The Capitalization of Public Services and Amenities into Land Prices – Empirical Evidence from German Communities

Alexander Ebertz

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Abstract

Applying the hedonic approach to land prices, this paper investigates the capitalization of public services and pure amenities in a cross section of German communities. Possible spill-over effects from neighboring municipalities are explicitly included in the analysis and prove to be of considerable importance. Estimates of the impacts of local attributes on land prices are obtained taking into account the spatial structure among unobserved variables. The results confirm that differences in land prices can largely be attributed to local conditions and policies. This implies a significant degree of mobility as well as a sizeable valuation of local attributes by German households.

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Keywords: Land Prices, Hedonic Regression, Spatial Dependence.

Alexander Ebertz
Ifo Institute for Economic Research
at the University of Munich
Poschingerstr. 5
81679 Munich, Germany
Phone: +49(0)89/9224-1394
ebertz@ifo.de

1 Introduction

How much are people willing to pay to live in a sunny and secure community featuring a good public transport system, nice recreational facilities, and plenty of shopping opportunities? This question is an interesting one, especially for politics at the community level. After all, many of the determinants of the local quality of life are, at least to some extent, publicly produced goods. However, local governments face a trade-off when it comes to the provision of public services. On the one hand, these services have to be financed by probably unpopular measures. On the other hand, if public spending ensures a high quality of life, this may both help to win elections and to attract new citizens, thereby increasing the tax base. Moreover, in the case of Germany, the attraction of new residents directly generates revenues via the system of municipal fiscal equalization ("kommunaler Finanzausgleich").

For quite a long time, economic theory has a method to answer questions of the kind mentioned above. The hedonic analysis of heterogeneous commodities dates back to the early works of Waugh (1929), Court (1939), and Griliches (1961, 1971). In the context of this paper, however, the idea of the hedonic approach is to utilize differences in land prices across communities to infer the marginal willingness to pay for single community attributes including the quantity and quality of public services. Rosen (1979) and Roback (1982) were the first to apply the hedonic approach in a general equilibrium context, including the location decisions made by firms. Since then, the method has been widely applied and developed in the USA (see Blomquist 2006 for an overview).

Nevertheless, there is hardly any analysis of this kind for German communities. Buettner (2003) finds capitalization effects of a number of amenities and disamenities in a set of German communities. However, his research mainly focusses on capitalization of the land tax. Given the large fraction of the public sector's budget consumed by sub-national governments in Germany, an evaluation of locally provided public services surely makes sense. The case of East Germany thereby fits especially well for several reasons. On the one hand, after the reunification of Germany, the eastern part of the land has experienced a massive and continued outflow of people looking for work in West Germany. Many small and more remote places now face severe problems in maintaining their infrastructure while the bulk of young and productive people is leaving. Among the 505 mu-

nicipalities of the Free State of Saxony, only 23 (including the cities of Dresden and Leipzig) show a positive population growth for the period from 2000 to 2006. A reliable evaluation of community characteristics that helps to change this trend and attract new residents should therefore be vital for most East German municipalities. On the other hand, precisely through the considerable degree of mobility that has been shown by the citizens of eastern Germany, it qualifies for hedonic analysis of this kind. After all, household mobility is a crucial assumption if the capitalization of public services or amenities is to be observed.

In order to investigate the capitalization of public services and amenities into land prices in German communities, I focus on the 505 municipalities of the Free State of Saxony, using data from a variety of sources. Due to a lack of reliable data on wages at the community level, the analysis is constrained to compensatory differentials on the market for real estate and does not consider the full general equilibrium model proposed by Roback (1982). Given the rather small dimension of communities, the possibility of spill-over effects of local characteristics must be considered. Residents of neighboring municipalities are likely to enjoy not only the amenities provided in their home community, but also those in the surrounding municipalities. The empirical analysis explicitly allows for such spill-over effects by including spatial lags of the variables capturing public services and amenities. Moreover, possible spatial dependence in the unobservables is taken into account to ensure correct statistical inference.

The results show that most public services included in the analysis do significantly capitalize into land prices, with the quality of public transport systems and the share of land dedicated to recreational purposes receiving the highest valuation by Saxony's citizens. The local crime rate seems to matter for households of higher income only, as a significant capitalization effect is found for land prices at sites of high quality exclusively. The conjecture that local characteristics also affect the land prices in neighboring communities is confirmed as most spatially lagged indicators prove to be significant. Thereby, up to 70 % of the variation in the value of land across communities can be explained by the used set of variables. These findings imply that household mobility in the state of Saxony is high enough to create capitalization effects. The hedonic approach is therefore a promising tool in the evaluation of the local provision of public services and can help communities to develop well defined strategies to regain some of their lost population.

