Urban Sprawl in a U.S. Metropolitan Area: Ways to Measure and a Comparison of the Sacramento Area to Similar Metropolitan Areas in California and the U.S.

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Abstract

For more than forty years, urban planners, environmentalists, and other social engineers have used the pejorative catch phrase of urban sprawl to categorize much of what Americans dislike about suburban life in U.S. metropolitan areas. In the early 1990s, coinciding with Joel Garreau's (1991) publication of *Edge City: Life on the New Frontier*, the term urban sprawl grew to common usage in the public's lexicon and is now a policy concern that is even debated at the national level. In his 1999 State of the Union Address, President Clinton devoted nearly 20 percent of his time to issues related to metropolitan development; he only spent more time on foreign policy. Vice President Al Gore, running for President in 2000, followed up with campaign speeches that attributed road rage, loss of fertile land, central city decay, and even a decline in family life to urban sprawl. Alternatively, Conservative commentators like Thomas Sowell (1999) and George Will (1999) attribute this national focus as the most recent crisis contrived by Liberals to justify government interference in what should be the private choices of where people and businesses locate.

Given this background, it is hard to find an individual or policymaker in any region in the United States who, at least publicly, favors urban sprawl. At the same time, it is equally difficult to find someone who can concisely define what urban sprawl is and how to best measure the degree to which it has occurred in a region. However, it is not hard to find an individual or policymaker in the United States concerned over the negative outcomes that are widely attributed to urban sprawl: loss of open space, traffic congestion, air pollution, a greater percentage of the poor living in the inner-city, central city blight, etc. To correctly test the causal connection between urban sprawl and these negative outcomes, ways are needed to measure the degree that urban sprawl has occurred in a metropolitan area like Sacramento. Once this measurement is chosen, factors cited as causes of urban sprawl can also be tested for validity, and if appropriate, these tests can then form the basis for public policies designed to reduce sprawl and the negative urban outcomes attributed to it.

About the Author

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Introduction

> In the next three or four years, Americans will have a chance to decide how decent a place this country will be to live in, and for generations to come. Already, huge patches of once green countryside have been turned into vast smog-filled deserts that are neither city, suburb, nor country and each day—at a rate of some 3,000 acres a day—more country is being bulldozed over… It is not merely that the countryside is receding; in the great expansion of the metropolitan areas, the subdivisions of one city are beginning to meet up with the subdivisions of another.

The above quote offers nothing new to Americans who regularly follow current events. The statement sounds like it comes from a recent commentary written in any newspaper or newsmagazine in the United States. Would you be surprised to learn that it appeared in the opening paragraph of an article by William Whyte that he titled "Urban Sprawl" in the January 1958 (p. 103) edition of *Fortune* magazine?

For more than forty years, urban planners, environmentalists, and other social engineers have used the pejorative catch phrase of urban sprawl to categorize much of what Americans dislike about suburban life in U.S. metropolitan areas. In the early 1990s, coinciding with Joel Garreau's (1991) publication of *Edge City: Life on the New Frontier*, the term urban sprawl grew to common usage in the public's lexicon and is now a policy concern that is even debated at the national level. In his 1999 State of the Union Address, President Clinton devoted nearly 20 percent of his time to issues related to metropolitan development; he only spent more time on foreign policy. Vice President Al Gore, running for President in 2000, followed up with campaign speeches that attributed road rage, loss of fertile land, central city decay, and even a decline in family life to urban sprawl. Alternatively, Conservative commentators like Thomas Sowell (1999) and George Will (1999) attribute this national focus as the most recent crisis contrived by Liberals to justify government interference in what should be the private choices of where people and businesses locate.

Given this background, it is hard to find an individual or policymaker in any region in the United States who, at least publicly, favors urban sprawl. At the same time, it is equally difficult to find someone who can concisely define what urban sprawl is and how to best measure the degree to which it has occurred in a region. However, it is not hard to find an individual or policymaker in the United States concerned over the negative outcomes that are widely attributed to urban sprawl: loss of open space, traffic congestion, air pollution, a greater percentage of the poor living in the inner-city, central city blight, etc. To correctly test the causal connection between urban sprawl and these negative

outcomes, ways are needed to measure the degree that urban sprawl has occurred in a metropolitan area like Sacramento. Once this measurement is chosen, factors cited as causes of urban sprawl can also be tested for validity, and if appropriate, these tests can then form the basis for public policies designed to reduce sprawl and the negative urban outcomes attributed to it.

In this short paper, I take the opening step toward this broad research agenda. First, I survey the previous urban, economic, planning, and popular literature to derive a consensus on the best ways to measure the degree of urban sprawl in a U.S. metropolitan area given the available data. I provide values for these measures for the Sacramento metropolitan region, two like regions in California, and three comparable regions in the United States. As evidence that metropolitan areas that exhibit greater urban sprawl are also more likely to exhibit undesirable outcomes, I also derive partial correlation coefficients (that measure the degree of association between two variables) for some of the chosen measures of urban sprawl and the chosen negative outcomes. A discussion on the need for further research to better verify a causal relationship, and a few suggestions on how to go about it, conclude this paper.

