A joint Initiative of Ludwig-Maximilians-Universität and Ifo Institute for Economic Research

Working Papers

INCOME DISTRIBUTION AND TAX STRUCTURE: MICROECONOMIC TEST OF THE MELTZER-RICHARD HYPOTHESIS

Lars-Erik Borge
Jørn Rattsø*

CESifo Working Paper No. 543

August 2001

Presented at CESifo Norwegian Seminar, June 2001

CESifo
Center for Economic Studies & Ifo Institute for Economic Research
Poschingerstr. 5, 81679 Munich, Germany
Phone: +49 (89) 9224-1410 - Fax: +49 (89) 9224-1409
e-mail: office@CESifo.de
ISSN 1617-9595

* The paper is part of a project on local and regional taxation financed by the Norwegian Research Council. We appreciate comments at seminars in Brescia, Trondheim and Umeå, and in particular from Tim Goodspeed.

CESifo *Working Paper No. 543*
August 2001

INCOME DISTRIBUTION AND TAX STRUCTURE: MICROECONOMIC TEST OF THE MELTZER-RICHARD HYPOTHESIS

Abstract

The tax structure is important for the income distribution and therefore a key playground for redistributive politics. The standard theory assumes that more unequal income distribution will create a majority for more redistribution (Meltzer and Richard). This study investigates the empirical validity of this relationship in a microeconomic study of the tax structure in decentralized government in Norway. The choice of revenue instruments studied involves user charges and property taxes oriented towards housing. While user charges act as head taxes, property taxes have distributive consequences. The approach is in the tradition of majority rule, and we show how the local government decisions regarding tax structure and spending level can be understood as one-dimensional. This motivates the empirical analysis where the actual income distribution is measured by the ratio of median to mean income. The estimated model confirms that more equal income distribution implies a shift in the tax burden from property taxes to user charges.

JEL Classification: D72, H71.

Lars-Erik Borge
Department of Economics
Norwegian University of Science and Technology
Dragvoll University Campus
N-7491 Trondheim
Norway
Lars.borge@svt.ntnu.no

Jørn Rattsø
Department of Economics
Norwegian University of Science and Technology
Dragvoll University Campus
N-7491 Trondheim
Norway

1. Introduction

When the median voter has less income than the mean, the typical income distribution observed, the decisive median voter will apply income taxation for redistribution.
This is the key insight of Meltzer and Richard (1981). In this model more uneven income distribution is associated with more redistribution, although it is held back by negative incentives to work and save affecting all. The setup assumes proportional income taxation financing lump sum government transfers. The theory is based on earlier work on optimal redistributive taxation by Romer (1975) and Roberts (1977), where the decisive voter chooses parameters of an income tax function. Cukierman and Meltzer (1991) continue this tradition and show conditions when marginal progressivity of the income tax is determined by the median voter.

In the related empirical literature, the Meltzer-Richard model is basically interpreted as a theory of government size. Government spending is assumed to concentrate on redistribution, and the income distribution is consequently understood as the major determinant of government size. It seems to us productive to get back to the relationship between income distribution and taxation as a basis of evaluating redistributive politics and to bring in microeconomic evidence to investigate the hypothesis. Our empirical analysis addresses the role of the income distribution for the choice of tax structure.

The empirical literature has concentrated on aggregate economic measures, first studying aggregate government spending and later moving to economic growth. Meltzer and Richard (1993) started up the empirical tests of the hypothesis in an analysis of US time series data of government spending. They conclude that the spending level is negatively related to the ratio of median to mean income. Cross-country studies of the relationship are less conclusive. It is hard to get away from the observation that many countries with equal income distribution have large government spending, notably the Scandinavians, while many countries with unequal income distribution have smaller public sectors, as in many developing countries. Saint Paul and Verdier (1996) review some critical arguments. Alesina and Rodrik (1994) and Persson and Tabellini (1994) extend the empirical cross-country analyses to economic growth. They introduce dynamic models arguing that income inequality is associated with

higher taxation and therby may contribute to slower growth. The evidence suggests that income inequality reduces economic growth, but the link via taxation is not documented.

More recent studies have investigated various measures of income distribution and redistribution across countries. The data of Perotti (1996) have the broadest coverage and include the marginal tax rate and different expenditure components. He concludes that there is little evidence of a negative association between equality and fiscal variables. Bassett et al. (2000) reach the same conclusion with other definitions of transfers and spending. Milanovic (2000) has a more direct measure of redistribution, the income gain of different income groups from factor income to disposable income. His estimates support the hypothesis that countries with greater inequality distribute more, but are less supportive of the median voter hypotheses. The spread of the income distribution, among the poor and among the middle class, is the background concern.

The conflicting evidence in cross-country studies opens up for broader analyses of differences in political systems and redistributive instruments. But the evaluation of the Meltzer-Richard hypothesis should look at more homogenous political systems. Decentralized government is a potentially interesting source of information about politics and distribution. Alesina et al. (2000) exploits this type of data base in a recent study of US cities. They find a positive relationship between inequality and public employment. We suggest an analysis of decentralized government emphasizing tax structure. The tax design of local government in Norway allows for this kind of test.

The empirical literature on the choice of tax structure typically has a broader background of political economy. Inman (1989) offers empirical evidence that income distribution influences the mix of property taxes and user fees and suggests caution in the use of the representative taxpayer model. His results are based on a model of institutional, political and economic determinants of local taxation in 41 US cities during 1961-86. Inman assumes a political compromise involving city council, mayor and city agencies. Hettich and Winer (1988) analyze the multi-dimensional aspects of tax policies and propose a probabilistic voting model where politicians set taxes and government spending in order to maximize the number of votes. In equilibrium the marginal political cost of raising tax revenue should be equalized across voters and across tax bases. As this can be achieved by a very complicated tax system, we should not be surprised by the complexity of actual tax systems. Chernick and Reschovsky

(1996) measures the degree of progressivity of the state tax burdens. Income inequality comes out as an important explanation of progressivity, and the result is seen as consistent with an interest group model of tax choice. The problem with the political economy models is that the decision making is a black box.