The remainder of the paper proceeds as follows. The next section briefly illustrates the theory behind hedonic prices. Section 3 discusses the investigation approach and section 4 describes the data. Section 5 presents the results from the land-price regressions. Section 6 is concerned with the illustration of the resulting hedonic prices. Section 7 provides a short summary.

2 Theoretical Background

This section provides a short overview of the hedonic analysis of the housing market. The presentation largely follows that of Sheppard (1999). In contrast to many simple consumption goods that show relatively little variation in composition as well as in prices, the good *housing* is much more heterogenous. Consumers on the housing market can choose between units differing in age, size, the number of bedrooms, etc. Moreover, since residences are inextricably linked to their location, regional conditions as well as regional public services become quasi attributes of a dwelling. Each unit of housing in community j, h_j, can therefore be viewed as a bundle of many characteristics, $a_{i,j}$, which are demanded by consumers but cannot be purchased on their own. Apart from these attributes, consumers derive utility from the consumption of a composite good, x_j, and receive an exogenous income, y. Preferences are thus given by the quasi-concave utility function

$$u = u(x_j, a_{i,j}). \tag{1}$$

Assuming that mobility between locations is costless, spatial equilibrium requires that residents' utility is equated across all regions, leading to the familiar no-arbitrage condition

$$u^* = V\left(\underbrace{y - R}_{x_j}, a_{i,j}\right), \tag{2}$$

where $V(.)$ denotes the usual indirect utility function. $R(u, y, a_{i,j})$ represents the bid-rent function that is defined as the maximum price a consumer is willing to pay for a unit of housing with attributes $a_{i,j}$, given her income and utility level. Let the price of one unit of housing, $r_j(a_{i,j})$, be

a function of the attributes of the respective dwelling. Then, maximization of (1) subject to the budget constraint, $y \geq r_j(a_{i,j}) + x_j$, together with implicit differentiation of (2) yields the following equality for the hedonic price of attribute i:

$$f_i = \frac{\partial r_j}{\partial a_{i,j}} = \frac{\partial R}{\partial a_{i,j}}. \tag{3}$$

Thus, the hedonic price f_i of any attribute a_i is defined as the marginal contribution of attribute a_i to the price of one unit of housing. Furthermore, in this simple setting, an estimate of the hedonic price allows direct inference of the consumers' marginal willingness to pay for the respective attribute.

3 Empirical Approach

To obtain empirical estimates of the capitalization of local amenities and policies into land prices, I estimate hedonic land-price regressions. In a first step, I regress the natural logarithm of the community land price on a set of (dis-)amenities and local public services:

$$\ln r_j = \alpha_0 + \alpha_1 z_j + \alpha_2 A_j + \varepsilon_j, \tag{4}$$

where z_j is a vector of characteristics of the market for real estate and A_j is the set of (dis-)amenities and public services in community j. Note, that there is no a-priori classification of the community characteristics as an amenity or disamenity at this point. However, when interpreting the results the nature of most of our variables is common sense. The vector z_j contains a couple of control variables in order to capture variations in the location rent as suggested by standard models of the urban land market (see DiPasquale and Wheaton, 1996). This includes population density as the main determinant of the location rent within metropolitan and urban areas and population growth as an indicator of the expected change in the location rent. Moreover, indicators of the relative land use and the distribution of residences within buildings are included here.

The issue treated in this study is of an intrinsically spatial nature. There are at least two points

to take into account in estimating such relationships. First, communities are rather small spatial entities such that it is perfectly reasonable to expect spill-over effects of (possibly publicly produced) amenities between neighboring communities. Publicly provided parks are a good example of goods that enhance the quality of life of all people within a certain distance regardless of their residential community. To capture such effects, spatial lags of most community characteristics are constructed. Formally, a_{-j} denotes the spatial lag of variable a_j and is transformed according to

$$a_{-j} = \sum_k W[j,k]a_k, \tag{5}$$

where W is a spatial weighting matrix containing inverse distances[1] as weights with:

$W[j,k] = 0$ if distance between k and $j > 30$km,

$W[j,k] > 0$ if distance between k and $j \leq 30$km, and

$W[j,j] = 0$.

