Tiebout Visits Germany: Land Tax Capitalization in a Sample of German Municipalities

Thiess Buettner

Centre for European Economic Research (ZEW)

and Mannheim University

L7, 1

D-68161 Mannheim

GERMANY

e-mail: buettner@zew.de

February, 2003

Abstract:

The paper explores the determinants of land value and rent level in a large cross-section of German municipalities, controlling for several amenities, disamenities, the local structure of land, and for economic and fiscal conditions. The effective land tax rate is measured from the statutory tax rate and a location-specific indicator of the assessment rate. Using an instrumental variable (GMM) approach the results show that land taxes do capitalize into land values, whereas the monthly rent level remains unaffected by the land tax. In addition, the results point to significant spillovers from amenities and the provision of public goods across municipalities.

Keywords: Land Taxation, Capitalization, Fiscal Externalities

JEL Classification: H73, R21, C21

1 Introduction

Besides of grants and revenue sharing the main revenue source of German municipalities is a local business tax. This tax is critized not only by the businesses, but also by the municipalities. In fact, it shows several weaknesses, in particular, a small and instable tax base. However, the municipalities also have a land tax to their disposal, and a thorough overhaul of the land tax is occasionaly discussed as one of the options to reform the finances of German municipalities (e.g., Zimmermann, 1999, Fuest and Thoene, 2002). In the light of the literature on local public finance a local land tax is quite appealing: if the supply of land is rather inelastic and if households are rather mobile the value of the land will reflect the supply of local public services. A huge empirical literature on the related property tax has by and large supported this view for the US (see Yinger et al., 1988, for an overview), and even though the efficiency of the property tax is a matter of debate, the main point critizised is not the taxation of real estate as such but the inclusion of improvements to the tax base (Zodrow, 2000).

As compared to the US property tax, surprisingly little is known about the German land tax. In particular, it is not known whether households are sufficiently mobile to generate capitalization effects. Also, it seems quite likely that institutions on the housing and real estate markets like rent controls and zoning object a larger role played by the land tax. Furthermore, there is, to the best of my knowledge, not a single empirical study of the capitalization of local fiscal policies in Germany. The lack of capitalization studies for Germany stands in marked contrast to the large number of important policy issues raised by the complex instititutions of the finances of German municipalities.

Given this background, the current paper aims at an analysis of land tax capitalization in Germany. Although capitalization is a rather standard issue in the literature, to approach this topic in the German context is new ground for empirical research. Hence, we look in the paper not only on the impact of the land tax on land value but also undertake some control estimations for the monthly rent. The empirical analysis is based on a cross-section of about 675 municipalities

in a major German state. The results confirm a substantial degree of land tax capitalization. In addition, the results point to significant spillovers from amenities and the provision of public goods from neighboring municipalities. The strong significance of density indicates that the cities which currently benefit from the business tax would also experience strong taxing power if the finances of municipalities were reformed towards a greater role of the land tax.

The reminder of the paper is organized as follows. The next section lays out the investigation approach. Then, a description of the dataset is provided, followed by a presentation of the results. The last section provides some conclusions.

2 Investigation Approach

Although the current analysis deals with a land tax, the impact of tax incentives can formally be derived analogous to the case of the property tax (e.g., Brueckner, 1982) when abstracting from improvements. Consider a household which derives utility from local amenities g, which may include public services, from a lot size of q, and from the consumption of a numeraire x. The utility function is $u = (g, q, x)$. In equilibrium, the household attains a utility level $h\,(y)$ corresponding to the income level y. Hence, the following condition must hold at each location

$$h\,(y) = u\,(\,g\,,\;q\,,\;y - R\,)\,,$$

where R is the rent level. This relationship defines the bid rent of the consumer

$$R = R\,(\,g\,,\;q\,,\;y\,)\,.$$

The land value V is now determined by the present value of the excess of the bid-rent over the tax payments