If the choice of tax structure is understood in the context of redistributive politics, we can take advantage of the stylized observation that income distribution conflict mainly follows one dimension – the income variation. This is the intuition of the promising theoretical results of median voter models where multi-dimensional policy is represented by a unidimensional conflict. The theoretical conditions are nicely laid out by Persson and Tabellini (2000). The empirical literature has to our knowledge not made use of this property.

Two empirical studies are of particular relevance. Goodspeed (1998) develops a majority rule voting model for the relationship between state income taxes and local property taxes in the US. Income distribution is important for the tax structure since the distribution of the income tax base is different from the distribution of the property tax base. The model allows a unidimensional decision since the two taxes are decided at different political levels. The related theory model of Henderson (1994) has motivated our study, as he outlines the choice between user fees and property taxes at the local level relevant for the US. He includes income distribution by separating between property owners and residents and by assuming that user fees act as head taxes. In practice, decisions about tax structure also involve the determination of government spending level. Inman (1979) recognizes this in a study of 41 US cities, but solves the resulting multi-dimensionality by a two step process. First the aggregate tax level is determined in an expenditure demand model, then the tax structure decision (property tax share of total taxes) is an allocation of the total taxes. We consider a situation where two revenue instruments and government spending are decided at the same level, but that can be understood as unidimensional under specific conditions.

This empirical analysis of tax structure exploits the comparable institutions in decentralized government in Norway where income distribution can influence the local choice of taxation. Norway has a centralized system of financing, dominated by grants and regulated revenue-sharing (of income and wealth taxes), but local governments have some discretion on the margin related to user charges and property taxes

Section 2 outlines a theoretical model of the relationship between income distribution and tax structure and shows the conditions for unidimensionality and a median voter outcome. Section 3 presents the empirical and institutional background of the empirical analysis, and documents the data and the econometric model. Estimation results are presented in section 4. Concluding remarks are offered in section 5.

2. Theoretical framework: Income distribution and tax structure

The tax structure is typically determined together with government expenditure and therefore in a multi-dimensional setting. We analyze the tax and spending decisions as generated by redistributive politics, and the choice of revenue instruments is understood as the outcome of majority voting in a setting where income distribution is important. The model below gives a stylized description of local governments choosing between user charges and property taxes to finance local public spending at the margin. The model clarifies under what conditions the decision about tax structure can be analyzed as one dimensional and generates hypotheses for empirical testing. To simplify the model we assume away mobility and redistributive spending, and the property tax is linked to a simple housing market. When the tax setting is motivated by distributive and fiscal factors, the user charges are not determined according to rules of public sector pricing.

The community comprises N voters with identical Cobb-Douglas utility functions:

$$U_i = c_i^{\alpha} h_i^{1-\alpha} g^{\beta} \qquad 0 < \alpha < 1,\ \beta > 0 \qquad i = 1,\ldots,N \tag{1}$$

The utility function includes private consumption (c), housing (h) and per capita provision of local public services (g). The individual voter chooses a mix of private consumption and housing by solving the following maximization problem:

$$\max_{c_i, h_i} c_i^{\alpha} h_i^{1-\alpha} \quad s.t. \quad c_i + (1+t)h_i = y_i - f \tag{2}$$

The voters have different exogenous income (y_i) that finances private consumption, housing and utility charge (f). We assume that utility charge work as a head tax. The market prices of private consumption and housing are normalized to unity, and the gross price of housing is

1+t where *t* is the property tax rate. Housing supply is perfectly elastic. The individual optimization problem leads to familiar demand functions for private consumption and housing:

$$c_i = \alpha(y_i - f)$$
$$h_i = \frac{1-\alpha}{1+t}(y_i - f) \tag{3}$$

By plugging the demand functions into the utility function, we arrive at the following indirect utility function:

$$W_i = A(1+t)^{\alpha-1}(y_i - f)g^{\beta} \qquad A = \alpha^{\alpha}(1-\alpha)^{1-\alpha} \tag{4}$$

The property tax rate, the utility charge and provision of local public services are determined by political decision-making. The political choice set is restricted by the local government budget constraint:

$$g = t\bar{h} + f + l \tag{5}$$

The unit cost of local public services is normalized to unity, and $\bar{h}$ is average housing demand and *l* per capita grants from the central government. The restriction imposed by the local government budget constraint implies that the local policy choice is two-dimensional. By inserting the budget constraint, we can write the indirect utility function with only *t* and *f* as policy instruments.

$$W_i = A(1+t)^{\alpha-1}(y_i - f)(t\bar{h} + f + l)^{\beta} \tag{6}$$

It is well known from the public choice literature that a majority-rule equilibrium may not exist when the policy space has more than one dimension. The decision-making process may suffer from a cycling problem where any allocation can be beaten by another proposal. However, a majority-rule equilibrium can be obtained by imposing restrictions on preferences or institutions.

