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Understanding Smart Growth Savings

What We Know About Public Infrastructure and Service Cost Savings, And How They are Misrepresented By Critics

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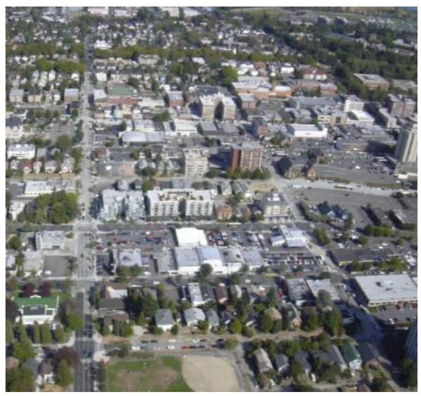

Abstract

Land use patterns affect various costs to consumers and society. Many of these costs tend to increase with sprawl (dispersed, urban fringe development), and can be reduced with smart growth (more compact, mixed, multi-modal development). Smart growth tends to reduce the costs of providing public infrastructure and services, and by improving accessibility and reducing per capita vehicle travel, tends to reduce direct and indirect transportation costs. Current development fees, utility rates and taxes fail to accurately reflect these location-related cost differences, which encourages consumers to choose more sprawled locations than is optimal. This paper summarizes estimates of smart growth savings, and critiques analyses which claim that such savings are insignificant.

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Introduction

Land use development patterns (also called *built form*) affect various costs. *Smart growth* policies tend to reduce per capita impervious surface area (land covered by buildings or paved for roads and parking facilities), vehicle ownership and vehicle travel, and increase use of alternative modes compared with more dispersed, automobile-dependent, *sprawled* communities. The can provide various savings and benefits:

- Reduced impervious surface reduces stormwater management costs and heat island effects (increased ambient temperatures on sunny days), and leaves more land for other productive uses, including farming and wildlife habitat.
- More compact development reduces the capital and operating costs of providing public infrastructure and services such as roads, utility lines, garbage collection, emergency services and school transport.
- More compact development improves overall accessibility (people's ability to reached desired goods and services). This increases the efficiency of activities that involve *distribution* (products delivered to a destination) or *interaction* (people and materials brought together).
- More compact development reduces transportation costs, including the per capita costs to consumers to own and operate vehicles, road and parking facility costs, traffic accidents, and pollution emissions.

These savings and efficiencies are why people and businesses tend to cluster into business districts, towns and cities. Although the basic concepts are well accepted by most experts (more compact development tends to reduce per capita infrastructure and transportation costs), these relationships are complex and so can be difficult to quantity. Some critics claim that smart growth provides little or no net savings (Cox and Utt 2004). This report reviews the evidence on smart growth cost savings and evaluates specific claims by critics.

Defining Density, Compact Development, Smart Growth and New Urbanism
Density refers to people, jobs or housing units per unit of land area (acre, hectare, square kilometer or square mile). Density is generally associated with other land use factors including centricity, mix, roadway connectivity, transport diversity (good walking, cycling and public transit service) and efficient parking management. Together these are called *compact development* or *urbanization*. Because density is relatively easy to measure, it is often used as an indicator of this set of factors.

In recent years some studies have tried to isolate the effects of individual land use factors (CARB 2010-11; Ewing and Cervero 2010). This research indicates that density itself has only modest travel impacts. It is possible for relatively dense regions to be automobile dependent if they lack centricity, mix, connectivity, modal diversity, and efficient parking management (Eidlin 2010).

Smart growth refers to land use development policies that result in more compact development. *New urbanism* generally refers to smart growth policies implemented at the local or site scale.

Defining Smart Growth

Smart growth is a general term for policies that result in more compact, accessible development within existing urban areas. Smart growth is an alternative to dispersed, automobile dependent development outside existing urban areas, often called *sprawl*. Table 1 compared these land use patterns.

Table 1 **Comparing Smart Growth and Sprawl** ("Smart Growth," VTPI 2006)

	Smart Growth	Sprawl
Density	Higher-density, clustered activities	Lower-density, dispersed activities
Growth pattern	Infill (brownfield) development	Urban periphery (greenfield) development
Land use mix	Mixed land use	Homogeneous (single-use, segregated) land uses
Scale	Human scale. Smaller buildings, blocks and roads. Designed for pedestrians	Large scale. Larger blocks, wider roads. Less detail, since people experience the landscape at a distance, as motorists
Services (shops, schools, parks)	Local, distributed, smaller. Accommodates walking access.	Regional, consolidated, larger. Requires automobile access
Transport	Multi-modal transport and land use patterns that support walking, cycling and public transit	Automobile-oriented transport and land use patterns, poorly suited for walking, cycling and transit
Connectivity	Highly connected roads, sidewalks and paths.	Hierarchical road network with numerous dead-end streets, and unconnected paths and sidewalks
Street design	Streets designed to accommodate a variety of activities. Traffic calming	Streets designed to maximize motor vehicle traffic volume and speed
Planning process	Planned and coordinated between jurisdictions and stakeholders	Unplanned, with little coordination between jurisdictions and stakeholders
Public space	Emphasis on the public realm (streets, sidewalks and public parks)	Emphasis on the private realm (yards, shopping malls, gated communities, private clubs)

This table compares Smart Growth and sprawl land use patterns.

Smart growth can be applied in various conditions, including rural, suburban and urban. In rural areas it means clustering more development into villages. In suburban areas it means creating complete, mixed-use, walkable neighborhoods.

Smart growth can provide various economic, social and environmental benefits, as summarized in Table 2. These benefits result from various features of smart growth, including reduced per capita land consumption, less dispersed development, and more diverse transportation systems. Of course, the benefits of a particular smart growth program depend on its specific features and the conditions in which it is implemented. The existence of these benefits has been demonstrated in numerous studies and is widely accepted by a diverse range of professions and interest groups, including the American Planning Association, the Institute of Transportation Engineers, the International City/County Management Association, the National Governors Association, the National Trust for Historic Preservation, and various farming and environmental organizations.

Table 2 **Smart Growth Benefits** (Litman 2002; USEPA 2004; Burchell, et al. 2005)

Economic	Social	Environmental
Infrastructure cost savings Public service cost savings Transportation efficiencies Economic resilience Agglomeration efficiencies Supports industries that depend on high quality environments (tourism, farming, etc.)	Improved transport options, particularly for non-drivers Increased housing options Community cohesion Cultural resource preservation (historic sites, traditional neighborhoods, etc.) Increased physical exercise and health	Greenspace & habitat preservation Energy savings Air pollution reductions Water pollution reductions Reduced "heat island" effect.

Smart growth can provide various economic, social and environmental benefits.

Smart growth includes more integrated transport and land use planning, so for example, most homes are within convenient walking distance of schools, shops and public transit. These features help reduce chauffeuring burdens and school busing, providing savings to households and governments.

