

A Dynamic Analysis of Growth, Transportation, & Home Prices

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The issues surrounding growth are complex ... and that's an understatement. Opponents of growth management, or growth limitations, often refer to "unintended consequences" as a basis for questioning limitations. However, political, economic and social "unintended consequences" of growth already abound. Our current policies toward growth affect housing prices and transportation congestion in a variety of ways.

To understand why things are happening as they are, and develop effective policies, we must use systems thinking, rather than linear thinking. "First, our cognitive maps of the causal structure of systems are vastly simplified compared to the complexity of the systems themselves. Second, we are unable to infer correctly the dynamics of all but the simplest causal maps. Both are direct consequences of "bounded rationality ... Axelrod found virtually no feedback processes in the cognitive maps of political elites; rather people tended to formulate intuitive decision trees relating possible actions to probable consequences – an event level representation."¹ This is not just a problem for some of us; it is the human condition. We can improve our intuition in dynamically complex situations, but it takes practice. And even then, system dynamics modeling and simulation is necessary, because in most cases the system is just too complex. The problem is similar to one where, even if we know the laws of physics, we cannot figure out in our heads what happens when galaxies collide.

Some of the models here are complex. That's because the problems are complex. "Everything should be made as simple as possible, but not simpler."²

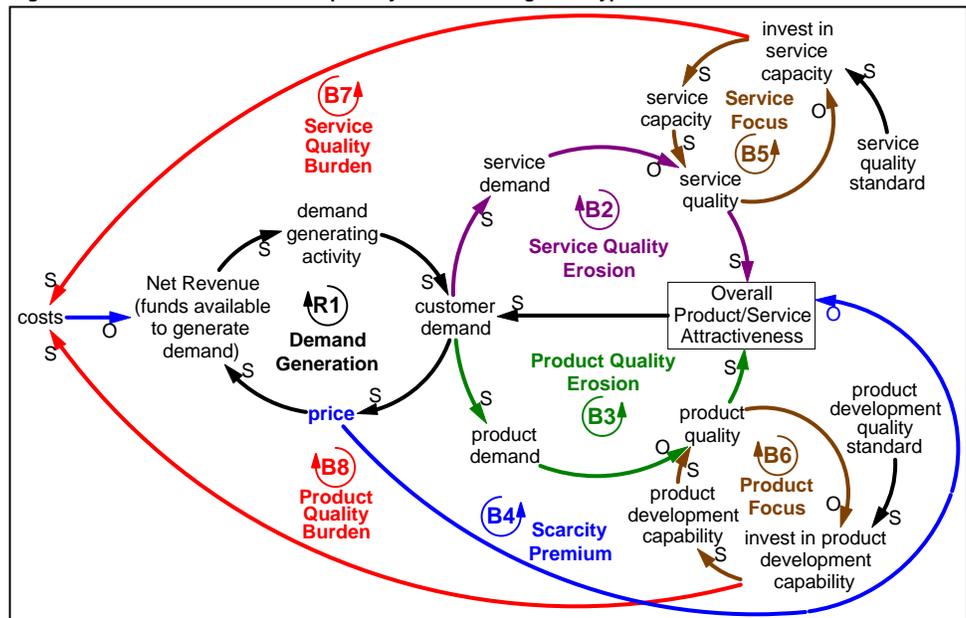
Drivers of Growth

"The Attractiveness Principle." Every business knows that it cannot be "all things to all people." If it tries to have the highest quality product, the lowest cost and the best service (delivery time), it will be overwhelmed on at least one of these dimensions. A business must choose among the factors relevant to its business and focus on the ones that characterize what it wants to be. For example, every restaurant knows it cannot at the same time have the lowest prices, the best quality food, and the best service. McDonald's makes the low prices and good service choices (with food quality not as

good), while Outback Steak House makes the "quality food at reasonable prices" choice (with waits that can be very long). No organization can be best at everything; each must make a choice.

"The Attractiveness Principle" is a systems thinking archetype³ that describes this dynamic (Figure 1).⁴ It shows price, service quality, and product quality as the determiners of attractiveness. Attractiveness is the extent to which the product or

Figure 1. "The Attractiveness Principle" Systems Thinking Archetype



¹ R. Axelrod, *The Structure of Decision: The Cognitive Maps of Political Elites*, 1976, Princeton University Press. Referenced in John Sterman, "Learning in and about complex systems," *System Dynamics Review*, Summer-Fall 1994.

² Albert Einstein (1879 - 1955)

³ Readers can find descriptions of the common archetypes in *The Fifth Discipline* by Peter Senge (1990), but not this one. The "attractiveness principle" archetype is one of the more complex structures not usually included in the basic set. It is related to the "limits to growth"

service “attracts” customers. Customer demand is a result of demand generating activities (such as a sales force or advertising, which create a reinforcing feedback R1) and “Overall Product/Service Attractiveness.” But for constant service or product capacities, increased customer demand can lower service quality or product quality (B2 & B3). It requires investment in personnel to maintain service quality (B5); or it requires investment in plant, equipment and design staff to create more products of high quality (B6). These investments reduce the funds available for demand generating activities (B7 & B8). Prices can be lowered to again increase “Overall Product/Service Attractiveness” and demand (B4), but this reduces the funds available for demand-generating activities. Everything we do to increase demand provokes limiting effects.

Just as no organization can be all things to all people, no region can be all things to all people. Applying this principle in the field of urban dynamics leads to the “theory of relative attractiveness” – **Given free migration, no place can long remain more attractive in an overall sense than any other place.** An attractive location attracts people from less attractive locations. In-migration continues until negative pressures arise to counterbalance an area's underlying attractiveness.⁵

This does not bode well for Colorado housing prices, because the region's underlying attractiveness is so high (e.g., mountain views). This means that other factors (traffic congestion, smog, housing prices, etc.) must get considerably more negative before people will stop emigrating from areas which they currently view as more undesirable than the Pikes Peak region. For example, housing prices tend to increase in an attractive region because of demand, whether the population is growing naturally, people are moving there, or incomes of a static population are increasing.

It's important to understand that “attractive” doesn't mean “prettier.” It means that there is a composite set of factors that attract. A location could be ugly and still “attractive,” if other factors are favorable. The other factors could be the price of land, tax structure, cultural amenities, investment incentives or robust economic activity. In addition, attractiveness factors can be different for different industries. For example, once a critical mass of a given industry develops with a base of suppliers and customers, a region can be attractive for that economic cluster even though it may not be attractive to other industries.⁶

The effects of delays and dynamic complexity. In addition, perception delays can cause population to overshoot, thus exaggerating the negative impact of growth. In-migration in response to *past* attractiveness differentials can lead people continue to move to an area after population growth, congestion, and housing affordability have already worsened. Other delays are introduced because development can be approved, producing early increases in economic activity that boost sales taxes and construction wages; but years later, when the residents move in, there is increased load on infrastructure (e.g., schools and roads) and we feel the negative impacts.

Such delays create what's known as “dynamic complexity” in a system. Even relatively simple situations can become dynamically complex when delays are introduced. For example, most individuals can drive perfectly well under normal conditions, but not when reflexes are slowed due to the influence of alcohol. Delays make economies and organizations difficult to manage for the same reason humans cannot safely drive when drunk. An urban example is the well-known cycle of boom and bust in the real estate industry. Market boom and bust cycles are a major problem that led John Sterman to title a chapter in *Business Dynamics* as, “The invisible hand sometimes shakes.”

Business recruitment strategy. The Greater Colorado Springs Economic Development Corporation uses this relative attractiveness to recruit companies and people from California and other parts of the U.S. As noted above, this will be a selling point as long as Colorado Springs is more attractive than LA, or other places of emigration, but only as long as Colorado Springs is more attractive than *other* locations to which companies and individuals can relocate.

Road building to relieve traffic congestion. A natural response to traffic congestion is to call for new roads and wider roads as a remedy. Linear thinking leads from the action, build roads, to the conclusion, less congestion.