One class of restrictions on preferences is so-called intermediate preferences. Voters have intermediate preferences if heterogeneity is limited and can be projected to a single dimension. Our intuition is that the redistributive conflict involved can be understood in relation to income variation. It appears that the indirect utility function satisfies the condition for intermediate preferences in our case. Following Persson and Tabellini (2000, p. 25), the condition is that indirect utility function can be written as

$$W_i = J(f,t) + K(y_i)H(f,t) \tag{7}$$

where $K(y_i)$ is monotonic in y_i, and $J(f,t)$ and $H(f,t)$ are common to all voters. It is easy to verify that the indirect utility function given by equation (6) can be written on this form with $J(f,t) = -A(1+t)^{\alpha-1}(t\bar{h} + f + l)^{\beta} f$, $H(f,t) = A(1+t)^{\alpha-1}(t\bar{h} + f + l)^{\beta}$ and $K(y_i) = y_i$. The political equilibrium is the policy preferred by the voter with median income, and is characterized by

$$\frac{\partial W_m}{\partial f} = \frac{\partial W_m}{\partial t} = 0 \tag{8}$$

where subscript *m* denotes the voter with median income. The equilibrium property tax rate and utility charge are determined by median income, mean income and central government grants. In this paper we are particularly interested in the impact of income distribution, and the effect of more equal distribution can be found by investigating the impact of higher median income (keeping mean income constant). As shown in the Appendix, higher median income has the following impact on the policy choice:

$$\frac{\partial f}{\partial y_m} > 0, \quad \frac{\partial t}{\partial y_m} < 0, \quad \frac{\partial g}{\partial y_m} > 0 \tag{9}$$

It appears that higher median income will change both the tax structure and the level of local government spending. The change in tax structure reflects that a relatively richer median voter prefers less redistribution, and less redistribution is achieved by shifting the financing from the redistributive property tax to the utility charge. The increase in the utility charge exceeds

the reduction in property tax revenue, which implies that provision of local public services increases. This effect is driven by the positive income elasticity for local public services.

The qualitative effects of an increase in mean income is as follows:

$$\frac{\partial f}{\partial \bar{y}} < 0, \quad \frac{\partial t}{\partial \bar{y}} > 0, \quad \frac{\partial g}{\partial \bar{y}} > 0 \tag{10}$$

Mean income has the opposite effect of median income on the two revenue instruments. An increase in mean income (keeping median income constant) leads to a more unequal income distribution and shifts the tax structure from utility charges to the redistributive property tax. As median income, mean income has a positive effect on the provision of local public services.

Grants have the following impact on the local policy choice:

$$\frac{\partial f}{\partial l} < 0, \quad \frac{\partial t}{\partial l} < 0, \quad \frac{\partial g}{\partial l} > 0 \tag{11}$$

The model predicts a revenue substitution effect in the sense that less revenue is collected locally when the local government receives more grants from the center. The effect on tax structure is ambiguous since we cannot tell which of the two local revenue instruments that will be reduced most. Moreover, grants have a positive effect on service provision. That is, the reduction in locally collected revenues following an increase in grants is less than the grant increase.

3. Data and empirical specification

Decentralized government allows empirical analysis of comparable political institutions influencing tax structure. In most countries, local governments can choose between user charges and property taxation, and they add revenue to grants and taxes regulated from the center. In the Norwegian case, the discretion to influence current revenues is limited to property tax and user charges, which account for about 15% of local government revenue.

The main purpose of the empirical analysis is to investigate income distribution as a determinant of the mix of residential property taxation and housing related utility charges.

The data set represents the 434 Norwegian local governments and covers the years 1996-1998.[1] About 15 % of the 434 local governments in the sample have residential property tax. Among the 70 municipalities with property taxation, the average tax is NOK 1300 (USD 150) per standardized house, varying from NOK 450 to nearly NOK 3000. Roughly 50% have a property tax between NOK 1000 and 1600. Among all 434 local governments, the average utility charge is NOK 5800 (USD 670), varying from NOK 2400 to nearly 13000. Nearly 50% of the local governments have utility charges between NOK 5000 and 7000.

Since we concentrate on the mix between user charges and residential property taxes, the tax structure is described by the property tax share of the sum of housing related utility charges and residential property tax. Local governments with property tax have an average property tax share of 18%. The tax structure is of interest since this share varies from 5 to 37%, and half of them have a property tax share between 14 and 22%. In the raw data there is no evidence of tax substitution where local governments with property tax have lower utility charges than local governments without property tax. Rather the difference goes in the opposite direction. During the period 1996-1998, the utility charges of average local governments with property tax were 1-5% higher than the sample averages for local governments without property tax.

The property tax is limited to urban areas and certain facilities (notably power stations), and is not available to all local governments. In practice around 200 of the 435 local governments have property tax. The present property tax does not generate much revenue, only about 5% of local government revenue and 0.3% of GDP. Most of the property tax revenue relates to electric power production. The local governments can choose property tax rate within a narrow band (0.2 to 0.7%), but most of the local governments with a property tax apply the

[1] In this study we take advantage of a data set collected by an association called Norwegian Household Economics (*Norsk Familieøkonomi*). Since 1996 the association has collected yearly data on property taxes and user charges in all local governments, and in this study we use a panel data set covering the years 1996-1998. The data are standardized and therefore comparable across the country. The local governments are asked to state the property tax for a standard house of 200 square meters and a market value of NOK 750 000 (about USD 85 000). Property tax revenue is only registered when property tax is levied on more than half of the residential property. The utility charges are calculated for a household with water consumption of 200 cubic meters per year, the weekly collection of a 'regular' garbage can, and yearly cleaning of one chimney.

maximum rate. Because of the large variation in assessment practice and the amount that can be deducted from the assessed value, there is more variation in the effective tax rates than in the formal rates. This study concentrates on residential property tax.

A key aspect of the theoretical model laid out in Section 2 is that the property tax is redistributive, while utility charges works as a head tax. The distributional consequences of the property tax are investigated by a government commission that in 1996 proposed a new Property Tax Act (NOU 1996: 20). They concluded that the property tax is roughly proportional to household income. Their finding fits our assumption of a redistributive property tax.

User charges are applied for a wide range of services, but utilities, care for the elderly and kindergartens account for most of the revenues. This paper focuses on utilities, or more precisely water supply, discharge of sewage, garbage collection and chimney sweep, which amount to nearly 50% of total user charges. The market for utilities can be characterized as a local government monopoly where the use of the services is compulsory. Central government regulation limits the local government use of user charges, and user charges cannot exceed total production costs.

