The Value of Zoning

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Zoning is a control device under which local government attempts to separate land uses that it views as incompatible. In its usual form, zoning has two legitimate uses: correcting for the market's failure to allocate land in efficient *quantities*, and correcting for the market's failure to produce an efficient *spatial distribution* of uses. In the absence of zoning, the market reduces total community benefits below what they otherwise could be by overallocating land to "lower" uses that produce *negative externalities*, which flow to "higher" uses. In theory, zoning can achieve an efficient allocation of land use in the presence of externalities.

Some Characteristics of Zoning

When zoning is *cumulative*, or hierarchical, all land uses are placed somewhere in a hierarchy. So called higher uses (residential) are allowed to locate in lower use zones (industrial), but not vice versa. This form of zoning is based on the belief that negative externalities flow primarily in one direction, from lower to higher land uses. Negative externalities, or *external diseconomies*, are costs that flow outside of market transactions. Noise, air pollution, congestion, water pollution, and visual pollution, as well as blocked or otherwise altered natural light, are examples of negative externalities that lower (industrial) uses might impose on higher use (residential) land. Thus, with cumulative zoning, each zone that produces negative externalities can injure the uses in all higher zones and, in turn, can be injured by negative externalities produced in the lower zones. A resulting problem is that, in the presence of externalities that flow primarily in one direction, the market's allocation of land to various uses will be inefficient.

Notice that the hierarchy of land uses specified with a cumulative zoning ordinance relates only to the *direction* of the flow of negative externalities; a higher use in this context does not necessarily bear any relationship to the term *higher* in the context of discussing *highest and best use*. A cumulative zoning ordinance will generally have low density, single family detached housing as the highest use in the hierarchy. It is then common to progress to greater density single family and then multifamily uses. Commercial categories (typically office and retail) come next, followed by industrial (factory and warehouse), with both classified in categories ranging from light to heavy.

With regard to the impact of zoning on land values, there is some disagreement about the relative importance of scale effects and boundary effects. *Scale effects* concern the impact of the *quantity* of lower-use land on values in the higher use areas. *Boundary effects* concern the impact that higher use areas suffer from their *proximity* to lower use areas. Scale effects suggest that the quantity of land in the lower use affects higher uses equally throughout the relevant area; boundary effects suggest that the impact is limited spatially to a boundary strip. If negative externalities do not travel very far, then boundary effects are the more important determinant of efficient land use.

In the literature on externalities, variables such as the percentage of land in an identified area (perhaps a census tract) allocated to some lower use is sometimes found to be insignificant as a cause of variations among the area's land values. Alternatively, land value studies that focus on proximity to externality sources generally find value effects. One factor that seems to be especially significant is whether a property is in *sight* of the externality source. Of course, scale effects are largely irrelevant as a rationale for *zoning*, because the incompatible land use issue does not relate to scale. For this reason, and because studies based on actual data show boundary effects to be more important than scale effects, this article focuses on boundary effects.

A Model With Two Land Uses

Consider a tract of land separated into two zones: residential and commercial. Commercial uses, which are lower in the zoning hierarchy, are assumed to produce negative externalities that can injure residential uses. A residential use is assumed to be injured if it lies within a narrow strip next to the lower use zone. Users demand residential and commercial land because of the role that real estate fills as an input into production processes. For example, users are willing and able to pay for land because of its contribution to the production of valued residential or commercial services.

Generally, the amount that a user is willing to pay for a unit (think of an acre) of land declines as the quantity of land allocated to that particular use increases. The demand for land to be put to a given use can be represented by a downward sloping curve, such as that shown in Figure 1. However, as we are concerned with the interaction of two land markets (residential and commercial), we utilize a graphical technique that allows for the analysis of both markets simultaneously.

Figure 2a depicts this same downward sloping demand, along with other characteristics of the market. For example, the quantity of land available for residential *or* commercial use is shown as Q, measured along the horizontal axis. Note also that the demand for residential land is now represented with *two* curves: one for land on the *interior* of the residential area and one for land on the *boundary* with commercial uses. Because there is less demand for land burdened with negative externalities created by an adjacent lower use, the demand curve for residential land on the boundary is shown below that for land in the residential interior (at any given price, residential users have less desire for land on the boundary).