In other words, the spatially lagged counterpart of the local crime rate in municipality j contains the inverse-distance-weighted sum of crime rates in all surrounding communities within a radius of 30 km[2]. Note, that by taking the sum of values in the surroundings explicit emphasis is put on the question of how central a community is located. This form of aggregation pays attention to the fact that municipalities surrounded by many other, possibly attractive, communities exhibit a greater quality of life to most people than remote places do. On the contrary, a row standardization would ignore this argument by assigning more equal weights to each location.

Another important point to be addressed in this spatial context is the likely presence of dependence in the unobserved variables. The literature on spatial econometrics emphasizes that inference based on simple OLS estimates might be incorrect if individuals are not independently distributed over

[1]Distances are own calculations based on UTM coordinates (zone 33, WGS84 ellipsoid) of the Federal Bureau of Cartography and Geodesy ("Bundesamt für Kartographie und Geodäsie").

[2]Although chosen arbitrarily, the mark of 30 km seems a reasonable guess when thinking of cross-border effects of community characteristics. However, regressions with varying cut-off values between 15 and 90 km have been carried out and the results proved very robust against such variations.

space.[3] Therefore, I follow Conley (1999) and estimate a heteroscedasticity and spatial-dependence consistent covariance matrix of the orthogonality conditions. Thus, the second set of regressions carried out in this study can be formalized as:

$$\ln r_j = \beta_0 + \beta_1 z_j + \beta_2 A_j + \beta_3 A_{-j} + \epsilon_j, \tag{6}$$

where A_{-j} denotes the vector of spatially lagged (dis-)amenities and ϵ_j are the spatial dependence robust error terms.

In a next step, the coefficients (β_2, β_3) are converted into implicit prices for the amenities and public services. In this case, these implicit prices are just the marginal effects obtained in the regression analysis and are given in € per sqm at the moment of purchase. This representation avoids any additional sources of imprecision that might arise through a translation into monthly budget figures.

4 Data

This study is concerned with the 505 communities of the German federal state of Saxony. Table 1 presents summary statistics for land prices, amenities, public services and control variables. Most of the data refers to the year 2006 and is obtained from two sources, the statistical office of Saxony and the Development Bank of Saxony (SAB). The latter provides a couple of interesting measures of public services at the community level; for example, the rate of physicians to patients as an indicator of the provision of health services. Another measure of health services is given by the dummy variable *Hospitals* which takes the value 1 if a hospital is located in the community itself or in an adjacent municipality. In order to capture traffic connections as well as remoteness, a weighted average of minutes of driving time to a number of common destinations such as place of work, school, shopping centers, train station, and airport is used. The SAB furthermore provides a self constructed measure of the quality of the public transport system. This figure basically relates the local number of daily driven kilometers in the public transport system to population

[3] See Anselin (2001) for an overview.

density.[4] Moreover, the number of criminal offences against persons per 1000 inhabitants is used as an indicator of the level of public security provided by a municipality. The degree of local provision with basic goods is captured by a variable representing the area occupied by food retail stores per inhabitant.

Another variable of interest is the local unemployment rate, which indicates the economic situation in the municipality as well as the individual labor market risk faced by residents. The figures are taken from the state's statistical office, and from the same source stem the variables reflecting the local structure of land use. Thereby, the percentage of land dedicated to recreational purposes is included as an amenity to households. The fractions of community area occupied by buildings or traffic, on the other hand capture features of the local market for real estate. By the same token the number of buildings containing 2, or 3 or more residences, respectively, are included in the analysis. Possible agglomeration effects that are not due to the considered characteristics are controlled for by including a dummy variable for cities with a population greater than 5,000 people and the population density itself. Furthermore, land prices are likely to be in part driven by expectations on future developments. Therefore, population growth between 2000 and 2006, as well as the share of inhabitants older than 65 years enter the regressions as further control variables. The state of Saxony has frontiers with the Czech Republic and Poland. As both countries show substantial differences with respect to the economic and cultural background, the distance to the Eastern border is included to control for such structural variation within the Saxon municipalities. Finally, a pure amenity is considered by including figures on average precipitation in the communities. This variable captures long term averages from 1960 to 1990 and stems from the Federal Meteorological Office ("Deutscher Wetterdienst").

