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Impacts of property taxation on residential real estate development

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ABSTRACT

Decisions about residential lot size and square footage are influenced by a variety of determinants ranging from zoning regulations to neighborhood characteristics. Our theoretical analysis suggests that the property tax rate could also affect residential lot sizes and the sizes of newly constructed houses. Using descriptions for over 36 thousand houses built in New Hampshire between 1985 and 2006, we find empirical evidence that higher property taxes are indeed associated with both smaller lots and smaller houses. On average, higher property tax rates are associated with more additional living space per newly developed acre. These effects are modest in magnitude, however.

1. Introduction

Housing and the local property tax are intimately connected in the United States. In fiscal 2008, property tax payments accounted for 72.3 percent of local tax revenue (US Census, 2007). A substantial portion of those property taxes was levied on homeowners and owners of rental housing. These property owners, in turn, benefitted from the municipal services that those property taxes helped to finance.

England and Ravichandran (2010) explore the theoretical connection between taxation of real estate and a developer's profit maximizing decision about how much physical capital to place on a vacant lot of a given size. They show through numerical simulations that a higher property tax rate would favor construction of houses with fewer stories and with more compact footprints. In this paper, we continue to investigate whether the reliance of municipal governments on the property tax might affect the design of single-family homes. We extend the England-Ravichandran theoretical model by (1) allowing lot size to be a choice variable, (2) modeling explicitly the land acquisition cost along with construction cost, and (3) presenting detailed comparative static analysis of the impact of property tax rates on lot size, building size, and building height that provides the theoretical basis for our empirical study. A case study of newly constructed single-family homes in 41 New Hampshire towns and cities from 1985 through 2006 is then presented to investigate empirically the connection between property taxation and residential housing development. Our case study shows evidence that property taxation affects negatively both lot size and the square footage of new houses.[1]

2. Conceptual framework

Suppose that a builder plans to construct a new house. The builder needs to calculate the lot size and structure size that will maximize her profit. If there exists a

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[1] We do not analyze the connections between the property tax and rental housing in this paper. For a recent contribution to that literature, see Tsoodle and Turner (2008).

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minimum lot size requirement, then the decision about the lot size (A) may be influenced by zoning regulations.[2] Let F be the area of the building footprint.

$$F = \omega \cdot A \qquad 0 < \omega < 1 \tag{1}$$

where ω is the footprint ratio, that is, the proportion of the lot being occupied by a structure. Define U to be the portion of A left as open space; i.e.,

$$U = (1 - \omega) \cdot A \tag{2}$$

The floor space of the structure built on the lot, denoted as K, can be expressed as:

$$K = h \cdot F = h \cdot \omega \cdot A \qquad h \geqslant 1 \tag{3}$$

where h is a height index to derive the total floor space given the footprint. In the simplest case of a straight-up, square building, h is the number of floors.

A land development decision involves multiple dimensions: The builder needs to decide on the lot size (A), the portion of the lot used for construction (ω), and the height of the structure (h). As seen in Eq. (3), the decision about floor space (K) is implied by the decisions about A, ω, and h. Alternatively, we may say that the development decision involves the determination of A, K, and h. The optimal choices of A, K, and h from the builder's point of view are likely profit driven.

Before formulating the profit function for the builder, it is important to first examine the value of (and therefore the price a home buyer is willing to pay for) a developed parcel. A home owner derives satisfaction from both the building and the open space on the developed parcel. Let S be the service flow derived from both K and U. It is reasonable to expect a certain degree of substitutability between land and physical capital in the production of housing services. Assume S production can be described by a constant elasticity of substitution production function.[3]

$$S = B(bK^{\chi} + (1 - b)U^{\chi})^{\frac{1}{\chi}} \tag{4}$$

According to Eq. (4), the elasticity of substitution between K and U is $\frac{1}{1-\chi}$. A builder will presumably take into account the willingness of homebuyers to substitute yard area and landscaping for interior living space (Cho et al., 2009).

The annual rent paid to use the developed parcel A will depend on its service flow and also a wide variety of neighborhood and location characteristics that can be both desirable and undesirable. For simplicity, assume the following rent function.[4]

$$R = g(S, N, Z) = S \cdot f(N, Z) \tag{5}$$

where N are the neighborhood and location characteristics, and Z are the land related regulations. A longstanding thesis of urban economics is that distance from and access to employers, retail outlets, and service providers will play an important role (Capozza and Helsley, 1989). Sirmans et al. (2005) report that pleasant views add value to residential parcels. Chay and Greenstone (2005) have found that lower concentrations of suspended particulates are associated with higher house prices. Cho et al. (2009) find evidence that proximity to parks and bodies of water increases the value of house lots. Finally, as Oates (1969) pointed out decades ago, the quality of local public services such as schools is an important neighborhood characteristic that can also influence the value of housing.[5]

Land use regulations at the local level can also have a complicated set of influences on residential land rents. A well-designed zoning system can protect homeowners from nuisance-creating commercial and industrial land uses. An overly bureaucratic system of land use regulations will slow down the construction process and reduce the number of residential lots offered on the land market. In either case, zoning and other forms of land use regulation are likely to be accompanied by higher prices for residential lots (Ihlandfeldt, 2007; Lutz, 2009). Minimum lot size requirements, however, favor bigger lots if those zoning rules are binding (Newburn and Berck, 2006).

Let R_t and P_t be respectively the rent and price of the developed parcel at year t. Let τ be the property tax rate levied on the developed parcel. For simplicity, assume that the assessed value of the developed parcel is equal to its present value so the annual tax payment is $\tau \cdot P_t$.[6] Also assume that the rent and tax are collected at the beginning of year t. Then, the price of the developed parcel at year t can be expressed as:[7]

$$P_t = R_t - \tau P_t + \frac{P_{t+1}}{1 + r} \tag{6}$$

where r is the annual discount rate. At its most fundamental level, land price is governed by the present value of expected after-tax agricultural rents at the edge of a metropolitan region and urban location rents at a parcel's specific location within that region (Capozza and Helsley,

[2] The minimum lot size requirements can result in censoring of lot size for some observations. Similarly, there are height restrictions in some municipalities so that some observations of building height may be censored. Zoning regulations tend to vary across neighborhoods in the same municipality and change over time. Without detailed GIS information, it is difficult to identify the censored observations. In our empirical study, we use a dummy variable indicating the presence of zoning regulation and the median minimum lot size requirement for a municipality as indicators of strictness of zoning laws in the municipality.

[3] b is a share parameter, and B is a scale parameter. Even though B is not an important parameter in our theoretical analysis, but it has to be chosen carefully in a numerical study especially when the elasticity of substitution between K and U is less than one (see the Appendix).

[4] We are in debt to one of the referees for suggesting this simplified rent function that makes the subsequent analysis much more tractable without much loss of generality.

[5] These findings assist the specification of our empirical models. For example, we include dummy variables to indicate waterfront properties and properties near the White Mountains. Waterfront lots and other lots in waterfront communities will command higher prices in the land market. We also expect that residential lots in towns with mountain views and with lots of national forest land will garner higher rents.

[6] An underlying assumption here is that the land and the building sited on the land are taxed at the same rate (τ). The vast majority of municipalities in the United States apply the same tax rate to both the land and the structure on the land. Some cities in Pennsylvania are an exception to this generalization.

[7] Thanks to one of the referees for suggesting the expression of P_t and the subsequent derivation of P_0.