Figure 1

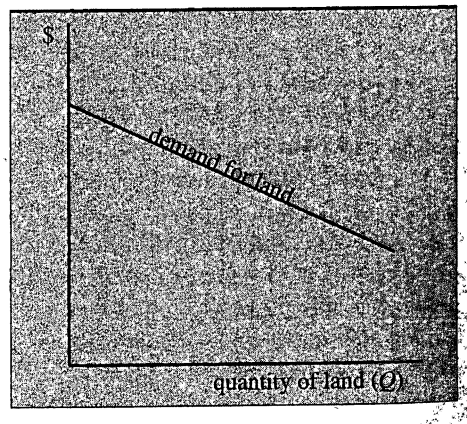
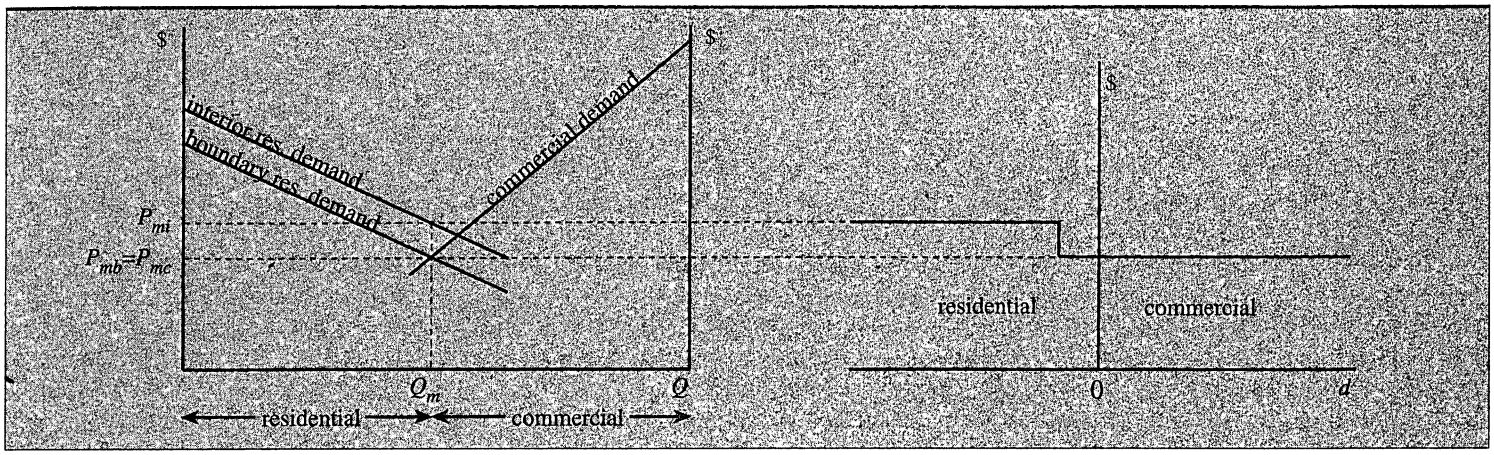


Figure 2a

Figure 2b



The vertical distance between these two curves is the *capitalized* cost, per unit of land, of the negative externality (the stream of future financial costs associated with the externality, discounted to a present value). Notice that the demand for commercial land is added to Figure 2a almost as a mirror image of residential demand. While the quantity of land allocated to residential uses is read from left to right in the figure, the quantity of land allocated to commercial uses is read from right to left. With this presentation of demand curves, the quantity of land allocated to one use is simply the amount that has not been allocated to the other.

Equilibrium Allocation: The Market

If left to its own devices, the market allocates land so that the price per unit at the boundary is equal in the two zones (*i.e.*, so that residential land affected by the externality sells for the same price as commercial land). The intersection of the demand for residential land on the boundary and the demand for commercial land occurs at Q_m. At this allocation, the price of residential land on the boundary, P_{mb}, just equals the price of commercial land, P_{mc}. The price of residential land on the interior, P_{mi}, is higher by the amount of the capitalized negative externality.

