Tax mimicking and yardstick competition among local governments in the Netherlands

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This paper provides a spatial-econometric analysis of the setting of property tax rates by Dutch municipalities. We find evidence of tax mimicking: a ten percent higher property tax rate in neighboring municipalities leads to a 3.5 percent higher tax rate. Mimicking is less pronounced in municipalities governed by coalitions backed by a large majority. This points to yardstick competition as the most likely source of tax mimicking. We also find that Dutch voters seem to be able to penalize incumbents for anticipated tax rate differentials, but not for unanticipated tax rate differentials. This limits the effectiveness of yardstick competition as a mechanism to reduce political rent-seeking.

1. Introduction

A number of recent studies show that tax policies are to a considerable extent influenced by tax policies in neighboring jurisdictions.[1] Ladd (1992) shows that an increase in the tax burden of neighboring US counties of one dollar is matched by an increase of about 50 cents in a county's own tax burden. Similar results were subsequently found by others; see the studies recorded in table 1. In these studies, the neighborhood effect typically ranges from 0.2 to 0.6 per unit of tax.

The literature offers three theoretical explanations for tax mimicking: expenditure spill-overs, the Tiebout model and yardstick competition. The first theory poses that since expenditure levels are spatially correlated across jurisdictions, so will tax rates. Spatial expenditure patterns can result from spill-overs: expenditures on local public services can have beneficial or detrimental effects on nearby jurisdictions. Kelejian and Robinson (1993), for example, show that police expenditures are higher when police expenditures in neighboring counties are higher. [2]

The two other theories correspond to the two options open to taxpayers to escape tax increases: the exit mechanism and the vote mechanism. The exit mechanism, introduced by Tiebout (1956), is based on the idea that jurisdictions have to compete for a mobile tax base. If tax rates are high relative to those in neighboring jurisdictions, firms or households are tempted to move away, thereby eroding the tax base and necessitating still higher tax rates. Beginning with Oates (1972), an extensive literature on tax competition had been developed,[3] often indicating that destructive competition for tax bases may lead to tax rates that are too low, thereby causing underprovision of public services.

The final explanation for tax mimicking, first expressed by Salmon (1987), attributes tax mimicking to political yardstick competition in that voters use information from other jurisdictions to judge the performance of their own politicians. The reason for this behavior is that voters do not know what level of services can be provided relative to a certain tax level. Only the authorities know the local governments' production function. Since tax rates in nearby communities are more easily observed, they can serve as a benchmark. If voters consider relative performance, rational politicians will do the same and mimic their neighbors' tax rates.

Table 1 Previous research on tax mimicking

Reference	Jurisdictions studied	Taxes studied	Method[a]	Interaction effect (order of magnitude)[b]
Ladd (1992)	Counties, USA	Total tax revenue as percentage of income	IV	0.5-0.8
Case (1993)	States, USA	Income tax (effective tax rates)	IV	0.6
Besley & Case (1995)	States, USA	Sales tax, income tax and corporate tax (per capita revenues)	IV, ML	0.2
Heyndels & Vuchelen (1998)	Municipalities, Belgium	Personal income tax and property tax (tax rates)	IV	0.5-0.7
Hettich & Winer (1999)	States, USA	Income tax (tax rates)	IV	-0.6 (negative)
Büttner (1999)	*Kreise* and *Kreisfreie Städte* (counties), Germany	Local business tax (weighted averages of municipal collection rates)	ML	0.2
Brett & Pinkse (2000)	Municipalities, British Columbia (Canada)	Business property tax (tax rates)	IV	Mixed results depending on model and weighting matrix applied
Büttner (2001)	Municipalities in Baden-Württemberg (Germany)	Local business tax (collection rates)	IV	0.05
Brueckner & Saavedra (2001)	Cities, Boston metropolitan area (USA)	Property tax (average tax rate residential and non-residential property)	ML	Mixed results depending on year studied and weighting matrix applied
Revelli	Non-	Property tax (tax rates)	IV	0.4-0.5

(2001)	metropolitan districts, England			
Revelli (2002a)	Non-metropolitan districts, England	Property tax (tax rates)	ML and IV	0.3-0.6
Schaltegger & Küttel (2002)	Cantons, Switzerland	Total cantonal tax revenue (per capita)	IV	0.2
Hernández-Murillo (2003)	States, USA	Capital tax (average tax rate on capital income)	IV (both lag and error)	0.4-0.6 (model estimated in logs)
Frederiksson et al. (2003)	States, USA	Utilization of tax capacity	IV	Mixed results depending on specification
Feld and Reulier (2003)	Cantons, Switzerland	Personal income tax	IV	0.42-1.07
Bordignon et al. (2003)	Municipalities, Lombardy (Italy)	Business property tax (tax rates)	ML	0.3 (spatial error model)
Solé Ollé (2003)	Municipalities surrounding Barcelona (Spain)	Property tax, local business tax and local motor vehicle tax (tax rates)	IV	0.39 (property tax), 0.33 (motor vehicle tax), no significant effect (business tax)
Feld et al. (2003)	Regions, France	Local housing tax, local business tax, property tax	IV	0.3-0.6
Rork (2003)	States, USA	Cigarette tax, gas tax, personal income tax, sales tax and corporate income tax	IV	Ranges from –0.24 to +0.64, depending on tax

a ML: maximum likelihood; IV: instrumental variables.
b Spatial interaction coefficient ρ from equation 2, unless stated otherwise (in case of spatial error model: λ from equation 1). This may be interpreted as the extra tax for one unit of extra tax in neighboring jurisdictions. If the model is estimated in log form, ρ can be interpreted as the elasticity.

