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Homeownership and Land Use Controls: A Dynamic Model with Voting and Lobbying

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Abstract

Homeowners have incentives to control and limit local land development and anecdotic evidence suggests that 'homevoters' indeed actively support restrictive measures. Yet, US metro area level homeownership rates are strongly negatively related to corresponding measures of the restrictiveness of land use regulation. To shed light on these seemingly contradictory stylized facts, we present a dynamic model with a planning board that maximizes a weighted social welfare function (SWF). The SWF can be interpreted as the reduced form of various political economy models of voting and lobbying. We consider three special cases: a median voter model, a probabilistic voting model, and an 'influence for sale' model. In all three cases conditions exist that predict outcomes which are consistent with the presented stylized facts. Generally, our model predicts that the homeownership rate has an ambiguous effect on the regulatory restrictiveness.

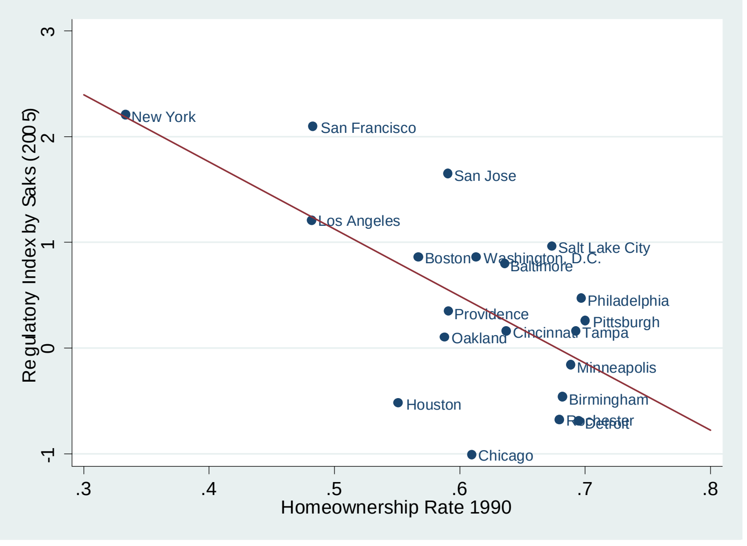
JEL classification: H7, Q15, R52.

Keywords: Homeownership, land use regulations, voting, lobbying.

1. Introduction

Recent empirical evidence suggests that the cost of land use regulation as a determinant of house prices in the United States is highly significant.[1] For example, according to conservative estimates by Glaeser, Gyourko and Saks (2005a), the cost induced by land use regulation explains more than 50 percent of house prices in Manhattan or San Francisco. In this context it is often asserted that tight land use controls are the result of politically active homeowners who constrain land use in order to maximize the values of their homes. Indeed, plenty of anecdotic evidence suggests that 'homevoters' opt for restrictive zoning measures to protect the values of their homes (Fischel 2003). However, empirical evidence seems to suggest otherwise. The arguably most tightly regulated locations in the US (Manhattan, the Bay Area, Los Angeles) have among the lowest homeownership rates. Table 1 documents the homeownership rates of 21 US metropolitan areas along with two measures of regulatory restrictiveness – the 'regulatory tax' as estimated by Glaeser, Gyourko and Saks (2005a) and the 'regulatory index' as developed by Saks (2005).[2] Both measures of regulatory restrictiveness are strongly negatively correlated with the homeownership rate (-0.52; -0.65). Figure 1 illustrates the negative relationship between the homeownership rate and the corresponding 'regulatory index'.

Figure 1: Homeownership Rates and the Restrictiveness of Land Use Regulation



[1] The economic significance of the regulatory cost is not confined to the United States or the housing market. Empirical evidence by Cheshire and Sheppard (2002) and Cheshire and Hilber (2006) suggest that the economic cost of land use regulation – both in the residential and the office sector – are orders of magnitude greater in the UK and a number of European cities than in the United States.

[2] Saks (2005) created a "comprehensive index of housing supply regulation" by using the simple average of six independent surveys carried out between the late 1970s and the late 1980s. The method of index construction is described in detail in the Data Appendix of Saks (2005).

One additional result from Glaeser, Gyourko and Saks (2005a) is that the 'regulatory' tax is estimated to be much larger for Manhattan than for the entire New York metro area, while the homeownership rate is much lower in Manhattan compared to the surrounding suburbs. Finally, Rudel (1989) documents that Connecticut's (high homeownership rate-) municipalities located at a greater distance to New York City adopted land-use laws later than (low homeownership rate-) municipalities closer to the CBD.

In this paper we provide a theoretical framework that sheds light on the link between the homeownership rate and the regulatory restrictiveness. In particular, we demonstrate that the above stylized facts can be reconciled with the notion that homeowners' voting and local political activities are guided by their concerns about home values (even in a setting where the regulatory restrictiveness is determined by the median voter).

More specifically, we postulate a 'dynamic' version of the monocentric city model (see Brueckner 1987 or Fujita 1989 for expositions of the standard monocentric city model); we consider three groups of agents: renters (people who do not own the dwelling in which they reside), homeowners (people who own the dwelling in which they reside) and absentee landowners (people who rent out the dwelling(s) they own ('landlords') *or* people who own undeveloped land). In a static model, a homeowner is an agent such that the landlord and the tenant are a single person (or household). Thus, the utilitarian social welfare function for a city inhabited by homeowners only will be identical to the utilitarian social welfare function inhabited by pairs made of one absentee landlord and one renter (in an ordinal sense). As a result, the homeownership rate plays no role in the social planner's choice in this simple model.

In a dynamic model in which different groups of agents make different tenure choices, this equivalence no longer holds and the homeownership rate becomes an important parameter of the model. In particular, many authors argue informally or formally that a given jurisdiction will adopt tighter land use regulations, the higher its homeownership rate (e.g., Fischel 2003, Glaeser, Gyourko and Saks 2005b, Ortalo-Magne and Prat 2005). We qualify this proposition and show conditions under which it holds and conditions under which it does not. We articulate these conditions mostly in terms of political economy forces; in particular, we consider both voting and lobbying models.