What Is Urban Sprawl?

In its broadest sense, urban sprawl is just another word for a certain type of metropolitan decentralization or suburbanization. Suburbanization occurs over time when a larger percentage of a metropolitan area's residential and/or business activity takes place outside of its central location. In most calculations of suburbanization, the central location is considered the metropolitan area's central city. In a metropolitan area consisting of multiple counties, the central location could also be the entire county that contains the central city. This expanded definition usually encompasses a metropolitan area's inner-ring suburbs, which in many cases in the 1990s faced the same losses of population and employment density as central cities.

As discussed by Ed Mills (1999) and Jan Brueckner (2000), the process of suburbanization has occurred in the United States for well over 75 years. In 1950, 57 percent of the population and 70 percent of the employment in the U.S. took place in central cities. By the mid 1990s, these percentages had respectively declined to around 35 and 45 percent. Urban economists have extensively documented, modeled, and statistically examined this occurrence. Their conclusion is that 20th Century suburbanization in the United States is due to population growth, rising incomes, falling commuting costs, and to some extent, changing tastes. As population rises in a metropolitan area, it becomes increasingly more difficult to locate the same percentage of residential and business activity in a central city whose boundaries remain fixed. Higher income residents, generally, demand larger quantities of housing and the cheap land to build it is more likely on the suburban fringe. The construction of federally subsidized highways, and the relatively low private cost of using an automobile to get to work, has further facilitated the 20th Century movement to the suburbs. In addition, many people

and businesses just prefer a suburban setting; though there is some debate as to whether this a preference induced by the limited choices provided them (see Ewing, 1997).

Concept

Yet, in its current usage, urban sprawl has come to mean more than just suburbanization; it is a code word for a certain type of "excessive" suburbanization. According to economists, the least value-laden way to define suburbanization that has become excessive is when further decentralization imposes greater private and social costs, net of private and social benefits, than if the development had remained more centralized. Private benefits and costs from an individual or firm locating somewhere in a metropolitan area accrue only to the entity making the location decision. Due to the location decisions of other entities, public benefits and costs accrue to all individuals and firms throughout the metropolitan. These public benefits and costs are not borne by the decision maker, and in most cases, the individual or firm does not fully consider them when making a location decision.

An example would be a family new to a metropolitan area that decides to live in the outer suburbs, even though the primary wage earner works in the central city. They make this decision by weighing the private benefits (possibly better public schools, cheaper housing costs, newer infrastructure, neighbors they would rather associate with, etc.) against the private costs (possibly longer commuting times, less urban amenities, etc.). This family determines that the private benefits are greater than the private costs at an outer location, and choose their residence in the urban fringe. In making this decision, they are unlikely to fully consider the social costs of their decision (perhaps greater air pollution from a longer commute, greater freeway congestion, increased publicly-funded infrastructure costs, the social and economic isolation of those left behind at the core of the metropolitan area, etc.)

To define when new suburbanization becomes excessive, economists look to see if the private and social costs of decentralization, net of private and social benefits, are positive. This is the economist's realm of evaluating a decision based upon the tradeoffs involved in it. In the United States, people and businesses freely chose to decentralize their location in a metropolitan area and it is reasonable to assume that they only do so if the private benefits they receive from such are greater than the private costs. As Ned Levine (1997, p.280) points out: "What to one person is 'sprawl' to another is his/her home." Suburbanization can become excessive when business and individuals ignore the social costs that their decision to decentralize imposes upon the metropolitan area, or the social benefits they would have generated if they would have chosen a more centralized location. Economists refer to these privately ignored social costs and benefits as externalities. Urban planners, environmentalists, and other social engineers have embraced the concept of excessive suburbanization (urban sprawl) because it offers a theoretically based reason for government to redirect, or "plan," the intrametropolitan location decisions of individuals and firms. However, the difficulty in deciding when to

impose this redirection has always been in determining when the total costs of a form of suburbanization are greater than the total benefits.

The previous explanation for the concept of urban sprawl is based in economics and rather abstract. It is not new, and Robert Harvey and W.A.V. Clark made a similar argument in as early as 1965. As a more concrete alternative, policy analysts and social activists have chosen to conceptualize excessive suburbanization in a way that they are certain that the total costs of a described form of suburbanization is greater than the total benefits. For instance, in a widely cited 1998 study, the Sierra Club defines sprawl as "low-density development beyond the edge of service and employment, which separates where people live from where they work—thus requiring cars to move between zones." Continuing this theme, the *Planning Commissioners Journal* (2000) describes urban sprawl as "dispersed development outside of compact urban and village centers along highways and in rural countryside." Anthony Downs (1998), at the Brookings Institution, defines urban sprawl by observable traits such as unlimited outward extension of new development, low density developments in new-growth areas, leapfrog development, and strip commercial development.

