Farmland Protection Programs: How Would We Know They Worked?

Ralph E. Heimlich
USDA - Economic Research Service

My task in this paper, as established by the organizing committee, is to provide an assessment of how we can better determine the consequences or effects of farmland protection programs, or, more broadly, of attempts to control urban growth and development. How do we determine whether regulations, incentives, or other means actually have an impact on patterns of land use change? Can a research strategy be suggested that promises to provide information on what works-and what doesn't?

It is especially ironic that I was assigned this topic: I am an indifferent scholar and the last person to do research planning. My inclination is to recognize an important topic, and identify an achievable piece of empirical research (read "data crunching") that may illuminate an aspect of it, rather than agonize over the bigger picture issues. As an example, our recent report includes an estimate of the total cost of purchasing development rights on U.S. cropland influenced by urbanization (Heimlich and Anderson, 2001, p. 60-64). The idea that all cropland affected by urbanization should be protected is not particularly realistic, but comparing the $130 billion cost for those 94.7 million acres to the $1.2 billion spent to date on the 820,000 acres currently under protection makes it clear that we are not going to solve the farmland protection problem by purchasing easements. The task is simply too big and too expensive. Other means, such as regulatory programs and land use controls, will be needed and may have to do most of the work. Such research cannot answer the larger question of what tools will work to protect farmland, but helps answer a related question: What won't work?

This paper begins with a reminder about what land use control programs are trying to accomplish, at least as I understand them. It then briefly outlines the major alternative regulatory and incentive-based tools for protecting farmland and controlling urban development. It then outlines a number of difficulties researchers and policy analysts face when evaluating anything to do with land use. It reviews the literature on studies focusing on values or prices as indicators, and those dealing more directly with land use change. Finally, the paper discusses two research approaches that have been used and suggests ways that some of the difficulties outlined earlier can be overcome.

What Are We Trying To Do, Again?

In evaluating programs or policies, it is always important to be clear about the intended consequences. Much of the muddle that goes on in these endeavors is due less to poor data, murky methods, and confounding variables than to confusion in initial assumptions about what the programs being evaluated are actually intended to accomplish. Economic theory involves notions of "optimality" or "efficiency" that have few counterparts in real-world policy making. Economists often substitute these notions in place of carefully examining what the framers of particular policies had in mind for them.

Another aspect of being clear about what growth controls are intended to do consists of being clear about the nature of the problem being addressed. Unfortunately, "sprawl" has become the indeterminate pejorative for everything that could possibly go wrong with growth. While all sides seem to be in agreement that sprawl is bad, there is very little agreement about even how to define sprawl (Heimlich and Anderson, 2001; Fina and Shabman, 1999; Wassmer, 2000). When both highly dense town house developments and land gobbling large-lot development can be lumped together under as "sprawl," little is added to the debate by using the term. The confusion over "sprawl" does spotlight a lack of consensus on what land use should be and how public policy should seek to influence it. Until there is more clarity about what we mean by "good land use", it will be difficult to effectively measure how particular policies work to produce it. The only solution to this problem, in the short run, is to avoid sweeping but meaningless generalizations like "sprawl" and focus on specific characteristics of development that can be quantified, such as density, acres of particular uses converted to developed use, etc.

What all the land use policies dealt with here have in common is that they are interventions in previously functioning markets for land to prevent a future negative externality or a future reduction in amenity. On the regulatory side, these interventions are carried out by tinkering with the "rules of the game," established heretofore, not by God or Adam Smith, but by the same body politic who must now sanction the changes to the rules. The motivation for changing the rules is that the existing or expected pattern of land use, or consequences flowing from that land use pattern, is displeasing to those exercising power over the rules.

In modern, democratic America, we may hope that those exercising power over the rules are broadly representative of public will, but it was not always so, and may not actually be so in particular circumstances now. When Baron Von Haussmann pulled down the ancient houses of Paris in the Second Empire to create the broad boulevards so characteristic of the city we know, he was not reflecting the contingent preferences of a million Parisian proletariat, so much as his own preferences for aesthetics, sanitation and unobstructed fields of artillery fire to put down riots like those of the Communards of 1848 (Boyer, 1994; Pinkney 1958; Streets of Paris, 2001). The instrument employed (direct condemnation) was no less effective in achieving the land use pattern desired by those in power (Von Haussmann, seconded by Napoleon III), and can only be clearly evaluated against those objectives, or by explicitly proposing alternative criteria for "success".

The motives for farmland protection are many and varied, and the motives for "growth control" are even more uncertain. Supporters of farmland protection include those who want to preserve active farming operations, those who want the open space and rural amenities provided by cropland, pasture, and farm woodlots, whether actually used for production or not, and those who value farmland for what it is not: more townhouses and shopping centers. Growth control is embraced by everyone from those who would return to a dense urbocentric pattern of settlement not seen in this country since before World War II, to those who simply want a more orderly transition and juxtaposition of land uses and traffic flows. The success of any given program of land use controls can only be evaluated through the eyes of the various beholders, and one or many objectives to be used as criteria for judging that success must be clearly stated at the outset or nothing but confusion can result.

It is especially important that economists not impose any artificial optimality or efficiency criteria in evaluating land use control programs, without first acknowledging whether those notions were objectives motivating the program originally. If faultlessly effective programs are serving flawed goals, the fault is with the goals, not the program, although a large dose of hubris accrues to social scientists who claim to "know better" what people should want. Fischel (1990) makes the point that growth controls are not imposed exogenously, but through a rational process involving goal-setting by the political leaders and participants involved, who may have quite different notions of "efficiency" and "optimality" than their ex-post evaluators do (p. 3).

The need to include growth controls endogenously in economic models has long been recognized (Davis, 1963; Fischel, 1978; Mills 1979). Growth control policies have been analyzed in many studies (Henderson, 1980; Shlay and Rossi, 1981; Epple et al., 1988; McDonald and McMillen, 1998; Levine, 1999; Phillips and Goodstein, 2000; Wallace, 1988; Erickson and Wollover, 1987). However, endogenizing the institutional mechanisms of growth control measures is a far more complicated task than most economists and modelers are willing to concede (Pgodzinski and Sass, 1994; McMillen and McDonald, 1991). An example from a recent paper attempting to endogenously model land use controls through zoning is illustrative. Starting from the unexceptionable premise that land planners are attempting to optimize a social welfare function, Seong-Hoon Cho and JunJie Wu (2001) abstract that notion into unreality in their theoretical model by assuming that county government seeks to maximize the net value from developed and farmland use less a term for the social cost of converting farmland (equation 11, p. 8). Going from not considering growth control policies as forces in the market at all, to modeling them in an unrealistic and distorting way doesn't constitute progress. Economists have a severe challenge in capturing the zoning and growth control process as it really exists: Not a hard-and-fast restriction on potential land uses, but a process of negotiation on what uses will occur on a particular site during what time frames.

Two trends in attempts to capture zoning and other land use controls in econometric modeling leave me particularly uneasy. First, the tendency to treat zoning and other growth controls as hard-and-fast classifications of land ignores the essential nature of land use regulation as a process, rather than an end product (Fischel, 1990, p. 7). The initial zoning for a parcel,

particularly one in a relatively undeveloped area, is only the starting point for a negotiation on what ultimately can and cannot be built. This is especially true for the larger, more sophisticated development projects that tend to alter the rural landscape in significant ways.

