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The impact of positive property tax differentials on the timing of development ☆

Jeremy R. Groves

Northern Illinois University, Department of Economics, DeKalb, IL 60115, United States

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ABSTRACT

To date, few empirical studies have focused on the location decision by residential developers in response to changes in the property tax. Based on a dynamic time-to-development model by Turnbull, this paper finds, using 17 years of parcel level data from Saint Louis County, Missouri, that higher than average tax rates increase the time-to-development for vacant parcels by between 4 and 11%, all else equal. Additionally this paper finds that the tax differential effect is cumulative, resulting in about a 20% increase in the time-to-development for the parcel facing the average number of years with a higher than average rate. These results support the analytical results by both Turnbull [Turnbull, G.K., 1988. The effects of local taxes and public services on residential development patterns. Journal of Regional Science, 28 (4), 541–562.] and McMillen [McMillen, D.P., 1990. The timing and duration of development tax rate increases. Journal of Urban Economics, 28, 1–18.] that the property tax can distort residential capital markets leading to inefficient urban growth, or sprawl.

1. Introduction

The expansion of the urban space is a major concern among governments, academics and activists in the United States due to the growing concerns with the environmental impacts of this growth, rising transportation costs, and contemplation by policy makers on how to best attract growth to a given area. While previous studies have focused primarily on the role of regulatory policies such as zoning and other land use controls (Anas and Pines, 2008), one tool that has received relatively little investigation is the property tax. As the primary source of revenue for most local governments, the property tax is believed to be, at least partially, a tax on residential capital that both reduces the return of residential capital globally, and changes its distribution across the economy (Mieszkowski and Zodrow, 1989). Currently there is little empirical research into the questions of how and to what extent the property tax can be used as a development tool. The goal of this paper is to help fill this gap and lead to a better identification and understanding of the impact of the property tax on urban growth.

Brueckner and Kim (2003) model the property tax within the framework of the inefficient expansion of the urban boundary, or sprawl. In their paper, the authors show that higher property taxes reduce the amount of capital invested per-unit of land (thus increasing sprawl), and reduce the size of residential structures demanded by home buyers (thus reducing sprawl). Analytically the authors are unable to determine which of these two opposing effects dominate except under very specific assumptions where the domination of the latter effect leads to less urban sprawl. Their model is evaluated further by Song and Zenou (2006) who, again, find the latter effect to dominate analytically and empirically verify this using data from more than four hundred urbanized areas in the United States.[1] The authors find, after controlling for population, transportation costs, income levels, and the endogeneity of the tax rate, that a 1% increase in the tax rate reduces the spatial size of the city by about 0.45%.

While these studies show property taxes can limit the total area of the city, they say nothing about how development is distributed within the city and how this distribution changes in response to property tax variations. The spatial location of development is just as much a factor in inefficient urban growth as the spatial extent of development, especially since most urban areas are spread across several, independent taxing jurisdictions. Turnbull (1988) approaches the spatial issue by modeling the role of property taxes, among other fiscal policy tools, on the optimal timing and size of development. Specifically Turnbull focuses on how changes in the time-path, or expectation, of the property tax rate impact development and finds

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E-mail address: jgroves@niu.edu.

[1] This general result is verified again by Song and Zenou (2009) using a duo-centric city model.

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that positive shifts in the time-path results in slower development, all else equal. McMillen (1990) also finds that unanticipated increases in a tax applied to residential development result in slower development rates, while anticipated increases result in faster development.

Few projects have attempted to empirically test the predicted response of the residential development rate to changes in the property tax. Wassmer (1993), in his project to test the validity of the New View of property tax incidence, finds a very small capital response to property tax differentials when using a simple count of new homes to measure changes in residential investment. Zax and Skidmore (1994) utilize a probit model to estimate the probability that a vacant parcel is developed in a given year and how this probability is altered by anticipated and unanticipated changes in the property tax rate. The authors found that, as predicted by McMillen (1990), expected changes increase the development rate whereas unexpected changes slow the development rate. This paper seeks to add to this literature by empirically estimating the survival function for vacant residential properties and investigating how this duration is altered by property tax differentials using data from Saint Louis County, Missouri. While this paper builds off of Turnbull's (1988) model by focusing on differentials from the county-wide average tax rate, it is also able to incorporate the idea of unexpected changes discussed by McMillen (1990).

The data used in this paper is parcel level data from the 2002 county assessment record and property tax rates from 1986 to 2002. What makes Saint Louis County ideal for such an analysis is the level of growth seen over the 17 years contained in the data and the variation in the tax rates resulting from the county containing ninety-one incorporated municipalities and twenty-four school districts. Additionally, the county's socio-economic make-up is rather diverse providing a high degree of variation in the control variables used. Finally, the availability of parcel level data for the entire county allows for detailed analysis as to when a parcel is developed, how it is developed, and with the assistance of GIS mapping software, the uses of nearby parcels.