The income distribution is measured by the ratio of median to mean income in income data collected by the tax authorities, and the average ratio is 0.83. Extreme observations are eliminated and the analysis applies observations in the interval [0.75,0.90].[2] We have ended up with an unbalanced panel of 1176 observations.

The empirical analysis is based on the following econometric model

[2] When all local governments are included, the ratio of median to mean income varies from 0.43 to 1.06.The analysis applies the 90% of the observations in the interval [0.75,0.90], assuming that most of the observations outside the interval reflect measurement error. This suspicion is strengthened by the fact that many of the local governments with observations outside the interval have extremely large fluctuations in median to mean income from one year to another. According to the database, 125 local governments levied property tax on more than half of residential property in 1996. The corresponding figures for the two later years are 66 (1997) and 59 (1998). The discrepancy probably reflects that many local governments in the first year of data collection reported the existence of property taxation. We have chosen to modify the property tax data for 1996 in the following way: If the local government reported a positive property tax in 1996 and zero property tax in 1997 and 1998, the property tax is set to zero also for 1996. This leaves us with 71 observations with a positive property tax in 1996.

$$DEP_{it} = \beta_t + \beta_1(\frac{y_m}{\bar{y}})_{it} + \beta_2 l_{it} + \beta_3 \bar{y} + \beta_4 RURAL_i + \beta_5 POP_{it} + \beta_6 SOC_i + u_{it}$$

where the dependent variable (DEP) is the three measures of taxation included: the utility charge per standard house, property tax per standard house, and property tax share. The subscript *it* denotes community *i* in year *t*.

The model is formulated with median to mean income ($\frac{y_m}{\bar{y}}$) as the measure of income distribution and with mean income ($\bar{y}$) as the measure of the level of private income. The predictions from the theoretical model is that median to mean income should have a positive sign in the utility charge equation and a negative sign in the two property tax equations. The coefficient of mean income reflects the impact of a proportional increase in median and mean income. Since median and mean income are predicted to have opposite effect on the two revenue instruments, the expected sign is ambiguous. Exogenous revenue (*l*) is expected to have a revenue substitution effect, and thereby a negative sign in all three equations.

In the empirical analysis *l* includes lump-sum grants and regulated income and wealth taxes. Per capita private income ($\bar{y}$) is measured net of income and wealth taxes to local, county and central government, whereas before tax income is used when the ratio of median to mean income is calculated. Time dummies (β_t) are included to capture the impact of shocks that are common to all local government. In addition to the variables motivated by the theoretical model, we include three control variables. These are the population size (*POP*), the share of the population living in rural areas (*RURAL*) and the share of socialist representatives in the local council (*SOC*). *POP* and *RURAL* are included for two reasons. First, they work as proxies for the cost of utility services, and may as such affect the utility charge. Second, they are important determinants for the property tax since it is restricted to urban areas. *SOC* captures ideological differences in preferences for tax level and tax structure. Sample averages and standard deviations of the variables are reported in Appendix Table A1.

Several of the variables included in this study have substantial cross-section variation, but very limited time-series variation. The political variables and the share of the population living in rural areas have no time series variation at all, as they are based on respectively

election data for 1995 and national census data from 1990. In order to utilize the cross-section variation in the data, we start out by estimating the models without any community specific effects. The utility charge equation is estimated by OLS, whereas the TOBIT method is used to estimate the property tax and property tax share equations where around 85% of the observations equal zero. We also check whether the results are robust to the inclusion of random community specific effects.

4. Estimation results

The Meltzer-Richard hypothesis assumes that income distribution influences taxation and redistribution. We assume that the tax structure is the key instrument of redistributive politics, and the income distribution is expected to influence the tax structure via the median voter. More equal income distribution motivates less redistribution by shifting the financing from property taxes to user charges. The estimates of the basic model, shown in the first panel of Table 1, are consistent with this hypothesis. The ratio of median to mean income is positive and significant in the utility charge equation, and negative and significant in the property tax equations. An increase in the ratio of median to mean income by 10 %-points (say an increase in the ratio of median to mean from 0.80 to 0.90) increases the user charges by nearly NOK 500 per standardized house or 10%, and reduces the property tax revenue by about NOK 770 or 60%. The calculation is based on an average community with residential property tax. The tax structure is shifted so that the property tax share is reduced by about 10 %-points.

While the results support the Meltzer-Richard hypothesis, they are not in accordance with the large empirical literature relating income distribution to government size. Increased inequality shifts the tax structure from user charges to property taxes and the net effect on the total tax level is limited. When the ratio of the median to the mean income is reduced by 10%-points, the sum of property tax and housing related utility charges are increased by only NOK 280 or 4%. Comparing with Alesina et al. (2000), one standard deviation reduction of the ratio of median to mean implies an increase of about 5% of the standard deviation of total taxes. Alesina et al. find that one standard deviation change of their income distribution measure raises public employment in US cities by 20% of the standard deviation of the employment. Interestingly, the assumed linkage between the ratio of median to mean income and government spending

goes against the conventional demand model of public spending. In this respect, our result also is inconsistent with the prediction of the theoretical model. Reduced ratio of median to mean income is expected to reduce the spending level via the conventional income elasticity effect.

