The Sprawl of Economics:
A Response to Jan Brueckner

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Abstract

Under a variety of labels, *smart growth* has risen rapidly in popularity in the United States. The reasons for this rapid ascendance are multiple—increasing traffic congestion, rising property taxes, continued loss of farmland and open space. But a significant contributor to the growing popularity of smart growth has been the work of an active and vocal set of interest groups including Smart Growth America, The Smart Growth Network, the Congress for New Urbanism, and many others. The remarkable success of smart growth advocates, however, has not gone unnoticed by interest groups with opposing points of view. Such interest groups contend that urban sprawl is simply the result of "natural" market forces and that the remedies to sprawl offered by smart growth advocates are certain to do more harm than good. Proponents of this point of view include The Reason Foundation, the Heritage Foundation, and The Thoreau Institute

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Introduction

Under a variety of labels, *smart growth* has risen rapidly in popularity in the United States. The reasons for this rapid ascendance are multiple—increasing traffic congestion, rising property taxes, continued loss of farmland and open space. But a significant contributor to the growing popularity of smart growth has been the work of an active and vocal set of interest groups including Smart Growth America, The Smart Growth Network, the Congress for New Urbanism, and many others.[1] The remarkable success of smart growth advocates, however, has not gone unnoticed by interest groups with opposing points of view. Such interest groups contend that urban sprawl is simply the result of "natural" market forces and that the remedies to sprawl offered by smart growth advocates are certain to do more harm than good. Proponents of this point of view include The Reason Foundation, the Heritage Foundation, and The Thoreau Institute.[2]

Until fairly recently, academic economists had written very little on this subject. According to Edwin Mills (1999),

> Academic economists have weighed in on issues relating to suburbanization. Their most important contributions have been in the areas of metropolitan location and spatial analysis, local government tax and expenditure analysis, and the analysis of interactions between metropolitan transportation and spatial issues. Yet, remarkably, academic economists have written almost nothing on the general government policy issue of allegedly excessive metropolitan suburbanization.

In recent years, that has changed; and for the most part, economists have joined the chorus of voices opposed to smart growth. Most economists contend that if urban growth is excessive, the best way to attack the problem is to use various forms of prices, taxes, and fees to discourage it.[3]

In this paper, I respond to economists critical of smart growth and challenge the suggestion that prices, taxes, and fees are sufficient for addressing the problem of urban sprawl. I proceed as follows. I begin by presenting the conventional view of economists

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[1] See http://www.smartgrowthamerica.org; http://www.smartgrowth.org, http://cnu.org.

[2] See http://www.reason.org, http://www.hertiage.org, http://ti.org

[3] See Brueckner, Jan, 2000, Urban Sprawl: Diagnosis and Remedies, *International Regional Science Review*, 23, 2: 160–171, and Mills, Edwin S., 1999, Truly Smart "Smart Growth," *Illinois Real Estate Newsletter*, 13:3, 1-7.

drawing primarily on a paper by Jan Brueckner. I then critique the "pricing" approach by making three arguments. First, if urban expansion, or falling urban densities is the primary problem, there is no theoretical reason why pricing is necessarily a superior approach to direct control. Economists who have looked closely at this question in other contexts conclude that the optimal approach depends critically on the institutional aspects of the problem. Second, I argue that the problem of urban sprawl involves much more than urban expansion or falling urban densities. A burgeoning literature now demonstrates that social welfare is a function of many attributes of urban form. Third, much of the character of urban growth is shaped by public investments in road networks, sewer systems, and public parks. These public investments—especially the critical elements of their design—are largely unaffected by the price system.

I conclude by asserting that the pricing approach to urban sprawl is a necessary but not sufficient approach to the problem. Clearly it is important to get prices right and to use economic incentives when appropriate. But getting the prices right will never adequately address some of the most critical elements of the urban form. A comprehensive, and less ideological, approach to urban sprawl will require the use of prices, taxes, fees, public investments, public-private partnerships, planning, *and* land use regulation.

Economists On Urban Sprawl

In an early and widely read paper, Wilbur Thompson (1968) characterized the "City as a Distorted Price System." Thompson argued that many urban problems stem from imperfect or nonexistent prices and that greater use of the price system should be used to "ration existing facilities", "guide the distribution of income", and "increase the range of choice." Imposing a toll during peak hour, Thompson suggests, is one example of how prices can enlarge the range of choice.

Jan Brueckner (2000) offers a classic statement on the economics of urban sprawl making several points. First, he contends that urban expansion, or falling urban densities, has been occurring for many years all over the world, and is primarily the result of three "natural" market forces: population growth, rising incomes, and falling transportation costs. Rising populations cause urban areas to expand to accommodate more residents. Rising incomes, with positive income elasticities of demand for space, cause residents to demand more urban space per person. Falling transportation costs enable residents to live at greater distances without increases in expenditures. If urban areas expand for largely these three reasons, he argues, there is no compelling need to contain urban growth.