Our strategy is to postulate a quite general weighted social welfare function that can be seen as the reduced form of the various political economy models we consider.[3] That is, the (local or regional) planning board is interpreted as a social planner that takes into account the weighted sum of the individual welfare of the agents with a stake in the (local or regional) planning outcomes. The advantage of this modeling strategy is to make clear the economic and political circumstances under which the amount of land use regulation and the homeownership rate are positively correlated – as it should be according to frequent claims made in the literature. As we shall see, this positive relationship is not robust in theory; yet, this is unsurprising in the light of the stylized facts we uncover above.

Our first result is that the homeownership rate does not matter in determining the equilibrium regulatory tax in very special circumstances only, namely, in a model in which all agents effectively discount the future at the same rate (as they are implicitly assumed to do in a static model). In such a model, any regulatory tax involves a pure transfer from tenants to landlords, so a utilitarian planning board is indifferent as to the level of the regulatory tax (in the absence of risk aversion, distribution does not matter to the utilitarian planner). We then propose a series of results that are the outcome of the dynamic structure of our model. As a benchmark, in the absence of homeowners, we show that the utilitarian planner chooses either the policy most preferred by the landlords or the policy preferred by the tenants; this is in stark contrast to the previous result. Our third result demonstrates that the regulatory tax is generally non-decreasing in the homeownership rate in the median voter model. As we show, this result is not robust. Specifically, in a probabilistic voting model (which might look like a benign alteration of the median voter model), our fourth result establishes that the two variables are negatively correlated. Our last result shows that the same holds true in a lobbying model in which pressure groups 'buy influence'.

Before proceeding with our analysis, it is useful to emphasize our contribution in light of previous work. Our paper is related to a number of theoretical studies analyzing the causes of land use regulation and, in particular, the role of homeownership. When trying to explain the causes of land use regulation, one popular hypothesis is the so-called 'homevoter hypothesis' (Fischel 2003), which suggests that homeowners have an incentive to protect their house values and that they therefore vote for restrictive zoning measures. Similar to Fischel (2003) we also argue that *individual* homeowners are in favor of land use restrictions. Merely, we point out that in a setting where land use regulations are partly determined by lobbying (in

[3] When each individual's utility gets an equal weight, this social welfare function coincides with the utilitarian one.

addition to or instead of a voting process), a higher homeownership rate can be negatively associated with land use regulation. The intuition is that landlords who rent out their property have even stronger (purer) interests in regulating land use than homeowners who can be considered as landlords who rent to themselves.[4] A few theoretical papers have formally linked the homeownership rate to the restrictiveness of land use regulation. Glaeser, Gyourko and Saks (2005b) develop a political economy model of zoning determination in which the political game is a struggle between homeowners and developers. One key prediction of their model is that the homeownership rate is positively related to the tightness of land use regulation. In contrast, in the present paper we identify alternative effects of homeownership that, empirically, seem to overwhelm the Glaeser, Gyourko and Saks (2005b) effect in our cross-section of US metropolitan areas. The only paper we are aware of that predicts a negative relationship between the homeownership rate and land use regulation is the static model by Brueckner and Lai (1996). Similar to our framework, Brueckner and Lai (1996) focus on the distinction between 'absentee landowners' (in our terminology: 'landlords') and 'resident landowners' (homeowners who pay rent to themselves). Our model differs from Brueckner and Lai (1996) in that we consider a dynamic framework and different models of voting and lobbying. For a more extensive review of the literature we refer to Hilber and Robert-Nicoud (2006).

The rest of the paper is structured as follows. In the section below we first outline the structure of our model. In Section 3 we investigate the relationship between land use regulation and social welfare; our criterion is a weighted social welfare function which is the reduced form of various voting and lobbying models (as well as of the utilitarian social welfare function). Section 4 then discusses three political economy models as special cases: the median voter model, a probabilistic voting model and a lobbying model. The final section summarizes our findings and reconciles them with the stylized fact that motivates this paper.

2. Model

We consider three groups of agents: 'renters' (people who do not own the dwelling in which they reside), 'homeowners' (people who own the dwelling in which they reside, i.e. owners-occupiers) and 'absentee landowners' (people who rent out the dwelling(s) they own

[4] In fact, as we demonstrate the negative link between the homeownership rate and the tightness of land use regulation can even be the outcome of a median voter model under some parameter configurations; this is the result of the convexity of the tenants' objective function.

('landlords') *or* people who own undeveloped land). In a static model, a homeowner is an agent such that the landlord and the tenant are a single person (or household).

Assumptions and basic structure

We study the determinants of the welfare of households living in a given jurisdiction, J. We assume that this jurisdiction is a simple, open monocentric city. In this city, each household earns an exogenous wage w at the CBD and lives at some distance h from it. Each household, which is composed of one individual, consumes an exogenous amount of land, normalized to one unit; there is one dwelling per unit of land.[5] As a result, we can identify each household by the variable h without risking confusion. Commuting from her residence to her working place costs τ dollars per unit distance and per unit of time. Thus, for the household h from the CBD, the commuting cost is τh.

Tenants and landlords

Consider tenants first. The instantaneous utility such a household earns is equal to

(1) $$u(h) = w - T - \tau h - R(h)$$

where T is a tax levied per unit of land to be determined later on and R (h) is the 'net' rent paid by the individual tenant living at distance h from the CBD (more on the distinction between the gross and net rents shortly). Let N be the equilibrium population in city J. There is perfect competition on the market for dwellings, thus at equilibrium landlords post rents R(h) such that R(N)=0 at the fringe and u(h) is everywhere the same:

(2) $$u(h) = w - T - \tau N \equiv u(N,T)$$

This way, at equilibrium, households are indifferent as to where they live in the city. Thus, the utility they achieve, u, is a function of parameters of the model (τ and w) and of endogenous variables to be determined later (N and T).