Figure 2b presents a less complicated picture of land pricing for the two uses. The vertical line represents the boundary between residential and commercial zones, with distance d from this boundary shown along the horizontal axis. Interior residential prices are higher than those on the boundary by the capitalized amount of negative externalities spilling over from commercial uses. Though the width of this boundary area is determined by technical factors (*e.g.*, how far into the residential area the negative impact of commercial use can be seen), the boundary's total area depends on the spatial distribution of residential and commercial land. The market's allocation, which equates prices at the boundary, is an *equilibrium* allocation; that is, there is no market pressure for land use to change.

An Aside: Positive Externalities

Thus far we have implicitly assumed that commercial users are indifferent to being near residential uses. In other words, residential land produces neither *negative* nor *positive externalities* for adjacent commercial users. If positive externalities prevailed, then land pricing would be similar to that presented in Figure 3. Each use has two demand curves, with interior commercial demand shown as *lower* than demand on the boundary by the capitalized value of *positive externalities* spilling over from the residential use. Thus, the price on the boundary is lower than for interior residential land, but higher than for interior commercial land.

Optimal Allocation

An optimal zoning policy would maximize the sum of land value and *consumer surplus*: all of society's benefits associated with land use. A policy that equates the interior prices of all land use zones (*i.e.*, holding other value determinants constant) will achieve this optimality.

