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Capitalization of Local Taxes and Expenditures

The case of Bavarian Municipalities

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Abstract

This paper examines capitalization effects of fiscal variables such as taxes and public expenditure into land prices in Bavaria. Based on a panel data analyses on municipality level we discuss the potential existence of capitalization as well as the changes over time which are possibly related to supply reactions. Especially, we check the persistence of these effects using the approach in [Stadelmann and Billon \(2015\)](#). So far, we conclude that a temporary capitalization of fiscal variables seems to occur in case of property taxes and for some categories of public expenditures. However, persistent capitalization seems to hold for property taxes but not for public expenditures. In addition, the effect of tax capitalization is only robust for less relevant German property tax A on agricultural land with fixed effects. Our results are contradictory to international studies ([Sirmans, Gatzlaff, & Macpherson, 2008](#)) and findings for German wages in case of the local corporate taxes in [Fuest, Peichl, and Siegloch \(2016\)](#). The missing capitalization of the German local corporate tax is surprising and may be explained by the observed tax harmonization. Our further research will focus on either confirming or invalidating these results and address the remaining lack of clarity.

Keywords: Capitalization, Fiscal variables, Tax incidence

JEL classification: R21, R31

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1 Introduction

People are mobile in our world and able to choose where to live. This choice determines the distribution of households in the area. It ranges from densely populated city centres over sprawling urban areas to sparsely populated peripheral regions. In individual households' decisions for a place of residence prices are essential. At the same time prices are fundamentally determined by the locational choice of households. All households would actually prefer to live in the most attractive locations. However, households are willing to live in less attractive areas if house or land prices are lower. House prices rise with a high demand for attractive locations and decrease through the lack of demand in rather unattractive locations. In a competitive market, this process will continue until no household is willing to migrate any longer and the market is in an optimal allocation. The same holds more or less for firms' location choice.

In the German housing market, on average real estate prices have risen significantly in recent years. Nevertheless, the development of prices in some cases differs tremendously among the different regional markets in Germany. In a study, the Deutsche Bundesbank (2013) actually warns about an overvaluation in some densely populated areas. These regional differences in the real estate price trend show that house prices and land values seem to be clearly related to certain locational conditions. Reasons are e.g. regional demographic or economic trends as well as general location-dependent industry structures. In particular for individual households the provision of local amenities, job chances, public goods is of great importance compared to the tax burden. Hence, it can be assumed that individuals will be attracted by regions offering e.g. a good traffic infrastructure and at the same time a relatively low tax burden. This would be mirrored in rising house prices over time. In general, the mobility of households or firms will trigger a capitalization of locational advantages into house or land prices. With respect to the Deutsche Bundesbank (2013) study, this implies that in certain metropolitan areas specific attractiveness prevails that encourages population growth which is reflected in increased demand and captured in rising house and land prices. In this respect, the empirical relationship between the tax burden related to the provision of public goods and property values is of particular relevance and the following questions may arise: To what extent are differences in the tax burden actually mirrored in house prices? Or, economically speaking, how strong does the tax burden capitalize into land values? Is there any evidence for changes over time?

These questions which relate back to a basic model of Tiebout (1956) have already been discussed theoretically

and empirically in the literature but mainly for the United States (U.S.). Since American and German tax system and real estate market differ it is not clear whether the findings obtained for the U.S. are applicable to Germany. Therefore, this paper is intended to contribute to the empirical study of capitalization effects in Germany. Specifically, we analyze the capitalization of fiscal variables for the German state Bavaria. A special focus is placed on the impact of tax variables. In an empirical study based on panel data of the lowest administrative level, the municipality level, we will examine potential capitalization effects and the role of fiscal variables in the Bavarian municipalities using average sale prices. Parts of the analyses are inspired by the work of Stadelmann and Billon (2015) who carried out a similar study for the Zurich Metropolitan Region in Switzerland. Our preliminary results reject the capitalization of local taxes in land values. Public expenditures seem to have a positive effect on land value but future research is necessary.

2 Theoretical Considerations

2.1 Tiebout Hypothesis

The economic foundation for capitalization provides the Tiebout model, named after Charles Tiebout (1956). The following considerations are known as benefit view (Mieszkowski & Zodrow, 1989) in particular for individual households. The government faces difficulties in detecting individuals' preferences for public goods and the free riding problem aligned to it. Opposed to public goods, for private goods usually no free-riding problems evolve since every individual reveals its true preferences and is free to choose its most preferred bundle and quantity in markets. This rarely holds for public goods where free riding often occurs. The basic idea of the Tiebout model is that individuals may reveal their preferences for public goods by moving from one municipality to another. As municipalities offer different sets of public goods, individuals reveal their true preferences for those goods by "voting with their feet". Tiebout (1956) argues that a large number of municipalities offering distinct local public good bundles financed by local taxes, provide individuals with the possibility to move to the municipality offering their preferred tax-financed public goods bundles. Thus, by their migration decisions individuals reveal their preferences for bundles of local public goods and taxes. Consequently, by a decentralized controlled provision of local public goods, individuals are driven to reveal their true preferences. Local governments tax

public goods adequately and solve the free rider problem in turn. An equilibrium situation similar to the private goods market is then possible.

However, Tiebout (1956) formulates seven critical assumptions which must be met to ensure that the “voting by feet” will take place. These are amongst others, the existence of perfect mobility, perfect information about taxes and public spending, a large number of municipalities as well as location-independent employment opportunities. Generally, the greater the number of competing municipalities and the higher the disparities among them, the more likely individuals’ preferences are satisfied. Apart from criticism of Tiebout’s restrictive assumptions, a controversial debate about the model is triggered by the fact that in the original version of the model taxation and house prices are only vaguely considered or not at all. The model unambiguously only states that individuals make decisions that reflect their preferences which may result in a Pareto efficient output similar to a competitive market scenario. Putting it differently, the original version may be regarded as only a simplified version without further details about what types of taxation and expenditure are considered. Consequently, the model leaves room for interpretations, extensions or applications in various ways.

One of the first who directly linked taxation to the Tiebout model was Oates (1969). He assumes a system with varying tax rates and provisions of public goods among localities. A utility maximizing individual then chooses the bundle of tax rates and public goods that provides it with the highest surplus of benefits over costs. Consequently, if the Tiebout hypothesis holds – which based on Oates’ (1969) interpretation means that individuals take into consideration fiscal variables when choosing their place of residence – it is expected that municipalities with higher supply of public goods and lower tax rates should be favored by many individuals. High demand of households for properties in favorable areas would in turn be mirrored by higher property values. Stated differently, the fiscal variables such as taxes and public expenditure related to the provision of the different public good bundles would capitalize into house prices that is called fiscal capitalization.