Reid Ewing (1994 and 1997), an urban planner, takes a very deliberate approach to conceptualizing what urban sprawl is. He surveyed 15 academic articles on the subject, written between 1957 and 1992, and found that the terms low-density, strip or ribbon, scattered, or leapfrog development are often used to characterize urban sprawl. Ewing lumps these characteristics under the term "non-compact development," but he is not satisfied with such a simple archetype. In his mind, urban sprawl is always a matter of degree and the difficulty in crafting a rule to recognize it occurs in distinguishing the degree of non-compactness that exist in the forms of polycentric development that exists in most U.S. metropolitan areas. In the end, Ewing equates the degree of urban sprawl in a region to the extent of residential inaccessibility to jobs and shopping, and lack of functional open space in the region. Ewing's definition of functional, applied to open space, is vacant land that performs some "useful" public purpose.

Measurement

The economist's method of defining urban sprawl is theoretically sound, but extremely demanding to quantify. It is very difficult to measure all of the benefits and costs that occur when further suburbanization occurs in a metropolitan area and policy activists instead prefer characterizations of types of development where they believe the total costs likely are likely greater than total benefits. The problems that arise when declaring that a type suburbanization is urban sprawl is not unlike the problem a court encounters when declaring something pornographic. We all know there are certain forms of metropolitan decentralization in which the private and social costs of it occurring are greater than the private and social benefits it generates. The difficulty, as with pornography, is in the creation of a specific rule that identifies a type of suburbanization that fails such a benefit/cost test. Though planners and other urban activists have stepped into this void and offered, characteristics of metropolitan suburbanization in which they

believe the costs are greater than the benefits. If we accept these characteristics, and Ewing's insight that defining sprawl is always a matter of degree, the declaration of the degree of sprawl in an urban area is possible, though still not simple.

Much of how planners define sprawl consists of descriptions of specific types of development. With existing data sources, there are no easy ways to directly measure the occurrences of many of these types of development in a metropolitan area. Nonetheless, there are measurable characteristics that do appear in these descriptions. These include low density, scattered, and/or dispersed development; the separation of where people live from where they work; and a lack of functional open space. These characteristics, along with the concept of excessive decentralization that occurs over time and measured in a relative sense, are what I rely on in this paper to begin to define ways of determining the degree of urban sprawl in a metropolitan area like Sacramento.

The Census Bureau defines U.S. metropolitan areas by a central city and the surrounding county or counties that are economically integrated—in regards to commuting and shopping patterns—with the central city. This is the definition used here. A centralized metropolitan area has a greater percentage of its residential and business activity concentrated at its core. Based upon Census definitions, this can be measured by the percentage of metropolitan population or employment occurring in the area's central city; or in the case of a metropolitan area consisting of multiple counties, the percentage of metropolitan population or employment occurring in the area's central county. If the percentage of residential or business activity at the center of a region is less than at comparable regions, then this could be an indicator that a region's suburbanization is excessive. If the percentage of residential or business activity at the center of a metropolitan area declines over time, then development in the area is less centralized. Comparing these temporal changes across similar metropolitan regions may also offer an indication of whether a region's level of suburbanization has been excessive. In addition, the employment to population ratio of the central city (or central county), relative to the employment to population ratio of the entire metropolitan area, acts as another measure of centralization. The change in this measure over time also says something about metropolitan changes in residential separation from place of work. David Rusk (1995), Peter Gordon and Harry Richardson (1996), John Brennan and Edward Hill (1999), Bruce Katz (2000), and others have also suggested the use of these forms of population and employment measures to measure the occurrence of decentralization in U.S. metropolitan areas.

An additional indicator that could possibly measure urban sprawl, and that is easy acquire for decennial Census years, is the percentage of a metropolitan area's population that lives in what the U.S. Census Bureau defines as a central city's "urbanized area." An urbanized area is a central place and places in the metropolitan area, plus the densely settled territory (urban fringe) that surrounds these places. An urbanized area must have a minimum population of 50,000 and the area's fringe must consist of contiguous territory that has a density of least 1,000 persons per square mile. The urban fringe can also consist of outlying territory of such density if it is connected to the central place by a

road no longer than 1.5 miles long, or a road 5 miles long if water or other undeveloped territory separates it from the central place. These last allowances makes the percentage of a region's population that resides in its urbanized area a less than ideal measure of a non-sprawled region because they allow for the inclusion of ribbon, scattered, and leapfrog development. Nonetheless, I later provide values for the percentage of a metropolitan area's population that lives in its urbanized area. Jan Brueckner and David Fansler (1983) used similar values in their analysis of causes of urban sprawl.

A final possible indicator of the lack of excessive decentralization in a metropolitan area is a comparison of the change in percentage of land devoted to farming in a region's central county to the same percentage calculated for the entire region. Over time, if the percentage of land in the entire area devoted to farming falls quicker than in similar metropolitan areas, or if the percentage of land devoted to farming in metropolitan area falls quicker than the percentage of land devoted to farming in the central county, then the region may have seen a relatively excessive decline in functional open space.

Since excessive suburbanization is a relative term, a metropolitan area's level of suburbanization at one point in time needs to be compared with both its level at earlier points in time and the degree of decentralization in similar metropolitan areas at the same time. In the next section, this is done for the Sacramento region and the two most similar metropolitan regions in California, and three other comparable regions in the United States.

