Urban Sprawl and the Finances of State and Local Governments

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I. Introduction

Concern over the rate of spatial growth of urban areas has become a significant national political issue and a major development issue in many urban areas. An often cited statistic, typically presented as evidence of sprawl, is that between 1960 and 1990 the urban population in the United States increased by 50 percent while the amount of developed land more than doubled (Benefield *et al.,* 1999).

While much has been written about the causes and consequences of sprawl, little attention has been paid to the implications of sprawl for the finances of state and local government. There are at least two possible channels for sprawl to affect the finances of state and local governments. First, if the causes of sprawl include market failures or government policies, there may be a role for governmental corrective action. Second, sprawl may affect the costs of and revenue sources for the public provision of goods and services. This paper considers the potential effects that sprawl might have on the finances of state and local governments and the possible policies that might be adopted to address the causes and consequences of sprawl.

The paper is organized as follows: first we discuss what is meant by sprawl and how pronounced it is (Section II). We then discuss possible causes of sprawl (Section III) and turn in Section IV to the consequences of sprawl for state and local government expenditures and revenues. In Section V we consider the pressures to address sprawl faced by state and local governments and the fiscal policies that they might choose to adopt to address sprawl and its consequences. We conclude in Section VI.

II. What is sprawl and how extensive is it?

While the news coverage and public dialogue of sprawl would suggest it is a new issue or force, it is certainly not a new concept. Hess *et al.* (2001), for example, found the concept used as early as 1938 by Buttenheim and Cornick (1938). Despite its age, there is no consensus definition of sprawl.

A. What is sprawl?

Some individuals associate sprawl with any expansion of the developed land of an urban area. But, in metropolitan areas with growing populations it would only be normal for additional land development to occur to accommodate the larger population.

Burchell *et al.* (1998), as an outcome of their extensive review of the literature, suggest that sprawl needs to be viewed as having many of ten characteristics, including low density, leapfrog development, and widespread commercial strip development (p. 124). Galster *et al.* (2000) review the literature on sprawl and find that the definitions of sprawl can be grouped into six general categories. Based on their review of the literature, they propose that sprawl be defined as a pattern of land use that exhibits some combination of eight distinct dimensions including low density, discontinuity of development, and little open space within the urban area.

For our purposes, we consider development patterns to be economically efficient if they are produced by a perfectly competitive market in the absence of distortions created by externalities or public policies. Sprawl, then, is a situation in which such distortions exist and the result is an urbanized area that is larger and a population density that is lower than are socially desirable.

B. The magnitude of sprawl

While we consider sprawl to be a situation in which expansion of the urbanized area is "excessive," measuring sprawl according to this concept would be exceedingly difficult. Most authors measure the degree of sprawl as some variant of density. Dye and McGuire (2000), for example, consider four measures: share of the population outside the urban core relative to the total population of the metropolitan area, the share of urbanized land area relative to total land area of the metropolitan area, the annual growth in urbanized land area, and the population density of the suburban area relative to the population density of the total metropolitan area. Dye and McGuire examined over one hundred large metropolitan areas and found that the mean share of total land area that lies in the Census-defined urbanized land area (population density greater than 1,000 persons per square mile) increased from 0.07 in 1970 to 0.14 in 1990, indicating that the share of land in these metropolitan areas that was highly developed had doubled.

Galster *et al.* (2000) applied their definition to 13 metropolitan areas and ranked them from least sprawling to most sprawling. The resulting ranking, from least to most sprawling is: New York, Philadelphia, Chicago, Boston, Los Angeles, San Francisco, Houston, Washington, D.C., Dallas, Denver, Detroit, Miami, and Atlanta.

A recent report from the Brookings Institution (Fulton *et al.*, 2001) considers an area as sprawling if the consumption of land increases faster than population. Between 1982 and 1997, they found that urbanized land in the United States increased 47 percent, while the U.S. population increased 17 percent (p. 4).[1] Metropolitan density declined from 5.00 persons per urbanized acre in 1982 to 4.22 persons per urbanized acre in 1997, or by 15.6 percent. Table 1

1 They use urbanized land as estimated by the National Resources Inventory, not urbanized area as measured by the Bureau of the Census.

shows the distribution of changes in density in metropolitan areas. All but 16 of the 281 metropolitan areas in their sample experienced declines in density.

Fulton *et al.* calculated the ratio of the percentage change in urbanized land divided by the percentage change in population, with higher values of this ratio implying greater sprawl. Ranking regions from least to most sprawling yields the following order: West, South, Midwest, and Northeast; the ratios are, respectively, 1.52, 2.68, 4.54, and 5.67 (Table 2). This result runs counter to what we believe to be the common perception, that is, that sprawl is an issue in the south and west. This perception is due, no doubt, to the fact that the metropolitan areas of the south and west have experienced relatively fast population growth. While land consumption for development in the Midwest and Northeast has been small in absolute terms, it has been large relative to population growth.

Viewing sprawl as some combination of a decrease in population density, an expansion of developed land area, and an emptying out of the center in favor of the periphery, we present in Table 3 descriptive statistics for the twenty largest urbanized areas and their corresponding metropolitan areas. We divide the twenty cities into ten "rust belt" cities (located in the midwest and the northeast) and ten "sun belt" cities (located in the south and the west).

The rust belt cities all experienced greater expansions of their urbanized land areas than of their urban populations between 1960 and 1990, resulting in declines in their population densities. These metropolitan areas also uniformly experienced declines in their central city populations over this period.[2] Population data for 2000 indicate that many central cities in these metropolitan areas experienced a turn around in the decade of the 1990s. The central city population growth rate was positive for New York, Chicago, Boston, and Minneapolis-St. Paul. These cities are

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not the ones that come immediately to mind when the topic is sprawl. Nonetheless, from St. Louis to Baltimore, the cities of the northeast and the mid-west experienced some of the classic symptoms of sprawl over the thirty-year period: declining population density, much more rapid population growth on the periphery relative to the center, and growth of the developed land area.