In contrast, there are also those advocating that a change in prices, a capitalization of fiscal differences into house prices, should not take place, at least not in the long run. Fiscal capitalization will occur if an insufficient amount of land or properties was offered. The example of Oates (1969) simply portrays that no supply response took place. According to the interpretation of e.g. Henderson and Thisse (2001) it can thereby not be considered a Tiebout equilibrium. They argue that capitalization will never take place in a real Tiebout equilibrium because

capitalization is only a demand-side phenomenon. Hence an equilibrium may only occur after a supply response and if the market has cleared. This may take time and e.g. in metropolitan areas with land scarcity and high population density be temporarily the case since migration accelerates more rapidly than the provision of housing.

Summarizing, general consensus prevails only with respect to the mechanism described in Tiebout's model that individuals migrate driven by their preferences of local public goods and taxes. However, what characterizes a Tiebout equilibrium is less clear. Of particular relevance in the entire debate are the elasticity of supply and the temporal dimension. Additionally to a variety of differing interpretations, Tiebout's basic model has also been extended or assumptions have been relaxed. Furthermore, numerous empirical studies on capitalization, potential supply reactions and implicit or explicit applications of the Tiebout model, have been carried out. Note, capitalization of fiscal variables is also predicted by the so-called capital model (Fullerton & Metcalf, 2002), which we do not outline here. Some important of them will be presented in the following section.

3 Literature on Capitalization into House Prices and Land Values

One of the first and most prominent in examining capitalization was Oates (1969) who used cross-sectional data to work out how local property taxes and public expenditure affect house values. He analyzed 53 municipalities in the New York metropolitan area and deduces that about two-thirds of property taxes capitalize into house prices. Oates (1969) concludes that if a stronger tax burden results in increased public spending it may potentially offset the negative effects of a reduction in house prices related to a tax increase.

Besides Oates (1969), Church (1974), Meadows (1976), McDougal (1976), Noto (1976), King (1977), Rosen and Fullerton (1977) and Reinhard (1981) are prominent in dealing with the capitalization of house prices. However, as regards the degree of capitalization their results are quite heterogeneous. While Oates (1969), McDougall (1976) and Reinhard (1981) presume full capitalization, King (1977) assumes capitalization of about two thirds, Rosen and Fullerton (1977) of nearly 90 percent and Church (1974) and Noto (1976) agree on overcapitalization. Yinger et al. (1988) compare and contrast most of the mentioned studies and particularly point out their methodological drawbacks. They criticize e.g. a simultaneity problems caused by the fact that in many studies the tax variable is endogenous. This holds true either when the paid tax is included in the model corresponding

to the value of the property multiplied by the nominal municipal property tax rate or when the tax variable mirrors the effective tax rate which is determined by the house value. Putting it more generally, they point out that there exists a correlation between the public service and the tax rate variables which is difficult to eliminate. In addition, they stress an omitted variable bias problem because no sufficient number of explanatory control variables e.g. regarding neighbourhood characteristics is considered. [Yinger et al. \(1988\)](#) draw the conclusion that in all papers they discuss the data sets and methods used have notable weaknesses. However, in accordance with their own model, they all find evidence of capitalization which consequently suggests that capitalization to some extent exists. This is worth mentioning, especially because starting with Pollakowsky's [\(1973\)](#) critical response to Oates' [\(1969\)](#) empirical methodology, some sort of counter-movement to the idea of the existence of capitalization emerged. Gronberg [\(1979\)](#) for instance did not find indications of capitalization in his empirical study. Similarly, Henderson [\(1985\)](#) and in particular Hamilton [\(1976\)](#) and Edel and Sklar [\(1974\)](#) argue that the Tiebout equilibrium as described by Oates [\(1969\)](#) can at best be a short-term equilibrium which disappears in the long run. A potential reason is the incurred ability to skim off profits through supply responses until the market clears. This line of reasoning mainly depends on implicit or explicit assumptions regarding supply elasticities and is discussed in detail by Stadelmann and Billon [\(2015\)](#). In more recent studies, e.g. Palmon and Smith [\(1998\)](#) aim at eliminating the methodological shortcomings related to the simultaneity problems described by [Yinger et al. \(1988\)](#) through improved methodology and the use of rental data. Their results provide evidence of capitalization by about 60 percent. However, Henderson and Thisse [\(2001\)](#) develop a model, an extension of the Tiebout problem, which indicates that based on housing developers reactions no capitalization is to be expected. Further [Sirmans et al. \(2008\)](#) conclude that the most empirical studies find partial capitalization which depends on the local housing supply. The presented insights portray that in the debate whether fiscal variables such as taxes and public expenditure capitalize into house prices, no clear consensus exists.

When dealing with capitalizing effects on property prices and in the discussion of empirical evidence of capitalization, several questions remain unanswered. Examples are the questions of which control variables are to be considered or what factors apart from fiscal variables could possibly have an impact on potentially different

capitalization rates. Portney (1981) for instance investigated the effect of air pollution on property values in Pennsylvania and concludes that it leads to a reduction in values. Hughes and Sirmans (1992) show that traffic intensity has a significant negative effect on property values in the Louisiana Metropolitan Area. The findings of Jud and Watts' (1981) and Clapp, Nanda and Ross' (2008) analyses are that the quality of schools is an important determinant for house values. More recent studies such as Agostini and Palmucci (2008) elaborate based on a study in Santiago in Chile that capitalization into house prices may also depend on the distance to a Metro station. They highlight that not only the provision of infrastructure but also its accessibility - in the Santiago example the distance to the closest metro station - may be of importance for capitalization into house prices. In an even more spatial-economic approach De Bruyne and Van Hoe (2013) show that for Belgian municipalities geographical barriers have a substantially negative effect on house prices.

To address the challenge of selecting appropriate control variables in an empirical analysis of capitalization into house prices, Stadelmann (2010) presents a possible solution making use of the systematic approach of Bayesian Model Averaging. He uses a panel dataset of 169 Swiss community units in the canton of Zurich over the period 1998 to 2004 to test the robustness of 33 community specific control variables. Then, based on the same dataset with only the variables remaining after performing the Bayesian Model Averaging algorithm, Stadelmann and Billon (2015) examine the persistence of fiscal capitalization effects over time. They derive that capitalization persists over time potentially due to the lack of supply reactions by housing developers. Our selection of empirical variables follows Stadelmann and Billon (2015) and Ebertz (2013) who studies the capitalization of local amenities and public goods for Saxony municipalities.

4 Data and Local German Taxes

The data set used in the analyses of this paper contains observations for the 1277 municipalities from a total 2056 Bavarian municipalities and cities of unitary authority over the period from 2000 to 2013.¹ In exceptional cases data for control variable are not available for individual years and have been interpolated. Further details are discussed below or described in the summary statistics, see table 4 in the appendix. Moreover, some data is

¹We excluded municipalities if we do not observe land prices in at least 7 years. Missing data is explained due to lack of land sales in the respective year or privacy reason. We impute missing data in the remaining sample using the last observed value. Results are comparable for non balanced and balanced panels using imputed values.

generally not available for municipalities but only for counties which represent the next higher administrative level.