In many cases, it is not immediately clear whether tax mimicking stems from tax competition, from yardstick competition, or both. This is because the reduced-form spatial reaction function of both theories is exactly the same (Brueckner, 2003). However, studies that have investigated which theory is the most likely source of tax mimicking all point to yardstick competition. The first is Case (1993), who shows that tax rates in US states are influenced by those in neighboring states only where the governor could be re-elected. This finding that tax mimicking is related to the political process rules out tax competition. Besley and Case (1995) find that the probability for a US state governor to be unseated increases as state taxes rise, and falls with tax rises in neighboring states. Apparently, voters are more willing to accept tax rises when they observe that other jurisdictions raise taxes as well. Like Case (1993), Besley and Case find that neighboring taxes only influence tax decisions in states where the governor is eligible for re-election. Revelli (2002b) concludes that tax increases diminish the popularity of incumbents in English districts, while tax increases in neighboring districts raise that popularity. Again, this points to yardstick competition as the most likely source of tax mimicking. Schaltegger and Küttel (2002) also find that tax mimicking depends on the political setting. Tax mimicking occurs only in those Swiss cantons where the influence of voters on the political agenda is relatively weak. In cantons where people can vote directly on policy proposals, a yardstick appears to be superfluous. Bordignon et al. (2003) find that business property tax mimicking among Italian cities exists only in those cities where mayors both seek re-election and are not backed by strong majorities. Finally, Solé Ollé (2003) shows that tax mimicking among Spanish municipalities is stronger in those municipalities where the majority of the ruling parties is smaller, where right-wing parties rule, and in election years.

The objective of this paper is threefold. First, we demonstrate that Dutch municipalities are engaged in tax mimicking. For this purpose, we introduce two spatial econometric models in section 2 and report estimation results based on these models in section 3.3. The occurrence of tax mimicking has important policy implications. It implies that raising taxes is not a risk-free strategy. To many this would seem obvious, but in the Netherlands, the central government is about to decimate the already modest tax-raising powers of municipalities, because it feels that local tax rates are raised with abandon. The same sentiment underlies the movement that capped property tax rates in many American states.

Second, we investigate whether tax mimicking can be attributed to yardstick competition (section 3.4). We have reasons to believe that the theories of expenditure spill-overs and tax competition do not have much explanatory power in the Netherlands. Tax mimicking as a result of expenditure spill-overs is unlikely, because only seven percent of local expenditures is financed by property taxes. Differences in expenditure levels are more closely related to the grant system, which is further discussed in section 3.1.

The hypothesis that tax mimicking is driven by tax competition is not plausible either. Recalculated as a percentage of property value, the tax rate for residential property varies between 0.09 in the cheapest municipality to 0.52 in the most expensive one, while the rate for non-residential property varies from 0.09 to 0.75. These differences are dwarfed by the stamp duty on the transfer of property ownership (6 percent) and the costs of moving. Moreover, the property tax will at least in part be capitalized in property prices. This limits the ability of property owners to escape tax hikes. In the (unlikely) case that the tax is fully capitalized, moving after a tax rise would be completely futile, as property values are immediately lowered by the net present value of future tax payments (Yinger et al. 1988). Another reason why tax competition is unlikely in the Dutch setting is the existence of a system of tax base equalization. Because of the inverse relationship between a municipality's tax base and grants from the central government, lowering tax rates in order to attract firms or households from other jurisdictions is not really financially rewarding.

In contrast to explanations based on expenditure spill-overs and tax competition, the hypothesis that the relative tax rate is one of the yardsticks used by voters to evaluate incumbent administrators is quite plausible. Property taxes are among the most resented taxes in the Netherlands, not because they are so high (revenues amount to 1.6 percent of total tax revenues), but because of their visibility. Most other taxes in the Netherlands are withholding taxes or included in prices of goods and services. Information on local tax rates is widely available since the second half of the 1990s. Consumer lobbies use these figures to brand municipalities with high tax rates. To test whether tax mimicking can be attributed to yardstick competition, we divide our data set into two parts based upon political characteristics and then re-estimate our spatial econometric model extended to different political regimes. This test procedure is further elaborated on in section 2, while technical details are taken up in an appendix. Estimation results based on this model are reported in section 3.4.

The third and final objective of this paper is to discuss the difference between anticipated and unanticipated tax rate evaluations by voters. Following Besley and Case (1995) and Bordignon et al. (2003), it seems that this issue is related to the type of spatial econometric model that is eventually chosen as the best candidate to describe the data. We discuss the possible consequences and call for further research in section 4. The paper concludes with a summary and a discussion of the main results in section 5.

2. Models of spatial interaction

The spatial econometrics literature has produced two basic models to describe spatial interaction (Anselin 1988): the spatial error model and the spatial lag model. Starting with a linear regression model with independently and identically distributed error terms, the first model is extended to include a spatial autoregressive process in the error term and the second model with a spatially lagged dependent variable. Which of these two models is more appropriate to describe the data is more than just an empirical question, as we will further explain in section 4.

The spatial error model posits that a municipality's tax rate depends on a set of observed local characteristics and that the error terms are correlated across space:

$$Y = X\beta + \varphi, \quad \varphi = \lambda W\varphi + \varepsilon, \quad \mathrm{E}(\varepsilon) = 0, \quad \mathrm{E}(\varepsilon\varepsilon') = \sigma^2 I_N , \tag{1}$$

where Y denotes a N×1 vector consisting of one observation for every spatial unit (i = 1,...,N) of the dependent variable (tax rate) and X denotes a N×K matrix of exogenous explanatory variables. $\varphi = (\varphi_1,\ldots,\varphi_N)'$ and $\varepsilon = (\varepsilon_1,\ldots,\varepsilon_N)'$ are the disturbance terms, where ε_i are independently and identically distributed error terms for all i with zero mean and variance σ^2. I_N is an identity matrix of size N, W represents an N×N pre-specified spatial weights matrix with zeros on the diagonal and λ represents the spatial autoregressive coefficient. The spatial error model is consistent with a situation where determinants of the tax rate omitted from the model are spatially autocorrelated, and with a situation where unobserved shocks follow a spatial pattern.

The spatial lag model, on the other hand, posits that a municipality's tax rate depends on the tax rates in neighboring municipalities and on a set of observed local characteristics:

$$\mathrm{Y} = \rho \mathrm{WY} + \mathrm{X}\beta + \varepsilon, \quad \mathrm{E}(\varepsilon) = 0, \quad \mathrm{E}(\varepsilon\varepsilon') = \sigma^2 \mathrm{I}_N , \tag{2}$$

where ρ represents the spatial autoregressive coefficient. As Brueckner (2003) has pointed out, the spatial lag model is theoretically consistent with the situation where tax rates interact with tax rates in nearby jurisdictions.