Urban Sprawl in Sacramento and Five Similar Regions

In 1990, the Sacramento/Yolo Consolidated Metropolitan Statistical Area (CMSA) consisted of the central city of Sacramento and the surrounding counties of Eldorado, Placer, Sacramento, and Yolo. The two California metropolitan areas that are most like the Sacramento region are the Fresno Metropolitan Statistical Area (MSA) and the Stockton/Lodi MSA. The three metropolitan areas, outside of California, chosen for similarities to the Sacramento region are the Reno, Nevada MSA; Tucson, Arizona MSA; and the Raleigh/Durham/Chapel Hill, North Carolina MSA. Table 1 contains a description of these metropolitan areas and the relevant variables used to determine the likeness between them all.

The choice of regions in Table 1, deemed comparable to the Sacramento/Yolo CMSA, occurred after a comparison of variables that account for the geographic and population size of a metropolitan and its central city, and the growth in metropolitan population over the last two decades. All of the metropolitan areas in Table 1 have experienced nearly the same levels of total population growth and are, to some extent, similar in size. The choice of the Fresno and Stockton/Lodi MSAs, as the metropolitan areas in California most comparable to the Sacramento region, was easy. All three of these regions are in California's Central Valley, have a similar development history, and do not border other major metropolitan areas. That said, the things to notice concerning non-comparability

between these two areas and the Sacramento/Yolo CMSA is the larger square miles that are in the Fresno MSA, and the smaller square miles that make up the Stockton/Lodi MSA and its central city.

Table 1: The Regions under Consideration

Region	Component County Names	1996 Central City Pop (1,000s)	1990 Central City Area (sq mi)	1997 MSA Pop (1,000s)	1994 MSA Area (sq mi)	1980-90 MSA % Pop Growth	1990-97 MSA % Pop Growth
Sacramento/Yolo, CA CMSA	El Dorado, Placer, Sacramento, and Yolo	376	96.3	1,656	5,094	35.8	12.2
Fresno, CA MSA	Fresno, Madera	396	99.1	869	8,102	30.8	15.0
Stockton/Lodi, CA MSA	San Joaquin	233	52.6	543	1,399	38.4	12.9
Reno, NV MSA	Washoe	156	57.5	306	6,343	31.5	20.1
Tucson, AZ MSA	Pima	449	156.3	780	9,187	25.5	17.0
Raleigh/Durham/ Chapel Hill,NC MSA	Chatam, Durham, Franklin, Johnston, Orange, and Wake	244	88.1	1,050	3,491	29.1	22.3

The search for U.S. metropolitan areas outside of California that are reasonably similar to the Sacramento region was not as easy. The Sacramento region, like most in the Western half of the United States, grew up in the 20th Century in an era of rising population, rising incomes, and falling commuting costs; and never developed a dense urban core. Thus, it made sense to concentrate the search for similar metropolitan areas in the United States in the West. This resulted in my choice of Reno and Tucson. The Reno MSA is different than the Sacramento/Yolo CMSA in that it is smaller in all measured aspects except total square miles. Alternatively, the Tucson MSA is larger in central city population and central city and metropolitan square miles than the Sacramento/Yolo CMSA, but smaller in total metropolitan population. The Raleigh/Durham/Chapel Hill MSA is similar in many ways to the Sacramento/Yolo CMSA and is the one non-Western metropolitan area chosen for comparison to the Sacramento region. Perhaps most important for comparison purposes, over the last 20 years all six of these metropolitan areas exhibited very similar rates of population growth.

Data

Table 2 contains information on the percentage of the six metropolitan area's populations that reside in the central city, or if relevant, in the area's central county. Sources for all the variables contained in Tables 2 through 6 are in a Data Sources list at the end of the paper. With the exception of pre-1990 Raleigh, the central city of Sacramento composes the smallest percentage of total population in these metropolitan areas. Between 1980 and the late 1990s, the percentage of metropolitan population in the city of Sacramento declined by nearly eight percent ((23.1—25.1) / 23.1), while the percentage of metropolitan population in the city of Raleigh rose by 6 percent. Alternatively, the county of Sacramento contained just over 70 percent of its region's population in 1980. Of the three regions's containing multiple counties, only Fresno County had a larger share of its area's population.