The dependent variable of the main regression is based on an official collection of purchasing prices for land.[5] The figures used are average values derived from purchasing prices for lots of nearly identical features and values. These so called standard ground values ("Bodenrichtwerte") refer to lots typical for the respective region and are reported separately for residential, commercial, and mixed areas. In order to take into account the fact that companies and households are both

[4]The exact formula is: $PublicTransport = \frac{1}{100} \frac{Avg.dailynumberofdrivenkilometers}{\sqrt{min(settlementarea/totalarea;5\%)}/\sqrt{inhabitants/settlementarea}}$.

[5]These prices are collected and stored by the Geschäftsstelle des Gutachterausschusses following §195 BauGB.

Table 1: Descriptive Statistics

Variable	Definition	Obs.	Mean	Std.Dev.	Min	Max
Land price:						
Land price	€ per sqm	505	29.2	23.2	4.03	362
Land price *basic*	lots in sites of basic quality in € per sqm	390	17.3	11.9	4.4	115
Land price *medium*	lots in sites of medium quality in € per sqm	495	25.1	15.6	4.4	170
Land price *good*	lots in sites of good quality in € per sqm	351	36.5	29.9	4.4	250
Controls:						
Land: *buildings*	share of total area in %	505	6.56	4.84	1.58	33.3
Land: *traffic*	share of total area in %	505	3.91	1.61	1.34	11.9
Buildings w. 2 residences	share of total buildings in %	505	24.6	6.93	7.49	45.3
Buildings w. $\geq$ 3 residences	share of total buildings in %	505	16.5	11.1	.962	54.3
Distance to eastern border	in km	505	28.6	22.0	0	101
Density	no. of people per sqkm	505	202	228	18.8	1702
City	1 if population $>$ 5000	505	.317	.466	0	1
Populationgrowth	2000 - 2006	505	-.062	.038	-.229	.116
Population projection	share of people of age $>$ 65 in%	505	22.4	2.91	11.4	29.8
Unemployment	unemployed per inhabitant in %	501	8.26	1.78	4.25	14.7
Public Services and Amenities:						
Land: *recreation*	share of total area in %	505	.717	.961	0	11.3
Hospitals	1 if hospital in municipality or in neighboring mun.	505	.673	.470	0	1
Physicians	no. of physicians per ordinary patient	505	.649	.356	0	2.33
Crime	no. of criminal offenses per 1000 inhabitants	505	4.71	2.41	.381	13.9
Peripherality	minutes of driving time to common destinations	505	20.0	7.13	1	48
Public Transport	avg. measure of frequency and vehicle capacity	505	.792	1.58	.082	27.1
Precipitation	annual average 1960 -1990 in l per sqm	505	713	114	486	1160
Commerce	food retail area per inhabitant in sqm per person	505	.299	.304	0	3.18
Spatial Lags:						
W Land: *recreation*	weighted sum of *Land: recreation* within 30 km	505	3.01	1.48	.637	8.18
W Physicians	weighted sum of *Phyicians* land within 30 km	505	2.74	1.05	.608	5.74
W Crime	weighted sum of *Crime* within 30 km	505	19.2	6.11	4.41	33.9
W Public Transport	weighted sum of *Public Transport* land within 30 km	505	302	106	68.5	764
W Commerce	weighted sum of *Commerce* within 30 km	505	1.27	.523	.266	2.94

Statistics for municipalities in Saxony, year 2006. Sources: Statistical Office of Saxony, Sächsische Aufbaubank (SAB), GSD Geographic Systems DataService AG, Deutscher Wetterdienst.

competing for land and to guarantee a maximum of representativeness, I calculate averages of these three categories using the corresponding shares of land as weights.[6] Moreover, the Development Bank of Saxony (SAB) provides similar data for purchasing prices for land, distinguishing sites of good, medium, and basic quality. This data is used to check the results of the main regression with respect to their robustness. Furthermore, income related patterns in the demand for local characteristics might be detected by separate analysis of the three categories, as better lots are likely to be demanded by households with higher income.