Brueckner then claims that urban expansion can be excessive for at least three reasons. First, undeveloped land may be underpriced. That is, land used for forests, farming, or other unimproved uses may provide benefits to urban residents that are not captured by the owner of the land. For this reason, the undeveloped land owner may sell or develop land for urban uses even though the social value of the land in its undeveloped state is greater than the social value of the land in a developed state. Under these conditions, too much land will be developed for urban use. The appropriate policy response to this

problem, according to Brueckner, is the imposition of a development tax that lowers the value of the land for urban development to a more appropriate level.

Second, Brueckner argues, automobile travel may be underpriced. When highways are congested, motorists impose costs on other motorists when they travel on the highway. As a result, the marginal cost of an additional motorist exceeds the average costs of that motorist—the price actually paid—and from a social welfare perspective, too many motorists travel too far for too long. The appropriate policy response to this problem, according to Brueckner, is the imposition of a congestion fee that raises the cost of travel to its true social cost. In a similar, though less widely cited article, Mills (1999) argues that automobiles impose more general environmental externalities (e.g., tail pipe emissions) and therefore gas should be taxed by an amount that equals these external costs. Although their diagnoses of the problem and policy recommendations are slightly different, both Mills and Brueckner agree that urban sprawl should be addressed by increasing the cost of automobility.

Third, Brueckner argues, other forms of public infrastructure—such as schools, sewer services, police and fire protection—may also be underpriced. If, as in the case of highways, these other forms of public infrastructure are congested, then the marginal capital cost of an addition resident exceeds the average cost of existing residents. In this case, property taxes, which generally equal the average cost of public infrastructure, are too low, and urban areas expand to include too many residents. The appropriate response to this problem, Brueckner argues, is the imposition of impact fees that equal the marginal cost of public infrastructure. In an extension of this argument, Knaap, Ding and Hopkins (2001) demonstrate how such optimal impact fees should increase over time as congestion increases and should fall abruptly after new investments in public infrastructure are made.

In sum, Brueckner argues that much of what constitutes urban sprawl is the result of natural market forces. Excessive urban growth, however, is caused by imperfect pricing and should be addressed by correcting those prices. Addressing such problems by directly restricting the growth of urban areas—via zoning or urban growth boundaries—he suggests, could have "draconian" effects.

If Excessive Urban Spatial Growth Is The Problem, Is Pricing The Solution?

While Brueckner's analysis of urban growth is sound, his case for using prices over land use controls is weak. Brueckner's case for prices is based on two propositions: (1) congestion costs and impact fees are relatively easy to estimate and (2) land use controls such as UGBs can have draconian effects. While excessively tight UGBs can indeed have draconian effects, so can excessively high taxes or impact fees. In general, whether it is better to impose fees or direct controls depends on the relatively difficulty of estimating appropriate fees or quantities, the risk of error in the estimation of each, and the likelihood that local governments will impose either at the appropriate level. These are all complicated issues.

Although Brueckner suggests that congestion costs and impact fees are relatively easy to calculate, the difference in recommendations for pricing automobility between Brueckner and Mills suggests that pricing task is not all that simple. Is it better to price congestion on specific highways or to impose higher taxes on gasoline? Should congestion fees be higher during peak-hour traffic and lower for carpools? Should gasoline taxes be higher in cities with stagnant air sheds where emissions do more damage? If local governments choose to impose impact fees, how do they estimate marginal capital costs of infrastructure when public infrastructure is expanded in large lumpy investments? Should impact fees vary with the size and location of the housing unit and the level of school congestion at the time the unit is built? If local governments impose open space development fees, should such fees vary by the type and location of open space as well as by the amount of open space that already exists? In short, is it any easier getting prices right than it is to get quantities right?

Whether prices or direct controls are the chosen approach, the level of fees or size of the urban area will be a political decision. Is there reason to believe that local governments are more likely to impose optimal fees or optimal growth areas if both such optimal levels could be determined? There is an extensive literature that suggests local governments use land use controls to exclude low income residents and constrain growth. But there is also growing evidence that local governments use impact fees and exactions do the same (Altshuler et al 1993).

Is Sprawl Primarily A Matter Of Density?

Sprawl has many defining characteristics, including low density development. But there are many others. While most economists still define sprawl in terms of density or rent gradients, Malpezzi (1999) defines and computes 10 measures of sprawl all based on US Census data on household and employment location. Where metropolitan areas rank on Malpezzi's sprawl indexes varies extensively, depending on the measure used. Using similar data and more complex methods, Galster et al. (2001) compute a number of additional measures of urban sprawl. These include density, contiguity, centeredness, and more. Ewing et.al (2002), computed an aggregate sprawl index based on several measures of urban form.