The sun belt cities' experiences were more variable, still there were some remarkable contrasts with the rust belt cities. First, population increased faster than the urbanized land area in half of the sun belt cities, resulting in an increase in population density for these metropolitan areas. In addition, several metropolitan areas (Los Angeles, Dallas-Fort Worth, Houston, Phoenix, and San Diego) witnessed robust growth in the population of their central cities, both absolutely and in comparison to their suburbs. Among the sun belt cities, the experience of Atlanta, the poster child for sprawl, was the most similar to the rust belt cities: declining population density and an emptying out of the center relative to the periphery.

III. Causes of sprawl

Forces driving land use patterns can be categorized into three groups: factors increasing the demand for land at the urban fringe, market failures, and public policies.

A. Factors increasing the demand for land at the urban fringe

In simple terms, land at the urban fringe is demanded by farmers and by developers.[3] By developers we mean anyone wanting to acquire land in order to build housing or commercial or industrial facilities. The more productive is land in agricultural use, the greater its value to farmers, and thus the higher the price developers will have to pay to acquire the land. To the extent that

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demand for development increases, it is expected that developers will bid away more land from agricultural uses.

There are three main economic forces affecting the demand for land and thus the development of land on or beyond the fringe of urban areas: population growth, rising income, and falling commuting costs (Mieszkowski and Mills, 1993; Brueckner, 2001b, 2000). In addition, changes in communication technology may have reduced the importance of spatial proximity in production, thereby increasing the demand for land on the urban fringe.

Population growth

Certainly, as population increases, additional land will be absorbed to accommodate this growth. Between 1980 and 2000, the population of metropolitan areas increased by 27.4 percent. Thus, assuming no change in density, land used for urban development would have increased by 27.4 percent.

Rising income

Rising household income increases the demand for most goods, including land and housing. Thus, even in the absence of population growth, growth in income will lead households to occupy larger tracts of land. Empirical studies suggest that the income elasticity of the demand for housing size is 0.46 (O'Sullivan, 2000, p. 392), while the income elasticity of demand for the land component of housing services has been estimated to be 0.32 (Witte *et al.* 1979). Margo (1992) finds that 40 percent of suburbanization between 1950 and 1980 can be explained by increases in household income.

Falling commuting costs

Automobiles and the development of the interstate highway system substantially reduced the cost of commuting by increasing speed and thus reducing the time it takes to travel between

residence and work place. This allowed individuals to live further from their place of work. Evidence of these trends is found in the Nationwide Personal Transportation Survey (U.S. Department of Transportation, 1997). The survey, conducted in 1990, found that between 1983 and 1990 commuting distance in suburban areas increased about 27 percent, while commuting speed increased 16 percent. For central city areas, commuting distance increased 20 percent and commuting speeds increased by 26 percent (pp. 154-155). This increased speed can be attributed to an increase in highway capacity through construction of more urban freeways and improved transportation technology, but also a shift away from slower public transit and an increase in less congested reverse commuting. The increase in speed should lead households to be willing to live further from their work site and to pay more for a residential tract at the urban fringe. Hence, developers will outbid farmers for land on the urban fringe and hence will acquire more agricultural land.

Brueckner and Fansler (1983) provide some evidence that existing levels of density are a result of these market forces. Consistent with what we argued above they predict that the size of an urban spatial area should be related positively to population and income and negatively to transportation costs and the price of land at the urban fringe. They find empirical support for their predictions; metropolitan areas with larger populations, higher incomes, lower transportation costs, and lower values of agricultural land occupy greater amounts of land.

Changes in communication technology

Another possible cause of the change in land use patterns is a decline in the importance of spatial proximity. Historically for many industries it was thought that a company would be more productive if it located in close proximity with other businesses in the industry. Likewise, it was thought that productivity would be higher if the divisions of a firm were located at the same site.

Some have speculated that improvements in communications (faxes, e-mail, internet, cell phones, etc.) may have reduced the importance of spatial proximity for firm productivity. Thus, just as manufacturing firms could seek suburban and ex-urban sites when they were no longer tied to rivers for power or railroads for transportation, it may be less important for firms and their divisions to be as spatially close to other firms. The result is that many firms and divisions are no longer restricted to major commercial centers, and thus have become more dispersed. There is anecdotal evidence that many firms have moved back-office functions out of the central city, but there is little systematic evidence as to the magnitude of the importance of changing communication technology on the spatial proximity of firms.[4] Glaster and Kahn (2001) discuss the decentralization of industry in urban areas.

B. Market failures

As long as the land market is perfectly competitive, economists argue that the pattern of development and the amount of land that is developed is efficient and thus there should be no concern about sprawl. To the extent that market distortions exist, however, the amount of urban land developed may be excessive or the pattern of development may be inefficient.

An important market imperfection is that open space on the fringe of urban areas may have value beyond its private value. Society may value the diversity of species and ecosystems associated with open space, the contribution of open space to clean air and water, and the potential uses of open space for public parks and rights-of-way. In the presence of such external benefits, the market price for land on the urban fringe is too low and more land will be converted from open space/agricultural use to urban-development use than is socially optimal.

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Another important market failure results from individuals making choices about commuting based on the private costs of travel. However, when a car enters the transportation network during rush hour, it slows the flow of traffic thereby increasing the time other drivers have to spend commuting. In addition, cars generate air pollution, which imposes additional costs on others. Commuters do not bear these congestion and pollution costs that they impose on others, and hence have no incentive to consider these costs when they make commuting decisions. Because individuals do not consider the full cost of using their cars, they will live further from their work site and commute further than is optimal. The result is lower density than is optimal.

C. Public policies

There are several ways in which public policies affect land use patterns. First, there are various subsidy programs that encourage low-density development. The federal income tax system provides a substantial incentive for owner-occupied housing; the resulting lower effective price of housing services encourages larger lots and homes.