The spatial lags of the variables *Crime*, *Public Transport*, *Commerce*, *Land recreation*, and *Physicians* are calculated according to equation (5). Note, however, that such a spatial transformation does not make sense for all kinds of community characteristics. Take, for example, the unemployment rate. This indicator is not irreversibly linked to specific areas of land, since there exists the possibility of commuting. If a community features a splendid labor market this fact will not only be reflected in the local unemployment rate, but also in the unemployment rates of all neighboring municipalities. Including a spatial lag of the above mentioned form is therefore not very promising. In a similar manner, the precipitation in adjacent communities is most likely to be of minor interest to residents. In contrast, the variables *Hospitals* and *Peripherality* are not transformed because both of them already include a spatial reference to neighboring communities by definition.

5 Results

Table 2 reports the results of the hedonic regressions of land prices on the set of amenities. For reasons of comparison, the results for regression equation (4) which ignores any spatial issues are reported in Column 1. Columns 2 - 5 report the results of different specifications of equation (6) with spatial dependence robust standard errors and including spatial lags. The specifications differ with respect to the dependent variable. The results in column 2 are obtained using the local averages of all land prices. Therefore, this "main regression" gives the most representative picture and is later used to infer the hedonic prices (see next section). Columns 3 - 5 provide the respective

[6] Alternative regressions with the untransformed data showed that the results presented in this paper are robust to this transformation.

results for the land prices in good, medium, and basic quality sites, which are based on fewer observations. First note that the explanatory power of the regressions in general is considerably high. The main estimation presented in column 2 is able to explain 66 % of the variation in local land values, and for sites of medium quality this figure even reaches 70 %. As the figures used as dependent variables are not directly observed market prices, the high goodness of fit is an important indicator for the validity of the presented results.

The different specifications by and large give a consistent picture. The bulk of coefficients on the explanatory variables prove to be significant at standard levels and practically all of them show the expected signs. Moreover, the results of the different specifications turn out to be consistent with respect to their significance levels and signs. Despite the varying dependent variables and the different number of observations, even differences in the absolute values of the coefficients are of minor magnitude.

High shares of recreational area, nearby hospitals and a good system of public transport all prove to be positively correlated with the local price for land, both when measured in the community itself or in its surroundings. In contrast, high levels of unemployment and precipitation are associated with a lower value of land. These effects are of similar magnitude throughout the different specifications, with the results for unemployment and the spatial lag of the public transport system being remarkably robust. A good provision of health services through physicians at the local level is also found to have a positive impact on land prices. However, the ratio of physicians to patients in the surrounding communities does not show a significant coefficient. This might indicate that the local provision of health services is considered to be sufficient, especially since the availability of hospitals is accounted for separately. No significant effect is found for the supply of basic goods, neither when measured locally nor in the neighbor communities. The remoteness of a community clearly goes hand in hand with lower prices for land. This result holds throughout all specifications, although the amenities of neighboring locations and the respective distances are explicitly controlled for. The results obtained for the crime rate and its spatial lag show an interesting variation across the quality levels of sites: The negative coefficient of the local crime rate is only significant in the specification referring to good locations. On the contrary, the crime rate in surrounding municipalities has a highly significant coefficient in all other specifications. Given that living space in sites