Land use in city J is being regulated and this generates a shadow tax, in the spirit of Glaeser, Gyourko and Saks (2005a). Specifically, land use restrictions distort land use choices and thus increase the value of land already being developed. Thus, this 'tax' is paid by the

[5] Conceptually, these assumptions are easy to relax but in the present setting the model would become intractable.

tenants to the landlords. More precisely, this tax is capitalized in the price of land and renters actually pay the gross rent given by

(3) $$r(h,T) \equiv T + R(h) = \tau(N-h) + T.$$

The value of a dwelling unit located at distance h from the CBD is thus equal to the present value of the stream of gross rents, namely

(4) $$W\left(h,T(t_0)\right) = \int_{t_0}^{\infty} e^{-(\rho+\delta)t} r\left(h,T(t)\right) \mathrm{d}\, t$$

where ρ is the discount rate and δ is the dying rate, i.e. the expected duration of a building is $1/\delta$ years. (At each time t, there is a probability δ that the dwelling unit collapses.)
In the remainder of the paper, we study the properties of the stationary steady state; thus, from now on, we can omit the time variable t and normalize t_0=0. At steady state, (4) simplifies to

(5) $$W(h,T) = \int_0^{\infty} e^{-(\rho+\delta)t} r(h,T) \mathrm{d}\, t = \frac{r(h,T)}{\delta+\rho}$$

The average value of all dwelling units in this jurisdiction is given by

(6) $$W(T) \equiv \frac{1}{N}\int_0^N W(h,T) \mathrm{d}\, t = \frac{1}{\delta+\rho}(T + \tau\frac{N}{2})$$

where we have used (3) to derive the second equality. It is readily verified that the average value of the dwelling is increasing in the size of the population (a demand effect) and in the shadow tax on land use (as usual, this tax introduces a wedge between the demand and the supply prices, thus restricting the quantity consumed at equilibrium). As a result, absentee owners of developed land (whom we call 'landlords') in contrast to owners of undeveloped land) are in principle favorable to attracting more people (which increases demand for land in the jurisdiction) and to restrict land use more stringently (for a given population size, this increases demand for each unit of land already developed). Landlords who are absentee do not commute to the CBD so the value of being a landlord in this jurisdiction is W(T) on average.

We assume that every so often, tenants are hit by a shock and leave jurisdiction J (to get married, start another job or retire in a sunny location, say). We model this by assuming that at each period of time dt each household faces a probability λ^Tdt to leave J; for the time being, we take λ^T as exogenous; we relax this assumption in the Appendix.[6] When they leave the monocentric city to another one, these tenants earn an exogenous $\bar{W}^T$, which includes the moving costs C^T and could be negative. As a result of these assumptions, the option value of being a tenant is equal to $\rho W^T(h,T) = u(h,T) + \lambda^T[\bar{W}^T - W_j^T(h,T)] + \delta[W_j^T(h',T) - W_j^T(h,T)]$, where the first term is the flow of instantaneous utility and the last term is the capital gain that arises when the tenant has to move out because her dwelling collapses; by virtue of (2), u(h',T)=u(h,T) and thus the last term in this expression is zero. Solving for W^T(h,T), we obtain:

$$\textbf{(7)} \qquad W^T(h,T) = \frac{1}{\rho + \lambda^T}\left[u(h,T) + \lambda^T \bar{W}^T\right]$$

By virtue of (2), this is equal to the average value of being a renter in jurisdiction J, which is equal to

$$\textbf{(8)} \qquad W^T(T) \equiv \frac{1}{N}\int_0^N W^T(h,T)\,\mathrm{d}\,t = \frac{1}{\rho + \lambda^T}\left(w - T - \tau\frac{N}{2} + \lambda^T \bar{W}^T\right)$$

which is decreasing in N (because of congestion) and T (because this increases the rent).

Homeowners

Turn now to the homeowners. Homeowners pay rents to themselves and commute to the CBD, so the option value of homeownership at distance h from the CBD is equal to $\rho W^O(h,T) = w - \tau h + \lambda^O[\bar{W}^O + W(h,T) - W^O(h,T)] - \delta W^O(h,T)$, where the first term is the flow of instantaneous utility, the second term is the expected capital gain that such a household pockets when she sells her property; this arises with probability λ^Odt and, when this happens, the household sells her house at its market price, W(h,T), forgoes the value of being the owner of her dwelling, W^O(h,T), and earns an exogenous $\bar{W}^O$ in the new dwelling, which includes the moving costs C^O and could be negative; like tenants, we assume that whenever homeowners are hit by such a shock they move out of the city and relocate elsewhere. Solving for W^O(h,T), we get

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[6] All the results we derive in this paper are robust to this extension. This extension is interesting insofar as we provide microeconomic foundations for having $\lambda^T \neq \lambda^O$.

$$\textbf{(9)} \qquad W^O(h,T) = \frac{1}{\delta+\rho+\lambda^O}\Big[w - \tau h + \lambda^O\big(W(h,T) + \bar{W}^T\big)\Big].$$

As before, we can compute the average value of being a homeowner in this city; using (6) this is equal to

$$\textbf{(10)} \qquad W^O(T) \equiv \frac{1}{N}\int_0^N W^O(h,T)\,\mathrm{d}t = \frac{1}{\delta+\rho+\lambda^O}\left[\left(w-\tau\frac{N}{2}\right) + \lambda^O\bar{W}^O + \frac{\lambda^O}{\delta+\rho}\left(T+\tau\frac{N}{2}\right)\right].$$

Note that homeowners are renting to themselves so, like tenants, they dislike congestion and regulatory taxes (this is captured by the term in the first parenthesis in the right-hand side of the expression above) but, like landlords, they benefit form congestion and regulation. The net effect is ambiguous and depends on the average length of the tenure duration, equal to $1/\lambda^O$.

This is the central element to our argument. To understand what is at stake, note that when homeowners frequently change locations ($\lambda^O>1$), then their economic interests are similar to those of the landlords because they sell their asset, which capitalizes the tax T and the congestion of land, equal to $\tau N/2$; by contrast, when they rarely change location ($\lambda^O<1$), they dislike congestion but still value regulation (this is because regulation creates no cost to them).

Before developing this line of reasoning further, let us close the model by explaining how N is pinned down at equilibrium.