Table 1: Estimation results
OLS and TOBIT estimates with t-values in parentheses

	Basic model			With additional controls		
	Utility ch.	Pr. tax	Pr. tax sh.	Utility ch.	Pr. tax	Pr. tax sh.
$\frac{y_m}{\bar{y}}$	4931	-7736	-1.043	5740	-9216	-1.272
	(3.52)	(-3.01)	(-2.97)	(4.16)	(-3.49)	(-3.56)
l	-0.064	-0.118	-0.000016	-0.051	-0.168	-0.000024
	(-6.56)	(-4.60)	(-4.61)	(-5.04)	(-5.86)	(-6.08)
$\bar{y}$	0.042	-0.072	-0.0000094	0.034	-0.036	-0.0000036
	(3.42)	(-4.15)	(-3.96)	(0.32)	(-1.80)	(-1.36)
RURAL	463	-4661	-0.637	56.2	-4007	-0.536
	(2.01)	(-8.35)	(-8.32)	(0.23)	(-7.05)	(-6.96)
POP	0.0023	0.0124	0.0000014	0.0036	0.0051	0.0000004
	(0.73)	(3.40)	(2.88)	(1.14)	(1.35)	(0.71)
SOC	2623	4297	0.562	1084	3069	0.409
	(7.69)	(6.02)	(5.77)	(2.79)	(3.92)	(3.86)
CH				-21967	-9690	-0.747
				(-4.29)	(-0.88)	(-0.50)
YO				-19958	-15261	-2.026
				(-4.39)	(-1.47)	(-1.44)
EL				-10122	-20506	-2.412
				(-2.07)	(-1.79)	(-1.56)
MOB				2448	-4321	-0.634
				(5.43)	(-5.29)	(-5.71)
# obs.	1176	1176	1176	1176	1176	1176
Estimation method	OLS	TOBIT	TOBIT	OLS	TOBIT	TOBIT
R^2_{adj}	0.148			0.203		
Log likelihood		-1718	-190		-1698	-167

The analysis also is relevant for the broader issues of tax structure. There is strong evidence of revenue substitution in the sense that local governments respond to higher exogenous revenue (lump-sum grants and regulated taxes) by reducing both the utility charge and the property tax. The relative reduction is largest for the property tax, and consequently, the tax structure is shifted from property tax to housing related utility charges. An increase in *l* by NOK 2000 per capita (roughly 10% of the average) reduces the utility charge by NOK 130 per standardized

house and the property tax by NOK 240. The sum of the utility charge and the property tax is reduced by nearly 5%, and the property tax share is reduced by 3.2 %-points.

The evidence of revenue substitution is consistent with the recent Norwegian study of Borge (2000) who uses a different data set for user charges. On the other hand, a selected review of the voluminous US literature indicates that the results are rather mixed. Inman (1979) estimates a positive (but insignificant) relationship between total tax revenue and grants in an analysis of the 41 largest cities. In an extended and updated analysis (Inman 1989) he concludes that exogenous revenue (lump-sum grants and regulated income and sales taxes less of exogenous interest payments) has a negative impact on user charges and property tax, but only for the property tax is the effect statistically significant. Holtz-Eakin and Rosen (1990) find that grants have a positive (but insignificant effect) on the property tax rate in a sample of municipal governments. Stine (1994) and Goodspeed (1998) report that increases in grants are associated with lower property tax revenue. The estimates of Skidmore (1999) show that grants have a significant positive effect on local own-source revenues and an insignificant effect on property taxes. Apparently there is some need for more concluding evidence on the revenue substitution in the US.

Increased private income raises utility charges and reduces property taxes, and leads to a significant shift in the tax structure away from property taxes. The impact of a 10% increase in private income is to increase the utility charge by 4% and to reduce the property tax by more than 30%. The sum of property tax and housing related utility charges will be reduced by 4% and the property tax share is reduced by 5.5 %-points. The result is in conflict with other empirical evidence that private income contributes to higher tax levels, as in Goodspeed (1998). On the other hand, Inman (1989) finds that richness may reduce the demand for city services as well as discourage redistributive services.

Taken together the impacts of exogenous revenue and private income point towards a substantial flypaper effect. Whereas most of a grant increase is reflected in higher spending, we are not able to document that increased private income has a positive effect on spending. The analysis adds to the international evidence of flypaper effect as summarized by Oates (1999).

The interests of the voters reflected by the income distribution is extended to include ideological orientation, which is measured by the share of socialists in the local council. Socialist orientation clearly drives up the tax level. The share of socialists comes out as significant with the expected positive sign in both the utility charge equation and the property tax equation. The estimates indicate that an increase in the share of socialists by 10 %-points will increase the utility charge by NOK 260 or about 4%, the property tax by NOK 430 or 30%, and the sum of the two by NOK 690 or nearly 10%. As the property tax is relatively more responsive than the utility charge, the property tax share increases by close to 6 %-points. Our interpretation is that socialists see property taxation as an attractive instrument of redistribution.

Controls are introduced to take into account cost factors in utilities production and the limitations imposed on property taxation. Communities where a large share of the population resides in rural areas rely less on property tax and more on utility charges compared to other communities. These findings probably reflect that the revenue potential of the property tax is small in rural areas and that sparsely populated communities have cost disadvantages in the utility sector. As the coefficient in the property tax equation exceeds (in absolute value) the coefficient in the utility charge equation, the sum of property tax and housing related utility charges tend to be low in communities where a large share of the population resides in rural areas. If the share of the population living in rural areas increases by 10 %-points, the utility charge is expected to increase by 0.8% and the property tax to be reduced by more than 30%. The sum of property tax and housing related utility charges will be reduced by about 5% and the property tax share will be reduced by 6 %-points. Due to the grant system in Norway, rural municipalities are rich. Larger communities rely more on the property tax than smaller communities. Population size also comes out with a positive sign in the utility charge equation, but this effect is not significant. The quantitative effects are rather small.

Additional controls are introduced to take into account conventional demand variables of local public spending, notably demographics and mobility. Our main result regarding the effect of income distribution is very robust to the inclusion of additional controls. Median to mean income is still positive and significant in the utility charge equation, and negative and significant in the two property tax equations, as shown in the second panel of Table 1. The quantitative effects are somewhat higher compared to the results of the basic equation reported in the first panel of Table 1. The revenue substitution effect of exogenous revenue is

also robust to the inclusion of additional controls. On the other hand, mean private income and the settlement pattern become insignificant in the utility charge equation. In the property tax equations population size loses its significance. These changes are probably due to correlation with the mobility variable. Mobility (or commuting) is high in larger urban municipalities where the level of private income is high.