However, common experience, as well as economic and system dynamics studies, tell us that road building does *not* relieve congestion. We can't build roads fast enough to keep up with the new demands caused by increased traffic. That's because any temporary reduction in congestion by reducing travel time leads to *more* traffic and *more* congestion. This is called “induced” traffic. A 1995 econometric study of U.S. metropolitan areas showed that a 10% increase in capacity led to a 9% in-

archetype that shows how a reinforcing feedback that promotes growth can be subject to the limiting action of a balancing feedback. The “attractiveness principle” is essentially a “limits to growth” structure with multiple limits to growth.

⁴ An “S” indicates an influence in the “Same” direction and an “O” indicates an influence in the “Opposite” direction.

⁵ See Appendix I for more on the “attractiveness principle.”

⁶ Colorado Springs is focusing on developing several economic clusters to reinforce this attraction.

crease in traffic in 5 years. The time lags for many of the induced effects take even longer and eat up the remaining 1%.⁷ Some roads even experience worse congestion when capacity is added by attracting more traffic than the capacity added. What road building actually controls is the number of cars on the road and the size of the metropolitan area. Road building is a driver of sprawl.

Figure 2 shows a relatively simple model that addresses the problem of traffic congestion.⁸ Professor Sterman prefaces his discussion of this model with these observations: Americans spend 8 billion hours/year stuck in traffic. Lost productivity due to traffic congestion is \$43B - \$168B. We have road rage & shootings. "What went wrong?"⁹

Loop B1 shows the basic attempt to regulate congestion by building roads to decrease travel time. However, an increase in the attractiveness of driving resulting from the decreased travel time leads people to take more trips (B2), take longer trips (B3) and not take the bus (B4). In addition, the decreased travel time leads people to move to the suburbs and increase the number of cars on the road (B5). Altogether, these four balancing loops act to counteract any decrease in travel time provided by new roads. These adjustments continue until commute times rise enough to stop the expansion into the suburbs. This is an example of what the field of system dynamics calls "policy resistance" ... where we design a solution to a problem only to find that the system has compensating feedbacks that undermine the solution.

Road building for access to the hinterlands. But road construction continues and increases the size of the region within the desired travel time to continue to create more economic activity and put more cars on the road (R1). Road building feeds a reinforcing feedback loop to drive the growth of a region and ever more road building. A characteristic of reinforcing (positive) feedback loops is that they create exponential increases as they have throughout the U.S. (Figure 3).¹⁰

Figure 2. Traffic Congestion and the Death Spiral of Mass Transportation

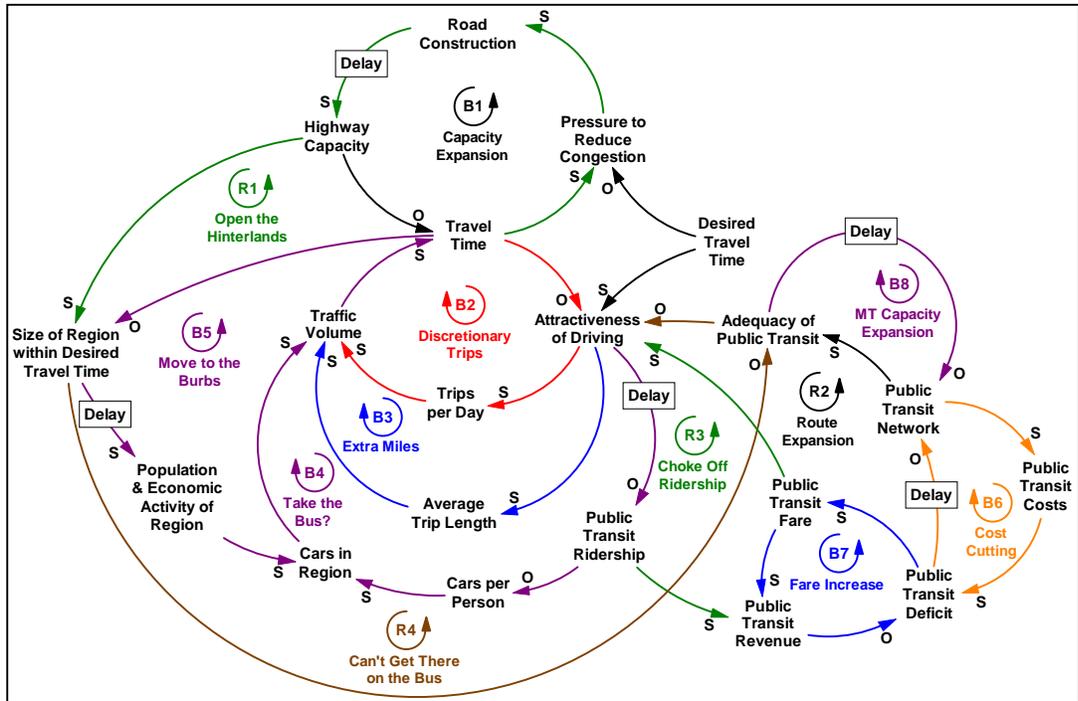
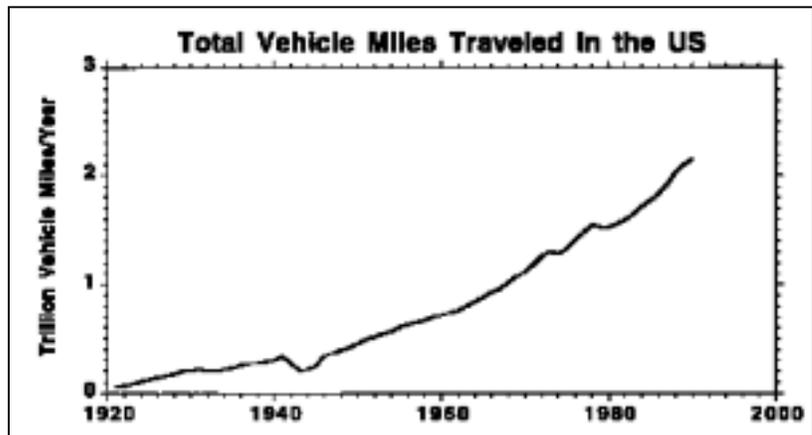


Figure 3. Exponentially Increasing Vehicle Miles Traveled



⁷ Hansen, M., "Do new highways generate traffic?" Access 7, Fall 1995, 16-22. This is referenced in a new, 982 page textbook from the director of the system dynamics group at MIT. *Business Dynamics: Systems Thinking and Modeling for a Complex World*, John D. Sterman, 2000, Irwin McGraw-Hill, pp. 177 – 190..

⁸ This model is built in stages in *Business Dynamics: Systems Thinking and Modeling for a Complex World*, John D. Sterman, 2000, Irwin McGraw-Hill, pp. 177 – 190. His model has been expanded here to show a "Speculation" loop. The causal loop diagram of the dynamics is also referenced in the section below on "The death spiral of mass transportation"

⁹ John Sterman, *Business Dynamics: Systems Thinking and Modeling for a Complex World*, John D. Sterman, 2000 p. 178

¹⁰ Taken from *Business Dynamics ...* source: *Historical Statistics of the US*, Kurian (1994)

Though one source of pressure for added road capacity is to make current resident's drive across town easier, it's not the only reason, and possibly not the major reason, there's so much pressure for new roads.¹¹ There is also pressure from land speculators who want increased access to their property so it can be developed and its value will increase thereby (R5). When government builds a major thoroughfare to open up the hinterlands, it increases the value of the property in the hinterlands in that it's newly made accessible to potential buyers.

Low gas prices. Low gas prices make it possible to create more sprawling cities than would otherwise be the case. This carries considerable economic risk, because as gas prices increase the region could become economically not viable. It's already difficult for low wage workers to afford a car to get to work and the lack of viable public transportation would leave workers no alternative and jeopardize the businesses who depend on them. Numerous national and state policies are directed at keeping the price of fuel, as well as the tax consumers pay at the pump, as low as possible. These all contribute to the pattern of development we see in Colorado and the U. S., as opposed to the pattern in many industrialized nations with higher gas taxes and prices.