An iterative two-stage procedure can be used to maximize the log-likelihood function of the spatial error model, and a simple two-stage procedure is available for the spatial lag model (Anselin, 1988, pp. 181–182).[4] The spatial lag model can also be estimated by methods using instrumental variables, a method that is frequently adopted (see table 1) because it is easier to implement and perhaps also easier to understand. The typical procedure under the IV approach in the spatial lag model is to regress WY on X and WX and to use fitted values $W\hat{Y}$ as instruments for WY. In effect, each y_j is thus viewed as depending on its own X_j vector and on X_i in neighboring jurisdictions according to the spatial weights matrix W. This method shows how people, as it were, compare tax rates between jurisdictions. Although consistent, one of the objections to IV-estimators of the spatial lag model is that they ignore the Jacobian term (Anselin, 1988, pp. 81-88) and therefore are less accurate than their ML counterparts (Das et al., 2003).[5] Moreover, 2SLS is not appropriate for obtaining a consistent estimator for the spatial autocorrelation coefficient in a spatial error model, as demonstrated by Kelejian and Prucha (1997).

A positive and significant coefficient ρ in the spatial lag model may be interpreted as evidence of tax mimicking. Some authors (Bordignon et al. 2003) interpret a positive and significant λ in the spatial error model as evidence of tax mimicking. To test whether tax mimicking can be attributed to yardstick competition (and, in the case of the spatial error model, not to unobserved shocks following a spatial pattern), there should be a link between the spatial interaction of tax rates and the political process. To investigate this, one may divide the data set into two parts based upon political characteristics and then re-estimate the spatial econometric model extended for two different political regimes. In the empirical analysis we distinguish municipalities where the governing parties enjoy a majority in the municipal council, and municipalities where they do not. If tax mimicking is driven by yardstick competition, we would expect local governments without a solid majority to be more susceptible to tax rates in neighboring jurisdiction than governments backed by a large proportion of the council. Similar tests are carried out for two other political variables.

A spatial lag model with two regimes is characterized by a regression equation with different intercepts and different spatial autoregressive coefficients for both groups of municipalities:

$$Y = \rho_{D=1} MWY + \rho_{D=0} (I_N - M) WY + \beta_{D=1} + \beta_{D=0} + X\beta' + \varepsilon, \quad \mathrm{E}(\varepsilon) = 0, \quad \mathrm{E}(\varepsilon\varepsilon') = \sigma^2 I_N , \qquad (3)$$

where M is a diagonal matrix whose diagonal elements equal the dummy variable D and β' is the vector of response coefficients of the explanatory variables X excluding the intercept. Note that the matrix (I_N-M) is a diagonal matrix with ones on the diagonal for those observations where D=0. The reason for considering different intercepts is that different political regimes may also set different taxes in advance, independent of the X-variables or tax mimicking behavior. The above notation with respect to M is taken from Bordignon et al. (2003), who describe a spatial error model with two regimes. Rietveld and Wintershoven (1998) were the first to consider spatial models with more than one spatial autoregressive of spatial autocorrelation coefficient. However, a detailed description of how a spatial lag model (or spatial error model) with two different autoregressive coefficients can be estimated efficiently is lacking in these studies. Therefore, we describe our estimation strategy in the appendix of this paper.[6]

Models of tax mimicking are often estimated using spatial panel data to control for non-observed fixed local characteristics. Unfortunately, the construction of a spatial panel for Dutch municipalities is hampered by the ongoing process of mergers and amalgamations. Since our control variables concurrently vary little over time, and a useful spatial panel should have a sufficiently long time span as a result, a panel would have many observations missing. In a spatial model, this is problematic, because it not only limits the number of observations, but also the number of spatial units in the spatial weights matrix used as point of reference for each observation. Therefore, we primarily focus on our cross-section data estimations.[7] To check whether the obtained spatial autocorrelation / autoregressive coefficient is robust, we also estimated the model reformulated in changes.

3. Empirical analysis

3.1 Local government finance and local politics in the Netherlands

There are three territorial levels of government in the Netherlands: central government, provinces (12) and municipalities (496 in 2002). Each level covers the whole country; all provinces and all municipalities more or less face the same responsibilities and have the same tax options. Municipalities, which spend 11% of GDP, provide many of the services which are of daily importance to citizens: from sewers to refuse collection, from local roads to poverty relief and theaters. Dutch municipalities are relatively large compared with those in other countries. The average municipality counts 32,000 inhabitants (table 2).

Dutch municipalities finance their spending through specific (37%) and general grants (30%) from the central government, municipal levies (14%) and income from property and market activities (19%).[8] Specific grants are received from different central government departments and are earmarked to finance local government tasks imposed by central government. In contrast, general grants are used to finance the so-called autonomous tasks of local government. The available money is distributed over the municipalities according to a detailed set of over forty criteria, which have been carefully designed in order to minimize both fiscal disparities and the municipalities' ability to influence their share. General grants depend neither on the level of other local income sources, nor on local expenditures. The aim is to enable all municipalities to provide an equivalent level of public services while levying a standard property tax rate. Still, municipalities are free to determine their preferred service levels. Municipal levies consist of local taxes (57%) and user charges. As user charges are not allowed to exceed (budgeted) costs, and municipal budgets must be balanced, increasing service levels implies raising the tax burden.[9] Since local tax receipts are dominated by property taxes (83%)[10], a municipality seeking higher tax revenues has little choice but to raise property tax rates.