The limitations of density as a measure of urban form are cleverly illustrated by Duany and Plater-Zyberk (1992) in Figure 1. The top half of the figure illustrates a typical suburban neighborhood design while the bottom half illustrates a traditional or new urbanist neighborhood. The density of development in both halves of the Figure, however, is the same. The primary difference between the two development types is the mixture of uses and the connectivity of the road network. In the typical suburban neighborhood, where uses are separated and roads are poorly connected, it is impossible to travel from one use to another without traveling on the arterial road. This has several potentially adverse effects:

- The arterial will have more traffic;
- Children in the low density housing are less likely to play with children in the high density housing;
- Few residents, if any, will walk or bicycle to the mall;
- Few children, if any, will walk or bicycle to school;
- Both the school and the mall will need bigger parking lots;
- More driving, larger parking lots, and greater income separation can have adverse health, environmental, and social impacts.

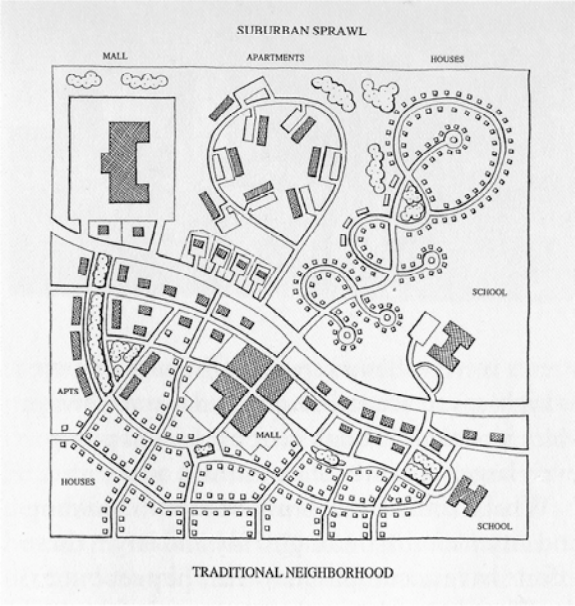

Figure 4.1

To be fair, it is clear that neighborhood design can not solve every urban health, environmental, or social problem. Economies of scale in education and retailing will require students and customers to travel on the arterial from other parts of the metropolitan area. The majority of residents of both neighborhoods will likely work in other parts of the metropolitan area as well. Finally, the benefit of greater internal accessibility in the traditional neighborhood comes at the cost of greater internal traffic exposure. So there are trade-offs which, at the some level, can be confronted in a competitive market of subdivision design, but at the larger scale, the design of cities is determined by public policy.

In a lengthy survey of literature across several disciplines, Knaap et al (unpublished) demonstrate that measures of form vary widely across disciplines. In general economists focus on spatial patterns of populations and employment over entire metropolitan areas, transportation planners tend to focus on distances between origins and destinations within metropolitan areas, planners tend to focus on spatial patterns of developments within parts of metropolitan areas, natural scientists focus on the spatial patterns of patches

outside metropolitan areas, and urban designers focus on streets, facades, and building design.

These multiple measures of urban form would not be relevant to economists if they had no impact on utility or social welfare. But ample evidence suggests that they do. Visual preference surveys reveal that individuals have clear and consistent preferences regarding neighborhood design (Nelessen 1994). Conjoint nalysis of these preferences reveals that individuals are able to trade certain features against others in a consistent fashion. Further, many measures of urban sprawl are capitalized into land values. Song and Knaap (2003) showed that individual measures of urban form, such as density, distance from open space, and distance from transit stations had adverse effects on property values, while commercial accessibility, internal connectivity and external disconnectivity have favorable effects on property values. These findings have two important implications. First, many of the attributes that define urban form—besides density--have impacts on household utility and thus social welfare. Second, a comprehensive pricing approach to urban sprawl requires that the prices of all of these attributes must be right as well.

Public Determinants of Urban Form

Given that urban form has multiple dimensions, it is reasonable to ask: what are the primary determinants of urban form? Clearly, density is a critical factor; and density is primarily a function of lot size and the price of land. But at least three major determinants of urban form are directly shaped by public policy with little or no direct influence by prices or market forces. These include the networks of highways, roads, sidewalks, bike paths, and transit service; networks of sewage treatment plants and pipes; and increasingly networked parks, greenways, and natural areas.