Table 2: Population Centralization in Sacramento and Comparable Regions

Region	1980 (Central City Pop. / Region Pop.) x 100	1990 (Central City Pop. / Region Pop.) x 100	2000 (Central City Pop. / Region Pop.) x 100	1980 (Central County Pop. / Region Pop.) x 100	1990 (Central County Pop. / Region Pop.) x 100	2000 (Central County Pop. / Region Pop.) x 100
Sacramento/Yolo, CA CMSA	25.1	25.0	23.1	71.3	70.4	68.7
Fresno, CA MSA	37.7	46.9	45.6	89.2	88.4	87.3
Stockton/ Lodi, CA MSA	42.9	43.9	44.1	Not Relevant	Not Relevant	Not Relevant
Reno, NV MSA	52.0	52.6	52.1 (1998 Data)	Not Relevant	Not Relevant	Not Relevant
Tucson, AZ MSA	62.1	60.7	58.2 (1998 Data)	Not Relevant	Not Relevant	Not Relevant
Raleigh/Durham/ Chapel Hill, NC MSA	22.6	24.3	24.0 (1998 Data)	45.3	49.5	53.1 (1999 Data)

Between 1980 and the late 1990s, the percentage of the Sacramento region's population living in the central county of Sacramento declined nearly 4 percent. While, like its central city, the percentage of the region's population living in the central county (Wake) of the Raleigh/Durham/Chapel Hill MSA increased over 17 percent. Population decentralization in the Sacramento region, by most measures, has been greater and is becoming greater than in the five other comparable regions.

Information on the degree of employment decentralization in each of the six metropolitan areas, and how it has changed over the last decade, is contained in Table 3. As in the previous measure of population decentralization, the central city of Sacramento contains the smallest percentage of its region's employment and this percentage declined between 1990 and 1999. However, for all six metropolitan areas the percentage employed in central cities declined over this period. In favor of relatively greater centralization in Sacramento, the decline in Sacramento City was near the lowest.

Second to Fresno County, among the three areas consisting of multiple counties, Sacramento County had the highest percentage of its region's employment. Like population decentralization, this relatively high percentage declined between 1990 and 1999. A decline in this measure also occurred for the central county of Fresno, but employment centralization increased for the central county of Wake in the Raleigh/Durham/Chapel Hill MSA. The findings for employment centralization in Sacramento's central county imitate the findings for Sacramento County's population centralization: a relatively high concentration in the central county that has declined in the last decade.

The final gauge of employment centralization in Table 3 is the percentage ratio of central city employment to central city population for 1990 and the late 1990s. In 1990, the number of employees working within the city of Sacramento was about 46 percent of the city's population. This ratio rose to near 49 percent in 1999. Since the city of Sacramento's population grew over this period, the city's employment growth more than kept pace. This bodes well for the maintenance of employment centralization in the Sacramento region. The preservation of employment to population was not the case for the two other central cities in California: Fresno and Stockton. Both of these Central Valley cities began the 1990s with a smaller employment to population ratio than Sacramento City and their ratios declined even further during the 1990s. Tucson also exhibited a central city employment to population percentage smaller than the city of Sacramento in 1990, but contrary to Fresno and Stockton, Tucson's percentage grew between 1991 and 1997. The city of Raleigh began the last decade with an employment base that was about 70 percent as large as its population base, and finished the 1990s about the same.

Regarding employment to population percentages in the Sacramento/Yolo CMSA, a different picture emerges upon examining county level statistics. In 1990, this ratio was lowest for Placer County at 45 percent; the central county of Sacramento was at 47 percent, while Yolo and Eldorado Counties respectively were at 49 and 50 percent. Between 1990 and 1999, the relative boom areas of Yolo and Placer Counties experienced the largest increases in their countywide employment to population ratios. Yolo's employment to population rose from 49 to 54 percent, while Placer's ratio rose from 45 to 50 percent. The other outlying county of Eldorado experienced an increase in its ratio from 50 to 52 percent. Only the central county of Sacramento maintained a constant employment to population ratio of 47 percent throughout the 1990s. If the employment to population ratio in the city of Sacramento increased during the 1990s,

while the county of Sacramento's remained constant, the area of Sacramento County outside of its central city must have experienced a decline in its employment to population ratio. This is a classic case of inner metropolitan suburbs exhibiting different growth patterns than their outer suburbs. Bruce Katz and Jennifer Bradley, in their 1999 Atlantic Monthly article "Divided We Sprawl," observe the same phenomenon across the United States and declare the "old city-verses-suburb view outdated." Many inner-ring suburbs face greater economic development challenges than the central cities they surround.

Table 3: Employment Decentralization in Sacramento and Comparable Regions

Region	1990 (Central City Emp. / Region Emp.) x 100	1999 (Central City Emp. / Region Emp.) x 100	1990 (Central County Emp. / Region Emp.) x 100	1999 (Central County Emp. / Region Emp.) x 100	1990 (Central City Emp. / Central City Pop.) x 100	1999 (Central City Emp. / Central City Pop.) x 100
Sacramento/Yolo, CA CMSA	23.5	23.1	69.9	67.3	46.4	48.7
Fresno, CA MSA	48.2	45.9	93.1	88.7	42.7	40.4
Stockton/Lodi, CA MSA	42.6	41.4	Not Relevant	Not Relevant	40.2	37.8
Reno, NV MSA	Not Reported	Not Reported	Not Relevant	Not Relevant	Not Reported	Not Reported
Tucson, AZ MSA	77.2 (1991 Data)	74.7 (1997 Data)	Not Relevant	Not Relevant	40.4 (1991 Emp.)	43.2 (97 Emp., 98 Pop.)
Raleigh/Durham/ Chapel Hill, NC MSA	36.8 (1992 Data)	34.1 (1997 Data)	54.8 (1998 Data)	55.6 (1998 Data)	71.0 (1991 Emp.)	70.0 (97 Emp., 98 Pop.)