The property tax base is identically defined over all municipalities. Municipalities are free to set tax rates and to spend revenues.[11] Since 1997, different property tax rates can be set for residential and for non-residential property (mainly commercial and industrial property). In 2002, tax rates varied from EUR 2.04 to EUR 11.70 per EUR 2,268 of property value for residential property and from EUR 2.04 to EUR 16.98 for non-residential property. Because of the small role of local taxation, modest expenditure changes may result in substantial rate adjustments (the so-called gearing effect). In 2002, changes in the rate for residential property ranged from a 12 percent reduction to a 27 percent increase. Changes in the rate for non-residential property ranged from minus 23 percent to plus 62 percent. On average, residential property accounts for 64% of property tax revenues.[12]

Tax rates are set by the municipal council, which is elected every four years through a system of proportional representation. A mayor and aldermen form the executive board. The mayor, whose executive powers are limited, is appointed by the central government. The aldermen are members of the municipal council. Their number is proportional to the number of inhabitants. The aldermen are elected by the council from the parties that form a coalition. Although national politics have a significant impact on local elections, 23 percent of aldermen represent local political parties, i.e., parties that do not exist at the provincial or national level.

In 2001, when the tax rates for 2002 were set, the number of coalition parties varied from two to six; none of the municipalities was governed by a single party. In 81 percent of the municipalities, the governing coalition consisted of either three or four parties. In 95 percent of the municipalities, the parties represented in the executive board formed a majority in the council, which often exceeded the minimum winning size. The median majority was 66.7 percent.

3.2 Data and variables

We use municipal data for 2002. Tax rates for 2002 were set in the Fall of 2001 by councils elected in 1998.[13] Due to this construction, a reverse causality of tax rates affecting the composition of the council is ruled out, while the sitting council has had enough time to leave its mark on local taxes.

As described earlier, a municipality can set different tax rates for residential and for non-residential property. The fraction by which the former may exceed the latter is limited by law. Since this fraction depends on local circumstances which are unobservable, mimicking of each tax rate cannot be observed separately. Therefore, we take the weighted average tax rate in each municipality as the dependent variable, using the values of residential and non-residential property as weights.

Local characteristics included in X are:

- Average disposable household income in 2000. Assuming publicly provided services to be normal goods, demand will rise as incomes rise (Wagner's law).[14]
- The tax price, defined as the proportion of the property tax base consisting of residential property (other than holiday homes). The property tax on holiday homes and non-residential property is to a large extent paid by non-residents. We expect that a higher proportion of property tax revenues paid by residents results in less or cheaper public services.
- The share of right-wing parties in the municipal council. Previous research shows that municipalities with a high proportion of right-wing parties in the local council experience a lower tax burden (Allers et al. 2001).
- The property tax base measured as the per capita value of taxable property in units of EUR 2,268. Normally, low property values necessitate higher rates,

and vice versa. General grants from the central government to municipalities used to equalize tax capacity may partly offset this inverse relationship.[15] Some studies have treated the tax base as an endogenous variable, since tax rates will be at least partially capitalized, or because high tax rates discourage economic activity (Ladd and Bradbury 1988). In the Netherlands, property is revalued once every four years. Since the tax base over the period 2001-2004 is defined as the value of property on reference date January 1, 1999, the tax base may be treated as an exogenous variable.

- The number of inhabitants, as a measure of the scale of the municipality.
- Unconditional grants per capita (euros), the most important income source of Dutch municipalities.[16]

Other demographic and social variables have been dropped from the regression after they were found to have no significant influence on tax rates.[17] The explanation is that general grants, meant to enable every municipality to provide an equivalent level of public services given a standard property tax rate, equalize most cost differences arising from demographic and social characteristics.

Table 2 Summary statistics

	Minimum	Maximum	Mean	Standard deviation	Source
Average property tax rate (euros per EUR 2,268 of property value)	2.04	13.23	5.14	1.62	COELO[a]
Share of right-wing parties in council	0.27	1.00	0.71	0.14	CBS[b]
Share of low-income households	0,05	0,20	0,11	0,03	CBS[c]
Tax price	0,37	0,94	0,73	0,09	Finance[d]
Value of taxable property (units of EUR 2,268 per capita)	39,268	190,244	72,839	18,119	Finance/CBS
Number of inhabitants	1,025	735,526	32,470	55,021	CBS[c]
Unconditional grant per capita (euros)	282	1,836	629	145	CBS[c]

[a] Center for Local Government Economics, University of Groningen, The Netherlands.
[b] Own calculation based on data from Statistics Netherlands.
[c] Statistics Netherlands.
[d] Own calculation based on data provided by the Ministry of Finance.

We consider two row-normalized spatial weights matrices. Which municipalities are used as jurisdictions of reference depends on the information on municipal tax rates available to administrators and voters. This information has not always been easily accessible. From the early 1980s, a consumer association published local tax rates, but less than half of all municipalities were covered in this list. Since 1991, a detailed yearly review of the tax rates of about 34 large municipalities has been published. Only from 1997 onward can tax rates for all municipalities be compared easily, using the *Atlas of Local Taxation*.[18] Since 1999, local tax rates for all municipalities are available on the Internet.

The first spatial weights matrix, W, is based on the idea that municipalities sharing a common border are used as areas of reference.[19] If proximity is the crucial factor, municipalities should be watching their neighbors most closely. Information about local tax rates is spread mainly through local and regional newspapers and television channels.

In the second spatial weights matrix, V, not only adjacent municipalities are grouped together, but also a group of 34 large municipalities, each municipality being assigned the average tax rate in the other 33 as a point of reference. These municipalities form an informal club, holding regular meetings of tax officials. Moreover, a yearly booklet (mentioned above) is published containing tax rates of member municipalities, which usually generates some press coverage.[20] These large municipalities are not treated as neighbors of adjacent (small) municipalities.

3.3 Evidence of tax mimicking in the Netherlands

Column 1 of table 3 reports the results of a log-linear non-spatial model estimated by OLS. The coefficients of this model can be interpreted as elasticities. The classic indicator of spatial patterns is Moran's I, which may be calculated from the residuals of the OLS-estimation. It amounts to 6.45 when using the spatial weights matrix W and 6.49 when using the spatial weights matrix V.[21] Since both outcomes are significant, the hypothesis of no spatial effects must be rejected. To find out whether the spatial lag model or the spatial error model is more appropriate to describe the data, we use the robust LM-tests proposed by Anselin et al. (1996).[22] The results reject the spatial error model for both V and W, but not the spatial lag model.