$$V = \frac{R\,(\,g\,,\;q\,,\;y\,) - T}{r}.$$

The tax capitalization formula is obtained when inserting a definition of the land tax such as $T = \tau V$, where the tax base is the market value of land. Solving for V yields

$$V = \frac{R(\ g\ ,\ q\ ,\ y\ )}{r + \tau}. \tag{1}$$

For the related case of a property tax, a large literature has dealt with the question of whether this strong theoretical result holds empirically (for a survey see Yinger et al., 1988). The estimation problem generally is to determine a relationship between the land value and local characteristics

$$V = V(\ g\ ,\ q\ ,\ y\ ,\ \tau\ ). \tag{2}$$

Given the above formula (1) the empirical estimate of the elasticity of the land value with respect to the tax rate ($\widehat{\gamma}$) should reflect the share of property tax payments in the annualized total cost of holding a piece of land (interest revenue obtained from an investment of the same size of the land value plus tax payments). Formally

$$\widehat{\gamma} = -\frac{\tau}{r + \tau}. \tag{3}$$

Even though most empirical studies point to a significant degree of tax capitalization they often fail to find support for full capitalization. However, there is a host of substantial measurement and estimation problems involved. One of the problems faced by empirical research is to properly take into account the specifics of each individual piece of property. Therefore, empirical research has mainly focused on on micro data. But in the context of the land tax the heterogeneity of transactions is probably less problematic, and, therefore, the analysis below uses on the average price of land for municipalities.

Another problem encountered in empirical research is to properly determine the tax rate on the property value. In fact, the *effective* tax rate on property generally differs from the statutory tax

because the tax is determined from the assessed property value not from the market value. This is also true in the current context of the Germany land tax. Actually, the German land tax is levied on the land value according to the official assessment ("Einheitswert"). But, whereas the current study focuses on a cross-section of land values in 1987 the last official land assessment took place in 1964. The increase in land prices since then has brought up a substantial gap between market values and tax rates and has lowered effective tax rates. More important, since trends in the prices of land have differed across municipalities this has created a situation where the effective tax rates may differ even if statutory tax rates are the same. Formally, the estimation problem in the case of the land tax amounts to estimate a function

$$V \;=\; V\,(\,g\,,\,q\,,\,y\,,\,\tau V_0/V\,)\,, \tag{4}$$

where V_0/V is the assessment rate of property, which is simply the relation between assessed value of land V_0 - in our case simply reflecting the market value in 1964 and V the market value in 1987. Thus, provided data are available on the market value in the last year of the assessment V_0 the effective tax rate is determined by the product $\tau V_0/V$. But, obviously, there is a simultaneity bias, since the effective tax rate depends inversely on the market value. A possible solution is to use instrumental variables. Consulting the determinants of the market value in the year of the last assessment

$$V_0 \;=\; V\,(\,g_0\,,\,q_0\,,\,y_0\,,\,\tau_0 V_{-1}/V_0\,)\,, \tag{5}$$

where V_{-1} refers to the value of land in the 1937 assessment, we note that the statutory tax rates at the two periods τ , τ_0 may serve as instruments for the effective tax rate. The analysis below utilizes this approach in a cross–sectional dataset of municipalities reporting land values and tax rates at different locations as well as control variables for g and y.

3 Data

The basic database consists of the complete set of municipalities in Baden-Württemberg. With a total number of 1111 observations these jurisdictions show considerable variation in demographic, geographic, economic, and fiscal conditions. Due to data limitations, the analysis below focuses on the land value at 675 municipalities, with population above 1000 and where a sufficient number of land transaction is reported.[1]

Two related but different variables are used to study land tax capitalization: the average price of building land (baureifes Land) and the average monthly rent for an appartment. Whereas the former is a measure of the price of current sales of land the latter is an indicator of the rent paid given an existing stock of buildings. According to the theory the rent level should not be affected by the land tax rate, only the land value should show a negative, capitalization, effect of the land tax. To use these two variables will thus allow us to check for the consistency of the empirical results.