Table 2: Estimation Results

Variable	log Landvalue		log Landvalue		log Landvalue *good*		log Landvalue *medium*		log Landvalue *basic*	
log Share of land: *buildings*	-.426***	(.077)	-.463***	(.070)	-.255**	(.108)	-.183**	(.071)	-.168*	(.093)
log Share of land: *traffic*	.022	(.087)	.073	(.087)	.106	(.093)	-.045	(.070)	.112	(.092)
Share of buildings w. 2 residences	.017***	(.003)	.010***	(.003)	.009*	(.005)	.009***	(.003)	.008**	(.004)
Share of buildings w. $\geq$ 3 residences	.022***	(.003)	.011***	(.003)	.017***	(.004)	.013***	(.003)	.010**	(.004)
Distance to eastern border	.003***	(.001)	.004***	(.001)	.004***	(.001)	.006***	(.001)	.005***	(.001)
log Density	.356***	(.064)	.373***	(.062)	.195**	(.088)	.199***	(.057)	.156**	(.077)
City	.118***	(.042)	.083**	(.038)	.234***	(.065)	.113***	(.037)	.041	(.052)
Populationgrowth	1.45***	(.542)	.807	(.496)	.918	(.697)	1.00**	(.479)	.238	(.623)
Population projection	-.030***	(.007)	-.018**	(.007)	.005	(.009)	-.009	(.007)	-.011	(.008)
Unemployment	-.060***	(.013)	-.033**	(.013)	-.036**	(.015)	-.041***	(.011)	-.049***	(.014)
Public Services and Amenities										
log Share of land: *recreation*	.076***	(.027)	.060**	(.025)	.082**	(.038)	.091***	(.026)	.115***	(.037)
Hospitals	.107***	(.040)	.093**	(.036)	.152***	(.043)	.101***	(.031)	.060	(.039)
Physicians	.122*	(.062)	.169***	(.056)	.174**	(.078)	.110**	(.048)	.072	(.060)
log Crime	-.060	(.043)	-.017	(.039)	-.086*	(.046)	-.019	(.032)	-.026	(.052)
log Peripherality	-.211***	(.054)	-.172***	(.052)	-.154*	(.087)	-.139**	(.058)	-.035	(.066)
Public Transport	.031***	(.007)	.045***	(.007)	.019*	(.010)	.020**	(.010)	.032*	(.017)
log Precipitation	-.652***	(.165)	-.701***	(.186)	-.821***	(.256)	-.378**	(.157)	-.419*	(.229)
Commerce	.001	(.055)	.033	(.048)	.005	(.052)	.087**	(.044)	.047	(.056)
Spatial Lags										
W Share of land *recreation*			.073**	(.029)	.088**	(.036)	.088***	(.024)	.157***	(.029)
W Physicians			.043	(.074)	-.133	(.097)	-.011	(.068)	.053	(.083)
W Crime			-.033***	(.007)	-.003	(.010)	-.035***	(.007)	-.045***	(.008)
W Public Transport			.001***	(.000)	.001***	(.000)	.001***	(.000)	.001***	(.000)
W Commerce			.094	(.128)	-.137	(.152)	.050	(.108)	.063	(.133)
N	500		500		346		490		385	
R^2	.608		.658		.676		.697		.623	

Column 1: OLS estimation, heteroskedasticity robust standard errors in parentheses. Column 2 - 5: OLS estimation, spatial dependence and heteroskedasticity robust standard errors in parentheses. * denotes significance at the 10% level (** at 5%, *** at 1% level).

of good quality is predominantly demanded by high income households, this might indicate that public security matters systematically more to people with higher income levels. The significance of the crime rate in the neighborhood might be explained by studies finding that criminal acts tend to be committed in adjacent locations providing more profitable opportunities, rather than in the residential region of the criminal (see, e.g. Katzmann 1981, or Buettner and Spengler 2008). However, without information on the origin of offenders, this cannot be confirmed.

Note that the results of all specifications clearly point at the existence of agglomeration effects. The coefficients on the natural logarithm of the population density, on the indicator for cities over 5,000 inhabitants, and on the share of buildings containing more than 3 residences are all significantly positive throughout the different specifications. However, the variables designed to control for expectations and speculation in the market, i.e. population growth and the share of old people, do not show consistently significant coefficients. A further interesting finding is the robust significant effect of the distance to the eastern border. Apparently, the proximity to the countries of the eastern enlargement of the EU is valued negatively at Saxony's market for land.

6 Hedonic Prices

The hedonic prices of public services and amenities are obtained according to equation (3) and are based on the results of the main regression shown in column 2 of table 2. Table 3 reports the resulting hedonic prices for the community characteristics. The figures in column 1 report the marginal willingness to pay for one unit of the respective amenity or public service in € per sqm at the moment of purchase. For example, the results suggest that households are willing to pay around € 0.96 per sqm to have a one percentage point smaller unemployment rate in their home community. Since each amenity is measured in different units, this exact form of representing the willingness to pay is not very convenient for getting a feeling of relative magnitudes. Thus, for ease of comparison, column 2 reports the prices in € per sqm for an increase of one standard deviation of the respective characteristic. Accordingly, a one standard-deviation increase in the unemployment rate is associated with a decrease in willingness to pay for one sqm of land of about € 1.72. By combining hedonic prices with the observed variation in amenities, this column gives an insight into

Table 3: Hedonic Prices (in €/sqm)