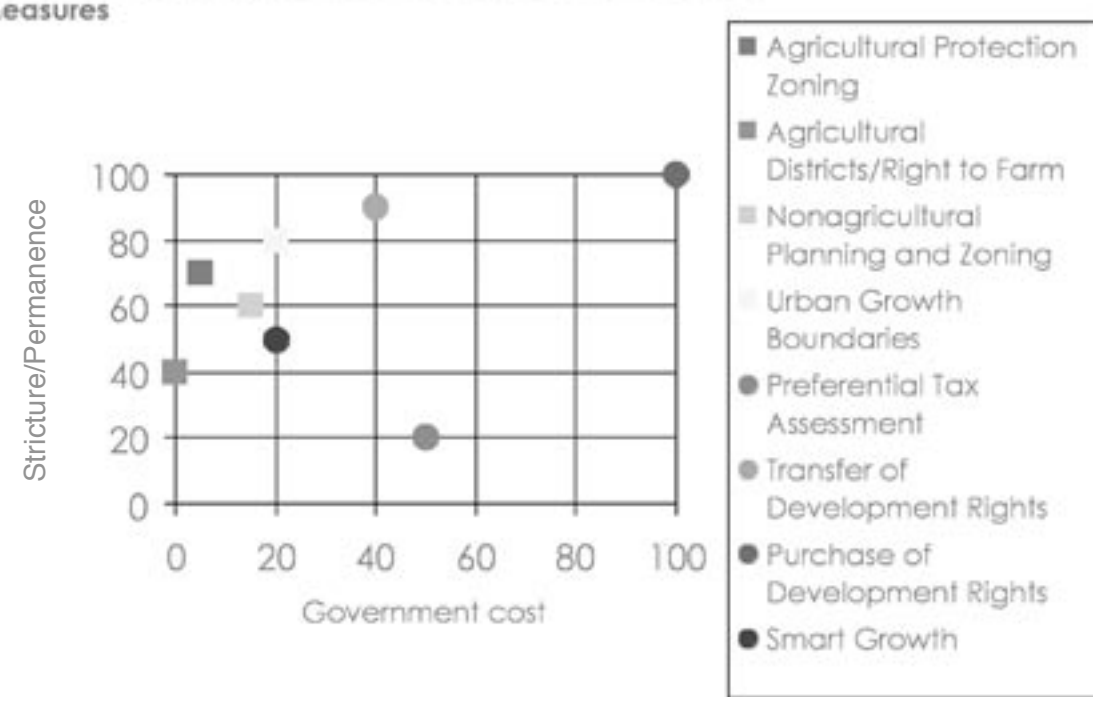
Because most econometric studies are nonspatial, the second tendency is to devise nonspatial ways to quantify growth controls, such as calculating the percentage of county land area zoned for a particular density of development, the number of growth control measures in place in a county, the number of variances granted, or some similar measure. Only rarely, for example in the case of urban growth boundaries, can such simple measures have a hope of capturing the effect of a complex institutional processes like subdivision and building permit regulation, zoning, and creation and implementation of a general land use plan.

Regulatory versus Incentive Approaches to Farmland Protection

There are two major classes of programs that apply to all attempts by government to alter patterns of land use, of which farmland protection is merely a special case (see figure 1). Most of the definitions used here are based on AFT (1997). Regulatory approaches proceed by altering the "rules of the game," rules previously established by government itself. This latter point bears repeating because economists have a tendency to write as though land markets are natural and unalienable, whereas anyone who has ever closed on a house knows that they are artifices constructed by generations of real estate lawyers. A profound philosophical division in fact exists between believers in the concept of naturally arising property rights, influenced by the writings of John Locke, John Stuart Mill and Adam Smith (Shabman, 1995), and a less romantic conception springing from Jeremy Bentham that rights accrue to those with the power to exercise them. Regardless of who is right about the origins of property rights in hoary antiquity, that current property rights are hedged about by legal stricture as much before imposition of land use control programs as after should be obvious.

The other major class of programs based in incentives operates by contrast by participating in markets according to the "rules of the game," without changing them. At the most fundamental level, when government purchases land from private landowners in fee simple title, it is no different than any other market participant. Most other incentive-based programs differ only in the degree of interest in the property, not in this fundamental characteristic.

Figure 1-Regulatory and Incentive-Based Growth Control Measures



What are Regulatory Approaches?

In ascending order of scope, one can distinguish the following changes to the market "rules," accomplished by regulatory approaches:

- Agricultural Protection Zoning-Sometimes called "Exclusive Agricultural Zoning," APZ refers to local government zoning provisions that designate areas where farming is the desired land use, discouraging or prohibiting other uses. APZ usually excludes non-farm businesses, and often restricts the density of residential development associated with farms (AFT, 1997, p. 49).

- Agricultural Districts/Right to Farm-I've lumped these two together because they are often linked in practice. Agricultural districts are special areas where agriculture is encouraged and protected by a variety of rule changes, including limitations on exercise of eminent domain, limits on special assessments, limits on non-farm public investments, requirements for agricultural impact statements, automatic eligibility for preferential tax assessment, and protection from nuisance suits based on a presumptive right to farm (AFT, 1997, p. 197). Ag districts differ from APZ because enrollment in them is voluntary for farmers, and not all land uses in an Ag District must be agricultural. However, they still fit in my notion of "regulatory" measures because they are created by changing the "rules" of development, not by bribing market participants.

- Nonagricultural Planning and Zoning-Moving beyond farmland protection, per se, general planning and zoning may serve to protect farmland by restricting alternative development opportunities. Local land use authority encompasses a number of powers, delegated from the states.

> "A wide variety of powers may be delegated by the state to local governments. Among those most frequently in local hands are the authority to establish and enforce a zoning ordinance and the authority to establish a planning board or commission to prepare a plan, usually called a comprehensive plan or a master plan, for the physical development of the jurisdiction. Other powers affecting land use which may have been delegated to localities include the authority to adopt subdivision regulations; official maps; building codes; capital improvement programs; shoreline, floodplain, or wetlands restrictions; and to acquire or preserve special areas such as open space or historical districts." (NRDC, 1977, p. 318.)

A more expansive variant that is not often pursued is regional planning and coordination of local plans, with zoning implemented by localities consistent with the broad outlines of a regional plan. A rash of regional plan implementation broke out in the 1970's, abetted by the Circular A-95 intergovernmental coordination of Federal funding, as state and local leaders realized that metropolitan growth required metropolitan powers (NRDC, 1977, ch. 13).

- Urban Growth Boundaries-At their broadest and most restrictive, urban growth boundaries have been established that prohibit most development outside the growth boundary, which is laid over existing planning and zoning (Knapp and Nelson, 1992; DeGrove and Metzger 1993; Johnson, 1999).

What are Incentive Approaches?

Incentive-based approaches participate in land markets, without abrogating any of the property owner's rights, generally by "buying" more or less of an interest or otherwise offering a "bribe" for preferred behavior. They include:

- Preferential Tax Assessment-Often called "differential", "use value" or "circuit breaker" tax programs, the general idea is to reduce the incentive for farmland owners to sell land for development by taxing the land at lower, agricultural values, rather than the higher values of developed uses (AFT, 1997, p. 147). There are usually some requirements that the owner engage in more or less active farming in order to qualify for the tax reduction, and many have "rollback" provisions that attempt to recover lost tax revenues if the land is developed.

- Purchase/Transfer of Development Rights-A more aggressive approach is to buy or trade the future development rights on farmland for ready cash (PDR, AFT, 1997, p. 81) or for an interest in higher density development elsewhere (TDR, AFT, 1997, p. 119). The interest obtained is a permanent one, and effectively prevents future development of the parcel, but cannot guarantee that farm use is feasible or will continue.