The land value is defined in DM per square meter of land, similarly, the rent variable captures the monthly gross rent in DM per square meter. The land tax rate used in the study is the statutory tax rate defined by a local multiplier (Hebesatz) and a basic tax rate of 0.35 % (in 1964: 0.50 %) on land value.[2] The sample shows a mean tax rate of 0.86 % and shows some variation from 0.65 % to almost 1.3 %. The effective tax rate is however significantly lower.[3]

Besides of rent and land value and aside of tax rates, several indicators of amenities, disamenities and other local characteristics are used. Table 1 shows descriptive statistics. Aside of density and population size several variables capture the land structure according to the zoning plan in

[1]The statistical office does not report data on transaction if the number is below a certain threshold. Moreover due to the restructuring of the municipality boundaries in the 1970's tax data referring to earlier periods were not available for all municipalities.

[2]Depending on the use and of the price of land, there are tax rate reductions up to a rate of 0.26 %.

[3]Actually the mean ratio of assessed to market value of land is approximated at .131 % which corresponds exactly to the figure reported by Bartholmai and Bach (1996) using data for 1988.

Table 1: Descriptive Statistics

	Definition	Mean	Std.Dev	Min	Max
Land value	DM / m^2	164.7	131.1	16.45	936.9
Land value in 1964	DM / m^2	19.83	17.51	2.118	127.7
Monthly rent	DM / m^2	6.290	0.994	4.120	9.420
Statutory land tax rate	in %	0.863	0.091	0.648	1.295
Statutory land tax rate in 1961	in %	0.855	0.133	0.325	1.250
Approx. effective land tax rate	in %	0.113	0.055	0.027	0.583
Debt level	in 1000 DM per capita	1.048	0.637	0.000	4.672
Income	in 10000 DM per cap.	4.860	0.681	3.489	10.31
Unemployment	no.of unemp. per cap.	3.598	1.177	0.861	9.525
Population		11.76	29.72	1.059	551.9
Area		384.7	323.7	25.00	2073
Recreational land	share of total area	0.005	0.006	0.000	0.067
Agricultural land	share of total area	0.512	0.148	0.041	0.857
Water area	share of total area	0.010	0.014	0.000	0.127
Forest land	share of total area	0.333	0.167	0.000	0.900
Density	pop. / settlement area	0.204	0.090	0.034	0.593
Golf course		0.037	0.189	0.000	1.000
Publ. swimming pools	per 1000 residents	0.077	0.127	0.000	1.127
Sanatorium		0.095	0.293	0.000	1.000
Tennis courts per cap.	per 1000 residents	1.170	0.665	0.000	5.384
Horse riding ground		0.373	0.484	0.000	1.000
Theater		0.007	0.086	0.000	1.000
Highway		0.129	0.335	0.000	1.000
Immig. in elementary school	share of pupils	0.110	0.075	0.000	0.425
Wild life reserve (cnty)	share of total area	0.009	0.008	0.001	0.049
Rural preservation area (cnty)	share of total area	0.190	0.112	0.046	0.640
Industry emmissions (cnty)	dust per total area	0.011	0.022	0.000	0.444

Statistics for 675 municipalities in Baden-Württemberg in 1987.

each of the municipalities. The latter includes the share of land used for recreational activities (e.g., parks), land used for agricultural production, land covered with water, and land used for forestry.

Some variables capture fiscal and socio-economic conditions: the debt level indicates the expected future tax burden, income and unemployment capture the economic conditions faced by the local residents. Turning to amenities, two specific variables capture the presence of wild life reserves and rural preservation areas at the corresponding county level using the share in the total county area. Also industrial dust emission are observed only at the county level. With regard to local (dis-)amenities, the analysis considers the density in the settlement area, dummy variables capture the presence of golf courses, sanatoria, horse riding grounds, theaters, and access to a highway (Autobahn). Other indicators refer to the number of open air swimming pools and tennis courts related to the population in 1000. Since parents are obliged to send their children to the local elementary school, if they do not choose private schools, the share of foreign residents among pupils at elementary schools is considered an indicator of educational disadvantages.