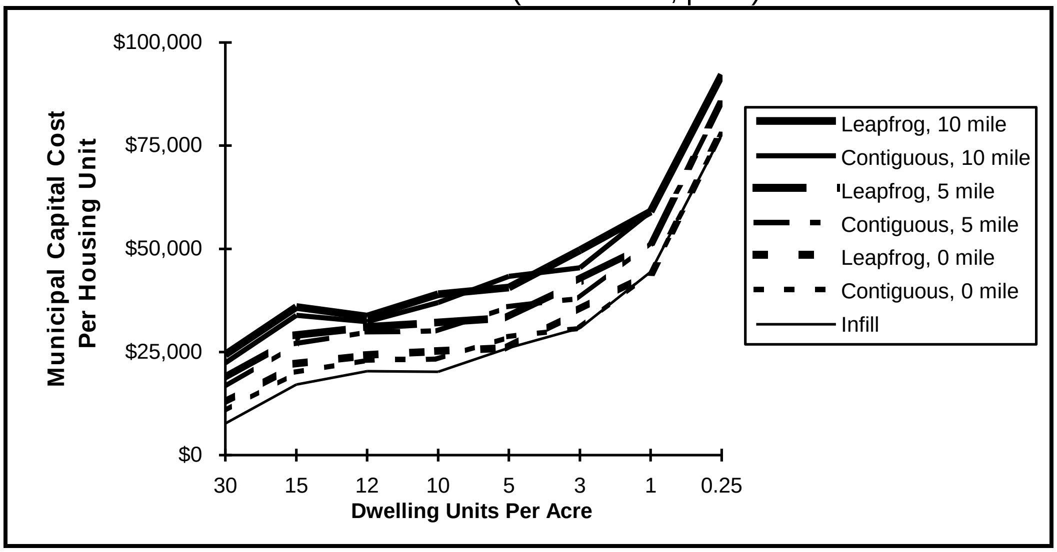
Smart growth can also increase some costs. More compact development can increase the traffic congestion intensity (Melia, Parkhurst and Barton 2011), although sprawl tends to increase the distances between destinations, and therefore the per capita vehicle travel and congestion delays (Cortright 2010). Other smart growth factors, such as increased land use mix, improved travel options, and more connected roadways reduce traffic congestion. One major study in Phoenix, Arizona found less traffic congestion on roads in older, higher density areas than in newer, lower density suburban areas due to more mixed land use (particularly more retail in residential areas) which reduces trip lengths, more transit and nonmotorized travel, and a more connected street grid which provides more route options and enables more walking (Kuzmyak 2012). As a result, residents of older neighborhoods generate less total vehicle travel and drive less on major roadways, reducing congestion.

Smart growth may increase some infrastructure costs, such as curbs and sidewalks, and may increase the costs per parking space, particularly if it requires structured rather than surface parking, although it tends to reduce the number of parking spaces per capita, so total parking costs per capita tend to be lower. People sometimes assume that smart growth increases housing construction costs, but detailed analysis indicates otherwise (Ford 2009; Miller 2008).

Evidence of Smart Growth Savings

Smart growth tends to reduce the per capita costs of providing public infrastructure and services (Burchell, et al. 2000; Muro and Puentes 2004; Burchell, et al. 2005; Blais 2010). Figure 1 illustrates how infrastructure capital costs tend to increase with dispersion and distance from the existing urban center (town or city).

Figure 1 **Residential Service Costs** (Frank 1989, p. 40)



Capital costs increase for lower density, non-contiguous development. Higher density, clustered, infill development can provide hundreds of dollars in annual savings compared with sprawl.

Burchell and Mukherji (2003) found that sprawl increases local road lane-miles 10%, annual public service costs about 10%, and housing costs about 8%, adding about $13,000 per dwelling unit. Table 3 shows how school, road and utility costs per residential unit vary depending on development density. Rural Sprawl costs are about 60% more than denser urban development.

Table 3 **Annualized Municipal Costs for Different Densities** (Smythe 1986)

Costs	Higher Density	Medium Density	Rural Cluster	Rural Sprawl
Units/Acre	4.5	2.67	1	0.2
Schools	$3,204	$3,252	$4,478	$4,526
Roads	$36	$53	$77	$154
Utilities	$336	$364	$497	$992
Totals	*$3,576*	*$3,669*	*$5,052*	*$5,672*
Incremental Cost	*NA*	*3%*	*41%*	*59%*

Per household annual municipal service costs increase with sprawl, based on a prototypical community of 1,000 units housing 3,260 people, 1,200 students. Compared with Higher Density, Rural Cluster increases costs 41%, and Rural Sprawl 59%.

Table 4 summarizes public costs (utilities, government services and transportation infrastructure) of three possible Toronto region development patterns, showing significant potential savings from more compact development. In addition to these costs, the *Nodal* and *Central* options provide additional savings by reducing per capita annual vehicle mileage, and therefore costs such as traffic congestion and pollution.

Table 4 **Public Costs of Three Development Options** (Blais 1995)

	Central	Nodal	Spread
Residents per Ha	152	98	66
Capital Costs (billion C$1995)	39.1	45.1	54.8
O&M Costs (billion C$1995)	10.1	11.8	14.3
Total Costs	*49.2*	*56.9*	*69.1*
Percent Savings over "Spread" option	*40%*	*16%*	*NA*

This table compares the estimated 25-year public costs of three land use development options, in millions of dollars. More spread development substantially increases costs.

Coyne (2003) found that in Colorado, "dispersed rural residential development costs county governments and schools $1.65 in service expenditures for every dollar of tax revenue generated." Table 6 compares public infrastructure costs of *Sprawl* and *Smart Growth* scenarios in the Twin City region. Costs more than double under the sprawl scenario, increasing infrastructure capital costs $565 annually per unit, not including ongoing costs such as utility maintenance, emergency response and school busing.

Table 5 **Twin City Development Patterns Compared** (CEE 1999, p. 23)

	Sprawl (2.1 units/acre)	Smart Growth (5.5 units/acre)
Miles of local roads	3,396	1,201
Costs of local roads per unit	$7,420	$2,607
Other infrastructure costs per unit	$10,954	$5,206
Total	*$18,374*	*$7,813*

This table shows infrastructure cost savings from "Smart Growth" development that increases residential development from low to medium density.

Computer models are available that calculate development costs in specific situations (CMHC 2008), although these only account for infrastructure capital costs and often overlook other public service costs that increase with sprawl, such as emergency response and school busing. The Utah's Governor's Office (2003), sponsored development of the *Municipal Infrastructure Planning and Cost Model User's Manual* (MIPCOM) indicates how development location and density affect costs of the following infrastructure:

- *Regional infrastructure*, including regional roads, transit, and water supply facilities.
- *Subregional (off-site) infrastructure*, including water and waste water treatment facilities and distribution networks, storm drain lines and basins, and minor arterial roads.
- *On-site infrastructure*, including local roads, water transmission lines, sewer transmission lines, dry utilities (telephone, electric, etc.), and storm drains.

Table 6 **Public Services Capital Costs, Billions** (IBI 2008)

	Dispersed	Compact	Difference
Roadways	$17.6	$11.2	$6.4 (-36%)
Transit	$6.8	6.2	0.6 (-9%)
Water and Wastewater	$5.5	$2.5	$3.0 (-54)
Fire Stations	$0.5	$0.3	$0.2 (-46%)
Recreation Centers	$1.1	$0.9	$0.2 (-19%)
Schools	$3.0	$2.2	$0.8 (-27%)
Totals	$34.5	$23.3	$11.2 (-33%)

Public services infrastructure costs tend to be higher for more dispersed development.

The City of Calgary *Plan-it* program compared the costs of providing infrastructure and public services to more compact and dispersed development patterns. The study found that the more compact land use saves about a third in capital and operating costs for roads, transit services, water and wastewater, emergency response, recreation services and schools, as summarized in tables 6 and 7.

Table 7 **Public Services Operating Costs, Annual Billions** (IBI 2008)

	Dispersed	Compact	Difference
Roadways	$0.23	$0.19	$0.04 (-18%)
Transit	$0.30	$0.30	$0.00 (0%)
Water and Wastewater	$0.06	$0.03	$0.03 (-55%)
Fire Stations	$0.28	$0.23	$0.05 (-18%)
Recreation Centers	$0.23	$0.19	$0.04 (-18%)
Totals	$0.99	$0.86	$0.13 (-14%)

Public services operating costs tend to be higher for more dispersed development.