Public infrastructure is also subsidized. Federal subsidizes in the 1960s, 1970s, and early 1980s meant that the price that developers paid for infrastructure was less than marginal cost, and thus geographic expansion was encouraged. Transportation, both mass transit and interstate highways, is also heavily subsidized, leading to a more extensive transportation network than may be efficient. The result is to lower the cost of transportation, which encourages longer commutes.

Governments typically fail to charge developers the full cost of public infrastructure needed to serve new developments. An issue that has received a great deal of attention is the additional cost of the infrastructure needed to serve less dense development patterns. To the

extent that the cost of infrastructure and service delivery are negatively related to density and that these costs are not fully borne by the new development, there is an incentive for development to be less dense than is efficient. In most urban areas, infrastructure and public services are paid for through property taxes levied on all property. Thus, the pricing of infrastructure is averaged over all property taxpayers and therefore the infrastructure cost of development paid by the new development is less than the marginal cost of the public infrastructure. Furthermore, since land being developed on the fringe of the urban area commands a lower price than in the more centralized and previously developed areas, property tax financing of infrastructure for new development results in an infrastructure price that is even lower than the average across all properties. This provides an incentive for less dense development and for extending the urban fringe.[5]

The use of property taxes results in less dense development than if a non-distortionary tax was used to finance public services. The property tax is levied on land and buildings, so compared to a pure land tax, the property tax results in development that is less land intensive (Nechyba, 1998). Brueckner (2001a) explores this issue by considering an urban area with a fixed population within a standard urban model and shows that the property tax leads to sprawl, i.e, a decrease in overall density resulting from an expansion of the urban area beyond what is economically efficient in order to accommodate the fixed population.

Another public policy associated with sprawl is government regulation of land use. Suburban land use is dominated by zoning and subdivision ordinances that have substantial

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Brueckner (2001a) explores the effect on spatial form of charging developers a tax equal to the average cost of infrastructure rather than the marginal cost.

effects on land use. Zoning and subdivision ordinances frequently require large lots, discourage multi-family housing, and mandate large parking lots for commercial and retailing developments.[6]

The existence of a large number of municipalities allows individuals a wide range of public services packages from which to choose, and the inter-jurisdictional competition that results encourages governments to be more efficient. However, the greater the number of local governments within an urban area, the greater the competition for property tax base. To the extent that communities on or beyond the urban fringe use incentives to encourage and promote the development of land before it otherwise would be efficient, tax base compeititon leads to an expansion of the urban area beyond what would be driven by market forces. In addition, the greater the number of local governments, the more difficult it is to adopt policies that might control sprawl because of the problems that arise in coordinating policies across a large numbers of jurisdictions. Fulton *et al.* (2001) find that sprawl is associated with metropolitan areas in which the average population of local governments is smaller. Dye and McGuire (2000) find that sprawl is positively associated with the number of local governments in an area.

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Leinberger (1998) claims that a neighborhood commercial center will "always be built on a 12- to 15-acre site, with 20 percent of space set aside for building and the remaining 80 percent dedicated to parking (p. 36)." He also claims that for every 1,000 square feet of office space, 1,500 square feet of parking will be provided, and for every 1,000 square feet of restaurant seating space, parking will require 3,500 square feet.

IV. The effects of sprawl and consequences for state and local governments finances

As Ewing (1994) points out, it is not sprawl itself that is undesirable, but the negative impacts associated with sprawl. The extensive literature survey by Burchell *et al.* (1998) uncovered 27 alleged negative impacts of sprawl and 14 alleged positive impacts. Conflicting arguments can be found in the literature regarding several of the suggested effects of sprawl; for example, there is research alleging that sprawl increases commuting times and other research alleging that it reduces commuting times. For many of the alleged effects, there is little evidence demonstrating a causal relationship with sprawl.

In this section we explore how sprawl might be expected to affect the expenditures and revenues of state and local governments. In Section V we consider the policies that state and local governments might consider to address sprawl.

A. Increased cost of public infrastructure

It is commonly argued that less dense development results in a higher cost of providing public infrastructure.

Highway and street networks

Consider the effect of density on the cost of providing a commuter highway network. Consider two cities of radius r and 2r, each with the same population evenly distributed over the space of the city and with all employment located at the center. The density in the larger city will be 1/4 the density of the smaller city. Suppose that the highway system starts at the edge of the city and expands as it reaches the center of the city in order to handle the increasing number

of drivers. Essentially, the highway system will be shaped like a set of cones. If the radius of the city doubles, the size of the cone, i.e., the number of lane miles, will also double.[7]

The neighborhood streets required to get commuters to the highways will also have to increase. If the density of neighborhood streets in the city with radius 2r has to be the same as in the city of radius r, then the miles of neighborhood streets will have to be 4 times as large in the city of radius 2r as in the city of radius r.[8]

These calculations are based on the assumption that all commutes are to the center of the city. If sprawl also results in a dispersal of employment locations, then sprawl might not result in longer commutes or reduced accessibility. However, actual development patterns have separated trip destinations such as residence, employment, and shopping, and thus commuting distances have increased over time. The Nationwide Personal Transportation Survey, conducted in 1990, found that the average distance traveled each day was 29 miles, an increase from 26 miles in 1977, and from about 24 miles in 1969 (U.S. Department of Transportation, 1997, p. 148).

Public transit

To be cost effective, public transit requires high residential and employment densities in order to generate sufficient trips. In addition, public bus transit is more cost effective if the bus lines can be focused on a limited set of destinations, such as a central business district (CBD). Even if employment remains in the CBD, a less dense population requires longer bus routes to

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The size of the cone will be rM/2, where r is the radius and M is the width of the road at the center of the city. M is the same regardless of r for a given population. Doubling r doubles the size of the cone.