The demographic controls are the fraction of the population below 7 years of age (*CH*), the fraction of the population between 7 and 15 years of age (*YO*), and the fraction of the population 80 years and above (*EL*). Since local services are oriented towards specific age groups of the population, notably schooling and care for the elderly, demographic factors tend to be important for service demand. Borge and Rattsø (1995) show how age groups compete for services. The results here imply that large age groups in the relevant ages (children, young and old) do not drive up the tax level. On the contrary, large shares of the population in the age groups in question seem to contribute to lower tax level, and in particular to lower user charges. A possible explanation is that increased demand for welfare services directed towards the young and the elderly imposes financial pressure on utility services. This may reduce the costs of utility services and thereby utility charges. Borge and Rattsø (2000) document that the share of elderly has a negative effect on the unit cost in the utility sector.

The mobility measure (*MOB*) is an indicator of commuting, and is the average of the following two variables: i) the fraction of employees living in the community that works in another community, ii) the fraction of employees working in the community that lives in another community. There is a large body of literature, both the theoretical and empirical, on the relationships between redistribution and mobility. The theoretical literature (e.g. Brown and Oates 1987) has emphasized whether decentralized responsibility for welfare and redistribution will lead to a 'race to the bottom'. The empirical literature has investigated whether generous welfare programs attract low-income households and whether governments respond to such migration by reducing the amount of redistribution, see Wheaton (2000) for a recent contribution. Our analysis adds evidence regarding the government response, and the estimates indicate that high mobility shifts the tax structure away from the redistributive property tax. The effect on total taxes is rather small.

Residential property taxation is not available to all local governments since the property tax is restricted to urban areas. Local governments without residential property tax can be divided

into two groups; one that does not have the defined urban areas and is not allowed to introduce the residential property tax, and a second group that have chosen not to introduce it. In the estimations reported above all local governments without residential property tax are treated equally. In an attempt to check the distinction between the two groups, we have applied population size as a proxy to exclude small local governments without urban areas. This approximation is necessary since there exists no clear-cut rule that determines whether a local government can levy residential property tax or not. In the end the issue is settled by the courts. Residential property tax is observed in less than 1% of local governments with population size below 2000 and for only 5 % of those with 2000-4000 inhabitants. The proportion with residential property tax jumps to 15% for local governments with 4000-5000 inhabitants.

Table 2: Estimation results excluding small local governments
OLS and TOBIT estimates with t-values in parentheses

	Population size > 2000			Population size > 4000		
	Utility ch.	Pr. tax	Pr. tax sh.	Utility ch.	Pr. tax	Pr. tax sh.
$\frac{y_m}{\bar{y}}$	4568	-7924	-1.068	4075	-9214	-1.262
	(2.79)	(-3.04)	(-2.99)	(2.03)	(-3.35)	(-3.35)
l	-0.055	-0.096	-0.0000131	-0.096	0.064	0.0000087
	(-3.04)	(-2.35)	(-2.34)	(-2.71)	(1.26)	(1.26)
$\bar{y}$	0.046	-0.080	-0.000010	0.059	-0.080	0.000010
	(4.16)	(-4.55)	(-4.36)	(4.44)	(-4.35)	(-4.15)
RURAL	386	-4795	-0.657	550	-4996	-0.679
	(1.33)	(-7.93)	(-7.91)	(1.31)	(-7.34)	(-7.29)
POP	0.0014	0.0123	0.0000014	-0.0002	0.0132	0.0000015
	(0.42)	(3.39)	(2.85)	(-0.06)	(3.65)	(3.13)
SOC	2678	3947	0.514	3867	4033	0.527
	(6.55)	(5.49)	(5.22)	(7.46)	(5.17)	(4.95)
# obs.	937	937	937	633	633	633
Estimation method	OLS	TOBIT	TOBIT	OLS	TOBIT	TOBIT
R^2_{adj}	0.106			0.133		
Log likelihood		-1680	-165		-1534	-147

Table 2 shows the results when the basic equation is estimated for local governments with population size above 2000 and 4000 respectively. It appears that the impacts of income distribution are very robust to the exclusion of local governments that cannot use residential property tax. Median to mean income is still positive and significant in the utility charge

equation and negative and significant in the property tax equations. The quantitative effects are similar to those obtained on the full sample in Table 1. Most other results are also robust to the exclusion of small local governments. The only exception is that exogenous revenue has no significant impact on the property tax when the sample is restricted to local governments with more than 4000 inhabitants.

Table 3: Estimation results
Random effects (RE) estimates with t-values in parentheses

	Basic model			With additional controls		
	Utility ch.	Pr. tax	Pr. tax sh.	Utility ch.	Pr. tax	Pr. tax sh.
$\frac{y_m}{\bar{y}}$	3305	-7112	-1.197	3892	-5819	-0.918
	(1.82)	(-3.53)	(-4.15)	(2.19)	(-3.86)	(-4.63)
l	-0.052	-0.099	-0.000023	-0.041	-0.119	-0.000023
	(-4.0)	(-6.10)	(-9.43)	(-3.06)	(-6.98)	(-9.53)
$\bar{y}$	0.037	-0.045	-0.0000030	0.009	-0.061	0.0000051
	(3.04)	(-3.61)	(-1.87)	(0.66)	(-5.45)	(3.48)
RURAL	294	-4562	-0.402	-8.04	-4554	-0.482
	(0.91)	(-9.81)	(-7.04)	(-0.02)	(-11.04)	(-9.60)
POP	0.0025	0.0109	0.0000015	0.0034	0.0168	0.0000001
	(0.55)	(6.61)	(6.85)	(0.75)	(9.77)	(0.33)
SOC	2718	2568	0.979	1417	2027	0.700
	(5.56)	(5.76)	(11.82)	(2.62)	(4.25)	(9.40)
CH				-20055	17088	-0.283
				(-3.13)	(2.28)	(-0.32)
YO				-17370	-14071	0.089
				(-3.05)	(-2.08)	(0.11)
EL				-7351	4232	2.842
				(-1.12)	(0.63)	(3.06)
MOB				2465	-3020	-0.374
				(3.95)	(-6.47)	(-6.45)
# obs.	1176	1176	1176	1176	1176	1176
Estimation method	RE	TOBIT with RE	TOBIT with RE	RE	TOBIT with RE	TOBIT with RE