Fodor (2011) estimated that new housing imposes public costs averaging $26,523 to pay for additional capacity for schools, transport systems, water and sewage, stormwater drainage and parks and recreation services in Austin, Texas. This reflects net costs after deducting credits for impact fees that average $1,818, and future tax contributions of the development that pay for infrastructure bonds that average $541. These costs average $36,625 for a new single-family unit and $17,912 for a multifamily unit.

The city of Lancaster, California development impact fees that reflect the infrastructure costs of a particular location (New Rules 2002). These fees are calculated by a civil engineering firm based on local development costs. The fees for a typical house located near the city edge are $5,500, but increase to $10,800 if located a mile away, reflecting the additional costs of providing more dispersed infrastructure. Since this price structure was implemented, virtually all new development has been located close to the city.

School travel costs are another example of potential smart growth savings. School busing costs average about $640 per student-year, represent 5-10% of typical school budgets, and even more in rural areas (STN 2004). Some students must be bused regardless of their home location, due to physical disability or to attend special schools, but for most students, the need to bus and therefore school bus services costs depends on the distance between their home and local schools. Below is the typical distance used by school districts above which students must be provided bus services:

- Grades K - 5: Student lives 1.0 mile or more from school.
- Grades 6 - 8: Student lives 1.5 miles or more from school.
- Grades 9 - 12: Student lives 2.0 miles or more from school.

If half of a community's land area is devoted to residential development, and there is an average of 0.2 elementary students per household, and an elementary school requires at least 300 students, then residential densities of approximately 1.5 housing units per acre can support an elementary school without requiring busing. As densities decline, an increasing portion of students must be bused. In addition, busing is sometimes provided for students who live much closer than these distances if a busy roadway creates a barrier to walking and cycling. As a result, as densities decline and vehicle traffic increases, schools must bear increased school busing costs, or households must bear increased financial and time costs chauffeuring children to and from school, and schools and local governments must devote more money to expand road and parking capacity to accommodate these vehicle trips. Note that, except for additional roadway capacity expansion costs, none of these costs are reflected in municipal budgets. Rather, they consist of increased school district expenditures or cuts in other school services, higher household transportation expenditures, and time costs imposed on parents.

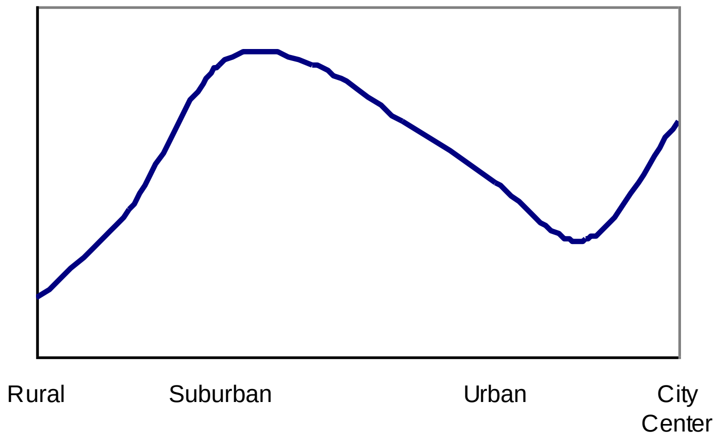
A study by the City of Charlotte, North Carolina found that a fire station in a low-density neighborhood with disconnected streets serves one-quarter the number of households and at four times the cost of an otherwise identical fire station in a less spread-out and more connected neighborhood (CDOT 2012).

The relationships between density and public costs are, of course, complex. Actual costs depend on the specific location and types of services provided. There are also incremental costs associated with increased density, including increased congestion and friction between activities, special costs for infill development, and often higher design standards. Ewing (1997) concludes that this relationship can be graphed as a tilde (~):

- Costs are low in rural areas where households provide their own services.
- Costs increase in suburban areas where services are provided to dispersed development
- Costs decline with clustering, and as densities increase from low to moderate.
- Costs are lowest for infill redevelopment in areas with adequate infrastructure capacity. Costs tend to increase at very high densities due to congestion and high land costs.

Figure 2 illustrates this pattern. Note that much of the public savings in rural areas are actually costs shifted from public to private budgets, or reductions in service quality. For example, rural residents tend to provide their own water, sewage and garbage collection. They actually spend more in total on these services (SC 1999), although the costs do not show up in public utility budgets (and so are ignored in Cox and Utt's analysis). On the other hand, the cost reductions associated with increased density are true resource cost savings, reflecting reductions in total costs per unit.

Figure 2 **Land Use Impacts on Public Infrastructure and Service Costs**



Public infrastructure and service costs tend to be low in rural areas, where most residents provide their own water and sewage, and service standards are relatively low. They increase in suburban areas as more services are publicly supplied to dispersed destinations, decline with density due to efficiencies, then increase at very high densities due to increased congestion.

Other factors also affect public service costs. Single-use development results in inefficient use of infrastructure, increasing per capita costs:

> "Because the home and the workplace are entirely separated from each other, often by a long auto trip, suburban living has grown to mean a complete, well-serviced, self-contained residential or bedroom community and a complete, well-serviced place of work such as an office park. In a sense we are building two communities where we used to have one, known as a town or city. Two communities cost more than one; there is not only the duplication of infrastructure but also of services, institutions and retail, not to mention parking and garaging large numbers of cars in both places." (Kelbaugh 1992, p. 17)

Rural residents traditionally accepted lower levels of public services such as unpaved roads, voluntary emergency services, and fewer libraries and parks. Sprawl encourages residents accustomed to urban quality services to move to exurban areas, pressuring governments to provide more services to low-density locations, despite their high costs.

None of the studies described here considers *all* public infrastructure and service costs affected by land use patterns, so total savings of smart growth are greater than they indicate. Most only consider a limited set of infrastructure costs borne directly by one level of government. Some ignore costs borne by private utilities, by other levels of government, (such as the post office or school districts), by businesses, and indirectly by consumers. On-going costs are often overlooked. For example, many studies consider the incremental costs of building longer water and sewage lines, but not the incremental costs of maintaining and operating them. Similarly, some studies consider the incremental costs of building more roads, but not the costs of maintaining them, or of providing additional parking at destinations due to more automobile-dependent land use patterns.

Overall, the various studies described above indicate that smart growth typically provides direct savings in publicly-borne development costs (roadways and utility lines) ranging from $5,000 to as much as $75,000 per unit, compared with the same quality of infrastructure provided to dispersed development one or more miles beyond the urban boundary. Annualized, typical savings range from $270 to $4,000 per unit per year. In addition, incremental operations, maintenance and service costs (maintaining longer roads and utility lines, increased pumping costs, higher delivery costs for public services, etc.) are probably at least as large, indicating that smart growth can provide public cost savings ranging from $500 to nearly $10,000 annually per unit.

Many communities use impact fees to internalize some of these costs, but in practice these seldom reflect full costs. Low-density homes generally do not pay sufficient incremental taxes to cover their total incremental costs for public services such as school busing, road maintenance, or water and sewer line (Sorensen and Esseks 1998; Blais 2010). As a result, households in older urban neighborhoods tend to subsidize households in newer, lower-density suburban locations (Guhathakurta 1998).