Transportation Networks. It is difficult to dispute that transportation networks have great influence on urban form. Every urban economics text explains the structure of the city in terms of a trade-off between land prices and accessibility to jobs. It takes only a marginal extension of this logic to understand that urban form is largely shaped by transportation infrastructure. Strong empirical evidence that highways shape urban development patterns is offered, for example, by Boarnet and Haughwout (2000).

At the neighborhood scale, urban form is also strongly shaped by transportation infrastructure. According to Southworth and Owens (1993):

> Street patterns are one of the primary design elements at the community scale. They invariably constitute the first marks of settlement on the undeveloped landscape at the fringe. As the basic skeletal structure of communities, streets both divide and connect urban space. They affect environmental interaction by dictating the means of access between home and other places. They determine where residents can go and what they observe and interact with along the way, providing, in a sense, public windows to a shared world.

Examples of the powerful influence of transportation networks on urban form are offered in Figures 2-4. Figure 2 illustrates the grid pattern of Philadelphia, as originally designed in the 17th Century by William Penn. Penn desired a city with large open spaces and shaded avenues oriented to the Delaware River. As the population increased, row houses replaced single-family structures and large blocks were divided into smaller rectangles. The basic structure of the original grid layout, however, remains to this day.

Figure 3 illustrates the urban form of Central Amsterdam. As shown, three canals and the dammed river in the center of the city shaped the pattern of urban growth in Amsterdam for centuries. Rings of canals surround the city center with larger basins and docks. To circulate land traffic, roads were built along dikes. People and goods were transported along both roads and dykes and buildings were designed accordingly.

Figure 4 illustrates the urban form of Calcutta. As shown in Figure 4, growth of Calcutta intended to follow a gridiron plan, though the irregularity in size, shape, form, and placement of structures leaves little evidence of this. There are three throughways running north/south and seven running east/west in addition to circular roads. Plagued by explosive population growth and wrought with drainage and sanitation engineering problems, the city has been prone to epidemics and cholera.