Finally, we reestimate the equations in Table 1 by including random community specific effects. The results are reported in Table 3, and it appears that the impact of income distribution is robust to this modification of the empirical model. Median to mean income is still significant with the expected signs, but the quantitative effects are somewhat reduced in the utility charge equation and the property tax equations. The quantitative effect on the property tax share is roughly the same as in Table 1.

We conclude that the tax structure is responsive to income distribution. More unequal distribution allows the majority to avoid user charges working as a head tax and shift the tax burden towards property owners. As discussed in the introduction, previous empirical studies of tax structure have shown the effect of income distribution, but they have not related the tax structure to distributive effects. Chernick and Reschovsky (1996) is an exception. They show an empirical relation between income distribution, measured by the ratio between the top and the bottom quintile average income, and tax progressivity.

5. Concluding remarks

The tax structure is important for the income distribution and therefore a key playground for redistributive politics. The standard theory assumes that more unequal income distribution will create a majority for more redistribution (Meltzer and Richards). This study investigates the empirical validity of this relationship in a microeconomic study of the tax structure in decentralized government in Norway. The choice of revenue instruments studied involves user charges and property taxes oriented towards housing. While user charges act as head taxes, property taxes have stronger distributive consequences. According to theory we hypothesize that more equal income distribution reduces the amount of redistribution. In the empirical analysis the actual income distribution is measured by the ratio of median to mean income. The estimated model confirms that more equal income distribution implies a shift in the tax burden from property taxes to user charges.

References

Alesina, A., R. Baqir and W. Easterly (2000): Redistributive public employment, *Journal of Urban Economics* 48, 219-241.

Alesina, A. and D. Rodrik (1994): Distributive politics and economic growth, *Quarterly Journal of Economics* 109, 465-490.

Bassett, W., J. Burkett, L. Putterman (1999): Income distribution, government transfers, and the problem of unequal influence, *European Journal of Political Economy* 15, 207-228.

Borge, L.-E. (2000): Charging for public services: The case of utilities in Norwegian local governments, *Regional Science and Urban Economics* 30, 703-718.

Borge, L.-E. and J. Rattsø (1995): Demographic shift, relative cost and the allocation of local public consumption in Norway, *Regional Science and Urban Economics* 25, 705-726.

Borge , L-E. and J. Rattsø (2000): Property taxation as incentive for cost control: Empirical evidence for utility services in Norway, Mimeo, Department of Economics, Norwegian University of Science and Technology.

Brown, C.C. and W.E. Oates (1987): Assistance to the poor in a federal system, *Journal of Public Economics* 32, 307-330.

Chernick, H. and A. Reschovsky (1996): The political economy of state and local tax structure, in G. Pola et al., *Developments in Local Government Finance*, Cheltenham: Edward Elgar.

Cukierman, A. and A. Meltzer (1991): A political theory of progressive income taxation, in A. Meltzer et al. (eds.), *Political Economy*, Oxford: Oxford University Press.

Goodspeed, T. (1998): The relationship between state income taxes and local property taxes: Education finance in New Jersey, *National Tax Journal* 51, 219-238.

Henderson, J.V. (1994): Community choice of revenue instruments, *Regional Science and Urban Economics* 24, 159-183.

Hettich, W. and S. Winer (1988): Economic and political foundations of tax structure, *American Economic Review* 78, 701-712.

Holtz-Eakin, D. and H. Rosen (1990): Federal deductibility and local property tax rates. *Journal of Urban Economics* 27, 269-284.

Inman, R.P. (1979): The fiscal performance of local governments: An interpretative review, in P. Mieszkowski and M. Straszheim (eds) *Current Issues in Urban Economics*, The Johns Hopkins University Press, Baltimore.

Inman, R. (1979): Subsidies, regulations, and the taxation of property in large US cities, *National Tax Journal* 32, 2, 159-168.

Inman, R. (1989): The local decision to tax, *Regional Science and Urban Economics* 19, 455-591.

Meltzer, A. and S. Richard (1981): A rational theory of the size of government, *Journal of Political Economy* 89, 5, 914-927.

Meltzer, A. and S. Richard (1983): Tests of a rational theory of the size of government, *Public Choice* 41, 403-418.

Milanovic, B. (2000): The median voter hypothesis, income inequality, and income redistribution: An empirical test with the required data, *European Journal of Political Economy* 16, 367-410.

Oates, W. (1999): An Essay on Fiscal Federalism, *Journal of Economic Literature* 38, 1120-1149.

Perotti, R. (1996): Growth, income distribution and democracy: What the data say, *Journal of Economic Growth* 1, 149-188.

Persson, T. and G. Tabellini (1994): Is inequality harmful for growth, *American Economic Review* 84, 600-621.

Persson, T. and G. Tabellini (2000): *Political Economics: Explaining economic policy*, Cambridge: MIT Press.

Roberts, K. (1977): Voting over income tax schedules, *Journal of Public Economics* 8, 329-340.

Romer, T. (1975): Individual welfare, majority voting and the properties of a linear income tax, *Journal of Public Economics* 7, 163-168.

Roubini, N. and J. Sachs, J. (1989): Government spending and budget deficits in the industrial countries, *Economic Policy* 8, 100-132.