Sprawl also imposes environmental costs. Jacob and Lopez (2009) found that stormwater runoff volumes, and the amount of phosphorous, nitrogen and suspended solid water pollution increase with density measured per acre but declined per capita. Their model showed that doubling standard suburban densities [from about 4 to 8 dwelling units per acre would usually do more to reduce contaminant loadings associated with urban growth than many traditional stormwater best management practices (BMPs), and that higher densities such as those associated with transit-oriented development outperform almost all traditional BMPs in reducing per capita water pollution emissions.

In addition, smart growth provides direct transportation cost savings and increased affordability to housing residents, totaling thousands of dollars a year (Litman 2008; Dodson and Sipe 2006). Because these are true savings to home occupants, translate into higher property values, reduced vulnerability to economic downturns and weak housing markets, and more stable communities (Leinberger 2008).

More affordable transportation tends to improve households' economic resilience, that is, they are better able to respond to unexpected financial burdens such as fuel price increases, vehicle failures or income losses, and so it reduces housing foreclosures. According to the *Location Efficiency and Mortgage Default* study, the probability of mortgage foreclosure increases as neighborhood vehicle ownership levels rise, after controlling for income (NRDC 2010). These results suggest that public policies that support location efficiency can help to reduce mortgage foreclosures, and that loans are safer for housing in more multi-modal locations.

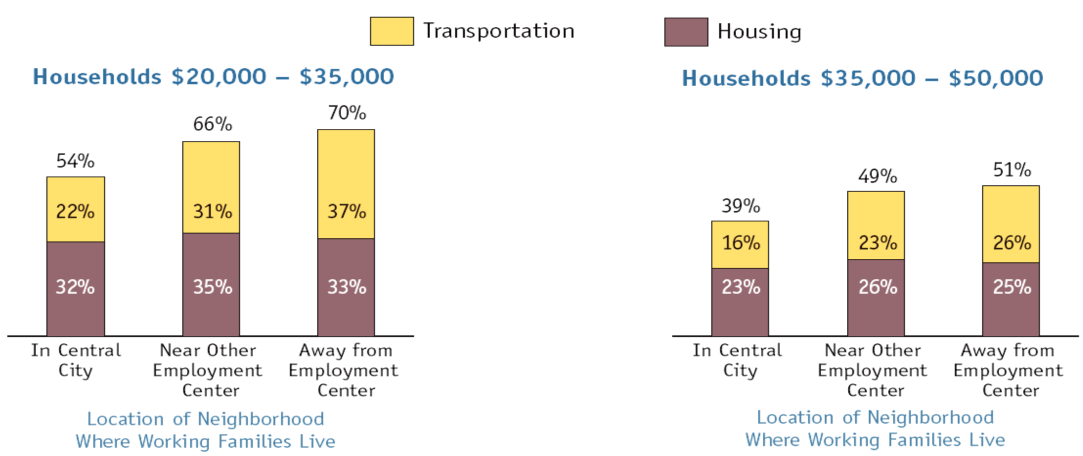
Transportation Costs

Smart growth communities are more accessible, requiring less travel to reach activities (jobs, services, recreation, etc.), and have better travel options (walking, cycling, public transit). This reduces transportation costs, including internal costs (costs paid directly by users) and external costs (costs borne by other people). Smart growth community residents typically own 10-30% fewer vehicles and drive 20-40% fewer annual miles than in conventional, automobile-dependent communities. Although fuel prices, insurance premiums and parking fees tend to be higher in urbanized areas, and residents spend more on public transit, they generally have substantial net savings. The *Housing + Transportation Index* calculates the combined housing and transport expenditures for various locations in 337 U.S. metropolitan regions (CNT 2008). It indicates that households in more compact neighborhoods enjoy combined housing and transport cost savings that average from $1,580 annually in lower-priced markets such as Little Rock up to $3,850 annually in higher-priced markets such as Boston (CNT 2010). For a typical household this is equivalent to a 10-20% increase in pre-tax income.

In addition to these direct transportation cost savings, smart growth can provide indirect savings and financial benefits. For example, smart growth policies include reduced residential parking requirements which can typically saves $500 to $1,500 annually per parking space reduced, and cashing out employee parking subsidies (employees who commute by alternative modes receive the cash value of the parking space they do not use), which typically provides $400 to $1,000 annually in additional employee benefits.

Smart growth is particularly beneficial to physically, economically and socially disadvantaged people who tend to be constrained in their ability to drive (Rodier, et al. 2010). Smart growth improves nondrivers overall accessibility and reduces the portion of lower-income household budgets devoted to transportation, as illustrated in Figure 3.

Figure 3 **Share of Income Spent on Housing and Transport** (Lipman 2006)



Source: Center for Neighborhood Technology calculations.
NOTE: Employment centers are job locations with a minimum of 5,000 employees.

The portion of income devoted to combined housing and transportation by lower and moderate income households is much lower for residents of more central locations.

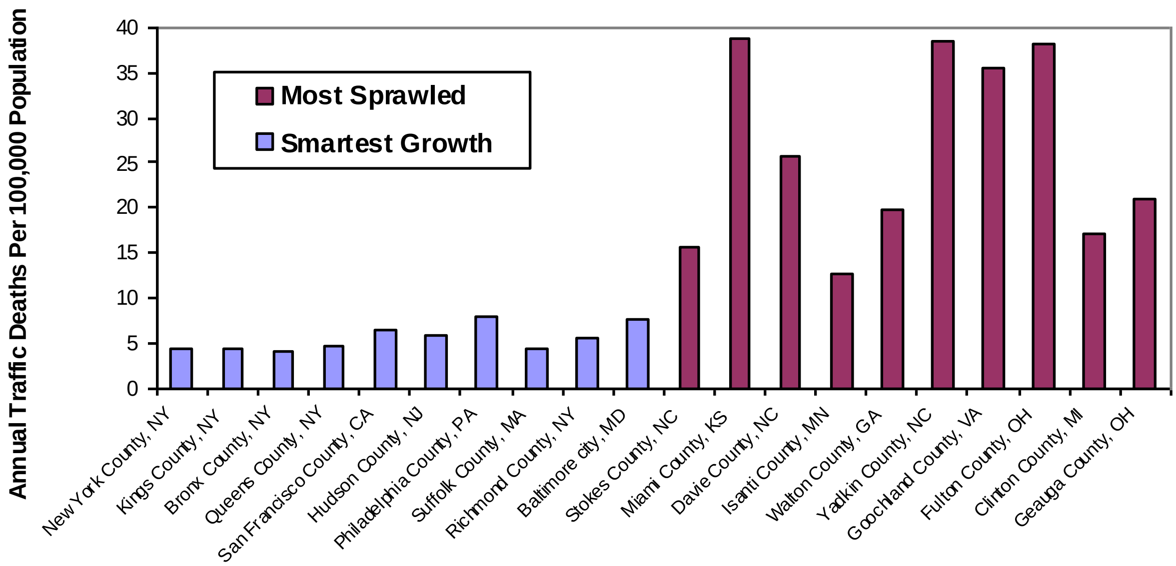
Congestion Impacts

Smart growth tends to increase traffic congestion *intensity* (the delay that motorists experience when driving during peak periods) but tends to reduce per-capita congestion delays because residents drive less and take shorter trips (Cortright 2010; Litman 2007). Compact development supports road pricing. Guo, et al. (2011) analyzed data from the 2006-2007 Oregon Road User Fee Pilot Program, which charged motorists for driving in congested conditions. The study found that households in denser, mixed use, transit-accessible neighborhoods reduced their peak-hour and overall travel significantly more than comparable households in automobile dependent suburbs, and that congestion pricing increase the value of more accessible and multi-modal locations.