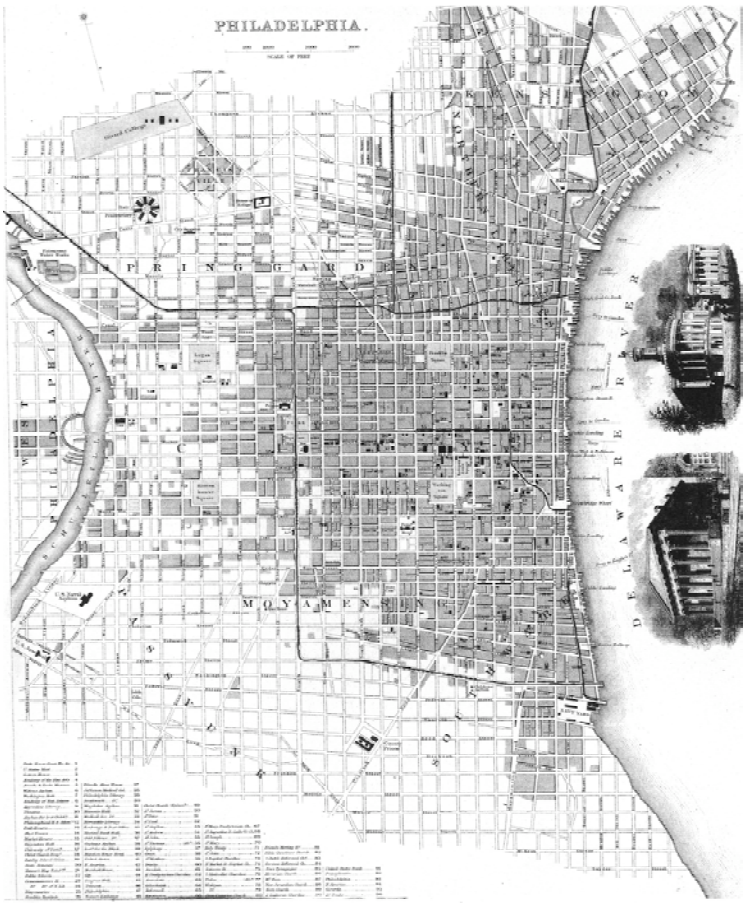

Figure 4.2

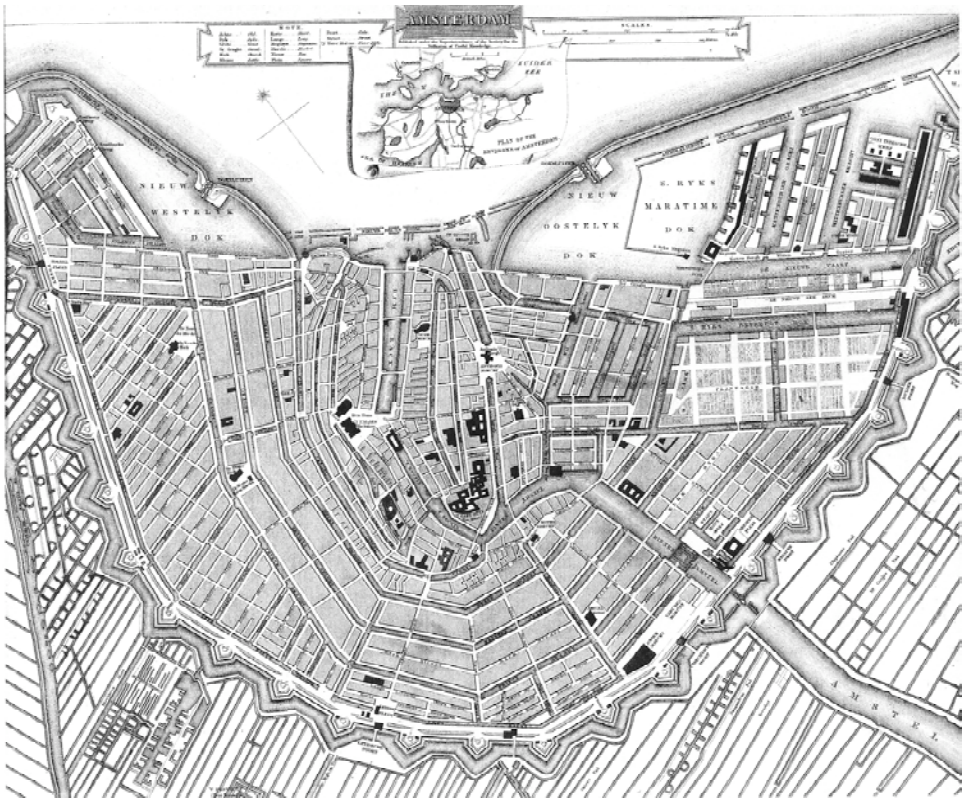

Figure 4.3

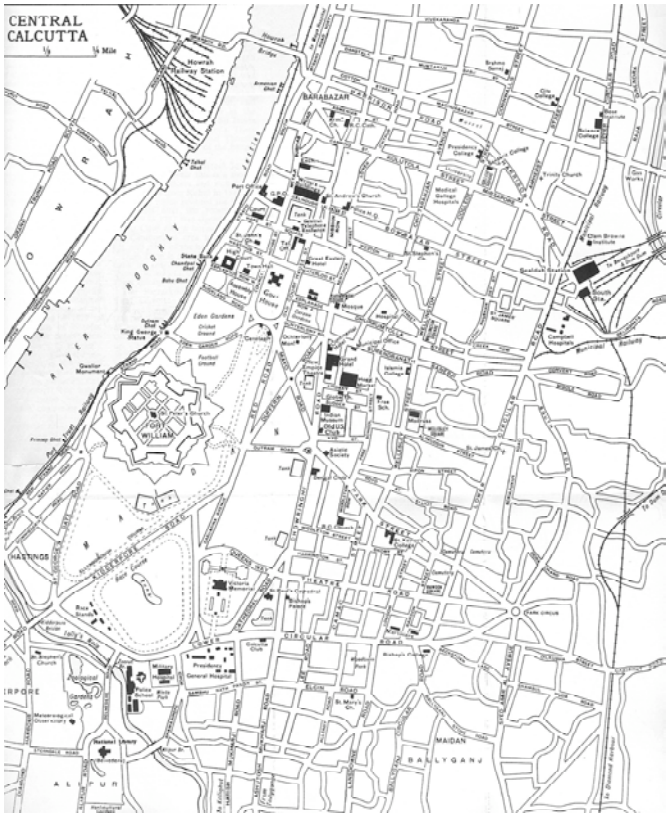

Figure 4.4

In sum, transportation infrastructure is clearly a major determinant of urban form. It shapes the character of neighborhoods and the relationship between neighborhoods. And while it might be advantageous to ration the capacity of transportation infrastructure using gas taxes, congestion fees, and tolls, it is hard to imagine that such pricing instruments can have much of an effect on street network design.

Sewer Service Networks. Other major determinants of urban form are wastewater service networks. According to Tabors, Shapiro, and Rogers (1976):

> Because of the fragmented and uneven manner in which zoning policies have been applied, they have not been the sole or even the major factors in determining land use patterns in the United States. In many areas location of major public facilities tends to be far more significant in determining actual land use patterns than zoning. There can be no doubt that the federal highway program, in particular, has had a significant impact on where American live and work. More recently, it has been recognized that the provision of public sewerage is having a similar secondary impact on land use development. (p.3)

Recent empirical evidence on the influence of sewer service networks on urban development patterns is offered by Hanley and Hopkins (forthcoming). Hanley and Hopkins demonstrate, using dynamic game theory, that development closely follows investments in sewer service infrastructure.