High Income Segregation

One economist describes the tendency of high-income consumers to seek more attractive jurisdictions. This is related to the pressures caused by "The Attractiveness Principle" discussed above.¹² He writes:

In addition to population growth, rising incomes, and falling commuting costs, another fiscal force has contributed to the suburbanization process in U.S. cities. It is the desire of high-income consumers to form separate jurisdictions for the provision of public goods such as education, public safety, and parks. When households of different incomes are intermixed, high-income households pay more than an equal share of the cost of public goods, a consequence of their larger property tax bills. In addition, high-income households may end up with lower public spending than they would prefer, a consequence of the lesser ability to pay of low-income voters. However, when high-income households "vote with their feet," forming their own jurisdictions for provision of public goods, both of these drawbacks are avoided. Separate jurisdictions eliminate the need to subsidize low-income households, so that taxes can be lowered at the same time that public good provision is increased. The location for such new jurisdictions is on the suburban fringe. Thus, spatial expansion of cities is partly driven by the fiscal incentive of high-income households to separate themselves from the less well off. Tiebout (1956) provided the seminal analysis of the fiscal incentives leading to such homogeneous communities, and Wildasin (1986) provides an overview of more recent studies.

This force cannot be categorized as a market failure like those discussed above. It is an outgrowth of the U.S. system of public finance, which gives local governments great autonomy in choosing spending levels. This autonomy spurs the process of voting with one's feet, which allows high-income households to insulate themselves fiscally from their low-income counterparts. To undo the urban spatial expansion created by this impulse for fiscal segregation, a change in the underlying structure of fiscal incentives is required. For example, the current system of autonomous jurisdictions could be modified by adding a higher level metropolitan-area government with the power to tax suburban residents and to spend the proceeds in the central city. Alternatively, a more restricted type of tax base sharing among municipalities could be implemented. Because either change would limit the ability of high-income households to escape redistributive taxation that benefits low income consumers, the incentive to form separate communities on the suburban fringe would be weakened, curbing the spatial expansion of cities.

Any proposal for a metropolitan-area government, however, is likely to encounter fierce political opposition from well-off households, making such a change impractical. An account of such opposition is provided by the Orfield (1999) article, in the Brookings symposium, which documents the political struggle over metropolitan government in Minneapolis. In addition, such proposals have the drawback of interfering with freedom of choice in the public sector, which comes from a household's ability to select a place of residence from among a host of fully autonomous jurisdictions offering different amounts of public spending.

The death spiral of mass transportation

Sprawl development and road building reduce the public's ability use mass transportation. In fact, it leads to a death spiral since 1943, as can be seen in Figure 4.¹³ Referring to Figure 2, as a region expands it's more difficult for people to get to where they need to go by bus, which makes driving more attractive (R4). The more people drive, instead of taking the bus, the less transit system income and the more pressure to cut routes and trips (R2) and increase fares (R3). The more service is cut and fares are increased, the more people drive. Figure 4 shows the decline in the use of public transit in the U.S.¹⁴ This mass transportation death spiral contributes to more trips by car. Capacity could be expanded (B8), but the expense and delays are large and the payoff is years away.

¹¹ In the case of Colorado Springs to open up a major east-west thoroughfare.

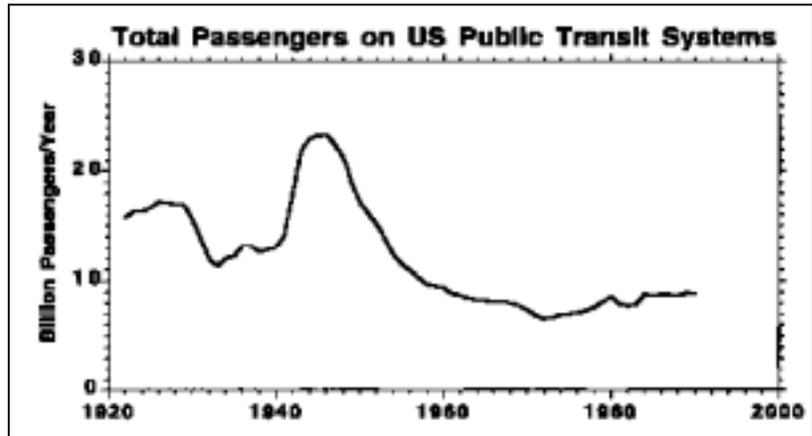
¹² Jan K. Brueckner, "Urban Sprawl: Diagnosis and Remedies," *International Regional Science Review* 23,2: 160-171 (April 2000). Department of Economics and Institute of Government and Public Affairs, University of Illinois at Urbana-Champaign, jbrueckn@uiuc.edu.

¹³ Again see Sterman, *Business Dynamics*, p. 185 on "The Mass Transit Death Spiral."

¹⁴ From John D. Sterman, *Business Dynamics* ... source: *Historical Statistics of the US*, Kurian (1994)

We see this dynamic playing itself out in Colorado Springs as the percentage use of public transportation declines. Figure 5 shows data on what's happening here.¹⁵ Figure 6 shows that, even though Revenue Miles actually increased approximately 22% from 1991 through 1999, Ridership/Population has declined by approximately 19%. If revenue miles had not increased, there could have been an ~40% decline in relative use. This relates to the public's unwillingness to approve ballot issues that subsidize mass transit and the increasing "cost crunch" on low-income workers.

Figure 4. Exponentially Decreasing Use of Public Transit



Housing costs, economic growth, and tax limitations

Housing costs are increasing ... period. They're increasing now without growth management. According to a recent article in the Denver press 44% can't afford decent housing.¹⁶ To see the effect of growth boundaries on house prices, we can compare trends in Portland, a premier growth boundary example, to Denver, a "sprawl city" example. Figure 7 shows median single-family home prices from 1991 through 1999 from the Harvard Joint Center for Housing Studies.¹⁷ Because data is only available from 1975 to 1990 in 5-year increments, dashed lines are added to visually connect the data points.

Note that the rates of increase in house prices in Portland and Denver from 1991 through 1999 are virtually the same.¹⁸ Denver sprawl does not keep housing prices down relative to Portland. After the Portland growth boundary was imposed in 1981, home prices actually declined in Portland, rather than increased. Drops in all three regions are likely associated with the recession of the 1980s.

Of more concern is the drop by 1/3rd in LA house prices from 1991 through 1997. This was during an overall economic expansion in the U.S. as a whole. The drop is due to people wanting to leave LA and move to places like Denver and Portland, which are more attractive. Despite a great national economy in the last eight years, house prices in LA are just in the last few years recovering from the overshoot and col-

Figure 5. Springs Transit Ridership & Revenue Miles, Population

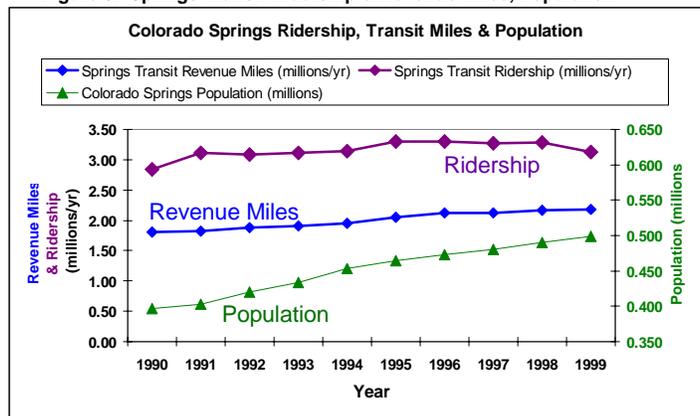
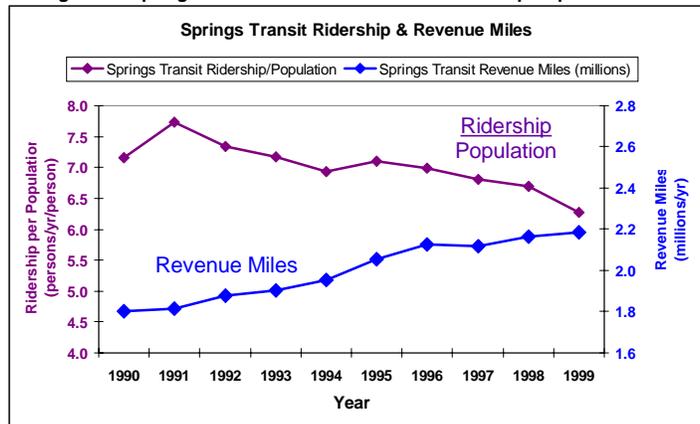