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The area of the city is πr^2. So doubling r, quadruples the area.

collect the same volume of riders. Thus, if sprawl results in lower population density and in numerous and widely dispersed employment centers, then public transit becomes a more costly option.

Water and sewer lines

The cost of water and sewer lines will also increase with lower density. Consider a square city subdivided into B square blocks of length L, with lots fronting all sides of the block. Assume that there must be one water line and one sewer line under every street, i.e., one line can serve houses on both sides of the street. Consider an alternative city with the same population and block size, but with lot sizes that are twice as big; density in the new city will be half of what it was in the old city and the number of blocks will double. The total distance of the water and sewer lines that have to be installed in the new city will be slightly less than twice what it was in the more dense city.[9] The implication is that the cost of installing and maintaining water and sewer lines will nearly double.

Existing studies

The above calculations assume that all commutes are to the center of the urban area and that block sizes are fixed. An alternative approach to exploring the relationship between land use patterns and infrastructure is to consider the effect of alternative development patterns on the cost of infrastructure. The Office of Technology Assessment (U.S. Congress, 1995), for example, estimated that sprawl increased the cost of infrastructure from 10 percent to 20 percent.

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The percentage increase in the miles of water and sewer lines will approach the percentage increase in the number of blocks as the number of blocks approaches infinity.

It cited one study that found that the cost of providing infrastructure for a house in a scattered, outlying development was 40 percent higher than for a house in the core area of the city.

Burchell (1997) estimated the future infrastructure cost required by the growth in South Carolina for the period 1995 to 2015, and argued that if current development patterns continue, statewide infrastructure costs will be $56 billion, or $750 per person per year, half of which would be for road construction. He estimated that about 10 percent of this could be saved by adopting a more compact development pattern; most of the infrastructure cost is related to growth, regardless of the pattern of development.

The State of the Cities 1999 (U.S. Department of Housing and Urban Development, 1999) reported that, "Road costs are 25 percent to 33 percent higher and utility costs are 18 percent to 25 percent higher in communities marked by sprawl than in sprawl-free communities."

These types of studies are not without flaws. For example, Altshuler and Gómez-Ibáñez (1993) point out that studies of fiscal impacts of alternative development patterns do not always use appropriate cost concepts or measures. Some of these studies assume that different residential density will lead to different household demographics, thereby confounding the effects on infrastructure costs of different densities with the effects of different demographics. Furthermore, the studies usually assume no difference in the level of service or in the technology used across developments of different densities. However, at low density streets could be narrower since there will be less traffic, and sidewalks could be built on only one side of the street since there will be fewer pedestrians.

B. Increased operation costs

There are several public services whose costs are likely to increase with lower density. Consider communities with the same population (both in size and characteristics) and the same

quality of public services, but with different densities. To maintain the same quality the response times for police, fire, and EMS need to be the same for both densities. Lower density will require more fire stations to ensure the same response time. There will have to be more police patrols to ensure the same response time and that each house and commercial building get patrolled the same number of times. Since traffic congestion will be less when density is less, the percentage increase in costs should be less than the percentage decrease in density.

The costs of collecting solid waste, of street cleaning, and of snow plowing could also be higher. Garbage collection costs vary directly with distance (and speed) between pickup stops and the amount of trash collected. Since the later will not change with density, the costs will not increase at the same rate that density decreases. Street cleaning and snow removal, however, vary in proportion to the miles of road. As noted above, the number of miles of roads could increase at close to the same percentage that density falls. With lower density, however, there will be fewer cars per mile of road to interfere with the operations, which should increase speed.

Sprawl should have little effect on the costs of other services. Assuming that park space is the same regardless of density, the cost of parks and recreation should be unaffected, although land prices may be higher with higher density. On the other hand, with larger residential lots, the demand for public parks may be reduced. Education, other than the cost of transporting students, is also unlikely to be affected by density. Likewise, there is no reason to expect that the costs of functions such as courts, jails, and general government would be affected by density.

Increased density may change the characteristics of the community in ways other than geographic size, ways that might increase the costs of public provision. Denser cities may have taller buildings and more congestion, both of which increase the cost of providing certain public

services, and there is a greater likelihood that fires might spread to surrounding buildings, so that more fire protection is needed.

Empirical studies of the cost of service provision suggest that per capita service costs are U-shaped with respect to density (Ladd 1998). In such studies it is difficult to sort out the direct effect of density from the effect of other factors such as population characteristics associated with denser cities. However, if all cities were to be more dense, presumably there would be no additional sorting of individuals across cities based on factors associated with higher density, and thus the demographics of the cities would not change.

C. Property taxes

Sprawl will have an effect on the property tax base and the effect may differ by the geographic location of the jurisdiction. Suppose that the price of land at the edge of the urban area decreases. Assume that the urban population does not change and that there are no other distortions. Within the context of a standard monocentric urban model the decrease in the price of land at the urban fringe will cause the urban area to expand. It is easy to show that the land-value gradient will shift down and will equal the new, lower price of undeveloped land at a greater distance from the city center. The result is that within the original urban area, the total value of land will fall, and thus, the land value of the property tax base will fall. Because there is more land within the now expanded urban area, the total land value could increase.

Since the price of land has fallen, the production of goods and services will become less capital intensive, meaning that the total value of improvements should also fall. Furthermore, some of the existing capital should be relocated to the previously undeveloped land. Unless the income effect from the fall in land prices results in a substantial increase in the demand and

hence production of local goods and services, including housing, the total value of the property tax base within the pre-existing urban area will fall.

The second aspect of the change in the value of the property tax base is how the change will be distributed across the urban area. Without putting some structure on the utility function in the monocentric model, the model does not yield a definite prediction regarding the percentage change in land value across the urban area. However, it is a common perception that commercial and industrial development is more dispersed with sprawl. Rather than all non-residential property located in the CBD or in a few nodes, under sprawl this property will likely be distributed more uniformly across the urban area. This will provide more suburban jurisdictions with non-residential property tax base and decrease the property tax base in the central city.