Table 4 contains three additional variables that gauge the 1987 to 1997 change in real dollar, retail sales for the central city, central county (if relevant), and entire metropolitan area. A comparison of the Sacramento/Yolo CMSA, and other similar California MSAs, to like regions in the United States is enlightening. Notice that for all central cities in California, real dollar retail sales fell between 1987 and 1997. The city of Sacramento experienced the largest decrease in retail activity at -12.5 percent. While for comparable central cities outside of California, real dollar retail sales rose in all cases. In Reno, the increase between 1987 and 1997 came out at 32 percent, while for Raleigh it was a respectable increase of 26 percent. These decreases for central California Cities, and for the central county of Sacramento, occurred concurrently with real dollar, retail sales increases in all six metropolitan areas. This points to two clear findings: (1) greater retail decentralization in the Sacramento region than in similar regions in California, and (2)

much greater retail decentralization in Sacramento and other similar California regions than in the three other comparable regions in the United States.

Table 4: Retail Decentralization and Farm Land in Sacramento and Comparable Regions

Region	1987-1997 % Change Central City Real Retail Sales	1987-1997 % Change Central County Real Retail Sales	1987-1997 % Change Region Real Retail Sales	1987-1997 % Change Central County Land Devoted To Farm	1987-1997 % Change Region Land Devoted To Farm
Sacramento/Yolo, CA CMSA	-12.5	-2.9	4.8	-25.3	-10.5
Fresno, CA MSA	-1.5	5.6	6.5	-4.8	-7.7
Stockton/Lodi, CA MSA	-8.5	Not Relevant	1.0	Not Relevant	-1.8
Reno, NV MSA	32.1	Not Relevant	27.7	Not Relevant	-12.3
Tucson, AZ MSA	13.1	Not Relevant	18.8	Not Relevant	-8.8
Raleigh/Durham/ Chapel Hill, NC MSA	26.3	48.9	35.4	-12.0	-5.2

The greater retail dispersion in the Sacramento/Yolo CMSA, compared to the Fresno and Stockton/Lodi MSAs, is likely due to the more polycentric nature of the Sacramento area. The Sacramento area has a far greater number of large cities that surround its central city than like Central Valley regions. Large suburban cities are likely to be magnets for retail expansion within a metropolitan area. The disparity between retail decentralization in California and non-California areas is not as easy to understand unless one is familiar with California's local fiscal environment since the 1978 passage of Proposition 13. The loss of property taxation as a discretionary revenue source for local governments has encouraged them to seek needed local revenues elsewhere. In post-Proposition 13 California this comes primarily in the form of a local government retaining at least one percent of all local sales activity through a situs based tax. The clamor for this discretionary revenue source has been termed the "fiscalization of local land use" and is perhaps one of the primary reasons for the widely divergent loss of retail sales in California's central cities compared to other similar central cities throughout the United States. Suburban cities in California actively recruit retail firms, prefer the big-box type that generate a large amount of dollar sales per customer, and hence may further along the decentralization of retail activity in California's metropolitan areas. However, the evidence in Table 4 is preliminary until further statistical tests confirm it.

Table 4 also contains values on the percentage change in total metropolitan area and central county land devoted to farming. In 1987, Sacramento County committed 67

percent of its land area to farm activity. In 1997, this percentage fell to 49 percent, or the percentage decline of 25.3 reported in Table 4. In 1987, the entire region of Sacramento had 37 percent of its land devoted to farming. This percentage fell to 33 percent in 1997, or the decline of 10.5 percent also recorded in Table 4. Based upon calculations like this, a possible indicator of sprawl may be the change in metropolitan-wide land devoted to farming in comparison to central county land used for farming. If a region is losing the percentage of it land devoted to agriculture quicker than its central county, unlike the Sacramento region, then perhaps leapfrog development is more likely occurring. For the three multi-county regions observed, this only occurred in the Fresno MSA.

Table 5 offers data on the percentage of an area's population that resides in what the Census characterizes as a central city's urbanized area. As described earlier, this is an imperfect measure of urban sprawl, but offers interesting information nonetheless. In 1990, third to only the Tucson and Reno metropolitan areas, the Sacramento region exhibited a rather large percentage of urbanized residents. Nearly three-quarters of its citizens lived in such an area and this percentage has remained relatively constant since 1970. In fact, throughout all the areas examined, this percentage remained quite consistent. Where it has changed, the percentage of a metropolitan area's population in its urbanized area has increased. If, when comparing like regions, greater residence in the non-urbanized area of region acts as an indicator of greater urban sprawl in a region, then the Raleigh region is the most sprawled of all considered.