- Smart Growth-A more diffuse participation in markets, usually exercised strategically at the State level, is the collection of positive incentives and reinforcements to desired patterns of growth and development labeled "Smart Growth" (Meck, 1999; Chen, 2000; DeGrove and Metzger, 1993; Nickerson, 2001). A voluntary version of urban growth boundaries may be used that does not restrict development, but directs infrastructure and other State funding to preferred development areas. States may coordinate transportation and other infrastructure investments to encourage development in certain areas and discourage it in others.

How Do Regulatory and Incentive-Based Approaches Compare and Contrast?

Regulatory and incentive-based approaches differ in the degree of "hardness" implied in changes to the "rules" of the game, and in the locus of costs imposed (figure 1). The uninitiated may think that ag and nonag zoning are "hard" changes to the rules, and would therefore result in rather permanent changes to the way land is developed. In fact, variances and zoning appeals are the norm, not the exception, so that changes in zoning are fungible, indeed. By contrast, permanent easements, whether obtained through PDR or donation of conservation easements for charitable tax purposes, are among the most enduring legal instruments, undergoing little reversal in practice. While they have enduring legal standing, their impact on the working agricultural landscape may diminish over time if they are scattered, isolated, and become surrounded by uses incompatible with agricultural operations. While they work well, they cost the government a lot of money, albeit less than fee simple purchase.

Urban growth boundaries and agricultural districts both draw a line in the sand-the former to limit where growth can occur, and the latter to define where agriculture has primacy. Neither are as absolute in practice as they sound in theory. Urban growth boundaries can function well to direct growth when there is still plenty of developable land inside them to accommodate growth. When little undeveloped land remains, the pressure to expand the boundary becomes irresistible and growth will spill over into a new ring around the existing conurbation. Similarly, agricultural districts function well when the surrounding landscape remains mostly rural. When a sea of development surrounds these islands of agriculture, the dike will burst and more and more exceptions will be granted, especially if the districts are too small to be viable and fragment to farms that remain willing to be included. Thus, both change the "rules," but only until pressure is sufficient to overwhelm them. These approaches cost the government very little, beyond some need to defend them in court, at least for the pioneers. The locus of private costs falls clearly on the side of the line where development is prohibited, but may be resented in the case of urban growth boundaries (because a development opportunity is foreclosed), and welcomed in the case of agricultural districts (because a conflict with development is avoided).

Use value assessment and "Smart Growth" are incentive-based approaches operating at opposite ends of the scale. Use value assessment operates at the most microscale (individual parcels) and offers a very direct incentive. Unfortunately, it is subject to a form of "freeriding" wherein landowners with no thought of development receive a subsidy, and landowners who are assembling parcels for development can lower their landholding costs by applying for it, as well. Thus, use value assessment has a tremendous cost to government, particularly in rural areas, which often goes unrecognized because it is a tax expenditure (a reduction in revenue that might have been received). Nonagricultural land uses pay a part of this cost, but in the limit they will resist shouldering the entire tax burden of which agricultural land uses are relieved. At the other extreme, Smart Growth, which seems like a very amorphous and indirect approach, when used in an aggressive and well-directed manner can have disproportionate impacts on the pattern of growth at the most macro scale. Smart Growth reallocates benefits geographically, so the costs could be viewed primarily in terms of the political costs to Governors or State planners who direct these approaches. Neither approach changes the "rules" of development, with both offering bribes of a more or less recognized nature for desired behavior.

Problems in Evaluating Anything On Land

Moving beyond this kind of generalization about the different approaches based on observation and experience is difficult. Evaluating the impacts of particular land use policies is a special case of the general problem of building causal models of land use change. As a general observation, economists, planners and regional scientists have not been hugely successful in understanding and predicting land use patterns and land use change. There are three classes of problems in these endeavors: the appropriate comparisons, the issues of

dynamics and timing, and uncertainty. The degree of abstraction from the geographical reality of the developing landscape is also an issue in our forecasting ability.

In order to evaluate a policy, we must be making the appropriate comparisons (Schwartz, Zorn, and Hansen, 1986). This is true of almost any policy analysis, not just policies affecting land use change. The simplest evaluations are usually conducted in terms of the amount and character of development occurring before the policy was enacted, compared with development after the policy was in place. This is flawed because a host of other variables also have changed over time, not least being the initial state of development. Demographics, the health of national and regional economies, transportation and communication infrastructure, and other policies affecting development will all be different "before" and "after" enactment of the policy to be evaluated. These differences may be subject to econometric control, but there may be little relevant data or too amorphous an influence to adequately prevent them from confounding the policy evaluation.

A "with" and "without" comparison is preferable to the typical "before" and "after" approach. The "without" requires either finding convincingly similar control areas, or modeling or constructing the counterfactual case: What would have been the state of development in the absence of the policy change? Just as it is difficult to econometrically control for all the various factors influencing land use change that could change between two periods, capturing their effects in a predictive model of land use is also difficult. Comparing areas with controls to those without controls may create sample selection bias because areas with controls were likely experiencing significant growth pressures, and thus would differ from areas without controls, even if controls were not imposed.

Issues of dynamics and timing are important in understanding the difficulty of adequately modeling land use change. Part of this is data-driven: We do not have very good data generally available on land use change on a frequent basis. Consequently, we are often modeling land use changes that occur over 5-10 years, rather than year-to-year changes that would better pick up the influences of changing economic conditions and other policy changes. Development decisions are often not instantaneous, with the time between initiation and actual development often taking several years. Other actions, such as the alignment of major transportation corridors or utilities, occur over decades. Comprehensive plans and zoning laws take time to implement as well. All of these timing issues result in lags of various dimensions between the time of initiation and the time of implementation. During these lags, both landowner and consumer expectations are affected by the impending action and participants' judgments about their likely success, failure, or modification. Development may accelerate in the face of news about a restrictive policy under consideration, or slow down if proposed highway corridors are opposed, supported, or delayed. All of this is extremely difficult to capture in a meaningful way in econometric modeling. (See Beaton, 1991; Beaton and Pollock, 1992; and Meyer and Somerville, 2000 for studies where timing issues are explicitly recognized).

In addition, even if the probability of particular parcels being developed can be modeled, the exact timing of development is often highly variable. Delays stem from a variety of institutional and economic factors in the development process that have little to do with the underlying potential for development (Meyer and Somerville, 2000).

Related to timing and dynamics are issues of uncertainty. Policies like zoning tend to be abstracted in the modeling process into simple zero/one conditions on tracts of land. In reality, many of the specifics in zoning or other regulations are subject to negotiation or outright reversal in the zoning appeals process. The outcome is very uncertain, even when the original zoning is upheld. Modifications, like exactions for public facilities, delays in getting building permits, exemptions for nonprofit development, and mitigations at other sites, are additional sources of uncertainty that change the simple "black and white" of zoning often seen in models.