Equilibrium

When households (tenants or homeowners) consider living in jurisdiction J or in another one, they compare the utility they would obtain in city J, which we generically denote by V ($V=W^O,W^T$), and the highest utility they would obtain elsewhere, which we denote as $\bar{V}$. For simplicity, we assume here that $\bar{V}$ is exogenous.[7] Next, we assume that households value natural and cultural amenities as well as economic wellbeing when they make their location decision. Cities differ in that respect, so even if $V<\bar{V}$, some households might choose to reside in the jurisdiction generating a poorer economic wellbeing (J in this case) because they like the climate, the variety of restaurants and the quality of its museums and theatres more

[7] This assumption is immaterial for our purposes; the interested reader might turn to Hilber and Robert-Nicoud (2006), where we relax this assumption.

than the same variables in the alternative location. As in Hilber and Robert-Nicoud (2006), we assume that households are heterogeneous in the sense that their private valuation of the natural and cultural amenities of the various locations differ; some people value mild and dry climates a lot more than the proximity of icy summits than others. Hence, given $\bar{V}$, the fraction of the population that decides to reside in J is equal to $G(V-\bar{V})$; let the total population be fixed to N^{TOT}; as a result of this assumption, the actual mass of people living in J will be equal to

(11) $$N(T) = G(V - \bar{V})N^{TOT}$$

The first derivative of N with respect to T is negative, namely, the *current* level of regulation increases the cost of residing in our jurisdiction, thus fewer people actually want to live there. For the time being, we do not specify any functional form for G(.), but we assume that its shape is such that the following holds:

(12) $$N_T \equiv \frac{\partial N}{\partial T} < 0, \quad \frac{\partial^2 N}{\partial T^2} < 0, \quad \lim_{T\to 0} \frac{\partial N}{\partial T} > -\frac{2}{\tau}$$

For further reference, it is useful to characterize the amount of land use regulation that maximizes the *average* gross rent in this economy. Define T^L as the tightness of the land use restriction that maximizes (6), i.e.

(13) $$T^L \equiv \arg\max_T W(T) \quad \Rightarrow \quad 1 + \frac{\tau}{2} \cdot \left.\frac{\partial N}{\partial T}\right|_{T^L} = 0$$

Given our assumptions in (12), T^L is a strictly positive and finite number. To avoid discussing uninteresting cases, we impose the restriction $N(T^L)>0$.

By the same token, let us define T^O as the optimal regulation from the homeowners' point of view, namely

(14) $$T^O \equiv \arg\max_T W^O(T) \quad \Rightarrow \quad 1 + (1 - \frac{\delta+\rho}{\lambda^O}) \cdot \frac{\tau}{2} \cdot \left.\frac{\partial N}{\partial T}\right|_{T^O} = 0$$

if $\lambda^O > \delta + \rho$ and there is no real solution to this problem otherwise. In economic language, if the likelihood at each point in time that a homeowner leaves J, sells her dwelling and pockets its value is high (i.e. if $\lambda^O > \delta + \rho$) then she looks like a landlord and she favors mild land use regulation; by contrast, if this probability is low, then she favors the toughest possible regulation because she wants to reduce the size of the population as much as possible to reduce congestion. From (12), it is clear that $T^O > T^L$ holds for any finite λ^O, namely, homeowners always favor more regulation than landlords. This confirms Fischel (2003) and other authors' claims that homeowners strongly favor land use regulations (but see Brueckner and Lai 1996 for a qualification of this result).

Finally, tenants' objective function is the mirror image of the landlords', so $W^T(T)$ has a U-shape reaching an interior minimum at T^L. As a result, tenants' preferred regulatory tax is either 0 (in which case they would favour a negative regulation if they could) or extreme regulation, depending on the sensitivity of N to T in (12). Specifically, assuming that N(T) is bounded above and that the support of T is $[0, T^{\max}]$ (where $T^{\max}$ could be arbitrarily large), we obtain

(15) $$T^T \equiv \arg\max_{T\in[0,T^{\max}]} W^T(T) = \begin{cases} 0, & \tau \dfrac{N(0)}{2} \leq T^{\max} + \tau \dfrac{N(T^{\max})}{2} \\ T^{\max}, & \text{otherwise} \end{cases}$$

3. Land use regulation and welfare

In this section, we ask the question 'to what extent is land use restriction desirable?'. Our criterion is a weighted social welfare function which is the reduced form of many possible models of voting and lobbying. In the next section, we then look at three special cases: when the social welfare function corresponds to

- The preferred platform of the median voter.
- The outcome of a probabilistic voting model à la Hinich (1977).
- The outcome of a lobbying model à la Grossman and Helpman (1994).

Before doing so, let us introduce the utilitarian benchmark and use it to stress the conditions under which the equivalence between a homeowner and a pair made of a tenant and a landlord holds.

Utilitarian benchmark and static model

For simplicity, assume that the population of J is fixed (we relax this assumption shortly), thus $N_T=0$. Let the homeownership rate in jurisdiction J be exogenous and denote it by θ. A utilitarian planner (who also takes into account the welfare of the absentee landlords) would then maximise the sum of each individual's W; with a given population size, this is equivalent to maximising the average of the W's, thus

$$
\begin{aligned}
\Omega^{Utilitarian}(T) &= \theta W^{O}(T) + (1-\theta)[W(T) + W^{T}(T)] \\
&= \text{constant} + \frac{\theta}{\delta+\rho+\lambda^{O}}\left[(w-\tau\frac{N}{2}) + \frac{\lambda^{O}}{\delta+\rho}W(T)\right] \\
&\quad +(1-\theta)\left[W(T) + \frac{1}{\rho+\lambda^{T}}(w-T-\tau\frac{N}{2})\right]
\end{aligned} \tag{16}
$$

where $W(T) = (T + \tau N/2)/(\delta+\rho)$ from (6) and N(T) comes from (11) and (12).

Using this, we now show that a homeowner is equivalent to a landlord-tenant combo in special circumstances only. In a static model, there are no shocks occurring, so $\delta=\lambda^{T}=\lambda^{O}=0$; we can also normalise ρ to unity. As a result, (16) simplifies to

$$
\Omega^{static}(T) = \text{constant} + \theta(w-\tau\frac{N}{2}) + (1-\theta)w = \text{constant} + w - \theta\tau\frac{N}{2} \tag{17}
$$

which does not depend on T. Thus, in this model, the homeownership rate has no bearing on the amount of regulation that would maximize the planner's objective function in (17). This is because T is a transfer from renters to landlords and this redistribution entails no deadweight loss. Also, in the case of homeowners, this transfer is trivial since the landlord and the renter are the same person. Note, however, that θ appears in the right-hand side of (17), that is, the impact of the congestion cost in J on Ω is larger, the larger the homeownership rate. This is because the rents tenants pay to landlords fully compensate for the commuting cost, whereas homeowners don't. Thus, in this respect, the equivalence breaks down.[8]

To summarize this discussion, let us write:

Proposition 1.The homeownership rate does not influence the utilitarian planner's choice of T only in a static version of the model in which the size of the population N is given.

