How Have Land-use Regulations Affected Property Values in Oregon?

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William K. Jaeger
Associate Professor
Department of Agricultural and Resource Economics
Oregon State University
and
Andrew J. Plantinga
Associate Professor
Department of Agricultural and Resource Economics
Oregon State University

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Contents

EXECUTIVE SUMMARY

This study examines the ways in which land-use regulations in general and Oregon's land-use planning system in particular may affect property values. The study is focused on Oregon, but it is framed within the broader context of research in economics. Our analysis of Oregon land value data finds no evidence of a generalized reduction in value caused by Oregon's land-use regulations, a result that is consistent with economic theory and with other research in the economics field.

Economists recognize three potential effects of land-use regulations on land values: restriction effects, amenity effects, and scarcity effects. The first effect likely will be negative for restricted properties, but in many cases amenity and/or scarcity effects have a positive and potentially offsetting effect. As a result, and despite the widespread belief that most land-use regulations have negative effects on property values, the opposite may be true in many cases.

We collected data on samples of parcels indicating the levels and trends of land values in parts of Oregon over the past 40 years—beginning before Oregon's land-use planning system was in place. By comparing land value patterns for regulated lands with those for unregulated lands, and by comparing patterns in Oregon with patterns for similar areas in Washington State (where land-use planning has only recently been enforced), we scrutinized the ways in which Oregon's land-use planning system has affected property values. The analysis was based on land value data for a sample of parcels in five counties, three in Oregon (Lane, Jackson, and Baker) and two in Washington (Lewis and Kittitas). The data are for intervals between the mid-1960s or early 1970s (before the implementation of Oregon's land-use planning system) until the early 2000s.

The results of this analysis indicate that:

- Land values (adjusted for inflation) have generally risen since the introduction of Oregon's land-use planning system in 1973, both for rural lands zoned for farm and forest use and for developable lands both inside and outside of urban growth boundaries (UGBs).

- Since 1973, when Oregon's land-use planning system was adopted, the rate of change in land values in Oregon has been about the same as for similar lands in Washington.

- The data indicate that over the past 40 years, lands with the most stringent development limits (e.g., those with exclusive farm or forest use zoning) have increased in value at about the same rate as lands without such restrictions.

- The value of lands outside the Eugene urban growth boundary in Lane County, Oregon grew slightly faster than properties inside the UGB.

- Finally, there is no evidence of slower rates of increase overall for the Oregon lands studied compared to lands in the Washington counties studied.

The data presented here do not, therefore, support the belief that Oregon's land-use system has systematically reduced the value of restricted properties. The results are consistent, however, with the design of Oregon's land-use planning system and with economic principles. Oregon's land-use planning system is not intended to limit the

amount of development that occurs, but rather it is intended to influence the *location* of development in ways that are consistent with various land-use planning goals. Among those goals is an interest in concentrating the location of development within urban growth boundaries rather than allowing dispersed and fragmented developments. Sprawl or scattered development can raise costs for public services and infrastructure and produce adverse effects when incompatible land uses (e.g., farming and residential) are mixed.

In addition, our analysis finds that government programs such as Oregon's special tax assessments for farmlands are likely to be "capitalized" into land prices, raising them by as much as 14 percent on average.

These findings are consistent with results from other economic studies. Studies from many other parts of the country, and some within Oregon, have found evidence of positive, negative, and neutral effects from land-use regulations, reflecting the fact that there are often substantial positive amenity and scarcity effects that can offset some or all of the negative restriction effects associated with land-use regulations.

How Have Land-use Regulations Affected Property Values in Oregon?

I. Introduction

Oregon's land-use planning system has been controversial since it was created in 1973 under Senate Bill 100. Critics contend that the system has had "tremendously negative economic consequences on property owners, especially those in the rural areas."[1] Oregonians in Action has asserted that "our planning system lowers the value of private property in Oregon by $5.4 billion a year."[2] Thus, Ballot Measure 37 was presented to Oregon voters as a way to "compensate suffering landowners."[3] The Measure requires state or local governments to pay compensation or waive a regulation that "restricts the use of private real property . . . and has the effect of reducing the fair market value of the property."[4] It was approved by voters in November 2004.