Figure 6. Springs Transit Revenue Miles and Ridership/Population



¹⁵ Source: Colorado Springs Transit, Sept. 2000

¹⁶ Denver Post, 9/21/00

¹⁷ Download the Excel file containing the data from their web address: <http://www.gsd.harvard.edu/jcenter/index.html> ... click on "The State of the Nation's Housing: 2000 ... read on-line!" ... then click on Table A-5. Home Prices by Region and Metropolitan Area: 1991-1999. Additional data for 1975, 1980, 1990 and 1995 was obtained by telephone. Notes: House prices are the 1990 median sales price of existing single-family homes determined by the National Association of Realtors, indexed by the Conventional Mortgage Home Price Index and the Weighted Repeat Sales Index by Freddie Mac, and adjusted by the Bureau of Labor Statistics Consumer Price Index (CPI-UX) for All Items.

¹⁸ It is possible to argue that home prices increased more in Portland than in Denver by picking 1985 as the base year. The recession of the 80s affected Portland home prices earlier, and more severely, than Denver, which gave more opportunity for improvement.

lapse. This time frame of the LA house price collapse is the same timeframe during which there is a reduction in LA's economic growth.

One interpretation of what happened is that this collapse was a result of decreasing quality of life and increasing traffic and pollution. Initially there were tax increases to pay for infrastructure that resulted in a tax limitation backlash. Thirteen years after tax limitation went into effect the infrastructure backlog increased to the point that traffic got so bad and quality of life got so low that people finally began to leave. *When there is unrestrained growth, tax limitation, and development fees that do not cover long-term costs, the combination does not allow a region to invest in the infrastructure necessary to support growth.*

Another suggestion has been that the aerospace layoffs in LA were responsible for the drop in LA home prices. However, Figure 8 shows that there was a similar drop in San Francisco.

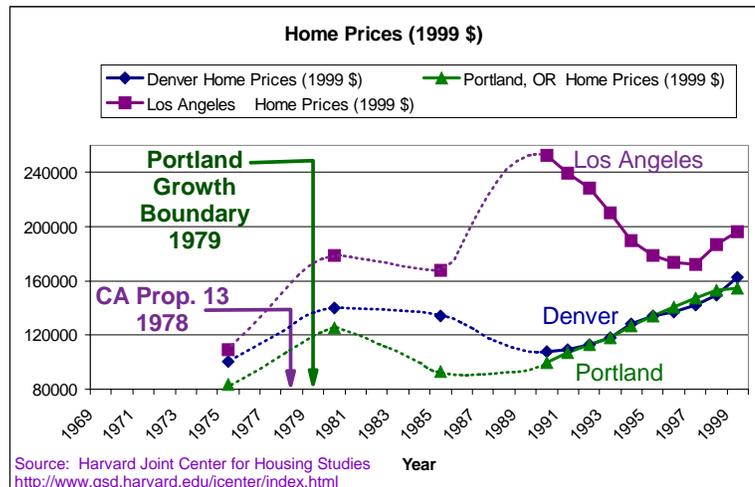
We have the same combination of factors in Colorado Springs as in California: *tax limitation and a growing infrastructure backlog.* The infrastructure backlog in Colorado Springs continues to mount, and it may already be too late to avoid an oncoming bust. In January of 1996 the infrastructure backlog was estimated at \$308M.¹⁹ We're now facing a \$1B infrastructure backlog in the next 10 - 20 years and, according to Dave Zelenok, Group Support Manager Public Works, if things keep going the way they are, we'll be facing a \$3-4 billion backlog.²⁰ It's been standard practice to allow development without a source of funding for infrastructure to support it, whether that source be taxpayers or developers.

Construction has continued in Portland and Denver alike. On 9/27/00 the Denver Post²¹ reported that the FDIC has just put Denver "on its list of 13 cities on the verge of overbuilding, which could put local banks in danger if the economy takes a downturn." The story notes that *Portland has been on this list for 2 years.* This could not happen if growth boundaries resulted in "no growth."

Regional policies to attract high-paying jobs.

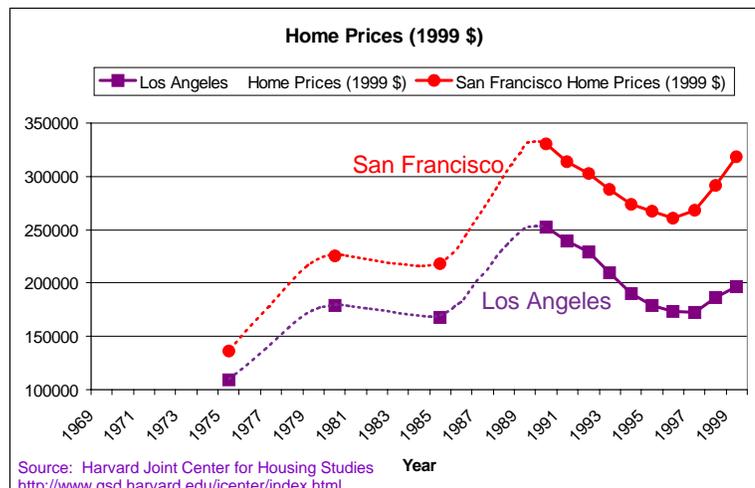
If we attract high-paying jobs and have a great economy, home prices are very likely to go up. If the area is attractive and per capita personal income is high, home prices are likely to be high. Per capita income in Colorado Springs is only 73% of that in Boulder ... it's no wonder home prices are higher in Boulder. The economic strategy of Greater Colorado Springs Economic Development Corporation is to attract high paying jobs. This may be good policy for some and even for the region as a whole, but it has clear companion effect: home prices will continue to go up and drive out affordable housing for those who don't share in the high incomes, growth boundary or not.²² Gentrification happens.

Figure 7. Home Prices: Portland, Denver and LA



Source: Harvard Joint Center for Housing Studies
<http://www.gsd.harvard.edu/center/index.html>

Figure 8. Los Angeles & San Francisco Home Prices



Source: Harvard Joint Center for Housing Studies
<http://www.gsd.harvard.edu/center/index.html>

¹⁹ "1999-2000 Capital improvement needs versus estimated funds," City of Colorado Springs, Capital Improvements Division, January 1996. Included in *The Springs Community Action Plan, City Government Task Force, Strategic Planning Workbook*, January 1996.

²⁰ Woodmen Edition, 7/28/00

²¹ Denver Post, 9/27/00, pp. 1, 22

²² The gap between wage growth at the low skill/low wage level and at the high skill/high wage level is not unique to Colorado Springs. A variety of economic, political and demographic forces over the last twenty five years have reversed the 1950's wisdom that growth will raise real incomes and the standard of living for everyone.

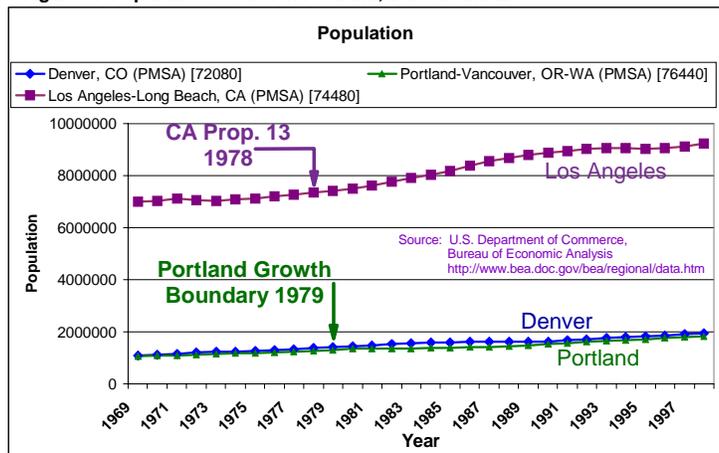
Market incentives and human psychology. High paying jobs create a market for high cost housing. Builders naturally prefer to build product for people with the most money ... not for those with less money. These yield the highest profit margins. Moreover, the more expensive the product, the easier it is to "hide" additional profit. Human psychology is such that we'll drive across town to buy a \$20 product for \$10, but we don't make a big deal over saving \$10, or maybe even \$100, out of \$10,000. These factors naturally drive the housing market to the high end and result in low availability of affordable housing.