The dataset contains variables similar to those used by Stadelmann and Billon (2015). In their study they use the property prices of a standardized house as dependent variable. Inspired by Ebertz (2013) in this paper we use average land prices (*LandPrice*) per square meter in euros as dependent variable. This data is available at the municipality level at the Bavarian statistical offices and is based on transaction data. We consider these data as a suitable proxy of local land values. Compared to studies analysing housing prices we do not need to decompose structure and land value here.

Probably one of the most important variables when dealing with capitalization effects of fiscal variables are taxes. With regard to the tax revenues of municipalities in most American studies as well as in Oates (1969) or Chay and Greenstone (2005), the property tax is used as it represents the main source of tax revenues of American municipalities. However, Stadelmann and Billon's (2015) tax variable adapted to the Swiss tax system represents the mean income tax rate multiplier of municipalities. Based on the German system of municipality financing, we use the collection rates of the three most relevant income taxes of German municipalities. These are property tax A, property tax B and the local corporate taxes. Note, the German property tax cannot be compared to property taxes in the US which are considered to be tax on immobile capital (land and structures). Historically, the German property tax is a tax on potential earnings of land and its structure but its tax base does not mirror today's property values due to missing revaluations of existing properties and if applicable structures (residential or commercial buildings) since 1964. For this reason, there is ongoing debate on the reform of the German property tax. Given this German peculiarity, the classification of German property taxes is not straight forward because it is also no land value tax.² Nevertheless, an increase of the collection rate increases the tax burden of land owners. The collection rates are an instrument for the municipalities in Germany to influence the amount of municipal taxes they receive. The municipalities independently decide on the assessment rate in the respective municipality. By setting a high assessment rate a municipality will receive more tax revenue given an unchanged tax base. However, at the same time it risks making its municipality less attractive in comparison to other municipalities.³ Obviously, the created variable are not perfectly mirroring the municipalities' tax burden

²We will discuss the classification and theoretical consequences in a future version of this paper. Property and land value taxes are assumed to (partially) capitalize.

³ Consequently, local property and corporate taxes are discussed in the context of tax competition and harmonization, the effects

but it is an attempt to both create variables considering all the particularities for the German case and to make comparisons to common measures used in the literature. Besides, our identification approach using multipliers reduces endogeneity issues. We also exclude some excise taxes that generate negligible revenues. In conformity with Oates (1969), Fullerton and Metcalf (2002) and Sirmans et al. (2008) we expect a negative impact on land prices by an increase in the tax rates.

Additional fiscal variables that potentially capitalize into house prices, are public expenditure. Thus, we include public expenditure variables that appear to be of explanatory power in Stadelmann and Billon (2015), but systematized in other (sufficient close) categories as German annual financial statistics differ in categories. We included all ten sections of the German annual financial statistics: Which regards expenditure on culture as well as science and research, social assistance, schools, law and public security, and others. In addition, we created the variable total expenditures representing the the sum of all single expenditure categories. All expenditure variables are per capita quantities in euros. In line with Stadelmann and Billon (2015) and Ebertz (2013) we expect them to positively capitalize into land prices which is a general assumption in the literature and already obtained by Oates (1969) for aggregated expenditure.

Furthermore, we add three school characteristics inspired by Stadelmann and Billon (2015). These are the calculated average distance to the nearest school (*DistSchool*) and the number of grammar schools per municipality (*GrammarSchool*) as well as the percentage of foreign pupils in the grammar schools (*SchoolForeigner*). In addition to the variables used by Stadelmann and Billon (2015), in numerous capitalization studies there are further variables that turned out to have a significant impact on land prices. Beyond that, the Bavarian municipalities might as well differ from the Metropolitan Region of Zurich in some general characteristics. Consequently, we examine the explanatory power of some additional variables. Concerning the distance variable, we consider the geographical positions of the schools in 2015 to calculate the average distance per municipality assuming that the distance over the years has remained constant. Given that geographical proximity is related to less travel time and costs, we forecast a positive sign of the coefficient for the existence of a grammar school in a municipality, a negative sign for the distances' coefficients as well as for the percentage of foreign pupils. The latter, we assume to negatively capitalize into land prices based on Stadelmann and Billon's (2015) hypothesis that

of fiscal equalization schemes at the state level. For further discussion see e.g. Buettner and von Schwerin (2015) or Wrede (2014). Our future analyses will be more sensible here.

it might function as quality indicator for the schools. Nonetheless, whether this variable really is an adequate proxy for school quality and should have a negative impact on land prices is questionable. Next, we subdivide the distance variables into different school types. Whereas Stadelmann and Billon (2015) do not differentiate the average distance between different types of schools, we divide it into *DistGramSchool*, the average distance to the nearest grammar school, *DistReal*, the average distance to the nearest secondary school and *DistElemSchool*, the distance to the nearest elementary school. In Germany, particularly in the countryside, certain school types might be more important than others. An elementary school, e.g. for parents with young children, might in certain municipalities be valued differently than a grammar school. This may potentially have a statistically significant impact on land prices. The data are again based on 2015 values assuming that the distances have not changed over the previous years and we continue to assume a negative effect on land prices related to an increase in distances. Furthermore, we calculated the median income (*MedianIncome*) for each municipality and inserted it into the data set. Due to lack of reliable data for some years, we assume the median income to be constant between 2001 and 2003, from 2004 to 2006 and from 2007 to 2009. Consequently, conclusions derived from the variable have to be interpreted cautiously. Considering the median income, a positive effect visible in almost all empirical studies beginning with Oates (1969) is to be expected. Subsequently, we added the municipalities' debt to the model. Stadelmann and Billon (2015) include the real net debt which we unfortunately do not include because we cannot correct the gross debts for assets due to a lack of adequate data. Therefore, we use the gross debt (*BrutDebts*) although this in principle is contestable and not directly comparable to the net debt. We expect the coefficient's sign to be negative. According to Banzhaf and Oates (2008), individuals in their utility maximization efforts will anticipate a higher debt to be repaid in the future. Next, in accordance with Stadelmann and Billon (2015) we insert three population variables: *Elderly*, *Foreigners* and *Commuters*. *Elderly* includes the number of residents being 65 or older and is used as a typical neighborhood indicator which is regularly used in capitalization studies e.g. by Rohe and Stewart (2010) or Brasington and Haurin (2006). The commuter flows are in line with Stadelmann and Billon (2015) as the share of commuters outgoing relative to the municipalities' labor force which may control for job opportunities in the municipality. The effect should be negative according to Stadelmann and Billon (2015) as commuting is costly. For *Elderly* the effect is in principle not clear but should be rather positive (Stadelmann & Billon, 2015). The number of

