

Appendix F

Accounting for Distortions by Aggregate Data

We note that our analysis, when applied at the level of the aggregate Urbanized Area (UA), including one or more central places and an urban fringe, does not capture geographic shifts of population within the boundaries of the UA. This requires additional measurements to ensure that such hypothetical shifts have not distorted the conclusions.

Hypothetically, it is possible that a disproportionately high share of a UA's population growth occurred on a small fraction of the already built-up central place (i.e. urban core) of the UA, while a small minority of residents settling in spacious new single-family dwellings on half-acre lots on the outer fringes of the city actually accounted for most of the overall increase in urban/suburban land. In such a scenario, the population growth would not be *directly* responsible for much or even any of the sprawl since most or all of the UA's net population growth was occurring in the core of the city – not on the periphery of the suburbs where the sprawl is taking place. (*Indirectly*, such densification might indeed facilitate or enable the expansion of peripheral sprawl through several means).²²

Thus, if an Urbanized Area's population growth is occurring primarily in the urban core, while densities are falling in the suburbs, the proportion of sprawl attributed to population growth from the analysis of aggregate UA data may be misleading. In these cases, using only the aggregated population growth and density figures for the entire UA would mask the fact that density had declined in the suburbs. Fortunately, the Census Bureau provides separate data for the urban cores and the suburban fringes. This makes it possible to test for the hypothetical distortion just stated. We have performed the test on all 100 cities and found nothing to indicate that the share of sprawl our formula has associated with population growth was systematically overstated, although we did find isolated instances of overstatement.

The initial sign that population growth might not be linked to as much sprawl as the aggregate analysis suggests would be the meeting of each of two conditions: (1) an increase in central urban density, and (2) a simultaneous decrease in density in an expanding suburban area. These two conditions were clearly and unequivocally met in six out of the 100 cities studied: El Paso, Mobile, Phoenix, Tacoma, Wilmington, and Stockton. An adjustment procedure was applied to these UA's that consisted of the following: The total growth in land area was apportioned between urban (i.e. central place) and suburban (i.e. urban fringe) shares. Since density rose in the urban share, 100% of this share was assigned to population growth. Then the same Holdren analysis used on aggregate UA data for all 100 cities was applied to the urban fringe share of growth. That is, the percentage growth in both suburban population and suburban land area were calculated in order to derive shares of the suburban land area growth attributable to suburban population growth and rising per capita land consumption (declining density).

In performing this adjustment, the share of sprawl explained by population growth actually rose in three of the six UA's – Mobile, Tacoma and Wilmington. In these cases, the central place land area grew by very little or actually shrank, and population and population density there increased only slightly. Urban fringe population growth was greater and was actually found by the Holdren formula to represent a higher share of urban fringe land increase than the share of overall UA land area increase attributable to population growth. In these three cases, we continued to use the overall aggregate UA figures for Mobile, Tacoma, and Wilmington, rather than adjusting these figures upwards.

In the three other cases, the initial aggregate UA Holdren analysis indicated that population growth explained 86% of El Paso's sprawl, and 100% of both Phoenix's and Stockton's. These were adjusted downwards to 63% for El Paso, 92% for Phoenix, and 84% for Stockton, respectively, based on the adjustment method described above. Table 6 in Section 4.4 and Appendix A show the adjusted percentages rather than the original 100% share attributed to population growth.

In the case of El Paso, Texas, the central core grew in area from 118.3 to 162.7 square miles from 1970 to 1990, while the fringe or suburbs grew from just 1.1 square miles in 1970 to 57.6 square miles in 1990. The total increase in area of the El Paso UA was 353.6 square miles, 44% of which is attributable to growth in the central place and 56% to growth in the urban fringe. Within the 44% attributable to growth in the central place, population growth had a 100% share of sprawl (reflected in a rising number of residents per square mile). Within the urban fringe (which constituted 56% of the total increase in area), the population grew from 13,827 in 1970 to 55,830 in 1990, an increase of 304%. Urban fringe land area increased by a whopping

²² The expansion of peripheral sprawl may be facilitated by means such as: 1) a diminished quality of life in the urban core due to crowding, higher crime, or social tensions, pushing out those long-time residents who have the option of leaving; 2) greater demand for inner city/suburban housing, which bids up prices on older or more run-down housing stock, thereby enabling the sale of homes and the departure of their long-term occupants; 3) the availability of more low-cost labor (i.e. associated with the higher numbers of lower-income, urban residents) for new housing and infrastructure construction, landscaping, etc., which effectively lowers expenses for and increases the relative affluence of higher-income consumers, permitting (among other things) the purchase of larger homes on larger lots further away from the central city.

5,136%. (The very small, very densely populated 1970 urban fringe area of just 1.1 square miles at a density of 13,827 per square mile, compared to just 2,724 per square mile for the urban core, suggests that in 1970 El Paso was an anomaly.) Applying the Holdren method to the urban fringe alone, 34% of the suburban sprawl is associated with population growth. Thus, 100% of the 44% urban share and 34% of the 56% suburban share of the El Paso UA are related to population growth; putting these together, 63% of the entire UA sprawl is related to population growth.

In the case of Phoenix, Arizona, the central core grew in area from 247.9 to 472.1 square miles from 1970 to 1990, while the fringe or suburbs grew from 139.6 to 269 square miles. The total increase in area of the Phoenix UA was 353.6 square miles, 63.4% of which is attributable to growth in the central place and 36.6% to growth in the urban fringe. Within the 63.4% attributable to growth in the central place, population growth had a 100% share of sprawl (reflected in a rising number of residents per square mile). Within the urban fringe (which constituted 36.6% of the total increase in area), the population grew from 281,795 in 1970 to 469,680 in 1990, an increase of 67%. Urban fringe land area increased 93%. Applying the Holdren method to the urban fringe alone, 78% of the suburban sprawl is associated with population growth. Thus, 100% of the 63.4% urban share and 78% of the 36.6% suburban share of the Phoenix UA are related to population growth; putting these together, 92% of the entire UA sprawl is related to population growth.

Finally, in the case of Stockton, the central core grew in area from 29.9 to 52.6 square miles from 1970 to 1990 (an increase of 76%), while the fringe or suburbs grew only from 16.9 to 21.2 square miles (a 25% increase). Thus, expansion of Stockton's urban core was responsible for 84% of the increase in land area for that California city from 1970 to 1990. Within that 84%, population growth had a 100% share of sprawl; within the 16% of Stockton's total sprawl that was suburban or urban fringe, population growth had a 0% share of sprawl (population actually declined in the urban fringe, although the area grew). Thus, overall, 84% of Stockton's total sprawl was due to population growth.

ENDNOTES

See footnotes