Hopkins (2006) offers a further illustration of the importance of sewer networks in Figure 5. Figure 5 illustrates the sewer network annotated with pipe design capacities for Urbana, Illinois. As shown, the entire network flows to a treatment plant in the east-central part of town. Treatment capacity diminishes in pipes upstream from the treatment plant. Flow capacity is also constrained at several lift stations. A brief consideration of this illustration reveals several insights. First, private development at all levels of density is must be coordinated with the distribution and treatment capacity of the sewer network. Poor coordination could have draconian environmental or fiscal impacts. Second, the layout of primary sewer interceptors must have large-scale and long-term impacts on development patterns. Thus it would be difficult to underestimate the effects of sewer-system design on urban form. Finally, it is hard to imagine a system of taxes or fees that is capable of efficiently allocating sewer service capacity over time and space without complementary land use planning and regulations.

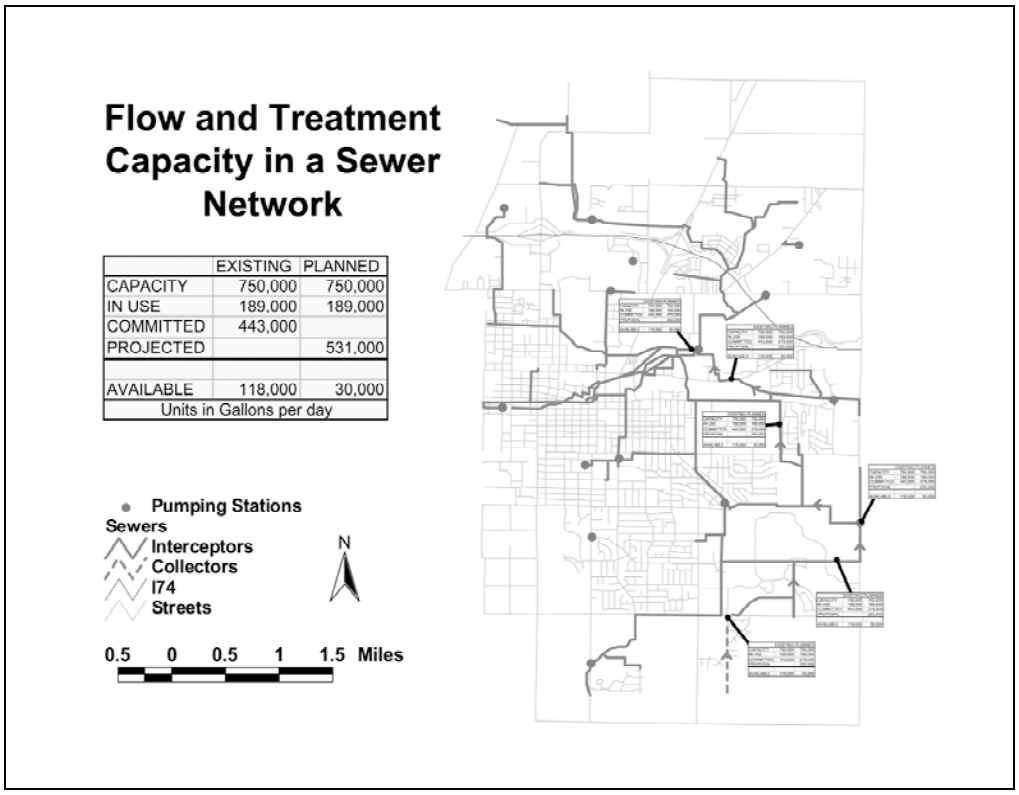

Figure 4.5

Public Parks and Open Spaces. A third major determinant of urban form is the network of public parks and open spaces. Although perhaps less influential than networks of roads and sewer pipes, networks of parks and open spaces also have a powerful and perhaps increasing influence on urban form. Figure 6, for example, illustrates the variation in property values on Manhattan Island in relation to Central Park. From the Figure one can clearly see how property values are higher near the park, especially on the eastern edge. Similar effects have been confirmed by a large literature in economics on the subject (Cromption 2001). Figure 7 illustrates the variation in household income in Washington, DC, relative to Rock Creek Park. Although it is not clear that Rock Creek Park was the cause of such a socially divided region (Brookings Institution 1999), it would be hard to deny that the Park helps sustain the division. Both cases illustrate the the location of parks—by local governments—have had major and longstanding effects on urban form.