foreigners may serve as a proxy for the ethnic and cultural composition of the population in the municipalities. However, as for this variable data was only available on county level, results have to be interpreted with caution. Another indicator for the attractiveness of a municipality might be its meteorological conditions (Ebertz, 2013). Therefore, we include the annual number of hours of sunshine (*WeatherSun*), the average annual temperature in Celsius degree (*WeatherTemp*) and the annual amount of precipitation in mm (*WeatherRain*). All values are based on one kilometre grid data sets and calculated as average of the single grid fields within a municipality. For Bavaria we expect a positive effect on land prices by an increase in *WeatherTemp* and *WeatherSun* and a negative impact of *WeatherRain* in line with Ebertz (2013). Since it can be assumed that based on Portney (1981), Ketkar (1992) or Chay and Greenstone (2005) environmental pollution has a negative impact on housing prices, we add a *NO2 Pollution* variable. It indicates the annual average NO2 in microgram per cubic meter of the nearest survey station. Unfortunately, in the Free State of Bavaria, reliable data could only be obtained from seven survey stations. Consequently, this variable for some municipalities might not indicate the true NO2 pollution and the results have to be interpreted cautiously. Next, we insert an additional infrastructure variable: the number of physicians per capita in 2015, subdivided into specialists (*MedSpecialist*) and general practitioners (*MedGeneral*). Especially in rural areas in Germany, the provision of medical infrastructure is of particular significance and may be an import locational advantage when directly competing among municipalities. We assume the number of physicians be constant over the entire observation period. Moreover, three further distance variables are included. These are *DistCentre*, indicating the average distance to the next agglomeration centre in 2012, *DistShop*, representing the average distance to the closest supermarket or discount store in 2015 and *AccessFastTrain* which describes the distance to the next long-distance train station.⁴ All three variables are commonly used as infrastructure variables and as in the work of Ketkar (1992) or Lafferty and Frech (1978) should have negative effects on land prices with increase in distance. The *DistShop* variable we created by calculating the average distance to the nearest supermarket or discounter based on their geographical coordinates. We considered the largest and most influential supermarkets and discounters in Bavaria (Lebensmittelzeitung.net, 2015). Again, we assume that the distances did not change in previous years, even if this assumption with respect to store locations compared to school locations might be reviewed rather critically.

⁴ Stadelmann and Billon (2015) calculate the average travel time to the Zurich main station as proxy for *AccessFastTrain*. However, the difference in coding should not significantly change the results and interpretations.

Based on the insights obtained by Rohe and Stewart (2010) or Chay and Greenstone (2005), with *Density* we add a further neighborhood variable. It represents the number of inhabitants per square kilometer and should positively capitalize into land prices. The summary statistics of all the variables mentioned can be found in the appendix in table 4.

5 Results and Interpretation

5.1 Existence of Capitalization - Pooled OLS and Fixed Effects

At first we perform a pooled Ordinary Least Squares (OLS) estimation to detect evidence of capitalization into land prices. Although, these results do not allow to discuss any causality, we expect at least to find significant correlations as prerequisite for some capitalization effects. There might be municipality-specific factors that cannot be measured and included into the model but have an impact on land values. An example could be the educational levels in the respective municipalities. Such factors are considered as unobserved heterogeneity. We account for both these aspects when including county dummies for the 33 counties of Bavaria and year dummies for the 14 years of the observation period. This to some extent prevents from over- or underestimating the coefficients of the explanatory variables of interest.⁵ Later we apply municipality fixed effects and restrict the identification to within variation to reduce the omitted variable bias. However, the number of multiplier adjustments in the considered period is limited and identification is more difficult. There are about 1000 changes of tax multipliers per tax type but 17863 observations at all.

As we are predominantly interested in how fiscal variables capitalize into land value we regress the natural log of land prices as dependent variable on fiscal and control variables. The model is of the following form:

$$\log(y_{it}) = \alpha_1 + \alpha_2 Tax_{it} + \alpha_3 ExpAgg_{it} + \dots + \alpha_{14} AccessFasttrain_{it} + \beta \mathbf{X} + \varepsilon$$

The dependent variable y_{it} represents land prices in municipality i at year t , the matrix \mathbf{X} is a matrix of covariates containing the year dummies and the county dummies and ε is the error term. We thereby estimate

⁵Stadelmann and Billon (2015) include the interaction term of the two variables which from a methodological point of view might be a more precise approach as it captures additional potentially unobserved heterogeneity. Without interacting the variables we do not capture unobserved heterogeneity of the variables that change on county level over time but we eliminate separately unobserved heterogeneity over time and unobserved heterogeneity between counties but not municipalities. When contrasting the results of the interacted model according to the approach of Stadelmann and Billon (2015) with the results of a model with separated dummies, no significant differences are visible.

eight different models, one for each of the three different tax variables (two property taxes, the corporate tax) with aggregated expenditure and then the same three tax variables using a more detailed expenditure structure (i.e. expenditure on culture, social, health and six others).⁶ In addition, we use clustered heteroscedasticity adjusted robust standard errors.

<insert table 1 here>

The results of the estimations which are presented in table 1 suggest that some of the fiscal variables as well as of the control variables capitalize into land prices. First of all, in this setup the property tax rates have a highly significant explanatory power regarding land values and show the expected signs in all the different model specifications. The local corporate tax rate is not significant. Although, the corporate tax concerns business earnings, we would expect capitalization since [Fuest et al. \(2016\)](#) provide evidence for negative effect on wages. In addition, rents and leases are partially added to its tax base. Considering single expenditure instead of aggregated expenditures in column 4-6 does not change our results. However, we find significant positive effects for health and venture&assets, but significant negative effects for expenditures on institutions and subsidies. The latter effect may reflect a correlation the level of subsidies and weak local economy. At the first stance, it is surprising that infrastructure, social and school expenditure are insignificant. One explanation may be that level of public services of this sectors is determined by state and federal law. The economic significance are not negligible, e.g. a increase in property tax B multiplier by one standard deviation (46 points) will decrease land prices by 3.6%.

With respect to the significance levels of the control variables, no clear difference among the models is visible. In most of the models the control variables are statistically significant with the expected signs. The average distance to the next school (in general and for different types presented in table 1) has a negative impact on land prices and the existence of a grammar school in a municipality positively affects land values. The coefficients of both variables are significantly different from zero at the one percent level. It underlines the importance that not only the existence of a school but also the locational disadvantages related to a distant school matter with respect to land values. The share of foreign pupils at school is statistically insignificant as the chair of foreigners. Population density, the median income and the share of people over 65 living in the municipalities positively

⁶The regression equation only shows the model specification for one single tax rate and the aggregated expenditure. In table 1 this would be column 1-3.