We crudely explored this issue by investigating how the distribution of the property tax base changed over time as the Atlanta urban area expanded. We estimated a property tax gradient for 1970 and for 1999 using as the unit of observation per capita property tax base, at the county level, for the 20-county Atlanta MSA. If sprawl reduces density and extends the boundaries of the urbanized area, then the gradient should become flatter with sprawl. However, we found the value of the gradient became slightly steeper, although the change was not statistically significant.

D. Quality of life

There are many ways that sprawl affects the quality of life. State and local governments may be called upon to address these consequences of sprawl.

Central city costs

To the extent that sprawl is the result of migration of central city residents to more distant suburbs, there are clear implications for the central city. Central cities have fixed infrastructure that has to be maintained. With out-migration of central city residents to the suburbs, the remaining central city residents will each have to bear a greater share of these maintenance costs. Furthermore, if the households who move to the suburbs are higher income households, then the tax base per capita in the central part of the urban area will likely decrease.

Environmental problems

Sprawl is also associated with environmental issues. Longer commutes associated with low density development contribute to air pollution. Low density development also increases water runoff since the larger the land area that is covered, the greater the water runoff. For example, parking lots generate almost 16 times as much runoff as undeveloped land. Sprawling low-rise shopping centers and office parks increase the land that is paved and therefore the amount of runoff (Hirschhorn, 2000). The result is increased costs of waste water treatment and greater health care costs from air pollution.

Psychic costs

Authors have also associated sprawl with psychic costs such as unaesthetic development and loss of community. Many authors decry the proliferation of strip malls and big box stores. Some authors associate the traditional suburban subdivision with an increase in the isolation of households, leading to a loss of community. It is argued that this loss of community is compounded by the increased time spent in automobiles commuting to work and running errands. To the extent that this is true, it may reduce the time individuals spend volunteering in the community and increase the need for local governments to take on the functions that the volunteers would otherwise have performed.

V. Possible state and local policies to address sprawl

Growing concerns about sprawl and its consequences have pushed it to a prominent place on the political agenda and therefore put pressure on state and local governments to take action. Katz and Bernstein (1998) argue that broad-based coalitions are being formed among a diverse set of interest groups, all of which, in Katz and Bernstein's view, have something to lose as sprawl accelerates. "These constituencies reject the conventional wisdom that current growth patterns are inevitable – the result only of invisible market forces and consumer preferences. Rather, they are focusing more on the role that government policies – spending program, tax expenditures, and regulatory and administrative actions – play in shaping our communities and, by extension, our lives (Katz and Bernstein, 1998, p 5)." Leo *et al.* (1998) discuss in detail the various interest groups that have found common ground in their concern over sprawl: local businesses because they see the consequences of sprawl as detrimental to the local business climate and view smart growth as a means of opening up development opportunities, environmentalists who have come to realize that policies that control sprawl are in line with their growing interests in the urban environment, and agricultural interests because anti-sprawl policies are seen as a means of limiting the conversation of farm land as well as the pressures that urban development place on the activities of surrounding farms.

Sprawl has also become an issue high on the public's agenda. For example, in a Pew Center for Civic Journalism national survey in October 1999, sprawl and crime were ranked first as the most important problems facing the respondent's community (Williams 2000). Sprawl is ranked as more of a problem among suburbanites, whites, and those with higher education.

This political pressure is forcing state and local governments to address sprawl and the consequences of current development patterns. The interest groups have lobbied governments to control sprawl through the use of growth management policies, impact fees, reduction of residential growth, and the purchase of land to preserve open space. By one count, in 2001, there were 240 smart growth initiatives being considered across the county (Gosling, 2001).[10]

Policies to address sprawl can be broadly categorized into two groups. The first set of policies is aimed at directly preventing sprawl, and include growth controls and regional growth management. The second set includes policies that are intended to discourage sprawl by correcting market failures by providing proper incentives and eliminating market-distorting public programs and policies.

A. Regulatory policies

Growth control policies implicitly assume that sprawl and its consequences are the result of population growth. Thus, the argument goes, by limiting growth sprawl can be controlled. However, growth control policies have largely been discredited as short sighted and ineffective (Downs 1994).

Growth management policies, which aim to direct growth to certain areas and away from others, have been strongly endorsed, particularly by planners (Nelson, 1999, 2000). The policies include regional planning or regional review of local planning and zoning,[11] restricting or

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For a summary of many of the policies that have been adopted by state and local governments to restrict the spatial expansion of cities see Brueckner (2001b).

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Gale (1992) discusses the characteristics of eight state-sponsored growth management programs, while Glickfeld and Levine (1992) discuss the adoption of such programs in California.

steering development to areas that are served by appropriate public infrastructure, urban growth boundaries, and green belts.[12] Several states have enacted legislation requiring regional planning, although the strength of these laws varies widely across states (Gale, 1992). Oregon established the most widely noted urban growth boundary around Portland in 1973 (Abbott, 1997), but growth boundaries have also been established around other cities (Lang and Hornbury, 1997; Easterly, 1992). Green belts have been created in Seattle and Boulder (Nelson, 1986).

As we discussed above, and as most students of urban land markets agree, urban land markets are not perfectly competitive, and thus development patterns are not economically efficient. Proponents of growth management policies argue, at least implicitly, that the solution to this inefficiency is through control of the development process. Such policies as growth boundaries are, however, very blunt policy instruments. Growth boundaries essentially replace market determination of how the boundaries of an urban area are set or adjusted to accommodate population growth with a planner's vision of the most desirable pattern of development. If growth boundaries are drawn tightly around the developed area, or not allowed to expand with increases in population, then development is constrained to a land mass that can be too restrictive. On the other hand, the boundary could be drawn so far out that it has no effect on development patterns.