Housing subsidies: Only for the Prosperous?

Affordable housing requires public subsidies. Because forces on the cost and income side are so powerful and outside the control of local governments, the only way there will ever be affordable housing for low-income workers is through public subsidies. The move to put funds into vouchers for privately owned apartments rather than directly into Section 8 programs has been less than effective, in the view of many housing advocacy groups. Many organizations like Habitat for Humanity and Greccio, Inc. help, but their impacts are small in relationship to a problem of major proportions. The greater the infrastructure backlog, the less likely it is for there to be funds available to subsidize low income housing.

Bias against subsidies at the low-income level. Unaffordable housing is viewed as an "intractable problem," when subsidies are automatically ruled out as interfering in the "free market." Economic incentives to attract companies are also public subsidies, as are the unlimited tax deductibility of home mortgages and capital gains exemptions on increased home values. As described below, taxpayers also subsidize the infrastructure costs of new housing, often for people who are more prosperous than they are.

Figure 9. Population Growth in Portland, Denver and LA



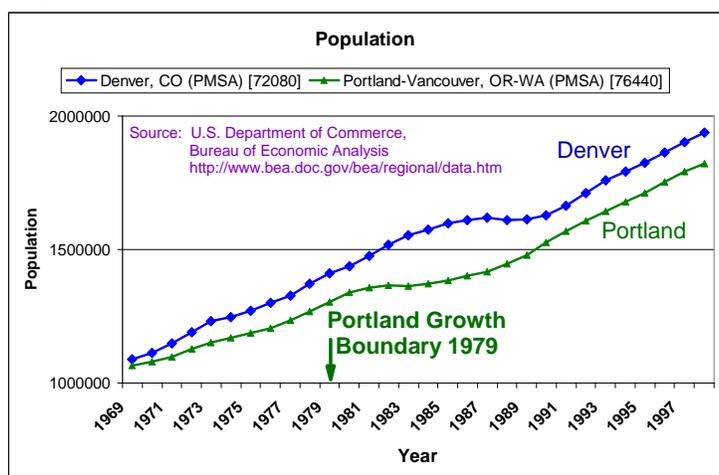
Growth Management and the Economy

It's been asserted that imposing growth boundaries is a "no growth" policy. However, population data from the U.S. Department of Commerce Bureau of Economic Analysis²³ (Figure 9) shows that population growth continued in Portland, Denver and LA (though LA flattened in the last decade).

Figure 10 shows the same data for Portland and Denver at an expanded scale. The population in Portland did begin to grow at a slower rate two years after a growth boundary was imposed. Yet by 1990, population in Portland and Denver differ by about the same amount, because there was a more severe reduction in the population growth rate in Denver in the late 1980s.

The data shows a slowdown in population growth in LA beginning in 1990 or 1991. We'll see below that this correlates with the beginning of a severe drop in LA housing prices. Growth management opponents complain that house prices will rise and economic growth will suffer at the same time. But these are mutually exclusive ... housing prices fall during an economic downturn. Opponents of growth management can't have it both ways.

Figure 10. Population Growth in Portland and Denver (expanded scale)



²³ U.S. Department of Commerce, Bureau of Economic Analysis, Regional Accounts Data: <http://www.bea.doc.gov/bea/regional/data.htm>.

It's clear from this data that a growth boundary is not a "no population growth" policy. In fact the continuing growth despite the boundaries has created a truly "no growth" movement in Oregon.²⁴

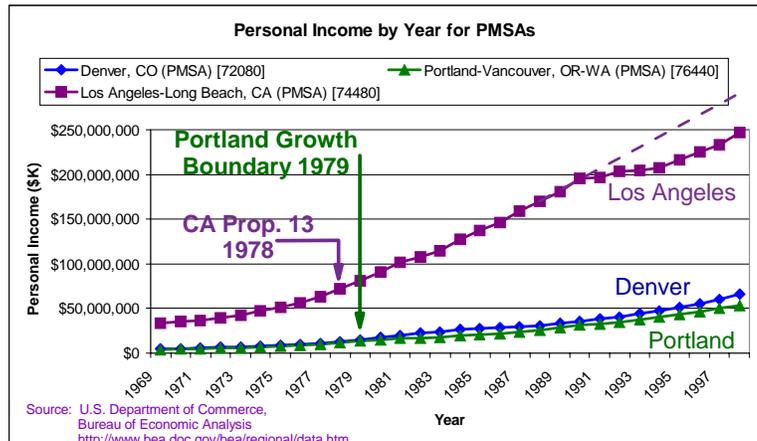
It's also been asserted that imposing growth boundaries will "kill the economy." But Figure 11 shows total regional personal income (from the same Department of Commerce site) at the three locations. Both Portland and Denver show continuing economic growth. A growth boundary did not cause an economic downturn in Portland.

The Effects of Tax Limitation without Growth Boundaries

However, Figure 11 shows a severe drop off in the rate of increase of total personal income in LA beginning in 1991, approximately 13 years after the imposition of CA's Proposition 13 tax limitation law. The dashed line shows what personal income would have been, had the previous growth rate continued. The cumulative economic impact is significant.

A growth boundary in Portland did not "kill the economy". But the combination of unrestrained growth and tax limitation did "kill the economy" in LA. The irony for Colorado Springs is that, if we'd had growth limitations there would most likely not have been the upward pressure on taxes to finance infrastructure that provoked TABOR.

Figure 11. Total Personal Income for Portland, Denver and LA



Voter Approved Constitutional Amendments and Growth²⁵

TABOR. TABOR, the 1992 initiative that rewrote Article XX of the Colorado Constitution makes taxpayers *think* they're protected. They're not. They just pay by waiting in traffic, by not having streets plowed in winter, by having sewage flood their homes, and by the loss of a myriad of other public services. Developments are approved and, in the near term, state and local governments get added revenue from taxes on materials and wages, because the TABOR formula allows tax increases for population growth. However, years later the infrastructure burden appears for roads, drainage, schools, etc., but there is insufficient revenue and TABOR prevents raising taxes, or even retaining the revenue already raised, to pay the costs.

The Gallagher Amendment. The Gallagher amendment, passed in 1982, establishes a 55/45 ratio on the total assessed value of nonresidential (business) / residential property. That is, business property shall account for 55% of total assessed value of all property in the state. The assessed value of property is obtained by multiplying market value (set by each county assessor) by an assessment rate. The non-residential property assessment rate is set in the State Constitution at 29%, so the residential assessment rate is changed every two years to meet the 55/45 ratio required by Gallagher.

When statewide residential development, and therefore the total value of residential property, surges faster than the total value of business property, it pushes the statewide ratio of residential/business value higher. Therefore, to compensate, the residential assessment rate must be reduced. Since 1982 the residential assessment rate has dropped from 21% to 9.74%.

The impact of Gallagher is that communities prefer to attract business property that can be taxed at a higher rate than residential. This pushes residential development into outlying areas that become overburdened with demands for public services but without a tax base sufficient to pay for them. Opponents complain that growth limitations would drive residential development out into smaller communities, but that's already happening due to other tax policies.

²⁴ Alternatives to Growth Oregon (AGO) at <http://www.agoregon.org/index.htm>. "An organization dedicated to bringing an end to population and consumption growth, and to the promotion of true economic, personal, intellectual, and spiritual growth by supporting policies that move Oregon toward sustainability."