Figure 3a

Figure 3b

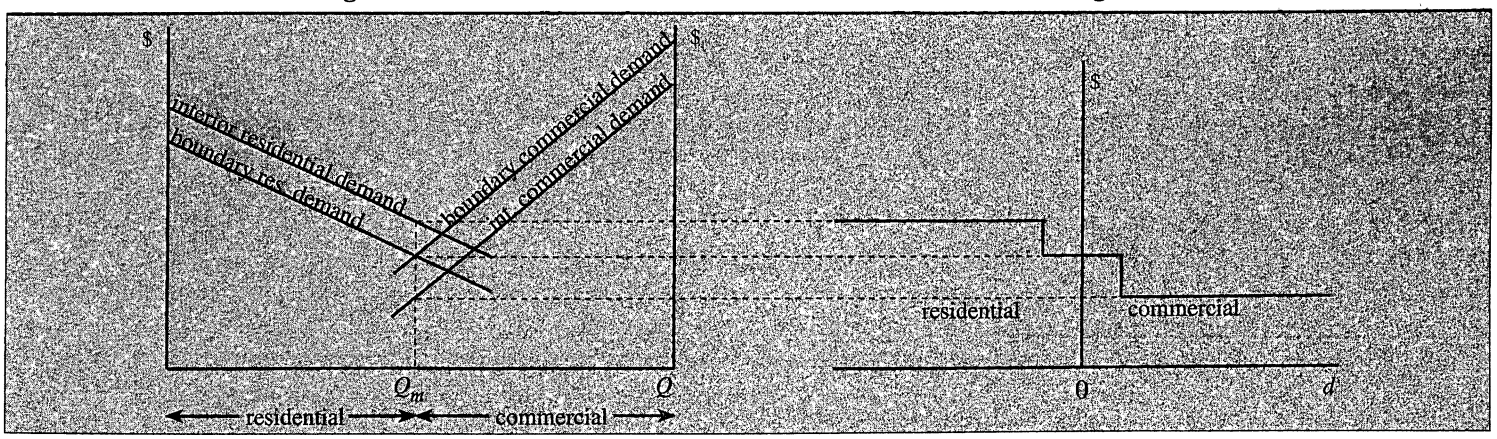


Figure 4a

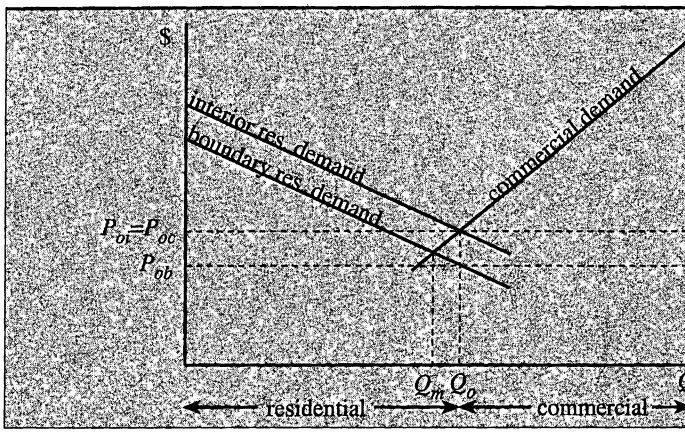
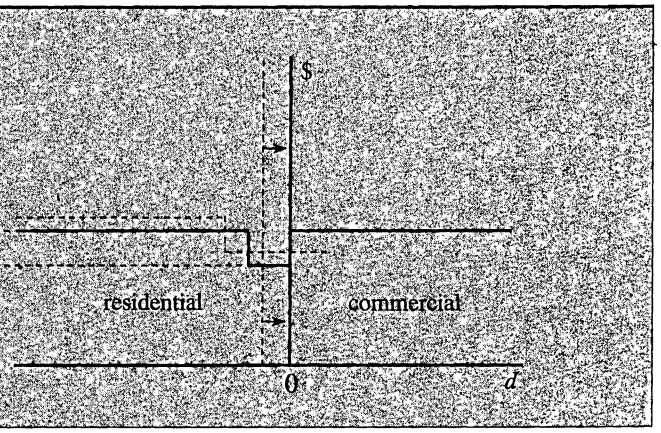


Figure 4b



The zoning policy that brings about an optimal allocation of land use is presented in Figure 4a. The optimal allocation, shown as Q_o, is the allocation that equates the price for residential land in the *interior*, P_{oi}, with the price of commercial land, P_{oc}. The price of residential land on the boundary is less than this amount by the capitalized value of the negative externalities.

Zoning that equates prices in the interiors of zones allocates more land to the higher use than does the market allocation. This situation is evident in Figure 4a (which can be compared to Figure 2a). With optimal zoning, the boundary shifts toward the right, effectively increasing the area available for residential and constraining commercial use. Thus, optimal zoning constrains the amount of land available to lower uses, in turn causing price for the lower use to rise and price for the higher use to fall.

Figure 5 reveals the difference in benefits between the market's allocation of land and that brought about by optimal zoning. The market allocation is illustrated in Figure 5a. Residential land value, which is the per-unit price of residential land in the interior multiplied by the quantity of residential land, is represented by the striped region to the left of Q_m. Commercial land value is the striped region to the right of Q_m. Consumer surplus (what users are willing to pay over and above the price) for each land use consists of the solid shaded triangular areas under the respective demand curves.

Recall that on the boundary, the price of residential land is lower than in the residential interior by the negative externalities' capitalized value. In Figure 5a, the amount by which residential land value would be greater in the absence of boundary effects is represented by the dark solid rectangle. The rectangle's area equals the area of the boundary times the difference in per-unit prices for the residential interior and the boundary. Of particular importance is the small unshaded triangle, whose area represents a *deadweight loss* (a potential benefit that no one realizes because of inefficiency). Thus, if there are negative externalities, boundary effects reduce combined benefits from residential and commercial use.

When land is allocated optimally, there are still boundary effects that affect the total benefits from land use. But more land is allocated to residential, such that prices in the interiors of the two zones are equated. This optimal allocation is illustrated in Figure 5b. It is clear that benefits under the optimal allocation exceed those under the market allocation; there is no deadweight loss in Figure 5b.

