.169*** (0.057)</td>
<td>-0.045 (0.050)</td>
<td>-0.072*** (0.016)</td>
<td>-0.041** (0.020)</td>
<td>-0.008 (0.010)</td>
</tr>
<tr>
<td>PROFIT VARIABILITY</td>
<td>0.003 (0.002)</td>
<td>-0.002 (0.004)</td>
<td>0.012** (0.005)</td>
<td>-0.006 (0.008)</td>
<td>-0.002 (0.002)</td>
<td>0.001 (0.002)</td>
<td>-0.006*** (0.001)</td>
</tr>
<tr>
<td>GRANTS</td>
<td>0.203*** (0.013)</td>
<td>0.311*** (0.018)</td>
<td>0.438*** (0.031)</td>
<td>0.159*** (0.044)</td>
<td>0.088*** (0.009)</td>
<td>0.105*** (0.012)</td>
<td>0.048*** (0.007)</td>
</tr>
<tr>
<td>PINCOME</td>
<td>-0.012*** (0.004)</td>
<td>0.014* (0.008)</td>
<td>-0.036*** (0.008)</td>
<td>-0.022*** (0.009)</td>
<td>0.009*** (0.003)</td>
<td>0.011** (0.004)</td>
<td>0.005 (0.004)</td>
</tr>
</tbody>
</table>

Variable statistics for the dependent variables, Current expenses by main chapter.

<table>
<thead>
<tr>
<th>NOK in 10^3 per capita.</th>
<th>Central administration</th>
<th>Education</th>
<th>Health, social services</th>
<th>Housing, environment</th>
<th>Church, culture</th>
<th>Technical services</th>
<th>Transport, communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (std.)</td>
<td>2.756 (1.477)</td>
<td>9.797 (2.419)</td>
<td>11.946 (3.522)</td>
<td>1.979 (2.037)</td>
<td>1.575 (0.754)</td>
<td>2.825 (1.058)</td>
<td>0.704 (0.655)</td>
</tr>
</tbody>
</table>

Notes: 1215 observations, period 1996-98. All explanatory variables from the standard model are included, and instruments for the mobility variables are the same as in table 2. Standard errors in parentheses. * = p < 0.1, ** = p < 0.05, *** = p < 0.01.
### Appendix Table 1. Variable definitions and summary statistics, 394 municipalities, 1998

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Mean</th>
<th>(st.dev)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variables:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEE INFRA</td>
<td>Fees on utilities per customer, in 10^4 NOK</td>
<td>1.77</td>
<td>(0.79)</td>
</tr>
<tr>
<td><strong>Mobility variable:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOB TURNOVER</td>
<td>Weighted average job reallocation rate of region (Percentage)</td>
<td>14.87</td>
<td>(1.47)</td>
</tr>
<tr>
<td>PROFIT VARIABILITY</td>
<td>Region’s weighted average standard deviation of return on capital in 1990 (Percentage)</td>
<td>62.67</td>
<td>(13.85)</td>
</tr>
<tr>
<td><strong>Other explanatory variables:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRANTS</td>
<td>Grants and tax sharing revenues per capita, in 10^4 NOK</td>
<td>23.00</td>
<td>(6.16)</td>
</tr>
<tr>
<td>PINCOME</td>
<td>Average private income per capita, in 10^3 NOK</td>
<td>76.09</td>
<td>(7.53)</td>
</tr>
<tr>
<td>CHILD</td>
<td>Population share of children aged 0-6 (Percentage)</td>
<td>9.33</td>
<td>(1.28)</td>
</tr>
<tr>
<td>YOUNG</td>
<td>Population share of persons aged 7-15 (Percentage)</td>
<td>11.89</td>
<td>(1.38)</td>
</tr>
<tr>
<td>OLD</td>
<td>Population share of persons &gt; 66 (Percentage)</td>
<td>15.76</td>
<td>(3.76)</td>
</tr>
<tr>
<td>TRAVEL</td>
<td>Index of distance to the local center, (based on 1995 data) When transformed: log(TRAVEL+1)</td>
<td>1.96</td>
<td>(1.70)</td>
</tr>
<tr>
<td>WAGE LEVEL</td>
<td>Relative wage level in the municipal sector (Percentage)</td>
<td>99.63</td>
<td>(1.44)</td>
</tr>
<tr>
<td>HERF</td>
<td>Herfindahl index, municipal council (Percentage)</td>
<td>26.82</td>
<td>(7.43)</td>
</tr>
</tbody>
</table>
### Appendix Table 2

Effect of firm mobility on infrastructure fee, spatial model 1998, mobility variables based on fitted values, 393 observations

<table>
<thead>
<tr>
<th>Variable</th>
<th>ML-lag</th>
<th>ML-lag</th>
<th>IV-lag (robust)</th>
<th>ML-error</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOB TURNOVER</td>
<td></td>
<td>-0.029</td>
<td>-0.035</td>
<td>-0.064**</td>
</tr>
<tr>
<td>PROFIT VARIABILITY</td>
<td></td>
<td>0.010***</td>
<td>0.005*</td>
<td>0.015***</td>
</tr>
<tr>
<td>GRANTS</td>
<td>-0.028***</td>
<td>-0.026***</td>
<td>-0.016***</td>
<td>-0.025***</td>
</tr>
<tr>
<td>PINCOME</td>
<td>-0.010*</td>
<td>-0.013**</td>
<td>-0.011***</td>
<td>-0.014**</td>
</tr>
<tr>
<td>CHILD</td>
<td>-0.094***</td>
<td>-0.082</td>
<td>-0.053</td>
<td>-0.094**</td>
</tr>
<tr>
<td>YOUNG</td>
<td>-0.055*</td>
<td>-0.075*</td>
<td>-0.045</td>
<td>-0.074**</td>
</tr>
<tr>
<td>OLD</td>
<td>-0.036**</td>
<td>-0.042***</td>
<td>-0.030***</td>
<td>-0.047***</td>
</tr>
<tr>
<td>TRAVEL</td>
<td>-0.030</td>
<td>-0.021</td>
<td>-0.008</td>
<td>-0.025</td>
</tr>
<tr>
<td>W. LEVEL</td>
<td>0.037</td>
<td>0.030</td>
<td>0.020</td>
<td>0.028</td>
</tr>
<tr>
<td>HERF</td>
<td>0.004</td>
<td>0.005</td>
<td>-0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>spatial lag (neighbours fee)</td>
<td>0.479***</td>
<td>0.428***</td>
<td>0.748***</td>
<td></td>
</tr>
<tr>
<td>error lag (λ)</td>
<td></td>
<td></td>
<td></td>
<td>0.442***</td>
</tr>
</tbody>
</table>

**Notes:** 393 local governments, standard errors in parentheses. * = p < 0.1, ** = p < 0.05, *** = p < 0.01.