²⁵ Greenwood, Daphne, "Do Colorado's Revenue Policies Encourage "Smart Growth?" Center for Colorado Policy Studies Working Paper.

When Does the Free Market Work and When Does it Fail?

The free market ideal. Before looking at failures, here is a description of how the free market works.²⁶

For a city to grow spatially, developers must be able to bid away additional land from agricultural users. A successful bid by developers means the land is worth more in urban use than in agriculture, reflecting a greater economic contribution in its developed state. In this sense, land conversion is guided by the economist's "invisible hand," which directs resources to their highest and best use.

The key implication of this principle is that urban growth is not an indiscriminate process, devouring agricultural land without regard to its worth. Although many critics of urban sprawl seem to hold this unfavorable view of the growth process the view is not consistent with the operation of a free market economy, where resources find their most productive uses. Buttressing this claim, evidence has shown that in regions where agricultural land is productive and its value high, cities are more spatially compact than in regions where agricultural land is unproductive and therefore cheap (Brueckner and Fansler 1983). Productive agricultural land is thus more resistant to urban expansion than unproductive land, reflecting the operation of the invisible hand.

Concerns about loss of "scarce" farmland are also misplaced.²⁷ Because the value of farm output is fully reflected in the amount that agricultural users are willing to pay for the land, a successful bid by developers means that society values the houses and other structures built on the land more than the farm output that is forgone. If farmland became truly scarce and in need of preservation, its selling price would be high, making the land resistant to urban encroachment. With only a tiny fraction of the U.S. land area occupied by cities, farmland scarcity is not a problem currently, nor is it likely to become a problem in the future.

Although the allocation of land is governed by competition between urban and agricultural uses, the outcome has increasingly tipped in favor of urban use, leading to substantial spatial growth of cities and prompting criticism of urban sprawl. Economists believe that three underlying forces - population growth, rising household incomes and transportation improvements - are responsible for this spatial growth (see Mieszkowski and Mills 1993). As the nation's population expands, cities must grow spatially to accommodate more people. In addition, rising incomes affect urban growth because residents of the city demand more living space as they become richer over time. By itself, the greater demand for space causes the city to expand spatially as dwelling sizes increase. This effect is reinforced by the residents' desire to carry out their greater housing consumption in a location where housing is cheap, namely the suburbs. So the spatial expansion due to rising incomes is strengthened by a price incentive favoring suburbanization.

A similar phenomenon occurs in response to investment in freeways and other transportation infrastructure. Because such investment makes travel faster and more convenient, thus reducing the cost of commuting, consumers can enjoy cheap housing in the suburbs while paying smaller commuting-cost penalties. As a result, suburban locations look increasingly attractive as commuting costs fall, which spurs suburbanization and leads to spatial growth of the city.

Job suburbanization has also occurred as cities have grown spatially. This relocation of jobs to the suburbs has been due in part to changes in the transport orientation of businesses. Rather than shipping their output through centrally located rail depots and port facilities, firms increasingly rely on truck transport and, thus, prefer the easy highway access (as well as the low cost) of suburban locations. However, the evidence shows that jobs also follow people. In other words, job suburbanization is partly a response to the suburbanization of the population, which occurs for the reasons discussed above. Thus, unlike the fundamental forces driving urban expansion, job suburbanization is partly an effect rather than a cause of this growth. Thurston and Yezer (1994) provide a useful empirical analysis of the interaction between job and population decentralization.

The confluence of an expanding national population, rising incomes, and falling commuting costs makes the rapid expansion of cities in recent decades unsurprising. The real question is whether this expansion has been too rapid. In other words, does the invisible hand, which guides the conversion of land to urban use, push too hard in the direction of bigger cities?

Economists use the term market failure to describe a situation in which the invisible hand fails to allocate resources in a socially desirable manner, so as to maximize aggregate economic well-being. Market failure arises when economic agents face incentives that are distorted because of institutional failings or some other reason, leading to economic outcomes that are bad from society's point of view. The classic example of a market failure is air and water pollution, where a factory has little incentive to take account of the environmental damage it causes and, thus, ends up polluting too much. Is a similar market failure involved in the spatial expansion of cities? If so, the criticism of urban sprawl is justified, and measures are needed to restrict urban expansion. Economists have, in fact, identified several market failures that may affect the urban growth process.

Market failures that lead to "sprawl":

- first, society does not take into account the social value of open space when land is converted to urban use;
- second, individual commuters do not recognize the social costs of congestion created by their use of the road network which leads to excessive commuting and cities that are too large; and
- third, society does not take into account all of the public infrastructure costs generated by real estate developers' products. Thus, development appears artificially cheap from the developer's point of view, encouraging excessive urban growth.

The social value of open space. "Open space benefits to society are not taken into account when land is converted to urban use." One remedy to correct the failure is to charge a "development tax on each acre converted ... (this is added to any

²⁶ Jan K. Brueckner, "Urban Sprawl: Diagnosis and Remedies," *International Regional Science Review* 23,2: 160-171 (April 2000). Department of Economics and Institute of Government and Public Affairs, University of Illinois at Urbana-Champaign, jbrueckn@uiuc.edu.

²⁷ Because of delays in recognizing the value of farmland, there's reason to believe that this argument is considerably overstated. Refer again to the quote above from Forrester's paper on the "Counterintuitive Behavior of Social Systems" and also see the section below on "Representing the future to the present." In addition, cities tended to grow around the best farmland, not the worst, and therefore as cities grow they devour the land most suited to farming; it's true that considerable land remains, but not the best land.

fees already levied). ... the tax retards the development process and slows the rate of urban expansion.”²⁸ The subjective nature of the benefits makes estimation difficult. It depends on the value the residents of different communities place on the availability of open space around their cities.

The social costs of congestion. There is “private cost” of commuting borne by the commuter. “Commuters incur substantial costs, which include out-of-pocket expenses of vehicle operation as well as the “time cost” of commuting.” Beyond this he notes the “cost ... due to extra congestion caused by the commuter’s presence on the road,” because “slight increases in traffic on a crowded roadway can lead to a substantial drop in traffic speed.” Everyone’s trip takes longer and this imposes costs on other commuters. “Because these congestion costs are borne by others, the commuter ... has no incentive to take them into account ... commuting on congested roadways looks artificially cheap to individual commuters. Therefore, congested roads are overused from society’s point of view.”

A suggested remedy is a “congestion toll” that “charges each commuter for the congestion damage imposed on others.” This creates incentives for a denser city and also reduces air pollution. The “proper magnitude of congestion tolls can be computed reliably, drawing from a wealth of accumulated knowledge about commuting behavior ...” If such a tax were imposed, it would be important to make compensating tax reductions very visible to avoid making it look like a net tax increase, which would create opposition. Electronic meters in autos could collect the tax without impeding traffic flow. Downtown parking taxes and bumper stickers that permit rush-hour use of major roadways can also be used. Such incentives would make public transportation more attractive and some businesses might shift work schedules so employees could commute during off-peak hours.

Public infrastructure costs generated by development. New development does not fully fund the infrastructure needed to support the development.

The cost of new sewers and schools is shared among all of the city’s residents rather than charged directly to those who require the new infrastructure. In effect, infrastructure is priced approximately at the average cost rather than the marginal cost. Because the property tax burden on new homeowners is lower than if they fully paid for their infrastructure costs, these homeowners are able to pay a higher purchase price for their houses than if the correct tax were levied. With their houses selling for more, developers are then able to offer more for agricultural land than would be possible if the correct tax burden were levied on new homeowners. Higher bids for agricultural land in turn mean more conversion of land to urban use, leading to too much development and excessive spatial sizes for cities. This by undercharging new homeowners for the infrastructure costs they generate, the current system of public finance leads to urban sprawl.

“Impact fees” can be used to alter the system of infrastructure financing. Such fees limit the amount that developers can pay for agricultural land and reduce the rate of urban growth. “Correct impact fees can be computed, however, and their use can lead to better development decisions.”