Modelers have used a variety of techniques to try and capture the effects of growth control policies in their models (table 1). The complexity of the institutional environment for land use change multiplies rapidly as researchers are forced to consider important real world issues. Is there more than one control measure in place (a simple yes/no does not suffice)? Are different measures in place in a jurisdiction of more or less importance in controlling growth (weighting may be needed)? Are the measures in place actually enforced (another kind of weighting, more subjective)? Some of the most sophisticated studies start from the realization that growth control measures are not hard-and-fast, cut-and-dried delineations, but reflect a process

Table 1—Approaches to modeling growth controls

Approach	Studies	Measure
None, analyze with controls	Landis (1992)	adopting cities vs. similar nonadopting cities
None, model as scenarios	Edwards and Anderson (1984)	allowing or not allowing building
	Parsons and Wu (1991)	displaced building activity
Yes/No	Shilling, Sirmans, Guidry (1991)	State land use controls: comprehensive state-wide planning, coastal zone and wetlands management, power plant and utility management, critical areas and wilderness areas, strip mining controls, floodplain, wetlands and shoreland controls, tax reductions
Percent of area	Bockstael (1996)	percent of area zoned low density
Specific requirements	Green (1999)	mobile homes permitted, minimum lot width, setback, subdivision standards, etc.
Number of Controls	Kuminoff and Sumner (2001)	ag element and growth mgmt element in county general plan, urban growth boundary, "Super" Williamson Act participation, growth policy, LESA use, local PDR program
	Levine (1999)	number of 18 measures, "strong" 4 measures and "weak" remaining measures
Severity of Controls	Logan and Zhou (1989)	moratorium, growth limitation, EIS, open space zoning, environmental zoning, public facilities requirement, public land dedication
Weighted Index	Cho and Wu (2001)	index of number of measures, weighted by effectiveness of implementation
	Pollakowski and Wachter (1990)	weighted average of zoning categories (e.g., RE-1 = 80)
Delay to Build	Mayer and Somerville (2000)	number of months for subdivision approval
Probability of Variance	Bliven, Lessley and Phipps (1984)	probability of zoning variance from ag zoning being granted.
Impact Fees	Mayer and Somerville (2000), Skidmore and Peddle (1998)	Modeled as a fee per unit or area
Growth Limits		
Urban Growth Boundaries	Knapp and Nelson (1988)	inside or outside UGB
	Kline and Alig (1999)	inside or outside of UGB, forest zone, farm zone
Ag Zoning/Districts	Henneberry and Barrows (1990)	estimated separate equations for zoned and unzoned parcels
Flood Plains/Critical Areas/Special Areas	Holway and Burby (1990)	zoning severity index, elevation requirement, and development permitted dummy
	Beaton (1991)	restricted and control areas
	Beaton and Pollock (1992)	inside or outside critical area

of negotiation. This results in measures of the delay in development imposed by controls that can cut across the variety of measures in place (Mayer and Somerville, 2000). Other approaches recognize that variances are a way of life, and attempt to model the outcome of the variance process itself (Bliven, et al., 1984).

More fundamental than any of these difficulties are questions of measurement: What is the appropriate measure of whether a land use control policy or program "works"? This returns us to the question of objectives, but also the degree to which readily available data can serve as proxies for the objective. Many proponents of growth control have very qualitative and elusive objectives such as "improving the quality of life" that do not readily translate into quantitative measures such as land value changes, population changes, or acres of a given land use type. One might think that in the area of farmland preservation, changes in the number of acres of farmland, or the rate of farmland conversion, would be a relatively objective measure of success. Even here, however, there are concerns about whether the farmland protected remains in farming and the quality of the farm activity. In general, the economic literature on growth controls involves two measures derived from welfare economics: impacts on prices and impacts on quantities.

The Market Test: Have We Affected Prices?

One way in which economists have tried to resolve these modeling difficulties is by using market prices as a precursor and proxy for effects on land use. The argument is that changes in the market "rules" embodied in zoning and other regulatory measures are first reflected in changes in the price of land, which reflect increased or decreased development potential. Obviously, this only works for policies that affect markets (such as zoning and growth boundaries), not for incentive policies (such as preferential tax assessment and PDR) that directly "bribe" current landowners, without affecting broader underlying markets. The affect of "Smart Growth" policies on land values is unclear, but in particular instances, such as redirecting infrastructure development, they could be significant.

Fischel (1990) provides an excellent review of the hedonic literature up to that time, examining whether growth controls affect land values. He reviews several categories of studies (impacts on undeveloped land values, impacts on housing prices, costs and benefits of growth controls, etc.) and concludes that there is convincing evidence from this literature that growth controls do influence the value of land and the price of housing. I highlight studies dealing with agricultural issues and append the following post-1990 studies to his review (table 2).

Anderson and Bunch (1989) found that Michigan's property tax credits for agricultural land retention and the homestead exemption are capitalized into land values, increasing them approximately 10 percent. Eligibility for the property tax credits, which reduce costs and increase income from farming in current years apparently offset the loss of expected gains from sale for development in the future. Changes in the rate of taxation itself are not capitalized into land values.

Henneberry and Barrows (1990) examined the extent to which exclusive agricultural zoning in Wisconsin was capitalized into farmland values. Their theoretical analysis identified four possible price effects: a negative one from foregone development potential, a positive one from avoiding externalities associated with nonag development near the farms, a positive one from certainty regarding future land use compatibilities, and a positive one from lowering potential property tax increases. An hedonic regression analysis of 140 parcel sales in one Wisconsin county showed that exclusive ag zoning had both positive and negative influences on farmland prices, depending on the characteristics of the specific parcel. Larger parcels located further from development generally experienced a positive net capitalization, while smaller parcels closer to developed areas had farmland value losses.

Nickerson and Lynch (2001) investigated what effect PDR and TDR programs in Maryland counties had on the value of parcels for which development was restricted. Using data for 224 restricted and unrestricted parcel sales in three counties, they estimated an hedonic regression model explaining sales price. Contrary to expectations from their theoretical model, they did not find statistically significant declines in farmland value on restricted parcels. Protected parcels have values equal to or greater than unprotected parcels, indicating that the restrictions are not being capitalized into the parcel's value.

Beaton (1991) similarly examined enactment of the New Jersey Pinelands Protection Act in 1979 and its implementation in the Comprehensive Management Plan in late 1980. They analyzed a dataset of property sales forest and agricultural parcels within the Pinelands and in control townships adjacent to the Pine-

Table 2—Summary of Growth Control Studies Using Housing or Land Price as an Indicator

Variable	Title	Author(s)	Source	Year	Area	Findings
housing price	Evaluating the Economic Impact of Planning Controls in the United Kingdom: Some Implications for Housing	Monk, S.; Whitehead, C.M.E.	*Land Economics* 75(1):74-93	1999	United Kingdom	Growth controls in one area increased prices in all area and changed relative prices.
housing price	Land Use Regulation and the Price of Housing in a Suburban Wisconsin County	Green, R.K.	*Journal of Housing Economics* 8(2):144-59	1999	Waukesha County, Wisconsin	Finds that forbidding mobile homes and requiring frontage increase housing prices 6.1% to 8.5%. Regulations decrease the share of affordable housing significantly.
housing price/ housing construction	Housing Prices, Externalities, and Regulation in U.S. Metropolitan Areas	Malpezzi, S.	*Journal of Housing Research* 7(2):209-41	1996	60 U.S Metro Areas	Based on the regression coefficients derived, Malpezzi estimates that moving from a lightly regulated environment to a heavily regulated one would increase rents 17 percent and housing prices 51 percent, and would reduce permits issued by 42 percent.
housing price	The Effects of Land-Use Constraints on Housing Prices	Pollakowski, H.O. ; Wachter, S.M.	*Land Economics* 66(3):315-24	1990	Montgomery County, Maryland	Housing and developed land prices increased; spillover to unconstrained areas. Zoning restrictiveness had a significant impact on housing price, but a development ceiling and the relative restrictiveness of surrounding areas produced only weak effects.
housing price	Land Regulation and the Price of New Housing.	Landis, J.D.	*Journal of the American Planning Association* 52(1): 9-21.	1986		
housing price	Land Use Controls: The Case of Zoning in the Vancouver Area	Mark, J.H. ; Goldberg, M.A.	*American Real Estate and Urban Economics Association Journal* 9(4): 418-35	1981	Vancouver, BC	This paper explores the relationship between rezoning and changes in observed property values and the ability of zoning to mitigate externalities. Results imply that rezoning does not necessarily lead to changes in land use and value.
land value	Land-Use Controls, Natural Restrictions, and Urban Residential Land Prices	Guidry, K.A.; Shilling, J.D. ; Sirmans, C. F.	*Review of Regional Studies* 29(2): 105-13	1999		This paper examines the impact of both land-use controls and natural restrictions on interurban variation in residential land prices. Results indicate that, as expected, land prices are significantly higher as the land supply decreases both as a result of natural and man-made restrictions.
land value/land use	Modeling Economics and Ecology: The Importance of a Spatial Perspective	Bockstael, N.E.	*American Journal of Agricultural Economics* 78: 1168-1180	1996	Patuxent River Basin, Maryland	Low-density zoning (negative) and community planning (positive) are significant variables in a hedonic model of land price. These findings play through into a probit model of land use conversion probabilities as a variable reflecting value in residential use.
land value	Economic Impact of Growth Management Policies Surrounding the Chesapeake Bay	Beaton, W.P.; Pollock, M.	Land Economics 68(4):434-53	1992	Maryland	Prices for existing properties within the Maryland Critical Areas boundary increased relative to those outside for counties under development pressure, not otherwise.