Since the Jarque-Bera test does not reject the hypothesis of normally distributed error terms, we estimate the spatial error and spatial lag model employing maximum likelihood. These results are reported in columns 2-5 of table 3. The log likelihood using matrix V appears to be greater than that of matrix W. Apparently, V better reflects the spatial interaction among municipalities than W. Irrespective of whether W or V is used, the log likelihood of the spatial lag model exceeds that of the spatial error model. This again indicates that the spatial lag model is the more appropriate model. According to an LM-test on spatial error dependence, the hypothesis of no remaining spatial error dependence within the spatial lag model cannot be rejected.

The most interesting coefficients in table 4 are ρ and λ, reflecting the impact of the spatially lagged dependent variable and the spatially lagged error term, respectively. In all specifications shown in table 3 these coefficients are significantly different from zero. In the model best describing the data (spatial lag, matrix V), this coefficient is 0.35. This means that a ten percent higher property tax rate in reference municipalities leads to a 3.5 percent higher tax rate, *ceteris paribus*. This sizeable effect is in line with the results of earlier studies.

The coefficients of the control variables are generally significant and have the expected signs. A higher proportion of right-wing parties is associated with lower tax rates. The higher the share of (non-holiday) housing in the tax base, the lower the tax rates. Higher disposable incomes go hand in hand with higher tax rates. Low property values are associated with high tax rates. Tax rates are positively related to the number of inhabitants, but only significant statistically in the spatial lag model using matrix W. Finally, tax rates are higher in municipalities receiving high amounts of grants. Perhaps the grant system does not adequately compensate high-cost municipalities.

The Breusch-Pagan statistic to test for homoskedasticity of the error terms in the spatial lag and spatial error model points to heteroskedasticity, which on further investigation is caused by the variable *tax base per capita*. Therefore, the observations were grouped into five quantile groups based on the per capita tax base and the original model is re-estimated using groupwise heteroskedasticity. Within groups, we assume constant variance, but between groups, different variances are allowed for. Columns 6 and 7 of Table 3 show the results using matrix V. A Likelihood ratio test confirms that variances between groups differ significantly. However, the results with and without the correction for heteroskedasticity (column 4 versus 6 and 5 versus 7) are virtually identical. Moreover, the spatial lag model is again the appropriate model.

As our estimations are based on cross-section data, the coefficient estimate of 3.5 might be biased because spatial fixed effects measuring non-observed time-invariant characteristics of municipalities have not been included in the regression equation. To investigate this we have also regressed tax rate *changes* between 2001 and 2002 on tax rate changes in neighboring municipalities. The number of municipalities fell only modestly over this period: eight municipalities merged into three new ones. For these municipalities, we used weighted averages of tax rates in 2001. The control variables are omitted from this regression, because of insufficient variation. Using matrix W, ρ equals 0.18 (z-value 2.8) and using matrix V ρ equals 0.20 (z-value 3.2). Although lower, these coefficient estimates are not significantly different statistically from their counterparts in table 3.

3.4 Evidence of yardstick competition

In countries where some incumbents cannot run for reelection because of binding term limits, the yardstick competition hypothesis can be tested by comparing jurisdictions whose administrators are eligible for reelection and jurisdictions whose administrators are not. Case (1993), Besley and Case (1995) and Bordignon et al. (2003) find that tax rate interdependency is manifest only in jurisdictions whose administrators can run for reelection. This suggests that political calculations influence tax setting behavior, which is in line with the yardstick competition hypothesis. If tax mimicking were due to tax competition, mimicking should occur irrespective of reelection opportunities.

In the Netherlands, there are no term limits. Moreover, local governments are not headed by a single person, as municipalities are jointly governed by the aldermen and the (appointed) mayor, who has a largely ceremonial role. In addition, the aldermen always represent a coalition of political parties. There is no municipality where one party enjoys an absolute majority in the municipal council. We test whether the occurrence of tax mimicking is related to the size of the majority supporting the governing coalition, to the political color of the local government, or to the degree of political fragmentation.

If the local administration is supported by a large share of the city council, it will be relatively confident of reelection, regardless of its tax-setting behavior. In other words, if yardstick competition is the driving force of tax mimicking, the need to mimic neighboring tax rates should decrease as the electoral margin increases. Bordignon et al. (2003) find that spatial patterns in tax rates are limited to those (Italian) municipalities where mayors are not backed by large majorities. Solé Ollé (2003) shows that the reaction to neighbors' tax rates is stronger in (Spanish) municipalities where the electoral margin is low. In order to test this hypothesis among Dutch municipalities, we created a dummy variable D that equals one if the parties forming the governing coalition control at least 75 percent of the municipal council, and re-estimated the spatial lag model extended for two different political regimes.

Mimicking could also be stronger when right-wing parties control the local government, as right-wing voters might resist high tax rates more strongly than left-wing voters. Solé Ollé (2003) finds this is the case in Spanish municipalities. We therefore repeated the above analysis using a dummy variable that equals one if right-wing parties make up more than 50 percent of the governing coalition.

If tax mimicking results from a tendency to hold local administrators responsible for diverging tax rates, political fragmentation could reduce tax mimicking, as it makes it more difficult to link tax policy to specific political parties (Lowry et al. 1998). For politicians, there is safety in numbers. As far as we know, this has not been tested before.[23] Political fragmentation is often measured as the effective number of parties forming a coalition (Laakso and Taagepera 1979), but in the case of Dutch municipalities this indicator is strongly correlated with municipal size, because the number of aldermen is proportional to the number of inhabitants (small municipalities have two aldermen, large municipalities have eight). Therefore, we use the proportion of parties represented in the council supplying aldermen (the number of coalition parties divided by the total number of parties represented in the municipal council). This proportion of parties in power (PPP) ranges from 0.2 to 1.0, while the median is 0.5. If the coalition includes all parties represented in the council, as is the case in seven municipalities, no party can be held responsible for diverging tax rates. The accountability of coalition parties increases as PPP decreases. To test whether tax mimicking is related to the proportion of parties in power, we repeated the above analysis using a dummy variable that equals one if PPP exceeds 0.5.