In the dynamic version of the model, T is a flow transfer from tenants to landlords and, since various groups of agents effectively discount the future differently, this equivalence breaks down in the dynamic version of the model.

[8] This is not a robust result, because the implicit assumption here is that homeowners are like settlers, namely, they did not buy the land on which the house in which they reside stands in the first place. Assuming instead that the current generation of homeowners did buy their house from other agents in the past *and* that they borrowed to do so, then the service of the debt would look like a rent. Importantly, this rent would increase with proximity to the CBD, so the last term in (17) would go.

A general social welfare function (SWF)

Let us now generalize (16) and give arbitrary weights to the various groups of agents. Let the current size of the population be N. Assume for simplicity that the planning board maximizes the welfare of the agents who *currently* have stakes in land use regulation T, namely, the planning board puts no weight on future residents' wellbeing.[9] However, ever in this case, we have to take into account how the welfare of each group of individuals would increase as N varies as a result of the choice of T. In particular, owners of undeveloped land currently earn zero but would earn a positive amount (the net rent) if the population grew; or, the owners of developed land at the fringe would lose their earnings (the gross rent) if the population decreased. As a result, in this case the SWF would look like

(18)
$$\begin{aligned}\Omega(T) &= N\left[aW(T)+bW^{O}(T)+cW^{T}(T)\right]\\ &+a\max\left\{0, N(T)-N\right\}\left[W(T)-\frac{1}{\delta+\rho}T\right]+a\min\left\{0, N(T)-N\right\}W(T).\end{aligned}$$

Note that the function Ω(T) displays a discontinuity at the T such that N(T)=N.

Let us analyze the problem into two steps. As a first step, let us analyze the first line of (18), which does not include the wellbeing of the landlords owning land at the margin of the city. We get:

(19)
$$\begin{aligned}\Omega_1(T) &\equiv N\left[aW(T)+bW^{O}(T)+cW^{T}(T)\right]\\ &= \text{constant } +\mathrm{N}\left[\frac{b}{\delta+\rho+\lambda^{O}}+\frac{c}{\rho+\lambda^{T}}\right]w\\ &+N\left[\frac{a}{\delta+\rho}+\frac{b}{\delta+\rho+\lambda^{O}}\cdot\frac{\lambda^{O}}{\delta+\rho}-\frac{c}{\rho+\lambda^{T}}\right][T+\tau\frac{N(T)}{2}]-\frac{Nb}{\delta+\rho+\lambda^{O}}\cdot\tau\frac{N(T)}{2}\end{aligned}$$

where we have made use of (6), (8) and (10) to derive the second line. Using this expression, we can already derive an important intermediate result:

Proposition 2. If the social planner puts no weight on the homeowners' welfare (b=0) nor on the absentee landowners who own land at the fringe of the city, then she maximizes the total rents of the jurisdiction, $T+\tau N(T)/2$*, which is equivalent to maximizing W(T), or chooses* $T=T^{L}$*, depending on the parameters of the model.*

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[9] This is perhaps the most reasonable assumption to make, for we view this SWF as a reduced form for various political economy models in which agents with current stakes influence the land use planning process.

This is an important result. It shows that when the social planner puts weight on tenants and landlords' wellbeing only, then she chooses a T that either maximizes tenant's wellbeing or landlords' wellbeing – recall that the interests of these two groups are exactly the mirror image of each other. More precisely, she chooses the former if the term in the first square bracket of the third line of (19) is positive and she chooses the latter otherwise.

This result resonates with Proposition 1. In a static model, b=0 would have made the planner indifferent as to the choice of T. In a dynamic model, however, landlords and tenants discount the future differently and thus a pure transfer between these two groups might increase or decrease welfare. To understand the economic forces that drive this result, let us impose b=0 and a=c=1 in (19) and omit the terms that do not include T or N(T) and write

(20) $$b=0, \quad a=c=1 \quad \Rightarrow \quad \frac{\Omega_1(T)}{N} = (\frac{1}{\delta+\rho} - \frac{1}{\rho+\lambda^T})[T+\tau\frac{N(T)}{2}].$$

As a result, the T that maximizes $\Omega_1(T)$ is $T^L>0$ only if $\lambda^T \geq \delta$, namely, if the frequency at which tenants leave their dwelling is larger that the frequency at which the value of the land on which the dwelling stands is destroyed; otherwise, the planner chooses $T^L \in \{0, T^{max}\}$. Realistically, δ is equal to zero as a first order approximation, so the planner chooses T as if she was only tacking into account the wellbeing of the landlords. This is because the value of a property is the discounted sum of all future rents, whereas current tenants will have left in a finite lifetime.

4. Three special cases

In this section, we consider three special cases of (16). The first two cases concern electoral politics, namely, we consider in turn the median voter model and a probabilistic voting model. The third case we deal with in this section is a post-election politics model, namely, a model in which organized groups lobby incumbent governments (or more precisely, planning boards). We conclude this section with a discussion of a model in which both pre- and post-electoral politics considerations play a role.

Median voter model

Many authors, among whom Fischel (1990a and 1990b) figures prominently, argue that land use regulations can be best thought of as the outcome of a voting model, namely, J's authorities implement the T that would be favored by the median voter. Denote the fraction of homeowners in this jurisdiction by θ, as before, and let us assume for simplicity that tenants rent their dwellings from absentee landlords. In other words, homeowners own only one dwelling – the one they occupy.[10] Under these assumptions, the objective function of the jurisdiction's authorities is a special case of (18), as follows[11]:

$$\textbf{(21)}\qquad \Omega^{median}(T) = \begin{cases} W^O(T), & \text{if } \theta > .5 \\ W^T(T), & \text{if } \theta < .5 \end{cases}$$

that is, a=0 and b+c=1, with b=1 if homeowners form the majority of the population and c=1 if they don't. As a result, we have

$$\textbf{(22)}\qquad T^{median} \equiv \arg\max_{T\geq 0} \Omega^{median}(T) = \begin{cases} T^O > 0, & \text{if } \theta > .5 \\ T^T, & \text{if } \theta < .5 \end{cases}$$

Thus, we have shown:

Proposition 3. In the median voter model, the shadow tax on land use, T^{median}, is non-decreasing in the homeownership rate θ if $T^T=0$.