In 1979, Mills (1979) noted that there had been very little scholarly analysis of land-use controls, by which he meant zoning. The same could be said today regarding growth

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Growth boundaries and green belts are ways to restrict the geographic expansion of urban development.

management tools such as growth boundaries. Hence we know very little about the effects of urban growth boundaries.

From a theoretical perspective, since growth boundaries, if binding, reduce the supply of land available for development, they should result in an increase in the price of land throughout the urban area, an increase in residential density, and an increase in the concentration of commercial development in the central city. There is some empirical evidence that residential density in Portland has increased and trip times have been reduced, but at the expense of an increase in housing prices (Nelson, 1999). Nelson, *et al.* (2002) reviewed the literature on the effect of growth management policies on land and housing prices, and found that land prices are positively affected by urban growth boundaries. However, they argue that the increase in land value might be due to an increase in housing demand resulting from the increased desirability of the urban environment in communities that control sprawl, and not just from restrictions on the availability of land.

B. Policies to correct market imperfections and misguided government policies

An alternative approach to growth management is to adopt policies that correct the imperfections that lead to sprawl. We consider each of the causes of sprawl and identify possible policies (all of which are discussed at length by others) to address each cause.

Open space is undervalued

There are two issues associated with open land: the land on the urban fringe and interior open space. Consider land on the urban fringe. As discussed above, if the social value of open space on the urban fringe exceeds the market price, then more land will be converted from open space/agricultural use to urban development than is socially optimal. An obvious policy is to adopt a development tax set equal to the external costs of converting agricultural land to

developed land. In other words, impose a tax equal to the dollar value of the social benefits to residents from the open space that would be eliminated by the development.

The obvious difficulty is determining the social value of land that may be converted from agricultural use to development purposes. It is unlikely that a uniform development tax would be appropriate for all land in all urban areas. It is likely that certain types of land will have greater social value; for example, a tract of land that contains a river may have greater social value than an open field. Furthermore, to the extent that the value of open space accrues to all residents, i.e., the externality is of a public good variety, then the development tax should increase with the population of the area.

There have been very few efforts to estimate the social value of open space. Lopez, Shah, and Altobello (1994) use data from previous studies to calculate the marginal social value of open space and find values that range from $12 to $103 per acre depending on the location.

One method that is currently being used to measure social values is contingent valuation, a method that relies on individual responses to questions about their willingness to pay for a reduction in an externality.[13] Brueckner (2001b) argues that the methods available to estimate such social values are not sufficiently creditable that they can be a reliable basis for policy. Thus, in setting such a development tax, a policy maker may just as easily set too low or too high a tax, both of which would produce economic inefficiencies. It is not clear, however, whether imposing no tax would be socially preferred to levying a tax that may be calculated incorrectly.

An alternative to taxing development is to subsidize farmers, e.g., by reducing property taxes, to encourage them not to sell their land to developers. Every state already has a program

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13 For a discussion of contingent valuation see Diamond and Hausman (1994).

that in one way or another reduces property taxes on certain agricultural land. These programs include applying a lower assessment ratio on agricultural land, using use value rather than fair market value, and levying reduced tax rates in return for long-term agreements not to convert the use of the land. Studies of the effect of use-value assessment on the retardation of farm land conversions have found the impact to be slight; see Chicoine, Sonka, and Doty (1982) and the references they cite. More recently however, Morris (1998) found that preferential assessment of farmland reduced the loss of farmland by about 10 percent relative to the base case. But the issue of determining the appropriate magnitude of the subsidy remains.

The above policy is concerned with the pace at which agricultural/open land on the urban fringe is converted to developed uses. But there clearly is a desire to retain open space within the urban area. Land for public open space should be acquired by the government. However, since parks are a public good and if they are provided by multiple local governments, park space may be under supplied. Small local governments will consider the benefits to their taxpayers, who are a small percentage of the metropolitan area's population. Because each local government will face the full price of acquiring land, it will likely purchase less open space than is socially optimal. Thus, there may be a role for a regional government in the provision of public open space.

While public parks are one form of open space, privately owned common areas are another. It is argued, for example, that instead of building 10 houses, each on half acre lots, it would be environmentally advantageous if the houses were clustered on 2 acres, with 3 acres set aside for common open space. To preserve a set of geographically dispersed private open spaces within the interior of the urban area, however, would seem to require a very complicated

developmental tax or subsidy policy. Such a policy would have to reflect the size, the location, and the environmental sensitivity of multiple tracts of open space.

Distortions caused by the property tax

If the property tax results in distortions leading to excessive expansion of the urban area, an obvious policy option is to replace the current property tax with a land value tax. While land value taxation is used in several countries, there is no jurisdiction in the United States that has shifted to a land value tax. Several jurisdictions have adopted a split rate property tax in which land is taxed at a higher rate than improvements. A study by Oates and Schwab (1997) found that the split rate property tax in Pittsburgh may have lead to increased development in the central city. Land value taxation has been extensively discussed elsewhere (Netzer, 1998; Bahl and Linn, 1992; Tideman, 1998) and thus is not further pursued here.

Mispricing of public infrastructure

The economic solution to inappropriate pricing of public infrastructure is to charge new development the full cost of providing the infrastructure. In an effort to impose such costs, many local governments impose impact fees on new developments. Typically, the impact fees are calculated by a formula derived from estimates of the differences in the cost of public infrastructure for different types of development. Altshuler and Gómez-Ibáñez (1993), who provide an extensive discussion of impact fees and other forms of development exactions, point out that many of the attempts to estimate these costs are flawed. Furthermore, impact fees are usually based on average costs, not marginal costs. Thus, impact fees are usually the same for an infill development that simply has to connect to the existing water and sewer systems and for a development on the urban fringe that requires an extension of the public infrastructure. The appropriate cost concept is the marginal infrastructure cost of the development. Thus, while

impact fees are widely used, their design is often inconsistent with economically efficient pricing of public infrastructure.