Table 4 reports the results of these regressions. As the yardstick competition hypothesis predicts, coalitions backed by a large majority mimic neighboring tax rates to a lesser extent than coalitions depending on a small majority. The spatial interaction parameter ρ is 0.22 if the majority is greater than or equal to 75 percent, and 0.41 if not. This difference is statistically significant. Table 5 shows how this difference between both parameters depends on the dummy specification chosen. Apparently, coalitions need a majority of at least 70% in order to feel secure enough to reduce the extent of tax mimicking. Interestingly, the spatial interaction parameter remains significantly different from zero. This implies that even coalitions backed by large majorities keep a beady eye on their neighbors' tax rates.

Table 4 Testing for yardstick competition

	Large majority[a]		Right-wing majority[b]		High proportion of parties in power[c]	
	yes	no	yes	no	yes	no
C	-1.34 (-1.09)	-1.68 (-1.36)	-1.48 (-1.19)	-1.39 (-1.12)	-1.29 (-1.04)	-1.19 (-0.96)
ρ	0.19 (2.29)	0.40 (8.22)	0.39 (5.90)	0.33 (5.92)	0.36 (7.00)	0.32 (4.53)
N	141	355	209	287	332	164
t-value of difference between ρ's	2.31		-0.72		-0.45	
Share of right-wing parties in council	-0.17 (-3.41)		-0.17 (-3.43)		-0.16 (-3.32)	
Tax price	-0.60 (-6.74)		-0.60 (-6.70)		-0.60 (-6.75)	
Average disposable household income	0.90 (5.51)		0.89 (5.40)		0.85 (5.17)	
Per capita value of taxable property	-0.66 (-9.45)		-0.66 (-9.44)		-0.64 (-9.13)	
Number of inhabitants	0.020 (1.74)		0.020 (1.76)		0.020 (1.73)	
Grants received	0.18 (3.10)		0.18 (3.00)		0.18 (3.02)	

Spatial lag model, weights matrix V, variables in logs, T-values or p-values in parentheses.
[a] Parties forming the governing coalition control at least 75 percent of municipal council.
[b] Fifty percent or more of governing coalition consists of right-wing parties.
[c] Number of coalition parties divided by the total number of parties represented in the municipal council is at least 0.5.

Table 5 Spatial interaction parameter for alternative specifications of the large majority dummy in table 4

Large majority threshold	60%	65%	70%	75%	80%
ρ when dummy = 0 (no large majority)	0.39	0.41	0.42	0.40	0.37
ρ when dummy = 1 (large majority)	0.34	0.31	0.23	0.19	0.24
t-value of difference between ρ's	0.61	1.34	2.37	2.31	0.95

The spatial interaction parameter ρ also appears to be higher when right-wing parties have a majority in the governing coalition, which is consistent with the yardstick competition hypothesis, but the difference is not significant statistically.

Political fragmentation does not have a significant effect either. This might be due to the fact that all municipalities are governed by coalitions; more than 80 percent are ruled by either three- or four-party coalitions.

4 Anticipated and unanticipated tax rates

The theory of public choice has pointed out that the aim of public employees is not only to fulfill the wishes of the electorate. They also look after their private interests. They attempt to "get ahead" by raising more taxes than needed to finance the optimal level of public services. This is because the power and status of a public employee is positively correlated with the size of his budget. In this view, formulated eloquently by Brennan and Buchanan (1980), any brake on tax increases is welfare-improving. Models incorporating yardstick competition show that tax mimicking may discourage politicians from rent-seeking. Besley and Case (1995) discuss a model with two types of politicians, those who seek rent and those who do not. Political rents can take the form of sloppy management, or the use of resources for pet projects not wanted by the electorate. Politicians who are free from rent-seeking behavior provide public services at cost, whereas rent-seekers charge higher taxes. Besley and Case demonstrate that due to yardstick competition, rent-seeking politicians are driven out of office in that they are not reelected. Although voters do not know the costs of public services, comparison of the relative performance of incumbents in different jurisdictions is sufficient to distinguish good politicians from bad ones retrospectively.[24]

Models analyzing the effect of yardstick competition or tax competition on rent-seeking behavior implicitly assume that tax rate differentials can be used as an indicator of the amount of rent-seeking.[25] In practice, however, tax rate differentials may be the result of many factors beside rent-seeking, e.g., differences in tax base, in the exogenous costs of providing services, and in preferences for public services. Voters should penalize incumbents only for that part of any tax rate differential for which they are to blame.

Besley and Case (1995) distinguish between anticipated and unanticipated tax changes. Anticipated tax changes result from changes in the known determinants of the tax rate, i.e., the explanatory variables in the tax rate models, while unanticipated tax changes result from changes in the unknown determinants of the tax rate, i.e., omitted variables from the tax rate models captured by the error term. Imagine that each voter regresses taxes on local characteristics and estimates a predicted tax change based on changes in the right-hand side variables of this regression. Then the difference between the predicted tax rate before and after these changes reflects the anticipated tax change, while the difference between the predicted and actual tax change reflects the unanticipated tax change. Besley and Case find that, just as anticipated tax changes do, unanticipated tax changes appear to be judged relative to those in neighboring jurisdictions. "*Unanticipated own tax increases reduce the odds of reelection, while unanticipated increases in neighbors' taxes increase the probability of reelection*" (Besley and Case, 1995, p.40). This suggests that it is the residual of the tax rate regression, relative to the residual in such a regression for neighboring jurisdictions, that indicates whether an unanticipated tax increase is justified.

This suggestion is further elaborated upon in the cross-section study of Bordignon et al. (2003) on local tax rate levels in Italy. They find the spatial error model to be the more appropriate model to describe spatial interaction among jurisdictions. According to this model, "*only the components of the tax rates that are not explained by the Xs tend to be correlated*" (ibid, p.207). To test whether tax mimicking can be attributed to yardstick competition and not to unobserved shocks following a spatial pattern, there should again be a link between the spatial interaction of tax rates among jurisdictions and the political process. To investigate this, Bordignon et al. (2003) divide the data set into two and even three parts based upon political characteristics, and then re-estimate the spatial econometric model. Just as in our spatial lag model for two political regimes, they find significant evidence of yardstick competition. Because it was the error terms that were found to be spatially correlated, Bordignon et al. (2003) conclude that local governments act as if voters are able to correct raw tax rate differentials for exogenous determinants and use the residual to evaluate incumbents.