Traffic Safety

Smart growth communities tend to have much lower per capita traffic fatality rates than sprawled communities, as illustrated in Figure 4. All told, city residents are much safer, even taking into account other risks that increase with urban living, such as pedestrian traffic fatalities and homicides (Lucy 2002).

Figure 4 **Annual Traffic Death Rate** (Ewing, Schieber and Zegeer 2003)

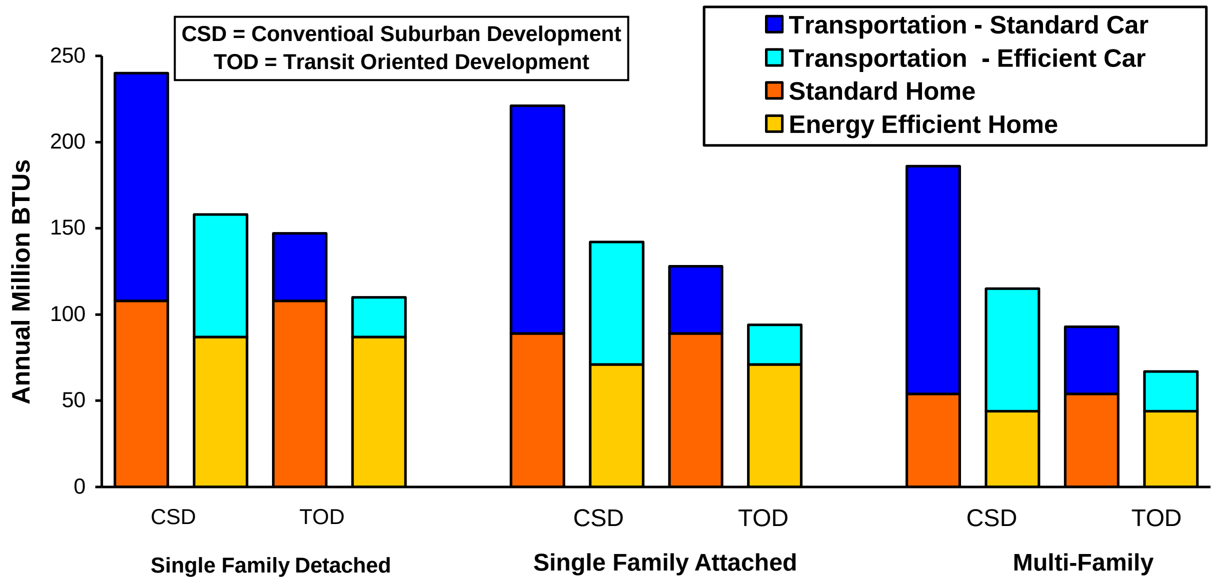


The ten most sprawled U.S. counties have about five times the per capita traffic fatality rate as the ten Smartest Growth counties.

Energy Conservation and Emission Reductions

Smart growth can provide significant energy savings and emission reductions, which provide direct consumer savings and affordability, and environmental benefits. Figure 5 illustrates one example of the energy savings that result from more efficient locations and compact housing.

Figure 5 **Household Transportation Energy Use By Location** (JRC 2011)



Housing location and type have more impact on household energy use than vehicle or home efficiency.

Because petroleum and vehicles are largely imported goods (even vehicles assembled in North America contain a major portion of imported parts), consumer transportation cost savings tend to provide overall economic development benefits by increasing domestic economic productivity and reducing trade deficits (Litman 2010). For example, according to *IMPLAN* input-output model analysis, one million dollars of fuel expenditures shifted to a typical bundle of consumer goods adds 4.5 jobs to the U.S. economy, and each million shifted from general vehicle expenditures (vehicles, servicing, insurance, etc.) adds about 3.6 jobs. Public transit expenditures create a particularly large number of jobs (Chmelynski 2008). These impacts are likely to increase in the future as oil prices rise.

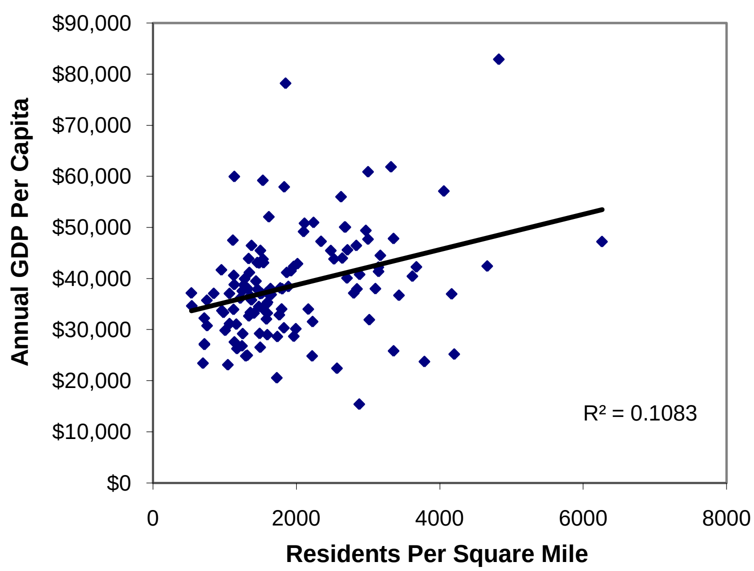
Economic Development

Both economic theory and empirical research indicate that smart growth tends to support economic development, including increased productivity, wages, business activity, property values and tax revenues (IEDC 2006). This reflects the savings and benefits that result more efficient provision of public infrastructure and services, improved accessibility which reduces transportation costs, agglomeration efficiencies, and reduced per capita land consumption.

Agglomeration efficiencies can significantly increase economic productivity (Melo, Graham, and Noland 2009). One published study found that doubling county-level density is associated with a 6% increase in state-level productivity (Haughwout 2000). Carlino and Hunt (2007) found that, all else equal, doubling employment density (jobs per square mile) increases patent intensity (patents per capita) about 20%. Meijers and Burger (2009) found that metropolitan region labor productivity declines with population dispersion (a higher proportion of residents outside urban centres), and generally increases with polycentric development (multiple business districts, cities and towns within a metropolitan region), suggesting that suburbanization is not economically harmful if new towns reflect smart growth principles, but automobile-oriented sprawl reduces productivity.

Figure 6 indicates that among U.S. urban regions, per capita Gross Domestic Product (GDP) tends to increase with population density.

Figure 6 **Per Capita GDP and Urban Density** (BTS 2006 and BEA 2006)[1]

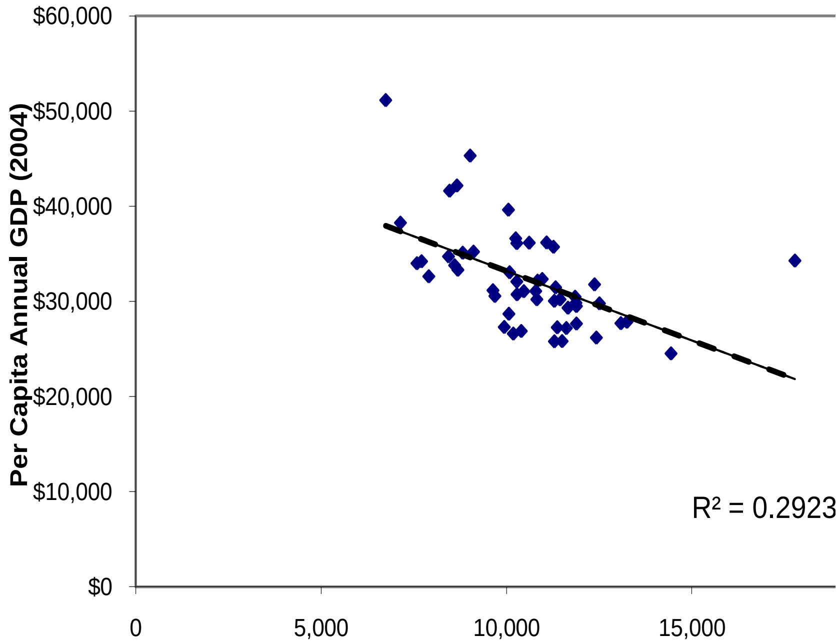


Productivity tends to increase with population density. (Each dot is a U.S. urban region.)