affect land values and are significant at the one percent level. This is consistent with general findings in the literature (see [Rohe and Stewart \(2010\)](#), [Brasington and Haurin \(2006\)](#) or [Oates \(1969\)](#)). It is no surprise that the higher the median income the greater the land prices. With respect to the elderly, the positive sign is in line with Stadelmann and Billon’s (2015) findings. Regarding the commuters the results of our estimations suggest the opposite effect to what Stadelmann and Billon (2015) obtain. Whereas Stadelmann and Billon (2015) argue the sign must be clearly negative due to the fact that “commuting imposes costs on individuals” ([Stadelmann & Billon, 2015](#), p. 345), we may rather interpret the variable as a an indicator of how good the infrastructure, the mobility and the working opportunities are in the respective municipality. Interpreting it in the sense of Stadelmann and Billon (2015) it indicates that there are less working opportunities in the municipality which should have a negative impact on land prices. With respect to the three additional infrastructure control variables (*DistCentre*, *DistShop*, *AccessFasttrain*) results are in line with Ketkar (1992) or Lafferty and Frech (1978) and increasing distances have the expected negative effects on land prices. This means, a lower distance to the next supermarket, agglomerated center and discounter as well as the access to the closest fast train station ceteris paribus increase prices of land. Concerning the NO2 pollution, the estimation results contradict general findings in the literature such as Portney (1981), Ketkar (1992) or Chay and Greenstone (2005). The same holds for unemployment rate and bad weather (rain). Possibly, those variables correlate with some omitted variables whose effect on land rents is positive. If we restrict the model for significant variables the results do not change.

All previous estimations are based on pooled OLS estimations with county and year dummies controlling for potential heterogeneity on the county level and time trends. However, this setup is based on the assumption that the unobserved heterogeneity captured by the included county and time fixed effect is uncorrelated with the independent variables in the model. This assumption is rather questionable. Consider again the following example: It is generally plausible that the educational level in some counties is strictly greater than in others. If for instance in the case of model 1 the educational level in a county had a positive impact on the municipalities’ median income, the influence of the median income on land prices would be overestimated, i.e. biased. This would be the case because the county-specific education level is included in the county fixed effect which is consequently correlated with one of the explanatory variables. Thus, the assumption that the fixed effect is

uncorrelated with all the explanatory variables is violated and this leads to the fact that all estimated coefficients in the regression are biased and inconsistent. This is the reason why we perform a within estimation. By the use of a fixed effect (within estimator) all potentially unobserved heterogeneity between chosen entities is eliminated. The within estimator subtracts for every observation the cross section specific mean over all periods. By the use of a fixed effect or within estimation, we can still run a regression of the model but the potential bias is eliminated. A great advantage is that we do not have to control for the impact of further unobservable control variables. However, a potential drawback of performing a within fixed effects regression is that only the within-variance of the fixed effects is considered and not the between-variance e.g. among entities. Consequently, if the variance of variables over time and entities is much smaller than the variance between different entities then a fixed effects model can be disadvantageous in the sense that the variables will have no explanatory power in a fixed effects model. A key characteristic of a fixed effects model is that time-invariant variables cannot be estimated as they cancel out. The non-significance of the values may then be related to the fact that with a fixed effects model time-invariant characteristics of the dependent variable cannot be examined because the time-invariant characteristics technically are collinear with the fixed effects. As our data set is of a panel structure it is automatically controlled for specific characteristics by performing a fixed effects estimation. In addition, we want to control for changes in capitalization over time while taking care of unobserved heterogeneity in an even more precise way we thereby move from a county fixed effect to a fixed effect on municipality level. This allows additional tests on the robustness of the results.

<insert table 2 here>

The results in table 2 show that property tax A but not B have a marginal significant impact on land prices level. None of aggregated or disaggregated expenditure variables is statistically significant. Besides dropped control values, only median income, population density and sunshine are significant. Other control variables are now insignificant or only marginal significant. Note, the coefficients of NO2 pollution, commuters and foreign pupils show now the expected sign but they are not significant. The insignificance of the values may be related to the fact that time-invariant characteristics of the dependent variable cannot be examined. It might be the case that the municipalities' median income is relatively stable over time which is reasonable due to our above mentioned assumption of values being constant over some the years related to lacking observations in the data.

Summarizing, the former results provide only limited evidence for capitalization. The robust effect for property tax A is not meaningful since this tax generates only small revenues compared to property tax B.

5.2 Persistence of Capitalization - Interaction Model

It leads to the model that Stadelmann and Billon (2015) use, namely a pooled OLS estimation in which the fiscal explanatory variables are interacted with year dummies. Finally, the question of supply reactions can be addressed. The base year is 2000. Hence, the model is of the following form:

$$y_{it} = \alpha_1 + \alpha_2 AggTax_{it} + \alpha_3 AggTax_{i,2001}d_{2001} + \dots + \alpha_{15} AggTax_{i,2013}d_{2013} + \alpha_{16} ExpAgg_{it} + \alpha_{17} ExpAgg_{i,2001}d_{2001} + \dots + \alpha_{29} ExpAgg_{i,2013}d_{2013} + \dots + \alpha_{41} AccessFasttrain_{it} + \beta X + \varepsilon$$

The dependent variable y_{it} represents land prices in municipality i at year t , the variable d reflects a dummy for the respective year t . As before, the matrix X is a matrix of covariates containing the year dummies and the county dummies and ε is the error term.⁷ The intuition of the results are mainly the same.

According to Stadelmann and Billon (2015), setting the first year as base year every subsequent year has to be interpreted relative to the base year, i.e. as a change over time. The coefficient for the base year is then the respective fiscal variable without interaction term and the capitalization over time for a chosen year can be determined by the sum of the respective interaction term and the non-interacted base year's coefficient. Consequently, if the coefficient of the base year is statistically significant, then independently of its sign a statistically significant coefficient of an interaction term with the opposite sign provides evidence for a decrease in capitalization. This should exactly be the case if supply reactions take place. The underlying intuition is that due to higher land prices house suppliers should react with building more houses in the respective municipalities. So, in the long run capitalization should disappear.

< insert table 3 here >

Table 3 presents the results of the linear interaction model inspired by Stadelmann and Billon (2015) for local taxes and aggregated expenditures. The results indicate persistent negative capitalization of property taxes due

⁷The regression equation only shows the model specification for aggregated tax rate and the aggregated expenditure. In table 3 this would be column 4.

the highly significant base year effect and only one-time marginal significant effects in the interaction term of 2007. With respect to the aggregated expenditure the results are not conclusive because base year and some interaction terms are significant. Following the interpretation of [Stadelmann and Billon \(2015\)](#), we have a positive capitalization in the long run. The effect for aggregated expenditure holds independent of the included tax type. Overall, the results replicate the findings in the former analysis. We cannot reject persistent capitalization for taxes with the exemption of the corporate tax. The fact that the interaction terms of fiscal variables with the year dummies are (with one exception) insignificant, points into the direction of no supply reaction taking place. This would be in line with the findings of [Stadelmann and Billon \(2015\)](#). The results for control variables are not changed in qualitative way.