Table 2—Summary of Growth Control Studies Using Housing or Land Price as an Indicator (continued)

land value	The Opportunity Cost of Coastal Land-Use Controls: An Empirical Analysis	Parsons, G.R. ; Wu, Y.	*Land Economics* 67(3):308-16	1991	Chesapeake Bay Area, Maryland	Restrictions on development in the coastal zone reduced housing value in terms of frontage, view and proximity to water.
land value	The Impact of State Land-Use Controls on Residential Land Values	Shilling, J.D. ; Sirmans, C. F. ; Guidry, K.A.	*Journal of Regional Science* 31(1):83-92	1991	37 States	Comprehensive state land use programs add 1.6 % to the price of residential land, with positive effects on both the supply and demand equations. Certain single-purpose land use control programs (power plant and transmission, strip mining) are also significant demand factors.
land value	The Impact of Regional Land-Use Controls on Property Values: The Case of the New Jersey Pinelands	Beaton, W.P.	*Land Economics* 67(2):172-94	1991	Pinelands Area, New Jersey	Properties in the restricted area had a 10 percent premium over control areas and maintained the premium over time.
land value	The Effects of Floodplain Development Controls on Residential Land Values	Holway, J.M.;Burby, R.J.	*Land Economics* 66(3):259-71	1990	9 U.S. cities	Elevation requirements and floodplain zoning decrease land values in the floodplain relative to controls.
land value	Agricultural Property Tax Relief: Tax Credits, Tax Rates, and Land Values	Anderson, J.E.; Bunch, H.	*Land Economics* 65(1):13-22	1989	Michigan counties	Tax credits for agricultural land retention and homestead are capitalized into land values, raising them by 10 percent. Property tax rates themselves do not affect land values.
land value	The Effects of Regional Land Use Controls in Oregon: A Theoretical and Empirical Review.	Knaap, G.J.;Nelson, A.C.	*The Review of Regional Studies* 18: 37-45.	1988	4 counties in Oregon	Reviewed theory and empirical studies of urban growth boundaries. Found that urban growth boundaries significantly reduced land values outside the boundary, but that local growth controls varied from one jurisdiction to another.
land value	The Price Effects of Urban Growth Boundaries in Metropolitan Portland Oregon.	Knaap, G.J.	*Land Economics* 61(1): 26-35.	1985	Portland, Oregon	
land value	Land Use Conflicts in the Coastal Zone: An Approach for the the Analysis of the Opportunity Costs of Protecting Coastal Resources.	Edwards, S.;Anderson, G.	*Journal of Northeastern Agricultural Economics*. April, 73-81.	1984	South Kingston, Rhode Island	Downzoning near coastal amenity results in loss of housing value of $509 per unit, $407, 200 for entire area.
ag land value	The Effect of Farmland Preservation Programs on Farmland Prices	Nickerson, C.J.; Lynch, L.	American Journal of Agricultural Economics, 83(2):341-351.	2001	Maryland	PDR and TDR do not decrease value of restricted parcels relative to unrestricted.
ag land value	Capitalization of Exclusive Agricultural Zoning into Farmland Prices	Henneberry, D.M.; Barrows, R.L.	*Land Economics* 66(3):249-58	1990	Wisconsin	Exclusive ag zoning has both positive and negative effects on farmland value depending on parcel characteristics.
ag land value	The Effect of Agricultural Zoning on Land Prices, Quebec, 1975-81	Vaillancourt, F.; Monty, L.	*Land Economics* 61(February):35-42	1985	Quebec, Canada	Land zoned exclusively for ag is 15-30 percent less valuable than unrestricted land.

lands area. Price index equations were estimated for 1966-72, 1972-81, and 1982 onwards, corresponding to unrestricted growth, transition, and under growth controls. They concluded that growth controls affected the restricted area and the adjacent areas, both after implementation and in anticipation of implementation, with properties in the restricted area garnering a 10 percent premium over control areas, which persisted over time.

Parsons and Wu (1991) estimated an hedonic price regression for housing using cross-sectional data from a developed coastal zone area in Anne Arundel County, Maryland, where land use controls for coastal development had been imposed in 1983 and 1984. They estimated the average value of lost coastal access at $233-$524 (lost proximity), $6,553-$7,883 (lost view), and $74,763-$96,672 (lost frontage) per house in 1983. They also estimated various scenarios for displacement of housing from the protected area to estimate the total opportunity cost of the controls, in terms of lost housing amenity value.

Beaton and Pollock (1992) examined growth controls imposed to improve water quality in the Chesapeake Bay under Maryland's Critical Area Law, which restricts new housing development within 1,000 feet of the Bay shoreline. Using a cross-section, time-series panel database of property sales occurring before and after imposition of the Critical Area legislation in 1988 and 1989, they estimated hedonic price equations for housing and vacant land, controlling for property characteristics in four Maryland market areas around the Bay. They found that property values within the Critical Area for both housing and vacant land did grow faster than comparable upland counterparts in two areas easily accessible to major population centers starting as much as a year prior to implementation of the law, but were not significantly different in more remote areas on the Eastern Shore. This is cited as evidence that the growth controls did restrict the supply of new housing and developable land in the affected area, presumably having a positive impact on the environment in that restricted area.

Malpezzi (1996) used an index of local regulatory stringency derived from sample data collected from planning officials in 60 large metro areas (Linneman et al. 1990; Buist 1991) and an index of state planning stringency based on a survey by the American Institute of Planners (AIP, 1976) to study changes in housing rents and sales prices and on the number of building permits issued. Based on the regression coefficients derived, Malpezzi estimates that moving from a lightly regulated environment to a heavily regulated one would increase rents 17 percent and housing prices 51 percent, and would reduce permits issued by 42 percent. In an attempt to measure the impact of regulation on some externalities often mentioned in association with poorly regulated development (traffic congestion, racial segregation, and neighborhood quality), Malpezzi found that local regulations had little effect in reducing these ills, although indirect effects on other related variables may have been confounding the results.

In the context of United Kingdom land use controls, Monk and Whitehead (1999) used a comparative static framework to examine changes in land prices, housing completions, and housing prices for three areas, given the history of planning permissions (units allowed) by county housing authorities. They concluded that the growth controls in one area pushed up prices in all three areas, and modified relative land prices. The controls maintained a level of density that they expected would have fallen without the controls.