Yet optimal zoning has a problem as well: unlike the market's allocation of land uses, optimal zoning *does not represent an equilibrium*. That is, if the interior prices are equal, then boundary prices must be unequal, a situation that presents opportunities for *arbitrage*. An individual could buy on the low-price side of the boundary and sell on the high-price side, thereby shifting the boundary to the point where the boundary prices were equal. Therefore, optimal zoning is not equilibrium zoning, because of the tremendous market pressures associated with optimal zoning. The only way to

Figure 5a

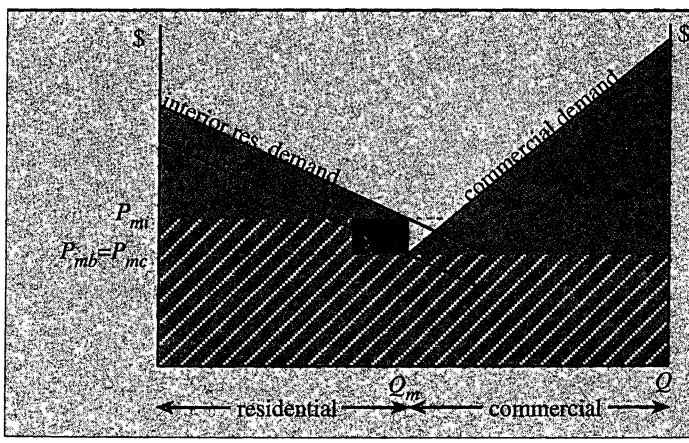


Figure 5b

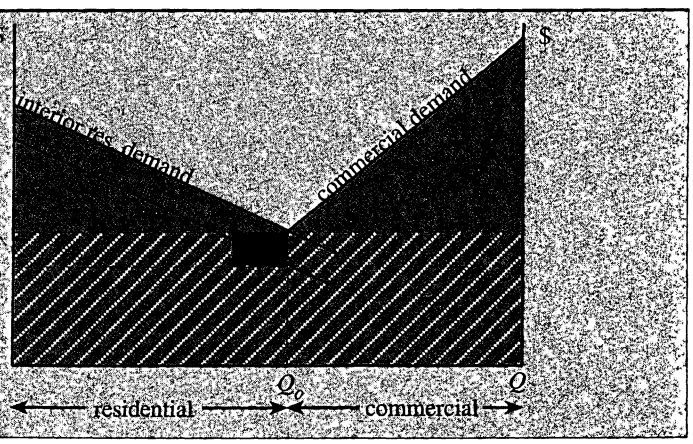
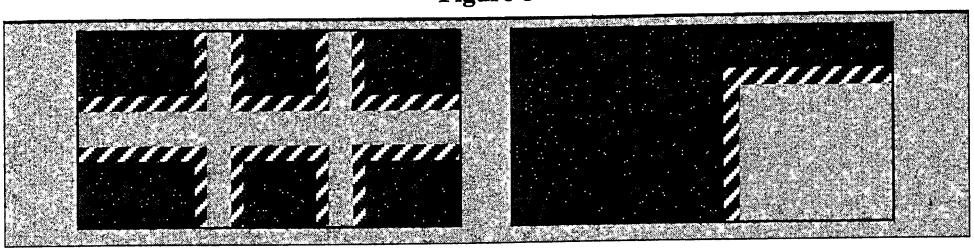


Figure 6



cause optimal zoning to represent an equilibrium is to introduce a price (an *impact fee*) in connection with a zoning change; this fee would be set to equal the price differential at the boundary between land uses (see "Impact Fees: Some Further Ruminations," *Illinois Real Estate Letter,* Winter/Spring 1996). This fee would have to be less than the capital gain associated with the change in land use – except in equilibrium. It would also have to substitute for current zoning processes; it would be totally inappropriate to add this fee on to current requirements.

Spatial Allocation

The discussion of optimal zoning has been concerned, up to this point, with increasing community benefits by allocating the right quantities of land to different uses. However, truly optimal zoning would also involve minimizing the boundary area. The previous section explains how community benefits are reduced by the per-unit price difference between the residential interior and the boundary, multiplied by the size of the boundary area. While government can do nothing productive about the price difference, zoning can minimize the size of the boundary area. In other words, zoning officials should strive to minimize the length of the boundary. Zoning policy can accomplish this goal by limiting growth of the lower use zone to sites that are contiguous with existing lower use properties, and in other ways.

Figure 6 might be viewed as a zoning map. The left side depicts typical spatial distributions of commercial and residential uses, where growth in commercial activity has proceeded in strips along major streets. Dark shaded areas represent residential use, while stripes indicate residential boundary areas. Unshaded area represents the commercial use taking place along the tract's main roads. The problem with this allocation is the large amount of residential land bordering the commercial district. A more socially desirable spatial distribution is depicted on the right side, with the same amount of commercial use restricted to a contiguous area. This allocation reduces boundary effects, thus increasing community benefits by increasing the total value of residential land.