In Colorado Springs these costs have created a growing infrastructure backlog, the costs for which are externalized onto the public with pressure for sales tax increases to pay for them. Without growth management, the infrastructure backlog will continue to increase. There will be increasing pressure to spend tax dollars on infrastructure, rather than on subsidies for affordable housing (... or parks or on any other public services ...). The infrastructure backlog in Colorado Springs continues to mount, and it may already be too late to avoid an oncoming economic bust. In January of 1996 the infrastructure backlog was estimated at \$308M. In November 2000 we were facing a \$1B infrastructure backlog in the next 10 - 20 years and, according to Dave Zelenok, Group Support Manager Public Works, if things keep going the way they are, we’ll be facing a \$3-4 billion backlog.²⁹

Market Consequences

Escalation produces a “race to the bottom. A dynamic that drives increases in infrastructure backlog and reduced regulation (and consequent degradation of the environment and worker protections) is represented by the structure of the “escalation” archetype (Figure 12). This structure is composed of two balancing loops that can be traced following the arrows in a “figure eight” pattern. If our growth is less than the growth of other regions, we can lower taxes and regulation to attract companies and increase growth so our growth is greater than other region’s. This however leads other regions to reduce their taxes and regulation to increase their growth so ours is less than theirs. Which leads us to again reduce our taxes and regulation. This is a downward spiral of taxes and regulation ... a “race to the bottom” that has become a global issue.

²⁸ This and the next 4 quotes are from Jan K. Brueckner, “Urban Sprawl: Diagnosis and Remedies”

²⁹ Woodmen Edition, 7/28/00

Representing the future to the present. A general shortcoming of the free market model is that it does not adequately represent the future to the present. Business schools teach that investments are evaluated by looking at the future income from a project and devaluing future income by some required rate of return, or "hurdle rate." If a project does not create a 20% or 30% return on investment, then the project would not be approved. The value of the discounted future returns is called the Net Present Value, or NPV. Discounting returns at such high rates has a dramatic effect on the value of future returns. Examples of the effect of using NPV calculations for decision-making are shown in Figure 13.

The downward spiral. In the near-term (B1) a region gains additional tax revenue from wages and sales taxes ... and perceives it is doing well financially. But in the long-term (R3), years later, when residents move into the development, there's additional demand for schools, for fire stations, and on the road and drainage systems. This increases the infrastructure backlog, decreases our actual "Economic Health" and after years of delay we finally *perceive* the problem. This downward trend in the actual "Economic Health of the Region" leads us to need **ever more** development to give us revenue in the short-term to make us feel better.

Solutions to the Growth, Transportation, Housing Price Spiral

As noted earlier "... attempts to control congestion through road building are vain. Any reduction in congestion leads to more trips and more cars, swiftly building congestion back up. What road construction actually controls is the size of the metropolitan area and the number of cars on the road."³⁰ So what's a mother to do to deal with traffic congestion? Few of us want to hear it, but "solutions" for traffic congestion involve making driving less attractive ... relative to alternatives. We can:

- Impose tolls
- Increase travel times by using traffic speed bumps or traffic circles
- Upgrade public transit
- Build bike paths
- Increase gas taxes

Most of these are unattractive. And that's just the point; we're caught in a spiral that will lead to an unattractive region in other ways.

Some decision factors relative to growth might be:

- Do we think current growth policies will reign in a growing infrastructure backlog?
- Have we seen evidence that anything will be done about the negative impacts of growth without growth management?
- Do we believe that continuing sprawl will
 - preserve quality of life to attract high tech workers & companies?
 - make public transportation practical to get to low pay jobs?
 - give the region economic advantage as oil prices increase?
- Does the data show that growth management (such as growth boundaries) will hurt us economically?

The decision hinges on how we want Colorado Springs to become unattractive.

Balancing individual rights and community rights. The free market values quality of life, and charges for it, as people are drawn to an area with high quality of life, but the growth industry pays no price for degrading quality of life of others. This

Figure 12. Escalation and Growth

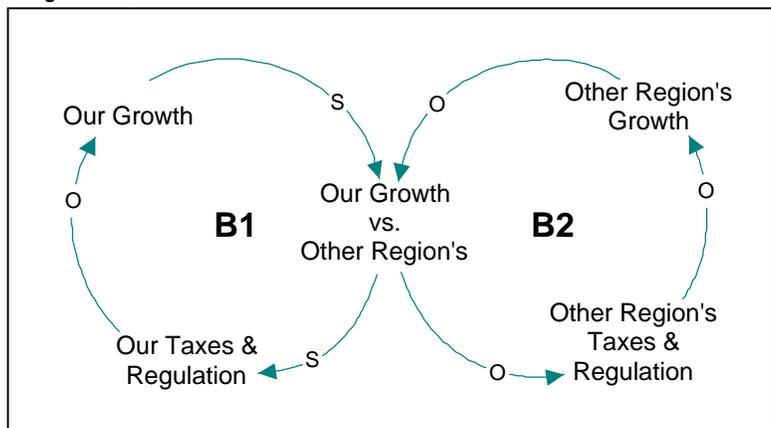


Figure 13. NPV Examples

To look at what the result of using net present value calculations, take an example of preserving something, say parkland that would be worth one billion dollars (\$1,000,000,000) to the public 100 years in the future.

At a 20% discount rate, that \$1B value is only worth \$12.07 today ... hardly worth saving.

A return of one trillion dollars 100 years in the future at a 30% discount rate is only worth \$4.03 today.

³⁰ John Sterman, *Business Dynamics*, p. 189

is an example of a “Tragedy of the Commons”³¹ where each individual maximize his own returns in the short run, but eventually destroys the commons and sacrifice his own, and everyone else’s, well being. To avoid such tragedies, a society must balance individual and community rights. Individual well-being is maximized when these common goods are appropriately taken into account, not when each person has absolute freedom. Traffic lights are a good example of limitations on individual freedom that on average increase well being.

Some groups benefit from preserving quality of life, while others do not. The complex of industries often termed the “growth industry” can make short term profits in one area and reinvest them in another regardless of what happens to the quality of life in the first area. There are two values of land: “use value” and “exchange value.”³² The main focus of the growth industry is to maximize “exchange value;” exchange value is increased through growth by more intensive use of land, which is why the growth industry promotes growth. The other value is “use value” for residents as a “home;” this value focuses primarily on preserving quality of life.

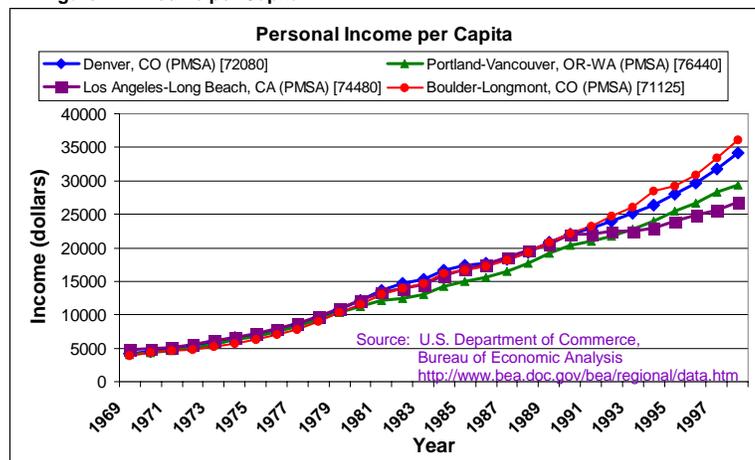
Non-growth industry companies that need quality of life to attract employees, the employees themselves, and their unions need to recognize their different interests and analyze the long-term economic and employment stability implications of various growth strategies. In particular, high tech companies and manufacturers should fear a continuation of current city and state policies, not growth management. The financial health of these companies is vital to the Colorado Springs economy, but if we continue as in California, they will have difficulty attracting workers.