Using a variety of measures for property tax differentials, this paper finds resounding evidence for Turnbull's and McMillen's results. Depending on the measure used, the estimates show that a vacant parcel sees a 4 to 11% delay in its time-to-development for every one unit increase in the property tax mill rate over the county-wide average. Even more interesting, however, is that the results show that this effect is cumulative meaning that parcels that see higher than average rates more often, see larger delays. The finding of this cumulative effect of tax differentials helps to explain why previous tests have had difficulties finding substantial capital mobility and has important implications for using the property tax to direct urban growth patterns. The robustness of these results is verified using both a restricted sample to control for outliers and a lagged sample to control for possible simultaneity problems.

Section 2 of the paper very briefly reviews the optimal timing of residential development model by Turnbull and discusses how the analytical model may be framed as an empirical test. Section 3 describes the data and outlines the econometric specifics of the estimating model. Section 4 presents the results of the estimations and the final section is a brief summary of the paper with suggestions for further refinements.

2. Defining a testable version of the model

Shoup (1970) first addressed the question of the optimal timing for residential development by modifying Wicksell's optimal timing model for wine sales and tree harvesting. Shoup's results show that the optimal time for property development is when the marginal development value is equal to the discount rate plus any land tax. Unfortunately, most of the subsequent work based on Shoup's model of development timing focuses solely on the use of a land taxes rather than the focus of this paper, improvement taxes (see, for example, Anderson (1986)).

Turnbull (1988), in a paper extending the optimal timing literature to address urban sprawl topics, expands a framework initially used by Fujita (1982) to include dynamic and spatial dimensions of development and yields the first results regarding how an improvements tax impacts development timing. Turnbull assumes all land is owned by absentee landlords who collect rents from the land in both the undeveloped and developed states. The landowner's objective function is shown in Eq. (1) where R^A and R represent the rent obtained from the property being in the undeveloped and developed state at time t respectively.[2] In a departure from Turnbull's original specification, the size of the parcel is removed as a choice variable[3] making the per-unit rent from a developed parcel a function of the distance to the CBD (k) and the date it is developed (t). On the cost side, the marginal cost of development (per-unit of land) is adjusted by the discount rate (β) and the property tax time-path ($\rho(t;\theta)$).

$$\overline{V}(t) = \int_0^T R^A(t)e^{-\beta t}\mathrm{d}t + \int_T^\infty \left\{\frac{R(k,t)}{s} - [\beta + \rho(t;\theta)c]\right\}e^{-\beta t}\mathrm{d}t. \quad (1)$$

The first order conditions from Eq. (1) show that in equilibrium, a parcel is developed when the marginal cost of development is equal to the marginal rent and comparative statics show that a given parcel is developed sooner (later) if there is a negative (positive) shift in the property tax time-path facing that parcel. Empirically, the time-path of the property tax is defined as the property tax expected by developers in each year.[4] This expected rate determines the equilibrium, or 'natural', rate of development. Any deviation from this expectation is defined as a shift in the time-path for a given district meaning that parcels within that district should see a change in their optimal time of development.

McMillen (1990) finds a similar result when modeling how anticipated, unanticipated, temporary, and permanent changes in a development tax impact the rate of residential development. In his model, unanticipated increases, or positive deviations from the expected tax rate, slow the development rate in a given district whereas anticipated increases speed up the rate of development. If one defines deviations from the tax time-path as unexpected deviations in the property tax, McMillen's model also implies that rates larger than the expected property tax rate should slow the rate of development. Defining the expected property tax rate as the average rate for the entire economy then allows for the hypothesis that higher (lower) than average tax rates slow (speed up) the rate of residential property development, all else equal.[5]

This hypothesis is easily tested by estimating the time-to-development for a given parcel of land and determining what impact a deviation from the average property tax rate has on that time-to-development. While a simple probit model estimating the probability of development at time t may be used, it ignores the fact that the probability of interest is conditional on the parcel existing in the undeveloped state prior to time t. In this case, the methodologies used in survival, or duration, analysis seem to be perfectly suited. The goal of duration analysis is to estimate the impact of several covariates on the conditional probability that a subject fails at time t given it has not failed prior to time t. Implicit in this analysis is the assumption that each subject has a natural tendency toward failure that may be altered

[2] This equation is from Turnbull (1988, p. 556).

[3] This assumption is to simplify the empirical analysis.

[4] There may be some concern as to appraiser bias causing a wedge between the effective and statutory mill rate, however, this is beyond the scope of this paper.

[5] Another attractive feature of casting the model in this way is that it parallels the model of Mieszkowski and Zodrow (1989). A significant, negative effect on development timing provides previously elusive evidence for the distortionary effect of property tax differentials on capital predicted by the New View of property tax incidence.