Typical Zoning

The preceding paragraphs examine how the market allocates land uses by equating prices on the boundaries of land use zones, and how optimal zoning would equate prices on the interiors of these zones. However, it is not uncommon for the land prices observed in communities to follow neither of these patterns.

In fact, it is most typical for zoning to result in prices in the interior of the lower zone that *exceed* the price in the interior of the higher zone (people generally *expect* that land zoned commercial should sell for more than land zoned residential). This type of zoning is depicted in Figure 7. How does such a phenomenon come about? Optimal zoning constrains the lower use below the market allocation (to equate interior prices), but typical zoning constrains the lower use even more, to something like Q_t. The dashed vertical line in Figure 7b shows the boundary under optimal zoning; the solid line represents the boundary under more typical zoning. In this scenario, the commercial land price, p_{tc}, is higher than that of interior residential land, p_{ti}, with other factors held constant (an outcome that creates its own pressure for changes in the allocation of land to different uses).

Conclusion

Zoning can correct for the market's inability to allocate land efficiently across different uses. Zoning is optimal when land is allocated to the various uses in quantities that cause the prices on the interiors of land use zones to be equal, and that minimize boundary lengths between zones. However, this optimal zoning does not represent the market equilibrium condition, in that there are market pressures for boundaries to shift. Typically, zoning *over*constrains, holding lower uses below their optimal quantities and causing prices for land in the interior of a lower use zone to exceed prices in the interior of a higher use zone (and we might note that the administration of zoning imposes its own costs on society). ■

Figure 7a

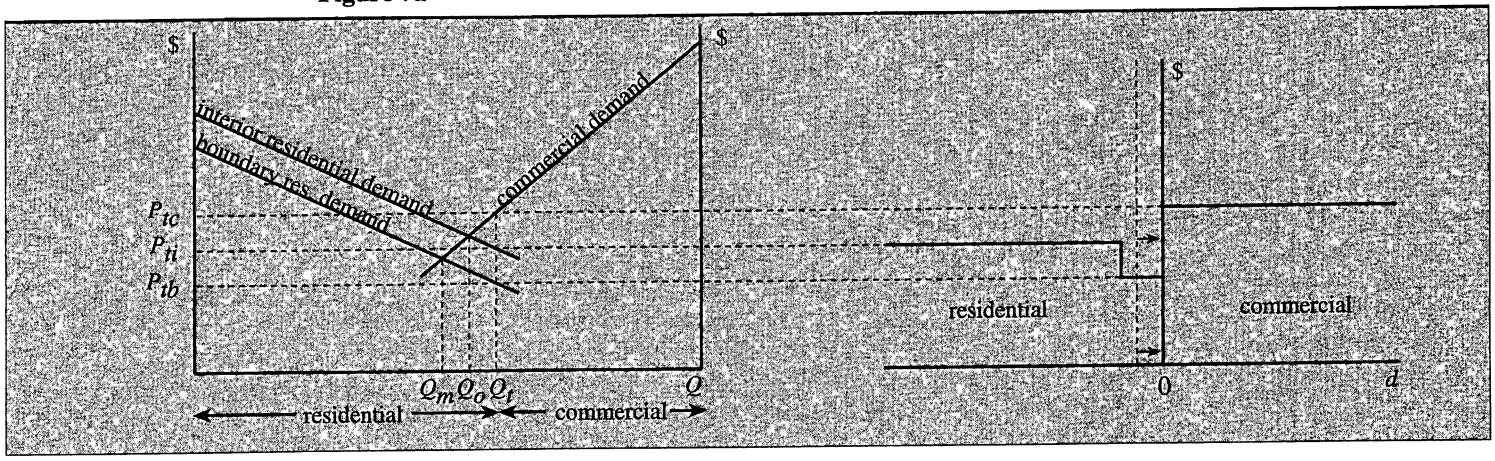


Figure 7b