The work of Besley and Case (1995) and of Bordignon et al. (2003) suggests two kinds of yardstick competition: tax-setting behavior affected by electoral competition based on voters' anticipated and on voters' unanticipated tax evaluations. The first type of yardstick competition can be tested using a spatial lag model extended with political regimes, and the second type can be tested using a spatial error model extended with political regimes. Following this way of reasoning, our finding in section 3.3 of no spatial error dependence within the spatial lag model indicates that Dutch voters penalize politicians for anticipated tax rate differentials but not for unanticipated tax rate differentials. As fiscal equalization in the Netherlands goes further than in Italy, we find it puzzling that Italian voters appear to be able to filter out the rent-seeking component of tax rates, while Dutch voters are not.

This is not just a theoretical nicety. In the case of yardstick competition based on anticipated tax rates only, fiscal disparities or a taste for public services resulting in higher taxes in a particular municipality give neighboring authorities leeway to set higher tax rates. It may also lead to an underprovision of public services in municipalities surrounded by low-cost jurisdictions. As a result, political rents may actually be higher in low-tax jurisdictions than in high-tax ones. Clearly, more work is needed to clarify this issue.

5 Conclusions

We have found strong evidence of tax mimicking among Dutch municipalities. A ten percent higher property tax rate in neighboring municipalities leads to a 3.5 percent higher tax rate, *ceteris paribus*. This sizeable effect is in line with the results of previous studies. Several other factors have been found to affect the property tax rate. Tax rates are positively related to average disposable income and the amount of grants received, and negatively related to property values, the share of right-wing parties and the tax price.

The extent to which neighboring tax rates are mimicked is lower when the governing coalition of a municipality is supported by a large majority. This finding points to the occurrence of yardstick competition. After all, if the observed spatial correlation between tax rates were driven by factors outside the political process (e.g., tax competition, spatially correlated shocks), the spatial interaction of property tax rates should not differ according to the size of the governing coalition's majority.

Yardstick competition may help voters evaluate incumbents by comparing tax rates. However, we found that Dutch voters appear to be able to penalize incumbents for anticipated tax rate differentials, but not for unanticipated ones. Anticipated differentials reflect known exogenous determinants of tax rates, but not rent-seeking behavior.

Appendix

In order to estimate the extended model (3), we have rewritten the MATLAB routine SAR, taken from James P. LeSage's website (www.spatial-econometrics.com), along the lines given in Anselin and Hudak (1992):

1. Obtain b_0, the OLS-estimator of regressing Y on the X variables, including a different intercept for the two groups defined by the dummy variable D;
2. Obtain b_1 and b_2, the OLS-estimators of MWY and $(I_N$-M)WY, respectively, on the X variables, including a different intercept for the two groups defined by the dummy variable D;
3. Find ρ_1 and ρ_2 that maximize the concentrated log-likelihood function of the model, which is

$$\log L_C(\rho_1,\rho_2) = C - {}^{N}\!/_{2} \ln[(e_0 - \rho_1 e_1 - \rho_2 e_2)'(e_0 - \rho_1 e_1 - \rho_2 e_2)] + \ln | I_N - \rho_1 MW - \rho_2 (I_N - M)W |, \quad (4)$$

   where C is a constant which may be neglected and e_0, e_1 and e_2 denote the regression residuals of the three OLS-regressions. Note that it is not possible to compute the eigenvalues of the spatial weights matrix W in advance, as is usual in spatial models, and then to determine the determinant of the last right-hand side using these eigenvalues;

4. Given ρ_1 and ρ_2, compute the GLS estimator of the spatial lag model $b = b_0 - \rho_1 b_1 - \rho_2 b_2$ and $\sigma^2 = {}^{1}\!/_{N} (e_0 - \rho_1 e_1 - \rho_2 e_2)'(e_0 - \rho_1 e_1 - \rho_2 e_2)$;
5. Determine the asymptotic variance matrix of the maximum likelihood estimator to obtain standard errors and T-values. This symmetric matrix, which we derived analytically along the lines in Anselin (1988, pp.64-64), is (for the parameters β, ρ_1, ρ_2 and σ^2, respectively):

$$\begin{bmatrix} \frac{1}{\sigma^2}X'X & \frac{1}{\sigma^2}X'A_1 b & \frac{1}{\sigma^2}X'A_2 b & 0 \\ . & \frac{1}{\sigma^2}b'X'A'_1 A_1 Xb + tr(A_1 A_1 + A_1 A'_1) & \frac{1}{\sigma^2}b'X'A'_1 A_2 Xb + tr(A_1 A_2 + A_1 A'_2) & \frac{1}{\sigma^2}tr(A_1) \\ . & . & \frac{1}{\sigma^2}b'X'A'_2 A_2 Xb + tr(A_2 A_2 + A_2 A'_2) & \frac{1}{\sigma^2}tr(A_2) \\ . & . & . & \frac{N}{2\sigma^4} \end{bmatrix}^{-1}$$

where $A_1 = MWB^{-1}$, $A_2 = (I-M)WB^{-1}$ and $B = I - \rho_1 MW - \rho_2 (I-M)W$.