We extend the analysis for single expenditure sections. The results for local taxes are unchanged. The reported negative effect of expenditures on institutions and subsidizes is non persistent because the negative base year coefficient is outweighed by positive significant interaction terms. The same holds for health expenditure in the opposite way. Interesting are the results for social expenditure. We find evidence for a positive capitalization effect in the long run. Our former results rejected any capitalization for this public services. For other expenditures there are no robust results. Consequently, these finding does not support an consistent capitalization of public service in land values.⁸ Apart from social expenditure, in [Stadelmann and Billon \(2015\)](#) all disaggregated expenditure as well as their aggregate and the tax rate, are statistically significant for the base year and capitalize into house prices. Based on the results for fiscal variables in table 3, for Bavaria we derive evidence for capitalization of property tax rate into land prices but not corporate taxes or expenditures with exemption of social expenditure. However, the latter result is not supported in the former analysis. Only the aggregated expenditure variables seem to positively capitalize into land values. Consequently, with respect to potential supply reactions no clear statement can be made given different findings for taxes and expenditures.

6 Preliminary Conclusion

Tax competition, mobility of individuals and land or house prices are closely interdependent. The economic foundation to which all capitalization studies implicitly or explicitly refer, is a model by Charles Tiebout ([1956](#)).

⁸Detailed results are available on request.

In his hypothesis he claims that if individuals move to their most preferred local community when maximizing their utility they reveal their true preferences for public goods. According to this “voting by feet” – approach, individuals are perfectly mobile and well informed when deciding on their municipality of residence. This enables the local governments to tax public goods adequately which solves the free rider problem. Different models on local taxation provide a theoretical foundation of capitalization on of fiscal variables into land and property values. However, other theoretical contributions contents this hypothesis.

In an empirical approach inspired by Stadelmann and Billon (2015) we examined potential capitalization effects and the role of fiscal variables based on a panel data set of Bavarian municipalities, which have some tax autonomy on property an corporate taxation. Based on the data analyses for the years from 2000 to 2013 and with respect to all 1278 municipalities, we find mixed evidence for capitalization. There is evidence that some taxes significantly affect land prices which indicates that individuals favor municipalities offering higher valued public goods relative to the related tax burden. Putting it differently, the households’ mobility seems to trigger a capitalization of locational advantages into land prices. This is supported by the results of a pooled OLS estimation with a time and county fixed effect as well as by a within estimation with time and municipality fixed effects for property tax A. But this finding is only robust for a tax generating negligible earnings. When studying in detail the changes of capitalization effects over time and with respect to potentially occurring supply reactions, no clear statement can be made because different results for taxes and expenditures.

This work aims at contributing to a general explanatory approach of variations in house or land prices related to capitalization of fiscal variables in Germany. Hence, further research should engage in applying a similar approach to different or extended geographic areas in Germany or taking longer time series into consideration. We will extend this paper for more detailed discussion of the particularities of the German Tax system and formulation of a sound theoretical foundation to reconsider our mixed findings. Furthermore, we may conduct an event study and a synthetic control approach to improve our identification strategy.

7 Tables

Table 1: Pooled OLS for Local Taxes and Expenditures

	Aggregated Expenditures			Single Expenditures		
	1 coef/se	2 coef/se	3 coef/se	4 coef/se	5 coef/se	6 coef/se
Property Tax A	-0.00072*** (0.00020)			-0.00069*** (0.00020)		
Property Tax B		-0.00077*** (0.00022)			-0.00074*** (0.00021)	
Corporate Tax			0.00016 (0.00035)			0.00024 (0.00034)
Total Expenditures	-0.00000 (0.00001)	-0.00000 (0.00001)	0.00000 (0.00001)			
Administration Exp.				0.00011 (0.00010)	0.00011 (0.00010)	0.00012 (0.00010)
Law&Order Exp.				-0.00006 (0.00011)	-0.00004 (0.00011)	-0.00006 (0.00011)
Settlement&Streets Exp.				-0.00003 (0.00003)	-0.00003 (0.00004)	-0.00003 (0.00003)
School Exp.				-0.00002 (0.00006)	-0.00002 (0.00006)	-0.00001 (0.00006)
Culture Exp.				-0.00015 (0.00019)	-0.00014 (0.00019)	-0.00017 (0.00019)
Social Exp. p				0.00007 (0.00007)	0.00008 (0.00007)	0.00008 (0.00007)
Health Exp.				0.00014** (0.00005)	0.00014*** (0.00005)	0.00015*** (0.00005)
Institutions&Subsidy Exp.				-0.00008** (0.00004)	-0.00008** (0.00004)	-0.00007* (0.00004)
Ventures&Assets Exp.				0.00007** (0.00003)	0.00007** (0.00003)	0.00008** (0.00003)
Finance Exp.				-0.00001 (0.00001)	-0.00001 (0.00001)	-0.00001 (0.00001)
Public Debt	0.00001 (0.00002)	0.00002 (0.00002)	-0.00000 (0.00002)	0.00001 (0.00002)	0.00002 (0.00002)	-0.00000 (0.00002)
Median Income	0.00003*** (0.00000)	0.00003*** (0.00000)	0.00003*** (0.00000)	0.00003*** (0.00000)	0.00003*** (0.00000)	0.00003*** (0.00000)
Grammar School	-0.00597 (0.00531)	-0.00713 (0.00527)	-0.01029* (0.00537)	-0.00665 (0.00521)	-0.00775 (0.00521)	-0.01105** (0.00526)
DistanceElemSchool	-0.00001** (0.00000)	-0.00001** (0.00000)	-0.00001** (0.00000)	-0.00001** (0.00000)	-0.00001** (0.00000)	-0.00001** (0.00000)
DistanceRealSchool	-0.00000 (0.00000)	-0.00000 (0.00000)	-0.00000 (0.00000)	-0.00000 (0.00000)	-0.00000 (0.00000)	-0.00000 (0.00000)
DistanceGramSchool	-0.00003*** (0.00000)	-0.00003*** (0.00000)	-0.00003*** (0.00000)	-0.00003*** (0.00000)	-0.00003*** (0.00000)	-0.00003*** (0.00000)
Foreign Pupils	0.00269 (0.00219)	0.00263 (0.00217)	0.00280 (0.00220)	0.00247 (0.00218)	0.00240 (0.00217)	0.00256 (0.00219)
Foreigners	0.00991 (0.00885)	0.01484* (0.00901)	0.01098 (0.00920)	0.00938 (0.00918)	0.01380 (0.00929)	0.01006 (0.00954)
Elderly	1.40981*** (0.39042)	1.39408*** (0.39076)	1.31567*** (0.39330)	1.28282*** (0.39035)	1.26617*** (0.39037)	1.17910*** (0.39237)
Commuters	0.22635** (0.10067)	0.20031** (0.10042)	0.18381* (0.09980)	0.21715** (0.10257)	0.19512* (0.10235)	0.17535* (0.10213)
Unemployment rate	0.02678*** (0.00883)	0.02806*** (0.00881)	0.02712*** (0.00886)	0.02395*** (0.00880)	0.02513*** (0.00879)	0.02417*** (0.00883)
PopDensity	0.00027*** (0.00006)	0.00028*** (0.00006)	0.00028*** (0.00006)	0.00027*** (0.00006)	0.00027*** (0.00006)	0.00027*** (0.00006)
DistCentre	-0.00201 (0.00164)	-0.00204 (0.00165)	-0.00228 (0.00165)	-0.00221 (0.00165)	-0.00222 (0.00165)	-0.00245 (0.00165)
AccessFastTrain	-0.00844*** (0.00112)	-0.00857*** (0.00112)	-0.00869*** (0.00112)	-0.00819*** (0.00112)	-0.00830*** (0.00112)	-0.00840*** (0.00112)
Shopdist	-0.00003*** (0.00000)	-0.00003*** (0.00000)	-0.00003*** (0.00000)	-0.00003*** (0.00000)	-0.00003*** (0.00000)	-0.00003*** (0.00000)
MedGeneral	97.09544*** (24.63464)	96.83531*** (24.64970)	96.55237*** (24.64192)	88.74904*** (25.20858)	88.40167*** (25.19830)	87.64423*** (25.16134)
MedSpecialist	54.46611*** (17.04569)	56.88425*** (17.34197)	52.10273*** (17.40197)	58.61708*** (17.26093)	60.93133*** (17.54202)	56.35156*** (17.58463)
NO2Pollution	0.00150** (0.00074)	0.00151** (0.00074)	0.00143* (0.00074)	0.00151** (0.00074)	0.00152** (0.00073)	0.00144** (0.00074)
WeatherSun	0.00001 (0.00010)	0.00002 (0.00010)	0.00001 (0.00010)	0.00002 (0.00010)	0.00003 (0.00010)	0.00001 (0.00010)
WeatherTemp	0.01743 (0.02635)	0.01619 (0.02665)	0.01863 (0.02681)	0.01652 (0.02649)	0.01525 (0.02677)	0.01798 (0.02689)
WeatherRain	0.00028*** (0.00007)	0.00028*** (0.00007)	0.00027*** (0.00007)	0.00027*** (0.00007)	0.00027*** (0.00007)	0.00026*** (0.00007)
Obs.	17828	17828	17828	17878	17878	17878
Rank	108	108	108	117	117	117
adj. R2	0.704	0.704	0.703	0.705	0.705	0.705
F	149.554	154.980	149.636	148.725	146.908	149.496
AIC	23141.235	23146.198	23194.628	23167.778	23171.098	23215.255
BIC	23982.396	23987.359	24035.789	24079.363	24082.683	24126.840