Note that we get the opposite result if $T^T=T^{max}$. Thus, the result in Proposition 3 is not robust, as we claim throughout the paper.

Probabilistic voting model

In many circumstances, the median voter model is naïve. In our case, many jurisdictions in the United States and other countries have a homeownership rate larger than one half, thus the model predicts that such jurisdictions should all have the same T, conditional on τ and N.

A deeper reason why the median voter model is dubbed as too unrealistic by many authors is that candidates do not know the identity of the median voter. Also, in reality, candidates are never perceived as perfect substitutes by voters and each voter's perception of their differences is idiosyncratic (Hinich 1977, Persson and Tabellini 2000). For all theses reasons, these authors have adopted a discrete choice approach to voting, whereby each individual makes a deterministic choice based on each candidate's platform and her perception of the other attributes of the candidates, but these choices cannot be observed by the candidates themselves – they only know the distribution of these preferences.

[10] The outcome that results from relaxing this assumption will become clear from our last special case.
[11] We omit the case θ=.5, which occurs with probability zero.

As a result of these assumptions, the objective function of each individual will enter the objective function of the candidates, which is more realistic than the median voter model in many circumstances. Usually, these models make the following assumptions. First, two candidates running for office announce and commit to a platform, i.e. they both announce a value for T. Second, observing the T's, the voters cast their vote for either of the two candidates. In doing so, they weigh in the difference between the W they would get under both platforms and other exogenous characteristics of the candidate they might cherish or disapprove of in various degrees (e.g. each candidate' gender, their political affiliations, etc.). Third, in the case the candidates both run on an identical platform, preferences are distributed in the population in such a way that, in this case, each expects to receive half of the votes. When this outcome occurs, the winning candidate is designated by tossing a coin. Fourth, the winning candidate implements the platform on which she ran for office.

In our model, the population is made of three groups. Following Persson and Tabellini (2000), assume that in each group both candidates running for election are equally popular a-priori (i.e. if they propose the same platform at equilibrium, then they each receive 50% of the vote) but that some groups have more voters with strong, inflexible, political beliefs on both sides of the spectrum. Such ideologically heterogeneous groups have fewer swing voters and hence they are less attractive to politicians. At equilibrium, such groups get a lower weight in the objective function of the candidates. Specifically, assume that the idiosyncratic component of homeowners is symmetrically distributed around zero with standard deviation σ_O and that the idiosyncratic component of tenants has the same distribution but with a different standard distribution, σ_T. Then each individual gets a weight which is inversely proportional to the σ of her group (Robert-Nicoud and Sbergami 2004). In such a probabilistic voting model, the elected official maximizes (16) with a=0 (absentee landowners don't vote) and $b=\theta/\sigma_O$ and $c=(1-\theta)/\sigma_T$. Without loss of generality, let us normalize b to unity and redefine c as $c \equiv (1-\theta)/\theta \cdot \sigma_O / \sigma_T$ to write

(23)

$$\begin{aligned}\Omega^{proba}(T) &= N\left[W^O(T) + cW^T(T)\right] \\ &= \text{constant } + \mathrm{N}\left[\frac{1}{\delta+\rho+\lambda^O} + \frac{c}{\rho+\lambda^T}\right] w \\ &+N\left\{\left[\frac{\lambda^O}{\delta+\rho+\lambda^O}\cdot\frac{1}{\delta+\rho} - \frac{c}{\rho+\lambda^T}\right][T+\tau\frac{N(T)}{2}] - \frac{1}{\delta+\rho+\lambda^O}\cdot\tau\frac{N(T)}{2}\right\}.\end{aligned}$$

Maximising Ω^{prroba}(T) is equivalent to maximising

$$\textbf{(24)} \qquad \tilde{\Omega}^{proba}(T) \equiv \alpha T + \beta\tau \frac{N(T)}{2}; \qquad \alpha \equiv \frac{\lambda^O}{\delta+\rho+\lambda^O} \cdot \frac{1}{\delta+\rho} - \frac{c}{\rho+\lambda^T}, \quad \beta \equiv \alpha - \frac{1}{\delta+\rho+\lambda^O}$$

The first thing to note is that if c is large enough, which arises when many swing voters are tenants (this itself arises when the homeownership rate is low and/or when tenants are a relatively homogenous group), then α and β are negative; in such a case, both candidates choose the policy that maximizes the wellbeing of tenants, namely, they choose T^T.

Assume instead that α and β are both positive (which holds if $\beta>0$). In this case,

$$\textbf{(25)} \qquad T^{proba}(T) \equiv \arg\max_{T\geq 0} \alpha T + \beta\tau \frac{N(T)}{2} \quad \Rightarrow \quad 1 + \frac{\beta}{\alpha} \cdot \frac{\tau}{2} \cdot \left.\frac{\partial N}{\partial T}\right|_{T^{proba}} = 0$$

is a strictly positive and finite real number if β/α is close enough to unity (otherwise $T^{proba}=T^T=0$). Note that β/α is increasing in α and thus decreasing in c and increasing in θ. Thus, using the necessary conditions for an interior maximum, see (12), it is readily verified that we have

$$\textbf{(26)} \qquad \frac{\partial T^{proba}}{\partial \theta} < 0$$

as long as both β and α are positive.

We summarize these results in the following proposition.

Proposition 4. In a probabilistic voting model, if tenants are numerous enough or form a group that is homogenous enough (in and ideological sense), then the platform implemented at equilibrium by the winning candidate is a corner solution corresponding to T^L. By contrast, when homeowners are numerous and/or homogenous enough, the platform implemented at equilibrium is an interior solution; in this case, the equilibrium regulatory tax is decreasing in the homeownership rate. More generally, the homeownership rate has an ambiguous effect on T^{proba}.

Note the contrast with Proposition 3: in the median voter model, the equilibrium regulatory tax, T^{median}, was non-decreasing in the homeownership rate.

Lobbying: buying influence

As our last special case, consider the 'influence for sale' model developed by Grossman and Helpman (1994) in a trade context and generalised in Dixit, Grossman and Helpman (1997) and simplified in Baldwin and Robert-Nicoud (2006). In these influential papers, the authors view lobbying as a menu-auction à la Berheim and Winston (1986) in which some special interest groups are perfectly organised (Olson 1971) and they lobby the incumbent government by 'buying influence'. Specifically, such models usually make the following assumptions.