These stories on NPR about Atlanta’s business community concerns about sprawl highlight these problems:

Atlanta’s Growth (14.4 | 28.8) -- From member station WABE, Joshua Levs reports on concern that Atlanta is growing too fast. The increase in new jobs has lead to an increased population that has created a serious case of urban sprawl and traffic congestion. Now, many Atlanta business and community leaders are trying to figure out a way to control. (7:30) Listen at:
<http://search.npr.org/cf/cmn/cmnpd01fm.cfm?PrgDate=5%2F25%2F1999&PrgID=3>

ATLANTA SPRAWL - Urban sprawl is on a lot of agendas right now. Ground zero for urban sprawl in the U.S. is the Atlanta metropolitan area. In the 1990’s, suburban development is eating up fifty acres of green space a day. But in Atlanta, it’s not just the politicians and the environmentalists who are concerned about the pace of the city’s growth - business leaders, too. NPR’s John Nielsen reports on developers who have built their businesses in the suburbs who are now focusing on in-town projects and big employers who are moving their offices from the suburbs to the city. (11:30). Listen at: http://www.npr.org/programs/weed/archives/1999/May/990522_weed.html

Figure 14. Income per Capita



The goals of maintaining quality of life *and* protecting high tech and manufacturing companies’ ability to attract workers are compatible. Boulder is often ridiculed locally for its growth policies, but they’re following the high-paying jobs strategy, too; and they’ve had steady growth in income, per capita income & population ... with growth controls (Figure 14).³³

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³¹ Hardin, Garrett. A systems thinking archetype also discussed in *The Fifth Discipline* by Peter Senge, 1990.

³² Harvey Molotch, “The City as a Growth Machine: Toward a Political Economy of Place,” *American Journal of Sociology*, 82, No. 2, p. 309. Also, Logan and Molotch, *Urban Fortunes, The Political Economy of Place*, 1987, University of California Press, pp. 1,2.

³³ Unfortunately the Harvard Joint Center for Housing Studies does not include data for Boulder on home prices.

Appendix I. The Attractiveness Principle & Urban Dynamics

The excerpt below describes "The Attractiveness Principle" applied to urban dynamics.³⁴

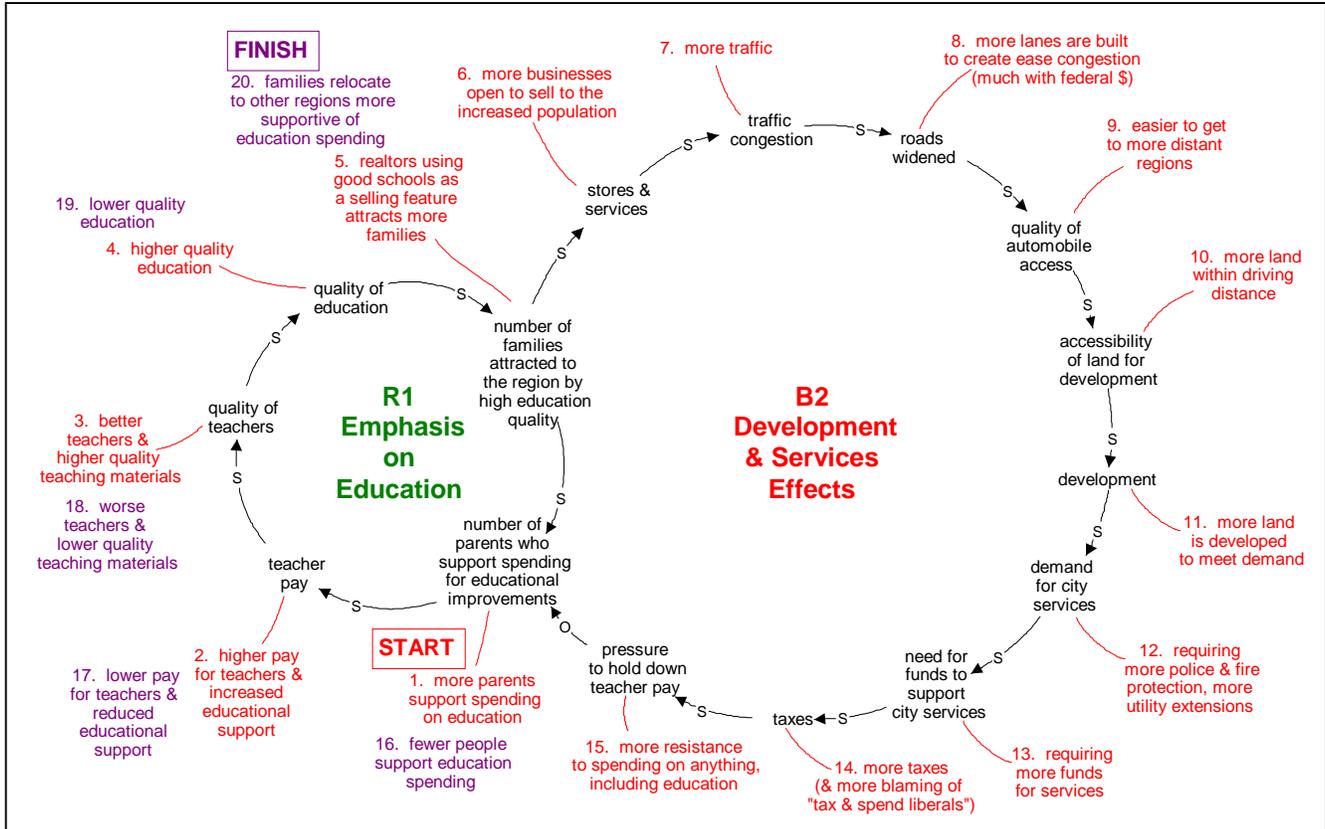
One of the principal assumptions behind urban dynamics is the theory of relative attractiveness. The theory states that, **given free migration, no place can long remain more attractive than any other place.** A corollary of the theory suggests the existence of negative counterbalances. **Population growth continues until negative pressures arise to counterbalance an area's underlying attractiveness.** Perception delays can cause population to overshoot, thus exaggerating the negative impact of growth. Concord, with its many attractive qualities would surely draw in more people than it could comfortably house and, in the process, erase its rural charm.

A second corollary of relative attractiveness is that **no two communities need suffer the same set of negative counterbalances.** All that is needed to bring a community into equilibrium with its surroundings is a set of pressures sufficient to deter further immigration. Any mix of pressures will do so, as long as people outside the community perceive them as sufficiently negative. Yet residents may choose which pressures they prefer. People pick where to live on the basis of such tradeoffs. One community, quite distant from downtown and requiring a long and difficult commute, might offer picturesque countryside and reasonable housing prices. Another community, close by downtown, might trade lack of parking and higher housing costs for urban proximity.

In most communities, such tradeoffs go unrecognized, much less openly debated. ... In a pluralistic society, such choices are virtually impossible to make. Each group, in seeking its own goals, unwittingly blocks others from achieving theirs. Parents support spending for educational improvements that attract more families. Stores expand to feed and clothe the newcomers. Roads are widened to ease traffic congestion. Better automobile access opens more land for development. New houses require utility extensions, more school buses and a larger fire department. Taxes rise. Voters curtail teacher pay rises. Educational quality begins to decline and concerned parents relocate to new suburbs whose residents support spending for educational improvements. Multiply the feedback structure a hundred times to reflect the different goals and preferences of every group. A community that tries to solve every problem and meet every need eventually satisfies no one.

Urban dynamics shows us the folly of traditional thinking, both for our cities and for our world. Human systems are too complicated for intuitive solutions. **Traditional cause-and-effect thinking does not work. Feedback, nonlinearities and hidden delays defeat most conventional policies.** Eventually we must shift the paradigm away from traditional analytical methods to the urban dynamics viewpoint -- conserve what we already have and **reinforce the counterbalances we prefer.** It is the mentality of the great cities of Europe and it is the mentality of the well-preserved American suburb. It works there and it can work worldwide.

The causal loop diagram below tells the story in the excerpt. Begin at START and follow the story in sequence around the loops to FINISH. Policies that attempt to reinforce education quality are accompanied by a side effect that counters the original intent.



³⁴ "Urban Dynamics -- The First Fifty Years." by Louis Alfeld, System Dynamics Review, Fall 1995. On experiences in Concord, MA in 1975.