[1] Information in these graphs is contained in the *2009 Urban Transportation Performance Spreadsheet* (www.vtpi.org/Transit2009.xls), based on data from the FHWA's *Highway Statistics*, and the Bureau of Economic Account's *Gross Domestic Product By Metropolitan Area* (www.bea.gov/regional/gdpmetro).

Similarly, Figure 7 indicates that per capita GDP tends to decline with per capita vehicle-miles of travel (VMT). This probably reflects the inefficiencies of sprawled land use, and the increased direct user costs and indirect costs automobile transport including increased congestion, road and parking facilities, accident and pollution damage costs. This suggests that transport policies that reduce VMT by improving alternative modes; more efficient road, parking and fuel pricing; and more accessible and multi-modal land use policies probably increase economic productivity.

Figure 7 **Per Capita GDP and VMT For U.S. States** (VTPI 2009)

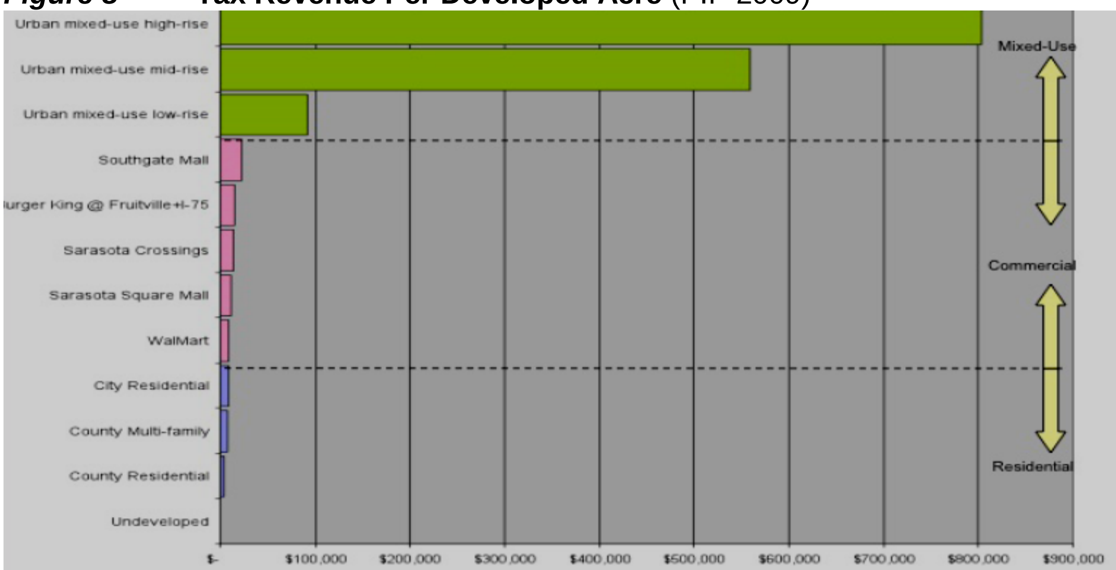


Per capita economic productivity increases as vehicle travel declines. (Each dot is a U.S. state.)

Tax Revenues and Economic Returns

Because smart growth encourages more compact, mixed development, it tends to increase tax revenue per acre, and because it reduces public infrastructure and service costs per unit, it tends to provide greater economic returns to developers and local governments. For example, a fiscal impact analysis study of Sarasota County, Florida showed that county property tax revenue per acre is many times higher for compact, mixed urban development than in low-density, sprawled development, as illustrated in Figure 8. Urban mixed-use high-rise generates 34 times as much tax revenue per acre as a successful shopping mall, and about a 100 times as much as a WalMart. Even low-rise urban development generates far more tax revenue than any suburban development.

Figure 8 **Tax Revenue Per Developed Acre** (PIP 2009)



Urban development generates far more tax revenue per acre than suburban development due to its density and high value.

Because infrastructure costs per housing unit are about half as high for compact development compared with sprawl, the annual infrastructure return on investment (annual tax revenue relative to annualized infrastructure costs) is about 35% for compact development, compared with only 2% for sprawled development, so an urban highrise repays its infrastructure costs in about three years, compared with 42 years for suburban multi-family development. Using real examples in Sarasota County, the study found that 3.4 acres of urban mixed-use development provides the same number of housing units as 30.6 acres of suburban multi-family housing, consuming about one-tenth of the land and only 57% of infrastructure costs, while provide 8.3 times as much tax return.

Cox and Utt's Analysis

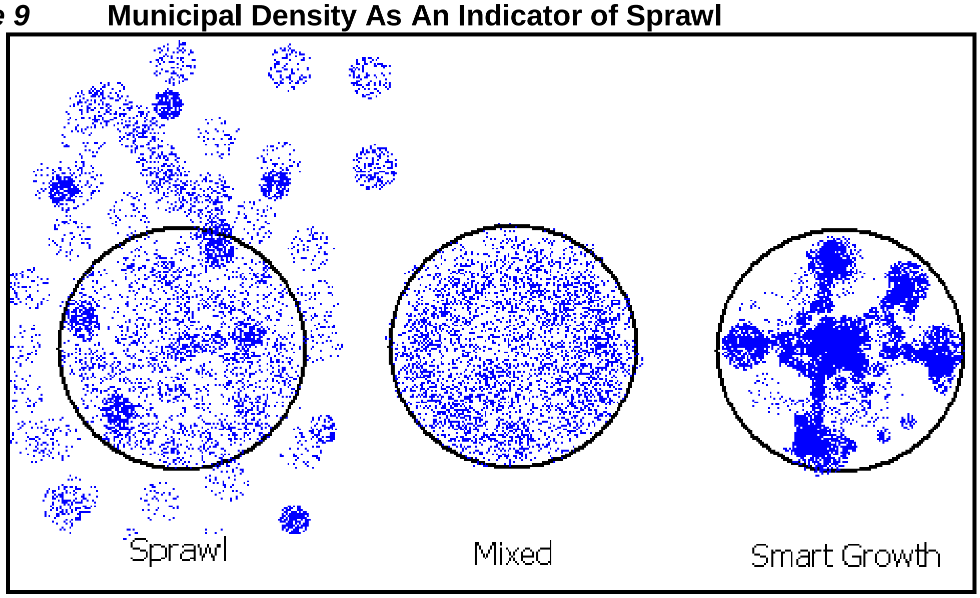
Cox and Utt analyzed various government expenditures by more than 700 municipalities in 2000. Based on the analysis results they conclude that density and growth rates do not significantly affect per capita local government expenditures, so smart growth provides no significant development or service cost savings. Their analysis contains several critical errors, as discussed below.

Definitions of Smart Growth

Cox and Utt base their analysis on the assumption that smart growth consists primarily of increased population density, and that these impacts can be measured effectively at the municipal scale. Both these assumptions are wrong.