While nearly all of these studies find some impact on prices for land or housing from growth controls, they are all equally unsatisfying regarding the question of "so what?" Price increases or decreases may indicate that growth controls are affecting markets for land and housing, but does that indicate that the growth controls are positively affecting the conditions they were designed to change and adding to social welfare, or just a restriction in supply? Welfare is not equivalent to changes in land values, and changes in the supply of land don't necessarily equate to improvements in conditions for people. If price increases result from an outward shift in demand, then the case for welfare enhancement is stronger, but it is not usually clear whether supply or demand factors have contributed to the increase in observed prices, and to what degree.

As Fischel (1990, p. 1) points out in the introduction to his literature survey, the problem with interpreting studies of the effect of growth controls on land or housing prices is that they could as easily result from monopolistic restrictions on supply as on benefits reflected by increased demand. That is, home or property owners may benefit from higher prices simply because of an (artificial) supply restriction caused by the growth control measures, rather than from higher prices reflecting increased demand due to higher social welfare from a more desirable land use pattern. In an extreme case, imagine that instead of imposing zoning

on a community to preserve farmland and open space amenities, we have instead sowed vacant land with radioactive plutonium. The effect on land values on the remaining, uncontaminated land might reflect the same price increase (ignoring the affects of proximity to radioactivity), but it is difficult to conclude that the community is better off. If we really believe that the objective of both zoning and spreading plutonium is to increase land values, both methods appear to "work," but they both do so by restricting supply. We hope that growth controls increase prices because improvements increase demand, but merely observing increased prices doesn't reassure us that this is the case.

There is something a bit disingenuous about claiming, on the one hand, that housing markets function perfectly and changes in prices should reflect the effects of sprawl and poorly planned growth, yet on the other hand condemn those neighborhood effects as unpriced externalities resulting from market failure (Baumol and Oates, 1988, p. 12). While the markets for housing and commercial real estate work efficiently, the market for "lifestyles", including landscape or rural amenities either fails to exist or fails to deliver the anticipated benefits. This market failure can be understood as arising from interactions between the following factors:

- Markets for positive externalities from agricultural production, such as open space and rural amenities, do not exist. Therefore, these attributes in the landscape are neither permanent nor even necessarily long-lived when development begins to occur. Housing construction does not impose negative spillover effects (externalities) in this regard, it removes a positive spillovers that were in place from the previous economic activity, farming.

- Negative spillovers from housing consumption, such as traffic congestion, destruction of visual amenities, and crowding, are not priced in the cost of the housing or other development. If the cost of the landscape amenities were accurately included, "housing" costs would be much higher and demand lower. For example, fully planned communities with carefully controlled land uses and landscape amenities such as open space, lakes, and recreational facilities included are more expensive than nearby developments without these amenities.

- Imperfect information creates a market failure because consumers do not anticipate future development patterns and do not weigh them perfectly in current housing purchase decisions. See the innovative call for "build out" maps to inform housing consumers of the potential future condition of the neighborhood they are buying into under full development (U.S. EPA, 2001; Lacy, 1990).

- Absence or failure of planning and zoning in local communities contributes to this failure because there is no information about the institutional framework within which future development can take place. When future development is dealt with on a piecemeal or ad hoc basis, neither consumers nor developers can adequately anticipate what development will occur on surrounding parcels.

- Developers, who generally have a good grasp of future development potential, have no incentive to inform housing consumers who value open space and other rural amenities that they are likely to be developed.

Other sources of failure in the "lifestyle" market derive from the nature of development and land use change. Development results from the cumulative impacts of many small decisions, with the rare exception of a large, planned, "new town", such as Columbia, Maryland, Reston, Virginia, or Irvine Ranch, California. Markets proceed on the basis of many small decisions, which when taken without an overall context, produce results that can neither be envisioned by nor anticipated by consumers and developers (Kahn, 1966). There is no problem when consumers of corn or soap fail to anticipate the resultant changes in supply and demand that result from their atomistic consumption decisions because corn and soap producers respond quickly and seamlessly to small variations in supply and demand in very short order. However, the cumulative effects of similar decisions in land use can result in significant disamenity over time (CEQ, 1997; Spaling and Smit, 1993). Specifically:

- Individual developers' decisions, which produce negative spillovers for existing land users, are generally small in scale relative to the entire landscape, occurring subdivision by subdivision, or even house by house (Fischel, 1999, p. 411).

- Consumers' decisions on housing consumption, which produce negative spillovers for each other from consumption, are made one house at a time.

- Both developers' and consumers' decisions are irreversible over time scales of a lifetime, providing little scope for adjustment except to move to a "clean canvas" in another rural setting (Tiebout, 1956; Hamilton, 1975).

- Efficiency in the real estate market increases property values as development proceeds in desirable new neighborhoods, creating greater incentives to develop (Lafferty and Frech, 1978; Burnell, 1985; Speyrer, 1989).

- Negative spillovers from development do not create a drag on property values in the real estate market until disamenities are quite high.

In summary, there are substantial costs imposed by allowing low-density development, both at the fringe of existing urban area and farther out in the rural countryside. People recognize substantial benefits from maintaining and conserving rural land uses in farming, grazing, and forestry. While some communities actively address growth control issues, private market forces often operate with minimal intervention from fragmented land use control authority at the State and local levels and cannot recognize and avoid these costs, nor capitalize on the benefits.

The underlying premise that changes in land use regulation result in land value changes correlated with increases in social welfare cannot be defended in all cases (see figure 2). Changes in density are a good example. If a parcel is down-zoned to allow for fewer units per acre (case A to case B), undeveloped land values are likely to decrease because the development value is reduced. However, the welfare of new and existing homeowners may actually be higher because they prefer lower density settlement patterns. Another case is where there is no difference in density, producing little difference in land value, but the arrangement of settlement is more preferable to surrounding neighbors and new residents because it is more aesthetic or preserves more public open space (comparing case B and C). Again, welfare may be increased, but land values may remain the same. Increased visual amenity from the public open space would tend to increase land values, but the undesirable lack of control in becoming part owner of a common could offset this increase in whole or in part.

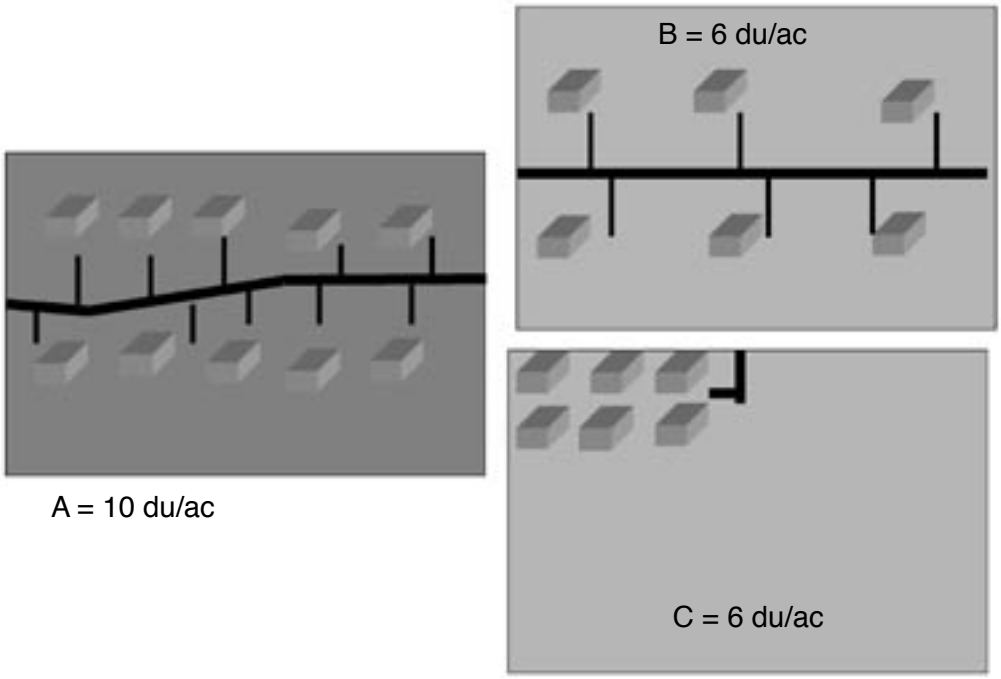
From a modeling perspective, some of the dynamic issues of trying to directly model land use or land use change are avoided by focusing on land values, but many of the other problems remain and some new ones are introduced. First and foremost is the fact that data on land values aren't any easier to get than data on land use. At least land use (or land cover) is directly and unambiguously observable at every instant in time, even if it isn't collected that often. Land value is only reliably observable in a market sense when a transaction occurs, which is relatively seldom for the typical parcel. Assessed or appraised values can be biased and inaccurate when conditions are rapidly changing, because of the dynamics and uncertainty discussed above for land use. The same kind of confounding factors influence land value as do land use, and must be controlled for econometrically or through sample design. As in the case of land use, the test is not simply did land values go up or down after a policy change, but did they go up or down more than they would have in the absence of the policy change.