Rubinfeld, D. (1987):The economics of the local public sector, in A. Auerbach and M. Feldstein (eds.), Handbook of Public Economics II, 571-645.

Saint Paul, G. and T. Verdier (1966): Inequality, redistribution and growth: A challenge to the conventional political economy approach, *European Economic Review* 40, 719-728.

Skidmore, M. (1999): Tax and expenditure limitations and the fiscal relationships between state and local governments, *Public Choice* 99, 77-102.

Stine, W.F. (1994): Is local government revenue response to federal aid symmetrical? Evidence from Pennsylvania county governments in an era of retrenchment, *National Tax Journal* 47, 799-816.

Wheaton, W.C. (2000): Decentralized welfare: Will there be underprovision?, *Journal of Urban Economics* 48, 536-555.

Appendix 1 The solution of the model and comparative statics

In this appendix we derive the solution of the model and the comparative statics. The solution of the model is defined by the following two equations

$$\frac{\partial w_m}{\partial t} = -\frac{1-\alpha}{1+t} + \frac{\beta}{g}\frac{1-\alpha}{(1+t)^2}(\bar{y} - f) = 0 \tag{A1}$$

$$\frac{\partial w_m}{\partial f} = -\frac{1}{y_m - f} + \frac{\beta}{g}\frac{1+\alpha t}{1+t} = 0 \tag{A2}$$

where w_m is the log of the indirect utility function of the voter with median income. Together with the local government budget constraint, equations (A1) and (A2) determine the property tax rate (t), the utility charge (f) and provision of local public services (g) as functions of median income (y_m), mean income ($\bar{y}$) and central government grants (l).

By differentiating the system, we can show that the effect of increased median income (keeping mean income constant) is as follows

$$\frac{\partial t}{\partial y_m} = -\frac{1}{\Delta}\frac{\beta^2}{g^3}\frac{1-\alpha}{(1+t)^4}(1+\alpha t)^2(1+\alpha t+\beta) < 0 \tag{A3}$$

$$\frac{\partial f}{\partial y_m} = \frac{1}{\Delta}\frac{\beta}{g^2}\frac{1-\alpha}{(1+t)^4}(1+\alpha t)^2(1-\alpha+\beta) > 0 \tag{A4}$$

$$\frac{\partial g}{\partial y_m} = \frac{1}{\Delta}\frac{\alpha\beta^2}{g^2}\frac{1-\alpha}{(1+t)^4}(1+\alpha t)^2 > 0 \tag{A5}$$

where $\Delta = \frac{\partial^2 w_m}{\partial t^2}\frac{\partial^2 w_m}{\partial f^2} - \frac{\partial^2 w_m}{\partial t \partial f}\frac{\partial^2 w_m}{\partial f \partial t}$ is positive from the second order condition. The impact of mean income can be derived in a similar way:

$$\frac{\partial t}{\partial \bar{y}} = \frac{1}{\Delta}\frac{\beta^2}{g^3}\frac{1-\alpha}{(1+t)^3} > 0 \tag{A6}$$

$$\frac{\partial f}{\partial \bar{y}} = -\frac{1}{\Delta}\frac{\beta}{g^2}\frac{(1-\alpha)^2}{(1+t)^4}[\alpha(1+t)t + (1+\alpha t+\beta)] < 0 \tag{A7}$$

The effects of central government grants are as follows:

$$\frac{\partial t}{\partial l} = -\frac{1}{\Delta}\frac{\alpha\beta^2}{g^3}\frac{1-\alpha}{(1+t)^3}(1+\alpha t)t < 0 \tag{A8}$$

$$\frac{\partial f}{\partial l} = -\frac{1}{\Delta}\frac{\alpha\beta}{g^2}\frac{1-\alpha}{(1+t)^2} < 0 \tag{A9}$$

$$\frac{\partial g}{\partial l} = \frac{1}{\Delta}\frac{\alpha\beta}{g^2}\frac{1-\alpha}{(1+t)^4}[(1-\alpha)(1+\alpha t+\beta)+(1+\alpha t)(1+t)\beta+(1-\alpha)(1+\alpha t)t] > 0 \tag{A10}$$

Appendix 2 Documentation of the variables

Table A1: Data description and descriptive statistics

Variable	Description	Mean (St. dev.)
Utility charge	The sum of charges for water supply, discharge of sewage, garbage collection and chimney sweep for a standard house, NOK	5843 (1677)
Property tax	Annual property tax payment for a standard house, set to zero if property tax is levied on less than half of residential property, NOK	196 (519)
Property tax share	Property tax as share of the sum of housing related utility charges and property tax	0.027 (0.069)
Income distribution ($\frac{y_m}{\bar{y}}$)	The ratio of median to mean income, based on before tax income net of deductions for all taxpayer	0.827 (0.034)
Exogenous local government revenue (*l*)	The sum of lump-sum grants from the central government and regulated income and wealth taxes, NOK per capita	21048 (5542)
Private disposable income ($\bar{y}$)	Taxable income minus income and wealth taxes to local, county and central government, NOK per capita	69642 (7762)
Settlement pattern (*RURAL*)	The share of the population living in rural areas (1990)	0.562 (0.283)
Population size (*POP*)	Total population, January 1	8794 (16370)
The share of children (*CH*)	The share of the population 0-6 years, January 1	0.093 (0.012)
The share of youths (*YO*)	The share of the population 7-15 years, January 1	0.118 (0.014)
The share of elderly (*EL*)	The share of the population 80 years and above, January 1	0.049 (0.015)
The share of socialists (*SOC*)	The share of socialist representatives in the local council	0.371 (0.143)
Mobility (*MOB*)	An indicator of commuting that is calculated as the average of the following two variables: : i) the fraction of employees living in the community that works in another community, ii) the fraction of employees working in the community that lives in another community.	0.212 (0.129)