Variable	Price per unit	Price per 1 Std. Dev.
Unemployment	-.964	-1.72
Share of land: *recreation*	2.45	2.35
Hospitals	2.72	1.28
Physicians	4.94	1.76
Crime	-.105	-.254
Peripherality	-.251	-1.79
Public Transport	1.31	2.08
Precipitation	-.029	-3.26
Commerce	.964	.293
W Share of land *recreation*	2.13	.653
W Physicians	1.26	.186
W Crime	-.964	-.872
W Public Transport	.029	.493
W Commerce	2.75	.271

what is mainly driving the differences in local land prices. Apparently, the share of recreational land and the quality of the public transport system play the biggest role in location choices of people, as they are valued at € 2.35 and € 2.08, respectively. Relatively high valuations are also found for physicians, the unemployment rate and good traffic connections, for which the hedonic prices lie around € 1.75 sqm for a one standard deviation enhancement. The prices for the crime rate and food retailing are of minor magnitude and are based on insignificant coefficients. Surprisingly, the only "true" amenity in the analysis, precipitation, is very highly valued by Saxony's inhabitants and has a price of € 3.26 per sqm for a reduction of one standard deviation. However, this high valuation might be a result of the severe flooding that took place in Saxony in 2002.

A somewhat puzzling finding is that the price of unemployment is not among the highest ones in this list. This is clearly at odds with the prevailing view that labor market conditions are the main determinant of inner German migration flows.[7] However, one possible explanation for this

[7]This view is, among others, confirmed by a similar study for Germany at the county level by Buettner and Ebertz (2008) who find that among a range of local characteristics the willingness to pay is highest for good local labor market conditions. Moreover, the "Perspektive Deutschland" study 2004, a survey among more than 500,000

might be the overall alarming state of the East German labor market. Given the fact that huge numbers of East German workers are commuting to the western part of the land, the local rate of unemployment might not be of major importance, especially not when compared to the east German neighbors. Moreover, the community level is likely to be a too small entity of aggregation to measure the willingness to pay for labor market conditions. Labor markets are usually defined as broader regions, even when ignoring the possibility to find work in West Germany.

Care must be taken when looking at the figures regarding the spatial lags in Table 3. The numbers in column 1 report the implicit prices calculated for the spatially lagged variables as described in equation (5). In other words, each of these valuations refers to the weighted sum of the respective characteristic within the neighborhood. Thus, a reduction of the aggregated and inverse-distance weighted crime rates in the neighboring communities of 1 crime per 1,000 inhabitants is valued at € 0.96 per sqm. On the contrary, the prices reported in column 2 are calculated for a one standard-deviation increase of the respective characteristic in the closest community. The observations of the amenities in the closest neighbor are, however, still weighted with the inverse distance of this community. This representation relates the valuations to amenity levels within only one municipality instead of a sum of community characteristics and should facilitate comparisons. Accordingly, the willingness to pay for a decrease of one standard deviation in the crime rate of the closest neighbor is € 0.87 per sqm. This is the highest valuation among the conditions in neighboring municipalities. High valuations are also associated with the share of land dedicated to recreational purposes (€ 0.65 per sqm) and the public transport system (€ 0.49 per sqm). Note, that all the neighbors' values are lower than their counterparts, which is a natural consequence of the lower influence on the local quality of life, that is reflected in the inverse distance weights.

7 Summary

In order to estimate hedonic prices for a number of public services and amenities, I apply the hedonic approach to land prices in the 505 communities of the Free State of Saxony. Taking into

German households, also finds that, along with personal relationships, the labor market is the main reason for moving in Germany.

account spill-over effects from neighboring municipalities as well as issues of spatial dependence, the capitalization of community attributes into land prices is investigated.

The hedonic regressions of land prices on a set of community characteristics are able to explain up to 70 % of the variation in land prices across the communities of Saxony. Estimation shows that capitalization of most of the investigated amenities and disamenities occurs in the expected way. The results indicate that the valuation of Saxony's citizens is highest for a good public transport system and high percentages of land dedicated to recreational purposes. Furthermore, the local crime rate seems to matter only at sites of higher quality, which are expected to be demanded by high-income households. In addition, a significant influence of attributes of neighboring communities is found. Accordingly, the public transport system, recreational land, and the crime rate in the surrounding communities are found to have the highest hedonic prices among all spatially lagged attributes.

The results confirm the usefulness of the hedonic approach in the German context. As many of East Germany's communities suffer extensively from the loss of young and productive individuals, an evaluation of the strengths and weaknesses of communities with regard to the attraction of households might help to recover some of the lost population. More centrally located, small municipalities could use it to develop strategies to take advantage of the recent rise in attractiveness of the big cities of Dresden and Leipzig.

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