4 Results

In our first attempt to test for land tax capitalization among German municipalities we run simple log-linear regressions of the land value on local characteristics. Aside of the land tax rate, variables which show rather skewed distributions are entered in logs. The results displayed in column (1) are obtained from OLS estimation using simply the statutory tax rate. The coefficient of determination is at 0.673. The income level, as well as unemployment show the expected signs and are significant. Population shows a strong positive and the total area a negative effect indicating the positive association with agglomeration. The two variables capturing natural reserve areas show a positive, industrial dust emissions show the expected negative effect. Of the local amenity variables, only three are significant: density in the settlement area, public swimming pools, sanatoria, and highways. Finally, we note that the land tax rate shows a negative significant

coefficient, indicating the presence of capitalization.

Even though the results are generally in accordance with the theoretical expectation, there seems to be a problem with several of the amenity variables. This could be related to the fact, that municipalities are rather small and some might gain from the presence of specific amenities in their local neighborhood. Therefore, spatially transformed values of the amenity variables were included.[4] As displayed in column (2) the coefficient of determination jumps to a figure of .790 and most of the spatial lags of amenities are significant pointing to benefit spillovers across municipalities. Even though the share of foreign citizens in local elementary schools proves insignificant, the argument of sorting is partially confirmed since the share in adjacent jurisdictions shows a positive effect. Finally, again the statutory land tax rate shows a negative coefficient, which however fails to be significantly different from zero.

However, the statutory tax rate may be a rather poor indicator of the effective tax burden. As discussed above, it seems more preferable to use the effective tax rate as defined above. To overcome the simultaneity problem involved, the current statutory land tax rate as well as the land tax rate around the time at which the land assessment was carried out are used as instruments. Column (3) provides results from a corresponding GMM estimation. Accordingly, the approximated effective tax rate shows the expected negative sign. Note that according to the $J-$statistic at the bottom of the table, the overall specification test does not indicate a problem with the implied moment restrictions.

[4]Formally variable x_i is spatially transforme into variable x_{-i} referring to neighboring jurisdictions using

$$x_{-i} = \sum_j \mathsf{W}[i,j]\, x_j.$$

The spatial weights are defined such that $\mathsf{W}[i,j] > 0$ for neighboring municipalities, $\mathsf{W}[i,j] = 0$ for more distant locations and $\mathsf{W}[i,i] = 0$. The criterion used to define neighbors is set to a distance of 30 km. The weights are inverse distances. Note that we do not employ spatial lags of the county level indicators related to industry emissions and natural reserve areas.