On the theoretical side, Breuckner (1997) explores the effects of three different schemes for financing infrastructure required by new development. The first scheme is impact fees, where the incremental cost is borne by the developer. The second scheme is an arrangement under which the infrastructure cost is shared among all landowners and is paid at the time of development. The third scheme is like the second one, except the cost is financed by infinite-maturity bonds. He analyzes the three schemes in an urban growth model. He finds that impact fees restrict growth over the other two options as long as the marginal infrastructure cost is greater than the average cost and the population growth rate is less than the interest rate.

There has been little empirical work on the effect of impact fees. Other than a paper by Skidmore and Peddle (1998), who found that impact fees in DuPage County, Illinois, reduced residential development, we found no recent empirical analysis of the effect of impact fees on development patterns. Yinger (1998) cites two studies that explore the effect of impact fees on the price of housing. Both studies obtain the surprising result that the price of a house increases by 2 to 3 times the value of the impact fee. The implication is that there is substantial over shifting of impact fees to the purchaser of the home.

Mispricing of road use

Individuals make choices about commuting based on the private costs of travel such as the cost of time. Since commuters do not bear the costs of congestion and air pollution imposed on others, they have no incentive to consider these costs. For example, when another car enters traffic during rush hour, it further slows the flow of traffic, thereby increasing the time everyone else has to spend commuting. But the driver considers only his commute time, not the effect he

has on everyone else. Because of this situation, individuals choose to drive longer distances than are optimal. One solution to this problem is to charge drivers for the cost they impose on other drivers, i.e., to impose congestion fees.

Optimal congestion fees should be set equal to the costs that the driver imposes on everyone else. The appropriate fee depends on the volume of traffic on the segment of the transportation system used. The toll should not be imposed just for the use of highways, since congestion also occurs on surface streets, and imposing a toll just on the use of highways would encourage drivers to shift from the highway to surface streets. The congestion toll provides an incentive for individuals to shorten the commuting trip, to shift to a time when the toll is lower, and to switch to an alternative mode of transportation.

Much research has been directed at determining the appropriate magnitude of a congestion toll. Decorla-Souza and Kane (1992), for example, estimate that the marginal social cost of congestion is between $0.34 to $0.56 (in 2000 prices) per vehicle mile, while Small (1997) estimates that the air pollution cost of urban transportation is between $0.007 and $0.037 per vehicle mile. Congestion fees are used in several places, particularly outside the United States, and there are a variety of ways that they can be imposed, some more practical than others, and some more politically acceptable than others (Small, *et al.* 1989).

One effect of congestion fees should be to reduce the number of miles traveled, which should also result in a reduction in air pollution. To the extent that commuting trips are directed to the CBD, then reductions in commuting distance imply residing closer to the CBD, which in turn implies greater density. However, not all work sites are located in the CBD but are spread throughout the metropolitan area. Suppose that employment centers remain fixed and individuals move their place of residences in order to be closer to their particular place of

employment. In that situation will density increase and will the developed area be smaller? If more individuals commute into the CBD than reverse commute, then this rearranging of residences should result in an increase in the central city population. At the same time, individuals will locate closer to other employment centers, increasing density around those centers. However, it is not clear that the urban area will be smaller, although there may be places within the urban area that will be less developed.

Related to the use of the transportation system is the cost of parking at work. Free parking encourages commuting. Requiring firms to charge employees for parking, or to pay employees who do not use the parking lot, would correct the distortion caused by free parking. The effect would be to reduce the number of commuters, thereby reducing congestion.

Competition among jurisdictions

Jurisdictional competition for tax base, either in the form of commercial development or housing types that contribute more in taxes than they cost in services, is thought to cause sprawl. This would occur if jurisdictions at or beyond the urban boundary provide incentives that lead to land being developed sooner than would be economically efficient.

Such competition could be reduced by implementing a tax base or tax revenue sharing arrangement within the urban and ex-urban areas. The principal example of tax base sharing is the program in the Minneapolis-St. Paul metropolitan area, implemented in the 1970s. Under this legislation, in the Twin Cities area 40 percent of the increase in commercial-industrial property tax value goes into a regional pool to be shared by all taxing jurisdictions in the area. The sharing formula is based directly on population and inversely on relative property tax base per capita.

Tax base sharing was enacted to reduce fiscal disparities[14] and to encourage more sensible land use decisions. To the extent that a jurisdiction's tax base does not increase by the full property value of the businesses that locate within its boundaries, inter-jurisdictional competition for non-residential tax base should be reduced. With the Twin Cities program, local governments still compete for the 60 percent of the increase in the commercial-industrial base that is not shared.

Another tax base sharing program is illustrated by the Hackensack Meadowlands Development and Reclamation Act in New Jersey. This program differs from the Minnesota program in how the shared tax base pool is distributed. There are three factors used. First, jurisdictions that take tracts of land off of their property tax roll for public purposes (e.g., wetlands) receive in-lieu-of-tax payments. Second, a municipality gets a payment for land zoned for residential purposes to compensate for increased student enrollments. Finally, the remaining shared tax base is allocated on the basis of land area. By tying the distribution to actual land use, the tax base sharing program should have more influence on land use decisions than does the Minnesota sharing arrangement.

There has been little research on whether tax base sharing has had an effect on land use decisions. In one published paper, Reschovsky (1980) reports that he found little evidence that tax base sharing had an effect on land use patterns; but the Minnesota program was still relatively new at the time of the study. Luce (1998), however, draws the same conclusion,

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Fisher (1981) and Fox (1981) discuss the flaws in the design of the Minnesota program in terms of how it addresses fiscal disparities.

noting that the use of tax increment financing suggests that local competition for business is still intense.