First, for each possible policy mix that the incumbent might chose, these lobbies propose to contribute a certain amount of money – a 'menu', which we can write as C(T). Such contributions can be interpreted as outright bribes or as perfectly legal contributions to finance electoral campaigns that will prove useful to the incumbent when she runs for re-election (re-elections themselves are usually not modelled). The politician can accept or reject such a contribution. If she rejects it, then she implements the utilitarian first best, call it T^U. Thus, lobbies who desire to twist the political outcome away from the first best have to compensate the government for implementing another policy. Second, it is often assumed that the government's objective function, call it $\Omega^{Lobby}(T)$, is a (linear) weighted sum of utilitarian welfare and contributions; this assumption is helpful in making the model tractable; the government cares about conventional welfare because it is going to seek re-election in the future. Third, since the lobbies move last, at equilibrium they just make sure that the government is on its participation constraint. One way to do this is for the lobby to make a contribution schedule of the form C(T)=W(T)-B, where W(T) is the lobby's welfare as a function of the policy variable at stake and B is a positive scalar. This way, the incumbent is the residual claimant on her policy choice. This assumption ensures that the equilibrium is unique (it also has the attractive feature to be the unique coalition-proof equilibrium among all the possible contribution schedules).

An important general result is the following. For simplicity, assume that only one lobby is organized and offers contributions to the government. Let T^W be the regulatory tax that maximizes the lobby's W(T) and assume without loss of generality that it is different from T^U. Assume further that $\Omega^{Lobby}(T)$ has a unique, interior maximum and that it is continuously differentiable. Then we can establish the following result:

Proposition 5. Assume that W(T) and $\Omega^{Lobby}(T)$ has a unique, interior maximum and that it is continuously differentiable. Let T^{Lobby} be the regulatory tax that maximizes $\Omega^{Lobby}(T)$. Then the government implements T^{Lobby}, which is between T^U and T^W, is being offered $C(T^{Lobby})$and accepts the contribution.

The intuition for this result is as follows (Baldwin and Robert-Nicoud 2006). Since the government default policy is to implement the first best, the welfare cost of any (small) deviation from its preferred policy is negligible. By contrast, the gain for the lobby is first order large, and hence the lobby is better off compensating the government to implement T^{Lobby} rather than T^U.

We could almost apply this result without alteration to our setting; however, the shape of Ω^{Lobby} violates some of the properties assumed in Proposition 5, so we have to be more careful.

To streamline the argument in this subsection, imagine that the incumbent government caters to the interests of the lobbies only. Also, assume that tenants and homeowners are not organized and thus do not lobby the government (we relax this assumption later). Thus, there are two groups that actively lobby the government: owners of developed land (who favor more regulation) and owners of undeveloped land (who favor less regulation). Both groups are 'absentee landowners' in the terminology we adopt in this paper. Each contribution offers a linear contribution schedule of the form W(T)-B. As a result, the government's objective function is like (18) with b=c=0; normalizing *a* to unity, we obtain

(27) $$\Omega^{Lobby}(T) = N(T)W(T) - \max\left\{0, N(T) - N\right\}\frac{1}{\delta+\rho}T.$$

where W(T) is given by (6).

Since this function has a discontinuity at T such that N(T)=N, we have to consider two cases: either the parameters of the model are such that there is some pressure for more regulation (in which case N will decrease) or they are such that there is pressure for less regulation. Assume that there are exogenous pressures for the population to grow; other things being equal, this pushes for more regulation (Hilber and Robert-Nicoud 2006). So let us consider the case in which $N(T^{Lobby})<N$ at equilibrium. Let $T^{Lobby} \equiv \arg\max_T \Omega^{Lobby}(T)$. In this case, for an interior solution, the first order condition of this problem can be written as

(28) $$\frac{N_T(T^{Lobby})}{N(T^{Lobby})}\left[T^{Lobby} + \tau\frac{N(T^{Lobby})}{2}\right] + 1 + \frac{\tau}{2}\cdot\left.\frac{\partial N}{\partial T}\right|_{T^{Lobby}} = 0$$

assuming that the second order condition for a maximum holds.

Compare this to (13) and (20), namely, to the optimal solution from the point of view the average non-marginal landlord. Here, the first term in the expression above is new; it captures the rents that accrue to landlords whose dwelling will be emptied at equilibrium by the increase high equilibrium T. Since this term is negative, $T^{Lobby}<T^{L}$, namely, the landlord's lobby takes this loss of revenue into account.

In the opposite case, namely, when $N(T^{Lobby})>N$ at equilibrium, then T^{Lobby} solves instead

$$\textbf{(29)} \qquad \frac{N_T(T^{Lobby})}{N(T^{Lobby})}\cdot\tau\cdot\frac{N(T^{Lobby})}{2}-\left[\frac{N(T^{Lobby})}{N}-1\right]+1+\frac{\tau}{2}\cdot\left.\frac{\partial N}{\partial T}\right|_{T^{Lobby}}=0$$

and is again larger than T^{L} for the same reason. Thus, in this respect, the qualitative result is the same. The difference comes from the fact that the regulatory tax is being felt for new developments (and is capitalized in the price of all), so this tax conveys no benefit to the owners of newly developed land.

What happens if homeowners or tenants are also organized? In either case, the incumbent maximizes an objective function that looks like (18) with b and c being also positive and equal to a=1. Thus, the reduced form objective function in such a model is exactly like a combination of the objective function of the probabilistic voting model and of (27), which is the special case a=b=c=1 in (18). If the maximand of this problem is an interior solution, then it lies between T^{Lobby} and T^{proba}. In this case, the equilibrium regulatory tax is decreasing in the homeownership rate.

Pre- and post-electoral politics

As we have seen, the 'influence for sale' lobbying model and the probabilistic voting model can be thought of as special, but non-trivial, special cases of the reduced form weighted social welfare function (18). They are also flexible enough to encompass a variety of sub-cases. For instance we have shown how the parameters b and c can capture economic variables such as the homeownership rate and sociological variables such as the ideological heterogeneity of various socio-economic groups.