Table 2: Results

Dependent variable	Land value			Rent level		
Method	OLS	OLS	GMM	OLS	OLS	GMM
	(1)	(2)	(3)	(4)	(5)	(6)
log Statutory land tax rate	-.481 **	- .230		-.009	.043	
	(.207)	(.167)		(.040)	(.038)	
log Effective land tax rate			-.248 **			.023
			(.111)			(.030)
log Income per cap.	.630 **	.428 **	.446 **	.190 **	.145 **	.144 **
	(.184)	(.150)	(.128)	(.044)	(.038)	(.035)
Unemployment	-.101 **	- .076 **	- .071 **	-.008 *	-.002	-.002
	(.018)	(.017)	(.015)	(.004)	(.004)	(.004)
Debt per capita	-.045	- .013	- .017	.007	.009 *	.007
	(.038)	(.027)	(.023)	(.006)	(.005)	(.006)
log Population	.437 **	.334 **	.291 **	.098 **	.095 **	.094 **
	(.116)	(.089)	(.081)	(.024)	(.022)	(.022)
log Total area	-.426 **	- .230 **	- .167 **	-.098 **	-.076 **	-.076 **
	(.115)	(.088)	(.084)	(.023)	(.022)	(.022)
Share of recreational land	2.25	6.14	5.44	.100	.733	.708
	(4.11)	(4.25)	(3.60)	(.762)	(.632)	(.640)
Share of agricultural land	-.626	.340	- .172	-.058	.196	.190 *
	(.713)	(.089)	(.489)	(.147)	(.133)	(.134)
Share of water	-3.32 **	- .842	- 1.25	-.096	.445	.454
	(1.64)	(1.35)	(1.21)	(.352)	(.315)	(.316)
Share of forest land	-.534	.344	- .132	-.009	.216	.251 *
	(.724)	(.518)	(.497)	(.147)	(.135)	(.138)
Wild life reserve (cnty)	4.92 **	5.71 **	3.71 *	3.16 **	3.45 **	3.69 **
	(2.01)	(1.97)	(2.08)	(.580)	(.575)	(.614)
Rural preservation area (cnty)	1.26 **	.894 **	.913 **	.282 **	.161 **	.159 **
	(.195)	(.167)	(.155)	(.043)	(.038)	(.037)
log Industry emmissions	-.066 **	- .082 **	- .083 **	-.012 **	-.015 **	-.016 **
	(.021)	(.019)	(.017)	(.004)	(.004)	(.004)
log Density (settlement area)	.415 **	.250 **	.345 **	.044	.018	.008
	(.139)	(.103)	(.103)	(.028)	(.026)	(.028)
Golf course	.034	.004	.023	.019	.015	.012
	(.107)	(.082)	(.073)	(.016)	(.014)	(.014)
Publ. swimming pools	.372 **	.308 **	.301 **	.007	.008	.010
	(.141)	(.112)	(.100)	(.032)	(.029)	(.027)

continued on next page

continued from previous page	(1)	(2)	(3)	(4)	(5)	(6)
Sanatorium	.170 **	.156 **	.148 **	.052 **	.044 **	.046 **
	(.062)	(.056)	(.050)	(.014)	(.014)	(.013)
Tennis courts	.021	.030	.029	.006	.009 *	.009 *
	(.029)	(.025)	(.022)	(.005)	(.005)	(.005)
Horse riding ground	.040	.030	.022	.008	.006	.006
	(.041)	(.034)	(.030)	(.008)	(.008)	(.008)
Theater	.106	.339 **	.233 **	.014	.063	.075
	(.174)	(.110)	(.100)	(.076)	(.068)	(.057)
Highway	.123 **	.056	.045	.022 **	.010	.011
	(.049)	(.042)	(.037)	(.011)	(.010)	(.010)
Imm. in elementary school	-.042	- .031	- .094	.004	-.034	-.035
	(.319)	(.282)	(.256)	(.065)	(.064)	(.063)
W log Density		.118 **	.095 **		.020 **	.022 **
		(.023)	(.023)		(.004)	(.005)
W Golf course		.307	.250		.017	.021
		(.283)	(.256)		(.062)	(.061)
W Publ. swimming pools		1.24 **	1.10 **		.097 **	.110 **
		(.222)	(.192)		(.049)	(.048)
W Sanatorium		.280 **	.281 **		.103 **	.103 **
		(.104)	(.095)		(.026)	(.025)
W Tennis courts		.188 **	.152 **		.039 **	.042 **
		(.036)	(.036)		(.007)	(.008)
W Horse riding ground		.262 **	.232 **		-.010	-.009
		(.063)	(.059)		(.013)	(.013)
W Theater		3.61 **	3.10 **		1.27 **	1.31 **
		(.605)	(.573)		(.134)	(.148)
W Highway		.357 **	.339 **		.059 **	.059 **
		(.076)	(.068)		(.018)	(.018)
W Imm. in elementary school		.658 **	1.07 **		.386 **	.357 **
		(.528)	(.506)		(.132)	(.140)
Constant	3.97 **	1.97 *	1.56 *	1.81 **	1.27 **	1.45 **
	(1.28)	(1.03)	(.885)	(.256)	(.134)	(.237)
J-Statistic (dof)			1.07(1)			1.63(1)
R^2	.673	.790		.662	.743	
R^2(adj.)	.662	.780		.651	.731	

Heteroscedasticity robust standard errors in parentheses. (3) and (6) use the statutory tax rates in 1987 and 1961 as instruments. If significant at 0.10 or 0.05 coefficients are marked with one or two stars.