A second approach to tax competition is to reduce the number of local governments. The greater the number of local governments, the more likely it is that they will try to compete for tax base and try to exclude households with high service costs. Thus, reducing the number of local governments or shifting certain services to regional governments, should reduce this form of competition.

To the extent that this incentive is operable, we should expect that metropolitan areas with few relatively large jurisdictions should have experienced less sprawl then in metropolitan areas with a large number of smaller jurisdiction in which the well-to-do are able to isolate themselves. Dye and McGuire (2000) find some evidence that metropolitan areas with a greater number of local governments are more sprawled.

While such schemes may reduce the incentive of high income households to move to the urban fringe, the likelihood of implementing such schemes is very low since political opposition would likely be fierce. Orfield (1998) provides an account of the political struggle to implement tax base sharing in the Minneapolis-St. Paul area and argues that to pass such legislation requires that there be more winners than losers. Orfield (1997) argues that a coalition of the central city and older, inner-ring suburbs, should be able to find sufficient common ground and be sufficiently large to get legislation passed.

Zoning and subdivision ordinances

It has been widely argued that existing zoning and land use regulations create incentives for sprawl. Thus, the obvious solution is to change these laws and ordinances (Downs, 1994). Another option is regional coordination and rationalization of local land use planning. Such

centralization of growth management or mandated changes in local zoning ordinances is opposed by local jurisdictions since they do not want to give up local control of growth.

VI. Summary and Conclusions

The finances of state and local governments can be affected by sprawl in many ways. The costs of providing highway and street networks, public transit, water and sewer infrastructure, and many city services such as police, fire, sanitation and EMS services increase as density falls and the urban area increases for a given population. The level and geographic distribution of the property tax base may also be affected by sprawl. In addition, state and local governments may be called upon to correct market imperfections and misguided government policies that lead to sprawl.

The two most important market imperfections associated with sprawl are that the social value of open space may be greater than the private value and that the social costs of commuting may exceed the private costs. Policies to address the former include fees or taxes on development, subsidies to farmers, and public acquisition of land at the urban fringe or open land in the interior of the urban area. Congestion fees are the obvious response to the external costs imposed by drivers when they enter congested highway networks. State and local governments have all of these tools at their disposal.

It can be argued that local government reliance on the property tax also contributes to sprawl both because the property tax results in less dense development than a land tax and because it results in average cost pricing of public infrastructure for new development. Shifting toward a land tax and imposing properly calculated impact fees would address these potential self-inflicted causes of sprawl.

Finally, through the proliferation of local governments and the zoning laws exercised by them, regional cooperation to address sprawl can be difficult. Regional government and a centralization of land use decisions are the obvious, although highly unpopular, solutions to sprawl. If the perception is that the social costs of sprawl have become unacceptable, then state and local governments will be compelled to consider a combination of many of the policies discussed herein.

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Table 1. Percentage Change in Density, 1982-1997

Percentage change	Number of metropolitan areas
>25% decline	88
10-25% decline	138
0-10% decline	39
0-10% increase	9
>10% increase	7
Source: Fulton et al (2001) p. 5	

Table 2. Percent Change in Urbanized Land and Population, 1982-1997

Census Region	Change in Land	Change in Population	Ratio of percentage change in land to percentage change in population
West	48.4%	32.2%	1.52
South	59.6%	22.2%	2.68

Midwest	32.2%	7.1%	4.54
Northeast	39.1%	6.9%	5.67
Source: Fulton, et. al, 2001			

Table 3. Population, Land Area, and Population Density of the Twenty Largest Urbanized Areas

		Percentage change, 1960-1990				Population density of urbanized area (1000s per sq. mi.)		
Rust Belt (Pop. 2000)		Urban population	Urbanized land area	Central city population	Suburban population	1960	1990	Change
1	New York, NY 20,119,458	14	57	-6	27	7.46	5.41	-2.05
2	Chicago, IL 8,272,768	14	65	-22	68	6.21	4.29	-1.92
3	Boston, MA 6,057,826	15	73	-18	28	4.68	3.11	-1.56
4	Philadelphia, PA 5,100,931	16	95	-21	39	6.09	3.63	-2.47
5	Washington, DC 4,923,153	86	177	-21	126	5.31	3.56	-1.75
6	Detroit, MI 4,441,551	5	53	-38	38	4.83	3.30	-1.53
7	Minneapolis-St. Paul, MN 2,968,806	51	62	-20	123	2.10	1.96	-0.14
8	St. Louis, MO 2,603,607	17	125	-47	46	5.16	2.67	-2.49
9	Baltimore, MD 2,552,994	33	169	-22	87	6.44	3.19	-3.25
10	Pittsburgh, PA 2,358,695	-7	48	-39	-3	3.44	2.16	-1.28
Sun Belt								
1	Los Angeles, CA 9,519,338	76	43	41	51	4.74	5.80	1.06
2	Dallas-Fort Worth, TX 5,221,801	123	57	40	246	1.56	2.22	0.66
3	Houston, TX 4,177,646	155	173	81	281	2.65	2.46	-0.18
4	San Francisco-Oakland, CA 4,123,740	49	54	1	66	4.27	4.15	-0.12
5	Atlanta, GA 4,112,198	181	362	-19	211	3.13	1.90	-1.23

6	Phoenix, AZ 3,251,876	263	198	125	335	2.22	2.71	0.48
7	San Diego, CA 2,813,833	181	150	94	202	3.03	3.40	0.37
8	Seattle, WA 2,414,616	102	147	-7	166	3.63	2.97	-0.66
9	Tampa, FL 2,395,997	173	197	2	228	2.87	2.63	-0.24
10	Miami, FL 2,253,362	125	93	23	145	4.66	5.43	0.77

Notes:
20 largest urbanized areas by 1990 population.
Central city is the city or cities named.
Suburban is the difference between the urbanized area's corresponding metropolitan area and the central city. 1999 metropolitan boundaries are used for both 1960 and 1990 data.