As indicated in Table 2 and related literature, population density is just one of many smart growth features, and density changes must be evaluated at a fine-grained geographic scale. For example, in their seminal analysis of land use patterns, Ewing, Pendall and Chen (2002) created an Sprawl Index with four primary factors: residential density, neighborhood mix, strength of activity centers and street network design, measured mostly at a fine grain (such as census tract) scale. Municipal-scale density represents less than a quarter of total smart growth factors. Simply increasing city-wide density by itself would do little to achieve smart growth objectives. A given level of city-wide density can provide very different results, depending on whether or not there is also clustering, mix and connectivity. To illustrate this distinction, Los Angeles has the highest gross density of any U.S. city, but ranks 45th out of 83 metropolitan areas on the Sprawl Index, because other cities rank higher in terms of other attributes such as land use mix, activity center strength and roadway connectivity.

Figure 9 **Municipal Density As An Indicator of Sprawl**



All three cities may have the same measured population density, although one reflects sprawl and the other smart growth. Sprawl consists of dispersed development outside existing urban boundaries. Smart growth consists of clustered, mixed-use development within urban boundaries.

Studies described earlier indicate that the most costly type of sprawl consists of dispersed development *outside* existing urban areas. Cox and Utt's only consider development *within* existing municipal boundaries and so ignore these savings. Smart growth policies that direct development into existing urbanized areas can provide far more savings than Cox and Utt found. Low-density housing built a few miles outside the urban fringe can cost hundreds of dollars more in annual public costs to provide a given level of public services than the same size housing build in clusters of mixed-use, urban neighborhoods.

Smart growth does not always reduces public service costs. As described earlier, some costs may increase at high densities due to increased congestion and friction (although high-density areas such as central business districts provide other benefits, such as land cost savings, reduced transportation costs, and increased economic productivity that offset these higher development costs). This is exactly the pattern Cox and Utt found.

Measuring Costs

Cox and Utt base their analysis on the assumption that municipal expenditures reflect the total costs of providing public services, so lower expenditures reflect greater efficiency and higher expenditures reflect reduced efficiency. This is wrong for several reasons.

First, in lower-density areas a greater portion of service costs are borne directly by property owners, but Cox and Utt ignore private costs. They assume that costs are avoided if residents maintain private wells and septic systems, and deliver their own garbage to the dump. In fact, rural residents actually spend more on basic services than urban residents (SC 1999).

Second, rural residents tend to have lower levels of public services than can be provided in urban areas. Smaller towns tend to rely on volunteer fire departments, have lower grade roadways (many roads are unpaved), lack facilities such as sidewalks, often lack public transit services, and may have minimal parks and recreational services. Cox and Utt do not account for such differences when comparing per capita costs.

Put another way, as more efficient land use patterns make municipal services more cost effective to provide, some of these savings can be reinvested as additional public services. As a result, residents gain from improved service quality rather than lower taxes. These additional public services often provide financial savings to consumers and businesses. For example, residents in smart growth community spend less on automobile transportation because their communities have better travel options (McCann 2000), and better parks and recreation facilities may avoid the need to join a private club.

In addition, larger cities bear special costs associated with concentrated poverty. In 1990, large U.S. cities comprised 12% of the nation's population but 17% of its poor, and as a result spent an average of $364 per capita on health, hospitals, and public welfare, 30% of local tax revenues, while smaller cities and suburbs spent only $40 per capita on those poverty-related categories, just 9% of local taxes (Gyourko and Summers, 1997). This partly results from suburban zoning and automobile-dependency that excludes residents who require affordable housing or cannot drive, offloading public costs onto cities.

Other Cost Savings

Cox and Utt assume that the three cost categories they measure (municipal expenditures, water supply and sewage) reflect total potential smart growth savings, but there are many more potential savings, as indicated in Table 8. Total cost savings are therefore much larger than those measured by Cox and Utt.

Table 8 **Types of Cost Savings Considered by Cox and Utt**

Costs Considered	Costs Ignored
Water and sewage services	Newspaper, mail, and courier delivery
Road and sidewalk networks	Business costs
Government services, such as policing	Consumer vehicle ownership and use
Parks services	Emergency services (some)
Emergency services (some)	Electricity, telephone and cable lines
	Garbage collection
	School busing
	Parking cost savings

Cox and Utt's analysis only considered a portion of total savings associated with smart growth.

Municipal Employee Wages

Cox and Utt argue that increased density reduces public service efficiency by increasing municipal employee wages and work regulations, due to "special-interest capture." Their analysis overlooks critical issues. Residents of larger cities with denser land use patterns tend to earn higher wages, due to the greater productivity resulting from agglomeration efficiencies (Meijers and Burger 2009). This drives up the cost of living in these cities. In addition, public services in large cities are often more sophisticated and productive. For example, larger cities often use larger transit buses and more automated traffic control systems, which require better trained operators. It is only logical that municipal employees in such areas should earn more than employees in lower-wage communities. To prove their point Cox and Utt would need to show that municipal employees in denser and older cities receive significantly higher wages compared with overall local wages, without any increase in municipal employee productivity.

Cox and Utt confuse costs and economic transfers. Smart growth provides true resource savings: per capita costs to provide infrastructure and services are reduced. Wage differentials, if they exist, are economic transfers not costs: higher costs to employers and higher benefits to employees. Whether such differences are good or bad is subjective. Cox and Utt assume that higher municipal wages are harmful, but it would be equally appropriate to say that lower-age employees in lower-density, newer communities are underpaid. Although there is no doubt that society benefits from smart growth resource cost savings, it is wrong to assume that society benefits from lower wages.

Economic Development Benefits

Research by the National Association of Local Government Environmental Professionals (NALGEP 2004) and the International Economic Development Council (IEDC 2006) identify several ways that sprawl can reduce business profitability and competitiveness and how smart growth can supports economic development. This research indicates that:

- *Quality of Life Is Critical to Business* – Business leaders emphasize that quality of life directly affects their bottom line and that sprawl undercuts their employees' quality of life. For example, the Silicon Valley Manufacturing Group and BellSouth have a commitment to smart growth strategies that provide transportation and housing choices for their employees, because they know that they must improve local quality of life to attract and maintain a highly qualified workforce. "For us, business and environmental issues go hand in hand. We care about protecting the environment because the health of the environment directly affects the quality of life for our associates, our customers and our communities," says Kenneth Lewis, Chairman and CEO of Bank of America.

- *Reinvestment in Established Communities Makes Business Sense* – Businesses are promoting reinvestment in established communities and existing infrastructure over the costly approaches of providing new infrastructure to new growth areas. These investments are reducing costs and boosting profits over the short- and long-term. For example, New Jersey Natural Gas is working in partnership with the City of Asbury Park and the State of New Jersey to encourage the revitalization of older urban and suburban communities by creating new models for upgrading existing infrastructure.

- *Smart Growth Is an Emerging Market Opportunity* – Retailers, developers, and other businesses are pursuing smart growth market opportunities to gain competitive advantage, tap new customer demand, and increase profits. The Whole Foods Market food chain now has an aggressive strategy to locate stores in transitional neighborhoods on the verge of revitalization. By specializing in brownfields redevelopment, infill and transit-oriented development, and reuse of historic areas, Struever Bros. Eccles & Rouse, Inc. has grown from a small company to a $150 million real estate development and general contracting company ranked among the top five in Baltimore.

- *Leading Businesses Seek to Improve Growth Management in Their Regions* – Business leaders are joining with localities, states, and grass roots organizations to encourage smart growth planning and management. The Wisconsin Realtors Association, for example, is an active supporter of the state's 1999 Comprehensive Planning Law because as the Association's Tom Larson remarks, "nobody has a larger stake in quality of life issues or a greater awareness of what is going wrong within communities than realtors."