Standard errors are clustered at the municipality level. All Models include year and county dummies. Signif. codes:
*** 0.01 **0.05 * 0.1

Table 2: Fixed Effects Estimates for Local Taxes and Expenditures

	Aggregated Expenditures			Single Expenditures		
	1 coef/se	2 coef/se	3 coef/se	4 coef/se	5 coef/se	6 coef/se
Property Tax A	-0.00060** (0.00027)			-0.00063** (0.00026)		
Property Tax B		-0.00040 (0.00028)			-0.00044 (0.00028)	
Corporate Tax			-0.00063* (0.00036)			-0.00064* (0.00036)
Total Expenditures	-0.00000 (0.00001)	-0.00000 (0.00001)	-0.00000 (0.00001)			
Administration Exp.				0.00005 (0.00007)	0.00005 (0.00007)	0.00005 (0.00007)
Law&Order Exp.				-0.00005 (0.00009)	-0.00005 (0.00009)	-0.00005 (0.00009)
Settlement&Streets Exp.				-0.00003 (0.00003)	-0.00003 (0.00003)	-0.00003 (0.00003)
School Exp.				-0.00005 (0.00005)	-0.00005 (0.00005)	-0.00005 (0.00005)
Cluture Exp.				-0.00015 (0.00015)	-0.00015 (0.00015)	-0.00014 (0.00015)
Social Exp.				-0.00005 (0.00006)	-0.00005 (0.00006)	-0.00005 (0.00006)
Health Exp.				0.00002 (0.00004)	0.00002 (0.00004)	0.00003 (0.00004)
Institutions&Subsidy Exp.				-0.00005 (0.00003)	-0.00005 (0.00003)	-0.00005 (0.00003)
Ventures&Assets Exp.				-0.00000 (0.00003)	-0.00000 (0.00003)	-0.00000 (0.00003)
Finance Exp.				0.00001 (0.00001)	0.00001 (0.00001)	0.00001 (0.00001)
Public debt	0.00000 (0.00002)	0.00000 (0.00002)	0.00000 (0.00002)	0.00001 (0.00002)	0.00001 (0.00002)	0.00001 (0.00002)
Median Income	0.00001*** (0.00000)	0.00001*** (0.00000)	0.00001*** (0.00000)	0.00001*** (0.00000)	0.00001*** (0.00000)	0.00001*** (0.00000)
Grammar School	0.08286* (0.04740)	0.08442* (0.04762)	0.07878* (0.04706)	0.08174* (0.04782)	0.08349* (0.04806)	0.07763 (0.04747)
Foreign Pupils	-0.00205 (0.00323)	-0.00208 (0.00323)	-0.00193 (0.00324)	-0.00219 (0.00320)	-0.00222 (0.00319)	-0.00206 (0.00321)
Foreigners	0.02357* (0.01364)	0.02485* (0.01363)	0.02513* (0.01356)	0.02385* (0.01365)	0.02513* (0.01364)	0.02550* (0.01357)
Elderly	0.55343 (0.63174)	0.52945 (0.63276)	0.57527 (0.62992)	0.57361 (0.63046)	0.54992 (0.63145)	0.59064 (0.62850)
Commuters	-0.16702 (0.29836)	-0.17619 (0.29883)	-0.18516 (0.29731)	-0.18789 (0.29922)	-0.19664 (0.29966)	-0.20882 (0.29825)
Unemployment rate	0.01601* (0.00878)	0.01623* (0.00879)	0.01559* (0.00879)	0.01529* (0.00882)	0.01552* (0.00882)	0.01487* (0.00883)
PopDensity	0.00043** (0.00020)	0.00042** (0.00020)	0.00040** (0.00019)	0.00044** (0.00020)	0.00044** (0.00020)	0.00041** (0.00019)
NO2Pollution	-0.00096* (0.00058)	-0.00094 (0.00058)	-0.00095 (0.00058)	-0.00094 (0.00058)	-0.00091 (0.00058)	-0.00093 (0.00058)
WeatherSun	0.00022** (0.00009)	0.00022** (0.00009)	0.00022** (0.00009)	0.00022** (0.00009)	0.00022** (0.00009)	0.00022** (0.00009)
WeatherTemp	0.03607 (0.03157)	0.03580 (0.03158)	0.03440 (0.03155)	0.03474 (0.03163)	0.03447 (0.03165)	0.03305 (0.03163)
WeatherRain	0.00002 (0.00005)	0.00002 (0.00005)	0.00002 (0.00005)	0.00002 (0.00005)	0.00002 (0.00005)	0.00002 (0.00005)
Obs.	17828	17828	17828	17878	17878	17878
Rank	30	30	30	39	39	39
adj. R2	0.042	0.042	0.042	0.042	0.042	0.042
F	15.102	14.926	14.836	11.867	11.710	11.627
AIC	15279.619	15284.429	15282.618	15307.893	15312.790	15311.498
BIC	15513.275	15518.085	15516.273	15611.755	15616.651	15615.360