An interesting combination is one in which the planner cares both about voters (because she might face re-election or because she is benevolent to some extent) and about lobbying contributions (because she needs the money to run again in the future or because she is corrupt). In this situation, her objective function is (18) with b,c>0 and a>0. If a is large compared to b and c, then post electoral politics are a very important determinant of policy choices. By contrast, if b and c are large compared to a then pre-electoral politics matter most in the determination of T. Finally, consider the situation in which homeowners and tenants are also organized and lobby the government, in addition to being voters. Normalize a to unity; in this case, b>1 and c>1 because W^T and W^O enter Ω twice – once as groups of voters, once as a contributing lobbies.

5. Conclusions

Homeowners favor land use regulation as many authors claim (e.g., Fischel 2003; Glaeser, Gyourko and Saks 2005b). However we have shown in this paper that this does not necessarily imply that a higher homeownership rate should be associated with tighter land use restrictions. Actually, the stylized facts we uncover in the introduction suggest the exact opposite: US metro areas with a larger fraction of homeowners are less regulated. Similarly larger cities and surrounding urbanized local municipalities with lower homeownership rates tend to be regulated earlier than suburban municipalities (with higher homeownership rates) at greater distance to the CBD.

So what does explain land use regulation? In a companion paper (Hilber and Robert-Nicoud 2006) we claim that more desirable and hence more developed places are more regulated. The underlying theoretical model is a lobbying model, in which the planning board maximizes the sum of contributions from land developers (owners of undeveloped land) and contributions from owners of developed land; in the mould of the 'influence for sale' lobbying model of Section 4, this is equivalent to maximizing aggregate land rents. In the terminology of this paper, the social welfare function puts an equal weight on both owners of developed land (homeowners and landlords of existing properties) and owners of undeveloped land depending on the aggregated land rents. The empirical findings for a cross-section of 82 US metro areas confirm the predictions of the model implying that land-use planning outcomes may not only be the outcome of a voting process but also that of lobbying. Future empirical research may shed further light on this proposition.

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Tables

Table 1: Relationship between Homeownership and Regulatory Restrictiveness

Metropolitan Area	Home Ownership Rate [i] 1990	Rank	Regulatory Tax in % of House Value [ii] 1998	Rank	Regulatory Index [iii] 1980s	Rank
Baltimore	63.6%	10	1.8%	11	0.80	8
Birmingham	68.2%	6	0%	12	-0.46	16
Boston	56.7%	17	18.6%	7	0.86	7
Chicago	61.0%	12	5.7%	10	-1.01	20
Cincinnati	63.7%	9	0%	12	0.16	12
Detroit	69.5%	3	0%	12	-0.69	19
Houston	55.1%	18	0%	12	-0.52	17
Los Angeles	48.2%	20	33.9%	3	1.21	4
Minneapolis	68.9%	5	0%	12	-0.16	15
New York	33.3%	21	12.2%	8	2.21	1
Newport News, VA	59.5%	13	20.7%	6		
Oakland	58.8%	16	32.1%	4	0.10	14
Philadelphia	69.7%	2	0%	12	0.47	9
Pittsburgh	70.0%	1	0%	12	0.26	11
Providence	59.1%	14	0%	12	0.35	10
Rochester, NY	67.9%	7	0%	12	-0.68	18
Salt Lake City	67.4%	8	11.9%	9	0.96	5
San Francisco	48.3%	19	53.1%	1	2.10	2
San Jose	59.1%	15	46.9%	2	1.65	3
Tampa	69.3%	4	0%	12	0.16	13
Washington, D.C.	61.3%	11	21.9%	5	0.86	6
Manhattan			>50%			

Pair:	Rank Correlation	Correlation
(Homeownership rate, regulatory tax):	-0.67	-0.52
(Homeownership rate, regulatory index):	-0.49	-0.65
(Regulatory tax, regulatory index):	0.65	0.68

Sources: [i] Homeownership rates are from the Census 1990 (tract level data geographically matched to the metropolitan area level). [ii] Estimated regulatory tax values are from Glaeser, Gyourko and Saks (2005a). [iii] Regulatory index values are from Saks (2005).

Appendix

In this appendix, we provide some microeconomic foundation for our assumption that, in general, homeowners' average tenure duration is larger than tenants' average tenure duration.

To do this, we assume that whenever tenants move out, they have to incur a transaction cost μ^T whereas, in similar circumstances, homeowners have to incur a cost μ^O ('μ' stands for 'moving'). There is a wide literature arguing that $\mu^O>\mu^T$ holds in practice.

To focus on endogenous tenure duration differences, let us look at steady state values of W^T and W^O. We assume that at each instant dt, there is a probability λdt that any household faces a change in its lifestyle that is big enough for it to consider moving out (the opportunity of getting a new job, of having children, etc.). When this happens, the household compares W^T or W^O with the corresponding outside option (i.e. $\bar{W}^T$ or $\bar{W}^O$). As in the text, households are heterogeneous in their valuation of the local amenities, so only a fraction $1-G(W^k+\mu^k-\bar{W}^k)$ of households of type $k\in\{O,T\}$ will actually move when hit by a shock. The implicit assumption is that when they are hit by such a shock, households draw a new idiosyncratic valuation of local amenities. To justify this, consider a household that learns that it is expecting a first child. In this case, the ideal city to live in might be quite different from a double-income-no-kid's ideal home.

In any case, the actual fraction of households of type k that decides to move at any moment in time, which we denote as λ^k, is given by

(30) $$\lambda^k \equiv \lambda[1-G(\mu^k+W^k-\bar{W}^k)], \quad k=O,T.$$

Thus, it follows that $\mu^O>\mu^T$ implies $\lambda^O<\lambda^T$, ceteris paribus.[12] In plain English, given that moving costs (transaction costs) are higher for homeowners than for tenants, then the latter are more likely to move out from jurisdiction J than the former when the identity of the household's ideal jurisdiction changes. As a result, average duration is larger for homeowners than for tenants, that is,

(31) $$\frac{1}{\lambda^O} > \frac{1}{\lambda^T}.$$

This completes the analysis.

[12] A sufficient condition for this inequality to hold throughout is that the difference in transaction costs is larger than the difference of the difference of economic benefits for the two types, namely: $\mu^O-\mu^T > (\bar{W}^O-\bar{W}^T)-(W^O-W^T)$.