Finally, Table 6 offers variables that attempt to account for a few of the negative outcomes, or in economic terms the social costs, generated through excessive suburbanization in a region. These measures include gauges of the degree of economic segregation in a metropolitan area (city poverty relative to suburban poverty, suburban wealth relative to city wealth, and city unemployment relative to suburban unemployment), and a measure of how the upper and lower levels of commute times compare (people who drive 45 minutes or more/people who drive 15 minutes or less). Researchers such as Reid Ewing (1996), Anthony Downs (1998), and Bruce Katz (2000) often cite these outcomes as the negatives that society needs to be most concerned about from excessive suburbanization. Greater economic segregation between a central city and its suburbs produces greater difficulty for the central city in collecting needed revenues for its probably greater per-capita local expenditures on social and welfare programs, less employment opportunities for the low-skilled left behind in the central city, and other less tangible harmful outcomes generated because of greater metropolitan segregation by class and race/ethnicity. A higher ratio of long commute times to short commute times may result in the increased freeway congestion and air pollution that perhaps concern the public most about urban sprawl.

Table 5: Percentage Metropolitan Population in "Urbanized Area"

Region	1970	1980	1990
Sacramento/Yolo, CA CMSA	74.8	73.1	74.9
Fresno, CA MSA	57.8	57.9	60.6
Stockton/Lodi, CA MSA	48.6	46.7	54.9
Reno, NV MSA	82.3	83.8	83.9
Tucson, AZ MSA	82.8	84.7	86.9
Raleigh/Durham/Chapel Hill, NC MSA	28.4	31.1	35.7

Table 6: Negative Outcomes Often Attributed to Urban Sprawl

Region	1989 (Central City Poverty Rate / Suburban Poverty Rate) x 100	1989 (Suburban % Households Top 20% Income / Central City % Households Top 20% Income) x 100	1991 Average Annual (Central City Unemploy. Rate / Suburban Unemploy. Rate) x 100	1990 # People ((Commute > 45 Minutes) / (Commute < 15 Minutes)) x 100
Sacramento/Yolo, CA CMSA	189.0	136.1	144.4	32.3
Fresno, CA MSA	136.4	129.0	83.3	18.4
Stockton/Lodi, CA MSA	196.3	135.9	129.0	33.4
Reno, NV MSA	164.3	145.6	120.0	12.9
Tucson, AZ MSA	159.1	244.2	133.3	27.2
Raleigh/Durham/ Chapel Hill, NC MSA	137.2	99.1	102.8	28.8

In terms of relative economic segregation between the central city and non-central city (suburbs), the Sacramento region always finishes in the top half of the six metropolitan areas considered. It is number one in terms of its 1991 central city unemployment rate being 144 percent greater than its suburban rate. Second to only the Stockton/Lodi MSA, its 1989 poverty rate was 189 percent of its suburban poverty rate. Behind the Tucson and Reno regions, but greater than the other two California regions, the Sacramento suburbs have 136 percent more households earning in the top income range than households in the Sacramento City that earn in the same top range.

A comparison of the number of extreme commuters in these six regions, to the number of below average commuters, indicates that the Sacramento/Yolo CMSA has its share of high-end commuters. Only slightly below the Stockton/Lodi MSA, extreme commuters in 1990 in the Sacramento region comprise in number nearly one-third of the below-average commuters.

Urban Sprawl and Its Relationship to the Negative Outcomes Often Attributed to It

The final bit of analysis completed for this paper is a simple assessment of the relationship between the previous measures of metropolitan centralization and the negative outcomes often attributed in popular literature to greater urban sprawl. Based upon the previous discussion, I have chosen to measure the lack of urban sprawl in a region in 1990 by: (1) the percentage of the region's population in its central city, (2) the percentage of a region's employment in its central city, and (3) the ratio of central city employment to population. Although the lack of retail sales loss from a central city is a good candidate to proxy for a lack of urban sprawl in a region, I do not use it here because the findings so clearly differ between California and non-California metropolitan areas. A more complex form of analysis—which I will complete later—is necessary to test the hypothesis that retail decentralization leads to these negative outcomes.

Recall from Table 6 that the four measures of negative outcomes in a metropolitan area in 1990 are: (1) central city poverty relative to suburban poverty, (2) suburban wealth relative to central city poverty, (3) central city unemployment to suburban unemployment, and (3) long commutes relative to short commutes. As each of these measures increase, the magnitude of each negative outcome increases. Hence, if as advocated by urban activists, greater metropolitan centralization leads to smaller negative outcomes, a rise in any of the centralization measures should yield a fall in these negative outcomes. Partial correlation coefficients, calculated from the 1990 data for the six regions, tell us whether this occurs.

A partial correlation coefficient between two variables takes on a value between one and negative one. The sign of the coefficient measures whether a positive or a negative relationship exists. The closer the absolute value of the correlation coefficient to one, the greater is the linear relationship between the two variables. A value of one indicates that as one variable increases (decreases) by one unit, the other variable always increases (decreases) by a constant unit. Nine of the 12 correlations in Table 7 exhibit the negative sign advocated by urban activists, or an increase in a measure of centralization leads to a decrease in three-quarters of the negative outcomes considered here. The strongest negative relationship of –0.57 occurs between an increase in the city employment to population percentage and a decrease in suburban wealth relative to city wealth.