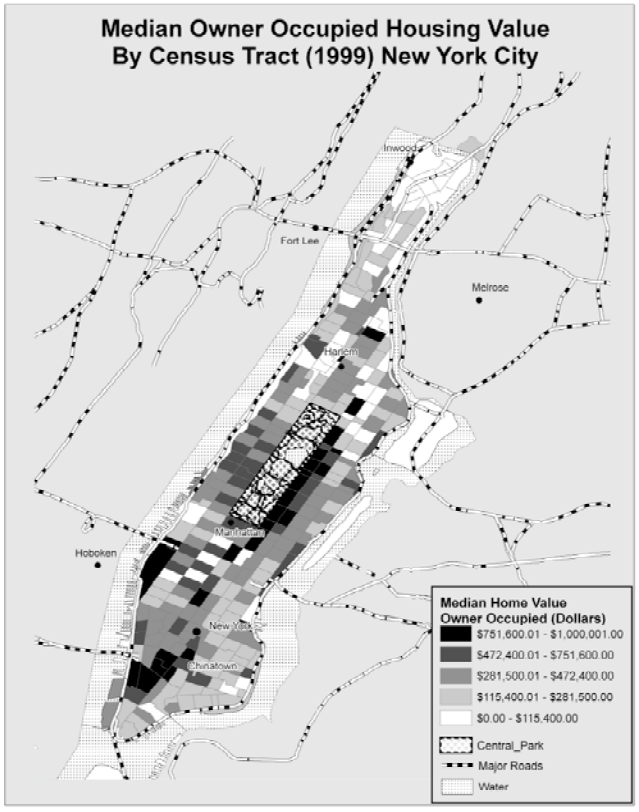

Figure 4.6

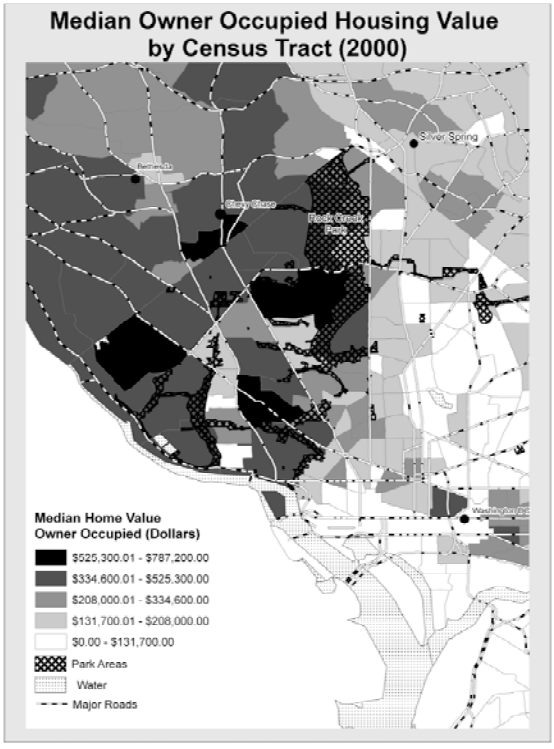

Figure 4.7

Prices, Regulations, Or Something Else?

The analysis above suggests that urban form is defined by multiple attributes only some of which are determined in markets. If so, then a pure pricing approach to urban sprawl is surely inadequate. Thus, both pricing and regulatory tools are needed. Recognizing this, Brueckner (2000) states:

> Because the stakes are high in the debate on sprawl, it is important to gain an understanding of the forces that might lead to excessive spatial growth of cities and to understand the nature of appropriate remedies. In working toward this understanding, the ensuing discussion does not address an issue frequently raised in criticisms of urban sprawl, namely, the proliferation of unattractive land uses such as strip malls and fast food outlets. Because this complaint concerns the character of development rather than its spatial extent, it lies outside the definition of urban sprawl used here. Although ugly development cannot be banned, a remedy for this problem lies in the use of zoning regulations and other tools of urban planning, which allow land use to be channeled toward more aesthetic outcomes. These tools can complement the policies discussed below, which are designed to limit the extent, rather than the character, of development.