As the current analysis is the first cross-section regression on land tax capitalization in Germany it seems interesting to compare the results with regressions where the land value is replaced by the monthly appartment rent. As shown in columns (3) to (5) the results are quite similar. But, regardless of whether the statutory or the effective tax rate is used, there is no significance on the property tax rate. Obviously, the landlords are not in a position to shift the tax incidence of the land tax to the tenants.[5]

Whereas the results confirm the existence of capitalization, it would be interesting to get some insights into the actual strength of land tax capitalization. To get an impression of the average magnitude of capitalization in the sample we note that the above coefficient estimate reflects a simple elasticity of land value with regard to the land tax rate. As remarked above under full capitalization this should just reflect (in absolute terms) the share of land tax payments in the total cost of holding a piece of land. With the mean effective tax rate of about 0.113 % and with an interest rate of 3 % this share should be around 0.036. The elasticity found is substantially larger pointing to substantial overcapitalization.

Now this could partly be due to the phenomenon of the "disappearing tax base". If the assessement ratio is not correctly measured from the difference in the market value of building land between 1964 and 1987 the change in the tax rate might imply a more than proportionate increase in the effective tax rate. Since, by depressing the market value, the assessment factor increases. As a consequence the response in market prices will be stronger than the capitalization formula would suggest. But, even if the distribution of the effective tax rate is accurately depicted there is considerable uncertainty with regard to actual level of the assessment rate. Moreover, in 1987 a substantial program of housing subsidies might also have contributed to a larger share of the tax in actual cost of holding land.

To explore this issue further more refined data on the ratio of assessed and market value are

[5]Although this is a standard result in the literature, this is a remarkable finding in the German context, as generally the land tax is listed as part of the side cost (Nebenkosten) which are routinely forwarded to the tenants and are not subject to rent controls.

needed to get reasonable estimates on the extent of land tax capitalization. Nevertheless, the significance of the tax rate is indicative of capitalization.

5 Conclusions

In this first study on land tax capitalization in Germany we find support for the view that land taxes are capitalized into land values whereas the level of the monthly rent remains unaffected. Although this is consistent with full capitalization, the actual degree of capitalization implied by the empirical result is larger than expected. This is related to the considerable uncertainty with regard to the gap between assessed and market values of land.

When capturing local amenities it proved important to take account of conditions in adjacent jurisdictions. This reflects the smallness of the considered municipalities. The significance of theaters and public open-air swimming pools, which are both subsidized by the municipalities point to significant benefit spillovers across municipalities. Benefit spillovers across municipalities are also found to be exerted by highway access which shows a particularly strong impact on the land values.

Another interesting result is the strong impact of density. This is important for the reform of the municipal finances in Germany. Under the current system, which basically rests on the business tax, cities experience substantial taxing power. As the land value shows a strong positive relation to density, cities would also experience strong taxing power if the finances of municipalities were reformed towards a greater role of the land tax.

Datasources and Definitions

All data have been obtained from the statistisches Landesamt Baden-Wuerttemberg.

Municipalities: The basic dataset consists of the 1111 municipalities of the German state of Baden-Wuerttemberg (BW). BW covers a total area of 35,752 square kilometer (sqkm)

(13,800 square miles (sqm)) with an average community area size of about only 32.2 sqkm (12.4 sqm). For comparison average US county size is about 1,127.5 sqm (own computations based on County and City Data Book, 1988).

Due to some problems with data availabilty the estimation uses a reduced dataset of 675 municipalities. As can be seen from Table 4, mainly small municipalities have been removed.