The Land Use Test: Have We Affected Outcomes?

The real test of a land use change policy is whether the policy changes the use of land over what would have occurred in the absence of the policy. Fortunately, for farmland protection, the desired change is relatively easy to observe: Is less farmland converted to developed uses or abandoned than otherwise? There is a qualitative dimension to farmland protection as well. Is the land that is retained in farming actually being used for production agriculture?

For growth control policies, the objective is more difficult to articulate and observe. The quantity of development is important, but some policies could be evaluated as successes if they affect the quality of the development that occurs. What the desired qualities are is difficult to say, in most cases. While much of the effort in land use controls is directed toward controlling the amount and timing of development, a great part is also directed at the spatial pattern of development. Even if the absolute amount of development (number of houses, number of acres) remains the same, over the same time period, the way new development is accommodated on the land changes social welfare. This was the original intention of density requirements in zoning, which were aimed at preventing slums by limiting density to a prescribed number of units per acre. In conjunction with preserving farmland and open space, we are more concerned with zoning to insure that densities are higher than the market might otherwise call for.

Figure 2 - Differences in Density and Settlement Pattern Produce Differences in Land Value and welfare That May Not Coincide



Subdivision and site review, planned unit development, and other planning measures are explicitly concerned with how a site is developed, not just the aggregate density.

One of the best examples of this is the work of Randall Arendt, a rural land use planner who has shown how the same density of development can be accommodated in rural landscapes without sacrificing visual and open space amenities (Arendt, et al. 1994; Arendt, 1996). By clustering development on a portion of the site and keeping the rest of the site in open space uses, different landscape impacts are achieved at the same overall density. This is a recent manifestation of ecological planning principles first espoused by Ian McHarg (1971) that somehow need to be incorporated into our models for evaluating what works in land use planning. The quantitative overlap between ecology and economics appears in the discipline of landscape ecology, which uses various quantitative measures to capture the matrix, network, patch, corridor and other features of landscapes that are ecologically important (Forman and Godron, 1986; Zipperer, et al., 2000).

Below, some examples of land use change studies from the literature are reviewed that focus on growth control policies as explanatory variables, emphasizing those dealing with agricultural programs (table 3). While not a comprehensive review, it does provide a flavor for how the growth controls are being incorporated in models, and what findings result.

Kline and Alig (1999) use detailed data on land use change from the Forest Inventory Analysis program to evaluate how effectively the Oregon urban growth boundary and forest use and exclusive farm zones worked to reduce forest and farmland conversion relative to Washington, where no such controls were in place. They conclude that conversion has been concentrated inside the urban growth boundary, but that conversion outside the growth boundary has not been measurably different than in Washington. Of several possible explanations, they conclude that because the growth boundary was drawn around areas experiencing growth, growth continued to occur inside the boundary, and not outside it.

Kuminoff and Sumner (2001) use similarly detailed data on land use change from the California Farmland

Table 3—Summary of Growth Control Studies Using Land Use or Housing Change as an Indicator

Variable	Title	Author(s)	Source	Year	Area	Findings
land use	Modeling Farmland Conversion with New GIS Data	Kuminoff, N.V.; Sumner, D.A.	AAEA meetings 2001	2001	California	Finds that population growth and edge length of urban interface are statistically significant and positively correlated with conversion. Zoning and development restrictions were not significant explanatory variables for converison.
land use	Land Use Regulation and New Construction	Mayer, C.J. ; Somerville, C.T.	*Regional Science and Urban Economics* 30(6): 639-62	2000	44 U.S. Metro Areas	Finds that land use regulation lowers the steady-state level of new construction. Metropolitan areas with more extensive regulations have up to 45 percent fewer starts and price elasticities that are more than 20 percent lower than those in less-regulated markets. Regulations that lengthen the development process alter short- and long-run effects of demand shocks relative to conditions in markets without such delays. Development or impact fees have rlatively little impact on new construction, but regulations that lengthen the development process or otherwise constrain new development have larger and more significant effects.
land use	The Effects of Local Growth Controls on Regional Housing Production and Population Redistribution in California	Levine, N.	*Urban Studies* 36(12): 2047-68	1999	490 California cities and counties	Local growth-management measures significantly displaced new construction, particularly rental housing. Measures impacted low-income households and minorities particularly. Measures which limited available land or which downsized existing zoning had stronger effects.
land use	Does land use planning slow the conversion of forest and farm lands?,	Kline, J.D.; Alig, R.J.	*Growth & Change*, (Winter): 3-22.	1999	Oregon	Results suggest that Oregon's land use planning program has concentrated development within urban growth boundaries since its implementation, but its success at reducing the likelihood of development on resource lands located within forest use and exclusive farm use zones remains uncertain.
land use	Do Development Impact Fees Reduce the Rate of Residential Development?	Skidmore, M.;Peddle, M.	*Growth & Change*, 29(Fall):383-400	1998	DuPage County, Illinois	Empirical results show that impact fees reduce rates of residential development by more than 25 percent.
housing price/ housing construction	Housing Prices, Externalities, and Regulation in U.S. Metropolitan Areas	Malpezzi, S.	*Journal of Housing Research* 7(2):209-41	1996	60 U.S Metro Areas	Based on the regression coefficients derived, Malpezzi estimates that moving from a lightly regulated environment to a heavily regulated one would increase rents 17 percent and housing prices 51 percent, and would reduce permits issued by 42 percent.
land price/land use	Modeling Economics and Ecology: The Importance of a Spatial Perspective	Bockstael, N.E.	*American Journal of Agricultural Economics* 78: 1168-1180	1996	Patuxent River Basin, Maryland	Low-density zoning (negative) and community planning (positive) are significant variables in a hedonic model of land price. These findings play through into a probit model of land use conversion probabilities as a variable reflecting value in residential use.
land use	Regional Growth…Local Reaction: The Enactment and Effects of Local Growth Control and Management Measures in California	Glickfeld, M.; Levine, N.	Cambridge, Mass.: Lincoln Institute of Land Policy,	1992	443 California cities and counties	
land use	Do Suburban Growth Controls Control Growth?	Logan, J.R.; Zhou, M.	*American Sociological Review* 54(3):461-471	1989	338 suburbs of U.S. cities	Growth controls have only modest effects on subsequent changes in local population, median family income, median rent, and black percentage.