- *Smart Growth Sells in Both Up and Down Economies* – Businesses are making long-term investments in smart growth because smart growth makes economic sense in both growing and slowing economies. Smart growth projects are often stable investments, smart growth services sell, and smart growth public policies help avoid the costs and inefficiencies of sprawl. Bank of America has expanded its commitment to smart growth projects, dedicating $350 billion to community development. Likewise, 275 employers in the San Francisco Bay Area have raised more than $150 million to invest in brownfields redevelopment, affordable housing and other smart growth projects.

Ignorance or Intentional Misrepresentation?

When writing a research paper it is standard practice to provide a balanced overview of the issue, including discussion of previous analysis on the subject, describe the new research, and discuss the strengths and weaknesses of the results (Litman, 2004). Cox and Utt fail to do this. They provide no discussion of the various definitions of sprawl or different ways to measure it. They reference only one previous study on the costs of sprawl (Burchell, et al. 2002). They claim incorrectly that smart growth consists simply of increased population density which can be measured effectively at the municipal level. They ignore extensive recent developments on techniques for evaluating the benefits and costs of sprawl and smart growth (Ewing, Pendall and Chen 2002). They cite Ladd (1992), but ignore cautions contained in that study against using that analysis to evaluating sprawl costs, and other critiques of that analysis (Litman 2003).[2] They do not discuss whether municipal expenditures reflect all sprawl-related incremental costs, or whether differences in service quality and area wage rates can be ignored. Either Cox and Utt are careless researchers, or they intentionally ignore alternative evidence and misrepresent these issues.

Unintended Praise

A bible story tells how the king of Moab once hired the soothsayer Balaam to curse the Israelites when the tribe camped by his land. Reluctantly (he had been warned against performing the deed), Balaam traveled to Mount Phogor, above the Israeli encampment to pronounce the curse. Seven bullocks and seven rams were sacrificed as prescribed. But instead of a curse, out of Balaam's mouth came unexpected praise, a blessing that has since become part of the Jewish liturgy ("*How beautiful are thy tabernacles, O Jacob, and thy tents, O Israel!*").

Similarly, despite their efforts to the contrary, Cox and Utt's research actually shows that smart growth actually does reduce public service costs. Per capita municipal expenditures are found to decline with density, except in the densest cities, just as previous research indicates. Cox and Utt argue that these cost differences are trivial, and so do not justify smart growth policies. However, as described earlier, their analysis greatly understates total potential smart growth savings because it only considers costs that show up in municipal government annual accounts. Total savings to utilities, school districts, state governments, businesses and consumers from more compact, mixed-use development are probably an order of magnitude higher than the $53 Cox and Utt found. This indicates that smart growth typically provides hundreds of dollars in annual per capita savings compared with sprawled, unplanned development patterns.

[2] In 2003 I debated Wendell Cox at the *Urban Streets Symposium*, sponsored by the Transportation Research Board and the Federal Highway Administration, during which I shared my criticisms of his misrepresentations of Ladd's analysis (Litman 2003). He therefore cannot legitimately claim that he was unaware of these issues.

Conclusions

Smart growth consists of various development features that create more efficient land use patterns. Numerous studies indicate that smart growth can reduce public infrastructure and service costs, providing savings on roads, water, sewage, garbage collection, utilities, school transportation, delivery services, and parking facilities.

Cox and Utt attempts to discredit these studies by showing that increased residential density provides relatively small municipal cost savings. Their analysis contains several critical errors.

- It incorrectly defines smart growth as simply increased density or slower growth.
- It measures density at a municipal scale, which is too large to reflect smart growth.
- It only compares differences between municipalities, ignoring differences between development within and outside of municipal boundaries, and between conventional and clustered development within municipal boundaries.
- It only considered a small portion of total costs affected by land use patterns (municipal, water and sewage expenditures), ignoring other savings resulting from more accessible land use patterns.
- It ignored costs of services provided directly by households in lower-density areas, such as well water, septic systems and garbage disposal.
- It ignores differences in service quality.
- It treats higher municipal employee wage in higher-density cities as a cost and an inefficiency, ignoring differences in average overall wages in such areas.

Cox and Utt's analysis greatly understates total potential smart growth savings. They calculate that a 25% increase in municipal population density provides $53 annual per capita in direct savings in municipal, water supply and wastewater management costs. This suggests that a comprehensive smart growth program that shifts dispersed, urban fringe development into more compact, mix-use, multi-modal urban villages could provide public infrastructure and service savings that total several hundred dollars annually per capita, or more than a thousand dollars annually per household. This is consistent with previous research.

Smart growth critics such as Cox and Utt claim that sprawl reflects consumer preferences, and that smart growth harms consumers. But this assumes that current markets are efficient. Efficient markets require that prices (what individuals pay) reflect marginal costs. Currently, many incremental costs resulting from sprawl are dispersed throughout the economy, rather than charged directly to individual consumers. Even where home-buyers pay development fees, such fees seldom reflect the full incremental cost of serving sprawl development. User fees and taxes do not generally reflect additional costs of maintaining and operating more dispersed infrastructure, of providing school busing services, or to deliver mail to dispersed locations. Described more positively, people who choose smart growth locations should be rewarded for the cost savings they provide to their community. This would allow individual consumers to make tradeoffs between cost and location.

This type of underpricing is just market distortion that stimulates sprawl. Table 9 summarizes others.

Table 9 **Market Distortions That Favor Sprawl** ("Market Principles," VTPI 2006)

Market Distortion	Description
Underpricing Location-Related Costs	Although public service costs tend to be higher for sprawl development, development charges, utility fees and local taxes do not generally reflect these location-related costs.
Excessive Parking and Roadway Requirements	Most zoning codes and development standards require generous road and parking capacity. This encourages lower-density, urban fringe development where land is cheaper, and underprices vehicle travel.
Roadway Right-of-Way	By convention, land use for public roads and parking facilities is exempt from rent and taxes. Economic neutrality implies that land used for roads should be priced and taxed at the same rate for competing uses.
Planning and investments that favor suburbs	Many current planning and public investment practices favor new, lower-density, automobile-dependent development over urban infill.
Undervaluing Nonmotorized Modes and Transit	Transportation planning practices tend to undervalue nonmotorized transport modes and transit services, and so underinvest in them.
Residential Lending Practices	Mortgage lenders usually treat car ownership as a financial asset. As a result, lower-income households are encouraged to purchase homes in automobile-dependent suburban areas rather than in multi-modal urban locations.
Underpricing Automobile Travel	Automobile travel is underpriced through underpricing of road use, free parking, fixed insurance and registration fees, and various external costs.

This table describes market distortions that encourage sprawl and automobile dependency.

Consumer surveys indicate that many households would willingly shift from lower-density, dispersed locations to smart growth infill locations if offered financial incentives of this magnitude. Experience with location-based development fees in Lancaster, California indicates that when consumers are charged efficient prices they will usually choose smart growth over sprawl.

According to analysis described in Litman (2009) and Nelson (2006), demand for smart growth housing is growing. Market research indicates that most households want improved accessibility (indicated by shorter commutes), land use mix (indicated by nearby shops and services), and diverse transport options (indicated by good walking conditions and public transit services) and will often choose small-lot and attached homes with these features. Demographic and economic trends are increasing smart growth demand, causing a shortage of such housing. Demand for sprawl housing is declining, resulting in oversupply and reduced value. As a result, the supply of small-lot and attached housing will need to approximately double by 2025 to meet growing demand.

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