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Table 3 Estimation results tax rate regressions

Model	OLS (1)	Spatial lag model (2)	Spatial error model (3)	Spatial lag model (4)	Spatial error model (5)	Heteroskedastic spatial lag model (6)	Heteroskedastic spatial error model (7)
Spatial weights matrix used[a]	None	W	W	V	V	V	V
ρ		0.30 (6.47)		0.35 (7.96)		0.35 (7.96)	
λ			0.35 (6.11)		0.38 (7.13)		0.37 (6.92)
Intercept	-1.12 (-0.84)	-1.62 (1.28)	-1.88 (1.30)	-1.37 (-1.10)	-1.02 (-0.72)	-0.49 (-0.39)	0.09 (0.06)
Share of right-wing parties in council	-0.20 (-3.73)	-0.18 (-3.66)	-0.18 (-3.48)	-0.17 (-3.40)	-0.17 (-3.27)	-0.18 (-3.91)	-0.19 (-3.72)
Tax price	-0.74 (-7.84)	-0.62 (-6.82)	-0.72 (-7.65)	-0.60 (-6.70)	-0.68 (-7.30)	-0.59 (-6.44)	-0.68 (-7.07)
Average disposable household income	1.08 (6.24)	0.84 (4.93)	1.11 (5.82)	0.87 (5.34)	1.04 (5.47)	0.80 (4.92)	0.94 (4.93)
Per capita value of taxable property	-0.86 (-12.44)	-0.65 (-8.81)	-0.81 (-10.22)	-0.66 (-9.41)	-0.80 (-10.03)	-0.67 (-9.47)	-0.82 (-10.2)
Number of inhabitants	0.03 (2.48)	0.038 (3.27)	0.023 (1.85)	0.021 (1.82)	0.012 (0.92)	0.032 (2.78)	0.022 (1.64)
Grants received	0.26 (4.05)	0.24 (4.03)	0.27 (4.10)	0.18 (3.07)	0.24 (3.51)	0.17 (2.65)	0.23 (3.20)
R^2 (adj.)	0.49	0.52	0.44	0.54	0.39	0.58	0.44
Log likelihood	77.9	98.3	94.5	106.5	97.0	111.9	109.6
Heteroskedasticity (Breusch-Pagan)	22.8 (p=0.0009)	29.9 (p = 0.00004)	23.1 (p = 0.0008)	33.2 (p = 0.00001)	23.5 (p = 0.0006)		
Likelihood ratio test on groupwise heteroskedasticity						10.9 (p=0.03)	25.1 (p=0.001)
(robust) LM spatial lag test	10.7 (p=0.001) for W 23.1 ($p=2*10^{-6}$) for V		3.58 (p = 0.06)		10.68 (p = 0.001)		
(robust) LM spatial error test	1.7 (p=0.19) for W 0.02 (p=0.90) for V	0.0001 (p = 0.99)		0.67 (p = 0.41)			

Number of observations is 496, variables in logs, T-values or p-values (probabilities of test-statistics) in parentheses

a W: contiguity-based; V: large municipalities "bordering" on each other.

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1 For a review of studies of strategic interaction among governments, see Brueckner (2003).

2 Other studies are Murdoch et al. (1993), Case et al. (1993), Schaltegger and Küttel (2002).

3 For an overview, see Wilson (1999).

[4] Anselin and Hudak (1992) give instructions on how to implement these procedures. One may also use Spacestat or the MATLAB routines which are freely downloadable from James P. LeSage's website (www.spatial-econometrics.com).

[5] For example, using IV-estimators may result in an autocorrelation/autoregressive coefficient greater than 1. If the spatial weight matrix is row-normalized, a coefficient smaller than 1 is necessary to ensure that the spatial model is stable.

[6] A matlab routine is also available on request.

[7] In a related study, Bordignon et al. (2003) also use cross-sectional data.

[8] The figures refer to 2002. Source: Ministry of Finance (2002) and Ministry of Home Affairs and Ministry of Finance (2002). Income from market activities is for a large part offset by the costs associated with these activities, and thus cannot be spent freely.

[9] Borge (1995) argues that user fees of Norwegian municipalities are fiscally motivated. In the Netherlands the receipts from user charges consist primarily of fees for garbage collection and sewerage. These are not typically areas for politically motivated increases in spending.

[10] In 2002. Source: Statistics Netherlands, http://www.cbs.nl.

[11] In every municipality, there are four property tax rates: a rate for owners of residential property, one for users of residential property, one for owners of non-residential property and one for users of non-residential property. In this paper, property tax rates are the rates for owners and users taken together.

[12] Source: Ministry of Finance (2003).

[13] Municipal elections take place every four years at a nationally uniform date. Only when municipalities merge or amalgamate, are by-elections organized. In 1999 this was the case in 29 municipalities, in 2000 in 20 municipalities and in 2001 in 5 municipalities.

[14] Disposable income is potentially endogenous, as high tax rates could drive affluent households away. However, the low level of the local tax burden in the Netherlands (on average less than one percent of disposable income) makes this unlikely.

[15] The grant for each municipality is reduced by 70 percent of the value of non-residential property and 80 percent of the value of residential property, multiplied by a nationally uniform rate (loosely based on the average tax rate in an earlier year).

[16] The distribution system of grants was derived using data on past local government expenditures. Islam and Choudhury (1990) show that, for this reason, using grants as an exogenous variable might lead to biased results. However, as there is no direct link between past expenditures and the grant distribution system, this does not seem to be relevant here. Moreover, exclusion of this variable has a negligible effect on the outcomes of this study.

[17] In a small country like the Netherlands, prices of most inputs are virtually constant across municipalities. Local government wages, for instance, are harmonized nationally. Therefore, no price level variable is included.

[18] *Atlas van de lokale lasten*, published by COELO, Groningen.

[19] Municipalities separated by sea or lakes were defined as sharing a common border if connected by a road link.

[20] Allers (2002). A list of participating municipalities can be found here.

[21] Moran's I is asymptotically distributed as a standard normal.

[22] Both LM-statistics are chi-square distributed with one degree of freedom. The LM-tests are robust in that the existence of a spatial lag does not bias the test for spatial error, and *vice versa*.

[23] Solé Ollé (2003) finds that coalition governments do not tend to react less strongly to their neighbors' tax policy than majority governments.

[24] However, Besley and Smart (2003) demonstrate that under certain circumstances yardstick competition may have perverse effects, encouraging rent seeking.

[25] Apart from the theoretical studies mentioned above, several others are of interest, e.g., Edwards and Keen (1996), Wrede (2001), Bodenstein and Ursprung (2001) and Bordignon et al. (2004).