But as the discussion above makes clear, the problem of urban sprawl extends beyond density, ugly strip malls, and fast food outlets. It involves the complicated problem of coordinating private investments in residential neighborhoods, industrial parks, and commercial centers with public investments in roads, sewer lines, and parks. Brueckner recommends that local governments plan for investments in public infrastructure, but use taxes and fees to guide the developments such infrastructure serves. Holcome (2001) offers more specific recommendations:

> The first step in the process would be to map out the area's major transportation corridors. In a growing area, this may mean determining where major thoroughfares will go in areas that are now primarily rural in character. The second step is to secure the right-of-way in undeveloped areas; this will be cheaper than trying to buy up land in already-developed areas……..When the right of way is secured, it must be adequate for its future purpose, and thus be wide enough to accommodate limited access divided highways, perhaps a rail line, interchanges at points where major thoroughfares will meet, and access roads so that local traffic will not be congesting major traffic thoroughfares… Once the right of way is secured, the next step is to build the roads. However, while the right of way to accommodate the future traffic must be secured, roads only need to be built to accommodate the current level of traffic…….If transportation arteries are built in this way, and if the right of way is secured and two-lane roads are built until more capacity is needed, land use patterns will evolve efficiently without any government planning for private land use. (p. 150)

In Holcome's conceptualization, urban development is a recursive process where local governments first ascertain and build desired, if not optimal, road networks; based on

these networks, private developers and landowners build neighborhoods and commercial centers. Knaap, Hopkins and Donaghy (1998) offered a more formal version of this conceptualization in which local governments signal their investment intentions in transportation plans. In this way, the market captures the expected impact of road investments and development decisions are adjusted accordingly. Knaap, Ding, and Hopkins (2002) offer empirical evidence that signals provided in transportation plans are indeed capitalized into land values and development decisions.

But even if plans for transportation investments are credible and clear, there will be variation in response to any government plan. And stochasticity in the timing and density of development is disadvantageous if trying to maximize efficiency in the utilization of public infrastructure. Road networks, sewer pipes, and to some extent even public parks are designed to meet specific traffic, wastewater, and population standards. And, from an infrastructure perspective, it is most efficient to have traffic, wastewater loadings, and urban populations rapidly reach and closely match design capacity. Thus any gains in private flexibility and freedom realized via a pricing approach might be lost in the variable and thus inefficient utilization of public facilities. Further, as Holcome's illustration makes clear, investment decisions in public infrastructure and private buildings and improvements are interdependent, not dependent. That is, optimal investments in transportation—and other forms of public infrastructure—are dependent on the extent of private investments just as the other way around. When development decisions are interdependent, optimality can be achieved via a variety of institutional approaches, but signaling through prices and plans is not likely to be most effective (Hopkins 2001).

In a widely distributed PowerPoint presentation, the case for smart growth is made using the sequence of three illustrations below. The Figure 8 is presented as a "typical" development in the United States while Figure 9 and Figure 9 are presented as successively "smarter" forms of development. While perhaps not everyone would prefer to live in Figure 9, a large number of citizens probably would—and would pay a price premium to do so. Suppose then, for the sake of illustration, that a sufficiently large segment of the population would prefer to live in Figure 10. Could this type of development occur if the local government simply built the road, charged a congestion toll, assessed an impact fee, and imposed a development tax? It seems highly unlikely. If not, then a potentially large segment of the population is disserved by the standard economic prescription.

Figure 4.8

Figure 4.9

Figure 4.10

Because the illustration is hypothetical, the institutional arrangements that could create the development in the third frame are unknown. But in most parts of the United States, it would probably require extensive interaction between residential developers, commercial developers, the state highway administration, the municipal government, the regional transit district, the Federal Transit Administration, and perhaps hundreds of condominium owners. It is possible, that the development in the third frame could occur through a series of arms-length market transactions following the construction of the highway and transit l ine. But more likely, the development would require extensive planning, communication, negotiation, and public-private partnerships between the city and the developers. Also likely are intergovernmental agreements between the state, the municipality and the regional transit agency, and many negotiated leases between land owners, building owners, and occupants. In short, producing richly complex and smart growth developments is likely to require similarly rich and smart set of tools and institutional arrangements.

Conclusion

The superiority of prices over regulations as an instrument for addressing the problem of urban sprawl has both intuitive and political appeal. But the proposition has yet to be proven either in theory or practice. As stated by Bohm and Russell (1985), in a detailed analysis of effluent fees as an instrument of pollution control:

> The message [of this assessment of effluent fees] may be seen as positive or negative depending of the perspective of the reader. The negative version is that no general statements can be made about the relative desirability of alternative policy instruments once we consider such practical complications as that location matters, that monitoring is costly, and that exogenous change occurs in technology, regional economies, and natural environmental systems. The positive way of stating this is to stress that all the alternatives are promising in some situation.....If the classic case for the absolute superiority of effluent fees is flawed by the simplicity of the necessary assumptions, the arguments for the superiority of rigid forms of regulation suffer equally from unstated assumptions and static views of the world. There is no substitute for careful analysis of the available alternatives in the specific policy context at issue.

In the case of prices as instruments to address urban sprawl, such careful analysis has yet to be conducted. And though economists have greatly enhanced our understanding of urban spatial structure, their advice on smart growth has sprawled beyond the extent of compelling theoretical or empirical support.

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