Mapping and Monitoring Program in a GIS framework to model change from agriculture to urban use, movement of land out of agricultural use, and movement of all rural land into urban use. They use a count of development restrictions for each county as a proxy for growth controls, but find that the variable is never statistically significant in explaining the land use changes observed. When each of the seven kinds of controls was tested individually, all had negative signs regarding conversion, but none were statistically significant at the 95 percent confidence level.

Mayer and Somerville (2000) conduct a very sophisticated piece of econometric analysis on quarterly data for a panel of 44 metro areas between 1985 and 1996 to investigate how land use regulations affect new housing construction. Their framework is well suited to considering subdivision and building permit regulations as processes to manage the timing of development, and detects changes in the dynamics of housing supply response and the overall elasticity of supply. They find that regulation has a significant negative effect on steady-state levels of new construction (up to 45 percent lower), that developers increase their inventory of approved development lots in response to stiffer regulations and longer regulatory delays, playing out over several quarters, and that price elasticities of housing supply are up to 20 percent lower than in areas with less regulation. Impact fees are found to have little effect on the supply of new housing. The authors point to the difference between impact fees, which are large but certain changes in the production function for new housing, and regulatory delays and uncertainty, with the latter being much more effective in reducing total new construction activity.

Skidmore and Peddle (1998) used a sample of municipalities in DuPage County, Illinois to examine whether impact fees had a measurable role in reducing residential development. They found that imposing impact fees would reduce the rate of development by 29-31 percent because they impose additional costs on new development, increasing prices and reducing demand. This finding appears to be in direct contradiction to the Mayer and Somerville (2000) finding above.

Bockstael (1996) develops a probit model of land use conversion probabilities that is a second stage of a land value hedonic model which includes variables representing percent of land zoned for low density development, and whether the lot is in a planned community. Low density zoning decreased land values significantly, while being in a planned community increased land values. When passed into the land conversion model, high-density zoning and being in a planned community would therefore tend to increase the probability of conversion, indicating that these land use controls are working counter to expectation. Because the model is integrated with an ecological model predicting water quality impacts, the outcome of different development scenarios can be estimated directly.

Landis (1992) examined local growth controls in 7 medium-sized California cities and control areas. He distinguishes growth controls, which put an absolute cap on the number of new residents, houses permitted, or areas to be annexed, from growth management policies, such as conventional zoning, subdivision regulations, annexation controls, and urban growth boundaries. Examining differences in population and housing growth and housing shortfalls in the case study and control cities, Landis found no evidence that absolute growth controls, as implemented, made a significant difference in reducing population growth or housing construction. He also found no evidence that housing sales prices were any higher in the case study cities than in control cities. He attributed this observed failure to loopholes in implementing the controls and "grandfathering" existing construction and development approvals.

Logan and Zhou (1989) used census data for 1970-80 and data from a 1973 survey of planning officials in cities over 10,000 in population regarding adoption of 7 growth control measures to measure whether the controls affected changes in key variables related to growth. They found that open space zoning and environmental zoning reduced increases in suburban black population, and requirements for environmental impact statements on projects increased median rents. No other measures were statistically significant with respect to population growth or growth in median income. The authors conclude that simply passing these kinds of controls does not necessarily produce an impact on growth, at least as they have measured it. Given the aggregate, summary measures used to represent "growth" however, it is equally likely that more subtle impacts associated with actually managing growth in land use are not captured in the model.

While more direct than the evidence on land or housing prices, the evidence from land use or housing construction studies remains unsatisfying. Even where a study shows that growth control measures are a sig-

nificant variable in explaining changes in land use or housing development, we are not sure that they "work" to actually improve the quality of development that does occur.

Anecdotes and Objectivity: Two Research Approaches

Evidence from econometric and other quantitative studies is necessary, but not sufficient to conclude that adoption of a particular set of growth controls has actually improved the pattern of land use and the resulting public welfare. While such studies provide credible, scientific evidence that the growth control program has (or has not) been responsible for some change in the market (price or quantity), it is very difficult to ascertain that the resulting market changes reflect increased demand, heralding an improvement, or simply result from monopolistic supply reduction. Less direct and less scientific methods of case study are needed to really understand what is happening in such situations, and to understand the institutional complexities that produced the result observed.

Examples of the kind of case study needed are Levinson (1997, Montgomery County), Richardson, et al. (1993, Pasadena, California), Knapp and Nelson (1992, Oregon), Schnidman, et al. (1990, New England), Babcock and Siemon (1985, 8 states), and Daniels and Lapping (1984, Vermont). However, very few of these employ both the in-depth examination embodied in the best examples of case studies, and the objective, scientific, quantitative approach of econometric studies. An exception is a study by Landis (1992), which examines growth control policies in 7 California cities, carefully matched to control cities of similar demographics and location. In addition to the usual qualitative comparisons, a number of quantitative comparisons of population growth, housing price trends, housing shortfall, and fiscal impacts are conducted between the adopting cities and the controls. While too small a sample for econometric study, the quantitative treatment adds an additional dimension to an otherwise-typical case study.

Conclusions and Reflections

I would be pleased if a more robust set of conclusions would emerge from this examination of research into evaluating growth control policies. However, the most I can provide is a catalog of what is troubling or clearly not working in this area. My conclusions are these:

- This field is fraught with confusion about exactly what these policies are trying to achieve. The diagnoses of the "problems" with development are so various, and even conflicting, that it is no wonder that the solutions are equally varied. Given that we are not particularly certain about the problem, it is perfectly understandable that we aren't really very clear about what we want to achieve. Do we want more agricultural land? How much more? Do we want denser housing, or less dense? Housing near open space? How much and how close? In fact, there is relatively little consensus on what we really want in our landscapes, despite attempts embodied in city planning in most areas. **Conclusion: We can't know what "works" until we know what end state we desire.**

- I hope by this point in the paper that I have convinced you that there is more to solving land use problems than simple, aggregated market tests. Neither the land price test, nor the land quantity test answer the development quality test. That is, the pattern of the landscape and the interactions of the various elements in it may be more important to our perceptions of the "goodness" or "badness" of land use problems than anything that results in significant market effects from aggregates such as land or housing price, land conversion, or construction. Conclusion: Conclusions based on economics alone will be inconclusive.

- Even the best case studies have an anecdotal quality to them that comes from their focus on the particular and the specific. This is exactly what convinces us that we really understand what is going on in a good case study. On the other hand, econometric studies provide objective, verifiable evidence for a specific effect, but don't go much further than that. Conclusion: Econometric studies are necessary, but not sufficient to understand what works and why. This is especially so if growth controls are simplistically modeled.

- Even the best econometric studies leave us feeling that things are too pat, and that the mathematics and economics don't capture everything that is going on in the messy real world. On the other hand, case studies can be made from any given set of anecdotes, and are perfectly suited to arguing both sides

of most issues. Econometric studies add a quantitative dimension that no amount of discussion can provide. The best combination would have that scientific certainty, preserving the qualitative distinctions and insights to be drawn from good case study material. Conclusion: Case studies can be usefully informed by econometric research.

While it is unlikely to please either the qualitative, case study-oriented school of institutional economists, planners and political scientists or the quantitative, econometrically-oriented school of modelers, regional scientists, and engineers, my conclusion is that there are strengths to be garnered by working together. Working across disciplines is hard enough: working across mindsets may be asking the impossible. Yet, sticking to our own particular knitting in the company of others with different points of view and approaches will most likely lead to stronger studies that will help society understand what we are trying to do about land use change, and what tools work best in helping use to achieve our aims.

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