Table 7: Partial Correlation Coefficients between Measures of Centralization and Negative Outcomes Attributed to Urban Sprawl

Variable	City Poverty / Suburb Poverty	Suburb Wealth / City Wealth	City Unemp. / Suburb Unemp.	Long Commute / Short Commute
City Pop. / Region Pop.	-0.06	0.74	-0.13	-0.49
City Emp. / Region Emp.	-0.29	0.84	-0.44	-0.36
City Emp. / Region Pop.	-0.50	-0.57	-0.32	0.09

Unexpectedly, the greater the percentage of an area's population or employment that is in the central city, the greater the household wealth in the suburbs relative to the central city. This is an interesting finding and should perhaps not be so surprising. It supports the more formal research findings of Richard Voith (1998) that indicate that stronger central cities in a metropolitan region enhance the region's suburban wealth. The positive, but weak correlation between city employment to population ratio and the ratio of long commutes to short commutes is likely the result of the long commutes generated by metropolitan residents at the suburban fringe who a more likely to work in the central city when its employment to population ratio is high. In such a situation, long commutes could fall with further employment decentralization. These positive correlations, between greater centralization and negative outcomes in a metropolitan area, illustrate the tradeoffs—stressed earlier in the economic description of how to determine when suburbanization is excessive—that arises when intrametropolitan land use patterns change.[1] They also demonstrate a point continually stressed by urban economists who have examined this issue: not all of a metropolitan area's problems are caused by greater suburbanization.

Conclusion

> *While economists may have the theoretical high ground, they can't always follow through and operationalize their ideas.*

This quote appears in an article by Paul Gottlieb (1999, p. 54) that he titled "Do Economists Have Anything to Contribute to the Debate on Urban Sprawl? (And Would Anybody Listen to Them if They Did?)." In this article, he deals with some of the same ground covered in the first half of this paper and laments the shortage of quality work by economists on urban sprawl. This shortage is in part due to the difficulty in measuring the metropolitan area land use patterns that urban activists have labeled as urban sprawl: decentralized, low density, non-clustered housing, leapfrog, too much strip, and separation of uses. In this paper, I "operationalize" the measurement of at least the degree of decentralized, low-density, and possibly leapfrog development in a metropolitan area. Over time, I calculated these measures for the Sacramento metropolitan region and like regions in California and the United States. In doing so, my goal was to reduce the shortage of work by economists on urban sprawl.

The picture that emerged concerning the degree of urban sprawl in the Sacramento region is somewhat mixed, but generally points to a comparably high degree of decentralization as measured by population and employment densities at its center. Data that shows the degree of retail decentralization in the Sacramento and other California

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[1] In assessing the validity of the correlation coefficients in Table 7, I would be remiss to not say that none of them were statistically significant from zero with greater than a 90 percent degree of confidence in a two-tailed test. However, with only six observations to work with, this is not surprising.

regions being far greater than like U.S. regions also offered preliminary support for my future research on "The Nexus Between Local Government Finance and the Generation of Urban Sprawl in California and the United States." Coinciding with the Sacramento region exhibiting a high degree of relative decentralization, it also displayed a high level of the negative metropolitan outcomes generally associated with a high degree of urban sprawl. I tested this relationship, between greater centralization and lower negative outcomes, in a formal manner using observations from all six metropolitan areas and found that three-fourths of the relationships were negative. There are also reasonable explanations for the one-fourth of the relationships that turned out positive. In offering these explanations, I illustrated the tradeoffs in greater metropolitan centralization often overlooked in the centralization agenda of many urban planners, but are at the heart of an economic analysis.

In my future research on this topic, I plan to expand the number of variables used to measure differences in the degree of urban sprawl in a metropolitan area. Another variable, that may better capture the concept of suburbanization that is excessive in terms of being low density and leapfrog, is the between Census year's growth in a region's urbanized area square miles, relative to the growth in the region's population and/or employment. It would also be informative to examine the growth patterns that occur in the large and medium sized suburban cities that exist around all major metropolitan areas in the United States. Declines in the density of population, employment, and retail activity in inner-ring suburbs, relative to the outer-ring suburbs, is often cited by urban activists as a type of suburbanization that imposes large social costs on society.

Whatever the form of data used to identify urban sprawl, analysts can learn from the economist's method of defining excessive suburbanization. If a type of suburbanization generates more private and social costs, than it does private and social benefits, then it is excessive. In my mind, and I believe in the minds of most of the public, this is what urban sprawl is. If policymakers know that a certain form of suburbanization fails such a benefit/cost test, they should be appropriately trying to do something to reduce it. At the same time, this does not imply that all forms of suburbanization should be slowed. To the contrary, quite the opposite.

Though in reality, the exact measurement of all the costs and benefits associated with a type of suburbanization is difficult, if not impossible. No matter, if policymakers keep in mind the fact that all forms of suburbanization yields benefits and costs, they can eliminate from consideration many of the purely value-laden and one-sided discussions that this issue has been relegated to for so long. Economists do have something important to contribute to the escalating debate on land use in U.S. metropolitan areas and it is my hope that policymakers in the Sacramento region and other metropolitan areas listen.

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