Standard errors are clustered at the municipality level. All Models include year dummies and municipality fixed effects. Signif. codes: *** 0.01 **0.05 * 0.1

Table 3: Persistence Capitalization of Tax - Interaction Approach

	Property Tax A coef/se	Property Tax B coef/se	Corporate Tax coef/se
Tax	-0.00087*** (0.00028)	-0.00108*** (0.00031)	0.00021 (0.00056)
Tax x Y2001	-0.00010 (0.00020)	0.00001 (0.00023)	0.00019 (0.00040)
Tax x Y2002	-0.00007 (0.00024)	0.00002 (0.00028)	0.00011 (0.00045)
Tax x Y2003	0.00002 (0.00030)	0.00023 (0.00034)	-0.00043 (0.00053)
Tax x Y2004	0.00028 (0.00030)	0.00055 (0.00035)	-0.00053 (0.00062)
Tax x Y2005	0.00017 (0.00028)	0.00015 (0.00033)	-0.00095 (0.00059)
Tax x Y2006	0.00034 (0.00030)	0.00052 (0.00034)	-0.00045 (0.00062)
Tax x Y2007	0.00055* (0.00031)	0.00069* (0.00036)	0.00026 (0.00062)
Tax x Y2008	0.00048 (0.00033)	0.00058 (0.00036)	0.00072 (0.00067)
Tax x Y2009	0.00044 (0.00034)	0.00055 (0.00036)	-0.00005 (0.00068)
Tax x Y2010	0.00008 (0.00035)	0.00024 (0.00039)	-0.00032 (0.00065)
Tax x Y2011	-0.00006 (0.00035)	0.00013 (0.00040)	-0.00013 (0.00066)
Tax x Y2012	-0.00013 (0.00034)	0.00019 (0.00038)	0.00000 (0.00064)
Tax x Y2013	-0.00001 (0.00033)	0.00029 (0.00036)	0.00050 (0.00064)
Total Expenditures	-0.00003* (0.00001)	-0.00003* (0.00001)	-0.00002 (0.00001)
Total Expenditures x Y2001	0.00001 (0.00001)	0.00001 (0.00001)	0.00001 (0.00001)
Total Expenditures x Y2002	0.00001 (0.00002)	0.00001 (0.00002)	0.00001 (0.00002)
Total Expenditures x Y2003	-0.00001 (0.00002)	-0.00000 (0.00002)	-0.00000 (0.00002)
Total Expenditures x Y2004	0.00002 (0.00002)	0.00002 (0.00002)	0.00001 (0.00002)
Total Expenditures x Y2005	0.00001 (0.00002)	0.00001 (0.00002)	0.00001 (0.00002)
Total Expenditures x Y2006	-0.00000 (0.00002)	-0.00000 (0.00002)	-0.00000 (0.00002)
Total Expenditures x Y2007	0.00002 (0.00002)	0.00002 (0.00002)	0.00002 (0.00002)
Total Expenditures x Y2008	0.00002 (0.00002)	0.00002 (0.00002)	0.00001 (0.00002)
Total Expenditures x Y2009	0.00003** (0.00002)	0.00003* (0.00002)	0.00003* (0.00002)
Total Expenditures x Y2010	0.00004** (0.00002)	0.00004** (0.00002)	0.00004** (0.00001)
Total Expenditures x Y2011	0.00002 (0.00002)	0.00002 (0.00002)	0.00002 (0.00002)
Total Expenditures x Y2012	0.00003** (0.00002)	0.00003** (0.00002)	0.00003* (0.00002)
Total Expenditures x Y2013	0.00005*** (0.00002)	0.00005*** (0.00002)	0.00005*** (0.00002)
Control Variables	Yes	Yes	Yes
Obs.	17828	17828	17828
Rank	134	134	134
adj. R2	0.704	0.704	0.703
F	124.455	128.113	123.509
AIC	23161.019	23168.240	23216.680
BIC	24204.681	24211.902	24260.342

*Standard errors are clustered at the municipality level. All Models include year and county dummies. Signif. codes: *** 0.01 **0.05 * 0.1*

Table 4: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Land Price	103.954	99.48	0.59	1333.73	17878
Property Tax A	326.401	50.844	150	600	17878
Property Tax B	324.898	45.583	150	570	17878
Coporate Tax	327.498	26.355	230	490	17878
Administration Exp.	131.785	76.698	6.504	3128.301	17878
Law&Order Exp.	41.975	42.239	0.97	971.278	17878
Settlement&Streets Exp.	223.149	149.351	3.814	2342.568	17878
School Exp.	123.276	97.017	2.822	1961.5	17878
Cluture Exp.	29.196	46.081	0.081	1808.124	17878
Social Exp.	146.023	121.163	0.034	1704.316	17878
Health Exp.	57.872	111.118	0	6273.557	17878
Institutions&Subsidy Exp.	255.597	176.148	0.065	5840.522	17878
Ventures&Assets	149.927	218.51	0	5773.885	17878
Finance Exp.	992.975	806.547	176.508	27644.525	17878
Grammar School	0.304	1.621	0	51	17878
Foreigners	5.88	2.506	2.111	24.144	17878
Freign Pupils	3.267	3.758	0	58.908	17878
Public Debt	680.847	596.904	0	6211.417	17878
Median Income	25300	3356.486	7026.381	43346.141	17878
Elderly	0.176	0.033	0.072	0.358	17878
Commuters	0.791	0.144	0.218	0.981	17878
NO2 Pollution	29.845	11.62	2.023	98.711	17878
DistCentre 2012	112.996	20.551	70	173	17878
Shopdist	2250.164	2242.447	16.58	11620.058	17878
AcessFastTrain	62.294	22.464	7	133	17878
WeatherSun	1727.014	163.463	1295.507	2222.333	17878
WeatherRain	906.548	272.64	386.667	2701.925	17878
WeatherTemp	8.768	0.843	3.118	11.556	17878
DistElemSchool	7410.43	4353.822	137.078	23891.288	17878
DistRealSchool	6181.076	3824.033	22.789	20027.124	17878
DistGramSchool	6627.868	4123.573	28.306	21554.059	17878
MedGeneral	0.001	0	0	0.004	17878
MedSpecialist	0	0.001	0	0.006	17878
PopDensity	220.152	306.356	14.976	4531.175	17878
Unemployment rate	4.697	1.797	1.2	15	17878

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