Table 4: Size Distribution of Municipalities

pop. size in 1,000		<1	1-2	2-5	5-10	10-20	20-50	50-100	>100
jurisdictions	N=1111	97	158	419	237	119	60	13	8
	N=675	0	53	255	183	105	58	13	8

1987 population figures.

Land value refers to the sales of building land (Bauland) divided by the area of the transactions in the municipalities of Baden-Wuerttemberg. The figure employed is the average land value over the period 1986-1988. Figures for 1964 are calculated on basis of the average land value in 1970-1972. Using county data for 1970-1972 as well as for 1964, county specific price trends were used to calculate figures for 1964.

Monthly rent refers to apartments of standardized size equipped with bath and kitchen taken from the last German population census 1987. Publicly supported housing is excluded.

Statutory tax rate is the implied land tax rate calculated using local collection rates in 1987 and the base tax rate of 0.35 % as defined in the tax code. Due to the restructuring of the municipality boundaries in the 1970's data referring to 1961 were not available for all municipalities. If applicable averages across municipalities were calculated using 1961 population figures.

Income defined as taxable income according to the income tax statistics of 1989 in 10000 DM per capita.

Unemployment refers to number of unemployed according to the population census relative to the population of working age in 1987 as taken from the German population census.

Area: Figures on area are obtained from the statistics of the zoning plan (Flächennutzungsplan).

Amenities: The list of amenity variables includes the number of open air swimming pools, tennis courts per capita, the presence of a golf course, of water sport opportunities, and of an equitation area all referring to July 1989. Moreover, the touristic classification of municipalities (taken from the German Automobile Association) indicating a health resort, a recreation locality, or a climatic spa as of 1987 is employed. Furthermore, a dummy variable captures the presence of a sanatorium in 1988. Also the number of theaters per capita in 1987 is used. Two variables indicate the share of natural resort and land reservation areas in the county or independent city. Finally the amount of industrial dust per county (or independent city) area as an average of the figures in 1985 and 1990 is employed.

Spatial weighting matrix: Euclidian distances are computed from a digital map of the geographical position of the administrative center of each community. The employed matrix defines local neighbors as communities located within a distance of 30 kilometers (km). This results from using commuting of the working population as an indicator of the geographic proximity, as 90 % of the male commuters – as a proxy for full-time employed commuters – have a commuting distance up to 30 km (18,65 miles). This figure was obtained by means of linear interpolation based on relative frequencies of commuting distances published by Heidenreich (1988). Each neighboring community is weighted according to the inverse of its relative distance. Note that due to a better empirical performance, row-standardization is not imposed. This implies, that the total strength of effects exerted by neighboring municipalities is not restricted to be the same across municipalities. If a municipality is located in large distance to others it will thus tend to be less affected by its neighbors.

References

Bartholmai, B. and S. Bach. 1996. Immobilienvermoegen der privaten Haushalte. *DIW-Wochenbericht* 04 (1996).

Brueckner, J. K. 1982. A test for allocative efficiency in the local public sector. *Journal of Public Economics* 19, 331-331.

Fuest, C. and M. Thoene. 2002. *Substitution der Gewerbesteuer: eine Kombination aus Zuschlägen zur Einkommen- und Körperschaftsteuer und reformierter Grundsteuer.* Manuscript, Köln.

Oates, W. E. 1969. The effects of property taxes and local public spending on property Values: An Empirical Study of tax capitalization and the Tiebout hypothesis, *Journal of Political Economy* 77, 957-971.

Palmon, O. and B.A. Smith. 1998. New evidence on property tax capitalization. *Journal of Political Economy* 106, 1099-1111.

Yinger, J., H.S. Bloom, A. Boersch-Supan, and H.F. Ladd. 1988. *Property taxes and house values: the theory and estimation of intrajurisdictional property tax capitalization*, San Diego.

Zimmermann, H. 1999. *Kommunalfinanzen*, Baden-Baden.

Zodrow, G. R. 2000. The property tax as a tax on capital: a room with three views, *National Tax Journal* 54, 139–156.