In light of this controversy, the Oregon Legislature in 2005 created the Oregon Task Force on Land Use Planning. It is charged with conducting a comprehensive review of the Oregon statewide planning program and recommending changes, if needed, to the 2009 Legislature.[5]

The purpose of the current study is to examine how land-use regulations in general, and Oregon's land-use planning system in particular, may affect property values. We frame the situation in Oregon within the broader context of empirical evidence reflected in the economics literature.

I.A. Potential effects of land-use regulations

Economists recognize three kinds of potential effects of land-use regulations on land values: restriction effects, amenity effects, and scarcity effects.

Restriction effects. When a regulation restricts the use of a particular piece of land so that its "highest and best use" is prevented, it can be expected to *decrease* the property's value.

If, however, the prohibited use would not be chosen because it is not the "highest and best use" of that piece of land, then the regulation will have *no effect* on the property's value. Farm and forest lands far from urban areas, for example, may not be sufficiently attractive for development uses to make their development value greater than their farm or forest value.

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[1] David Hunnicutt, President, Oregonians in Action, KLCC Radio, Eugene, OR, February 25, 2007.

[2] David Hunnicutt, Executive Director, Oregonians in Action, in *Looking Forward*, Oregonians in Action Education Center, September–October 2004 (http://oia.org/ec.html).

[3] "Talking Points on Measure 37 (Son of 7)," in *Looking Forward*, Oregonians in Action Education Center, September–October 2004 (http://oia.org/ec.html).

[4] Measure 37 (http://www.oregon.gov/LCD/MEASURE37/legal_information.shtml).

[5] Oregon Task Force on Land Use Planning (http://www.oregonbiglook.org).

Amenity effects. These effects represent many kinds of positive effects, and they often are the reason for introducing a land-use regulation. For example, regulations often are designed to support or enhance the livability of a neighborhood by excluding incompatible land uses. Regulations that protect open space and other natural amenities can have similar positive effects. Likewise, zoning that specifies the characteristics of residential properties can make neighborhoods more appealing and predictable.

The value of a particular property also reflects the quality of surrounding lands and land uses. Thus, laws that protect positive attributes of surrounding properties may raise the market value of a property. For example, laws that limit groundwater withdrawal may protect the sustainability of an aquifer. Restrictions on noisy, smelly, or other undesirable activities in residential areas may enhance property values. Exclusive farm use zoning may have positive effects on farmland values by clustering compatible land uses (farming) together and reducing potential conflicts with nonfarm residents who may object to the noise, smell, and dust often associated with farming. Amenity effects of this kind often are "reciprocal"; they create a positive feedback effect that all landowners enjoy, despite the fact that the regulation limits individual land-use decisions.

One important distinction between restriction effects and amenity effects is that restriction effects are expected to have a negative effect on the regulated property, while amenity effects can confer positive benefits on the affected property and on nearby properties.

Scarcity effects. These effects occur when land-use regulations change the supply of land that can be put to a particular use in a particular location. If a regulation allows use "A" but prohibits use "B" (for example, single-family housing), the supply of land for use "A" will increase and the supply of land for use "B" will decrease. Depending on how binding the restriction is, the price of land for use "A" may decline, and the price of land for use "B" may rise. If use "B" is prohibited on certain lands, thereby decreasing the supply of land for use "B," then the value of other lands in the same market that *can* be put to use "B" can be expected to *increase*.

Conversely, if a regulation is removed, thereby increasing the supply of lands available for use "B," then the value of other lands that already could be put to use "B" can be expected to *decrease*.

A property that receives an exemption or waiver from the regulation prohibiting use "B" would also benefit from the scarcity effect. Similarly, if a new regulation prohibits use "B" on a property where a house already exists, and this property receives a "grandfathered" exemption, it too will benefit from the scarcity effects.

Sometimes, land-use regulations of different types are introduced in nearby locations, or interconnected land markets have "spillover effects." In this case, there are likely to be both direct and indirect scarcity effects that affect supply, demand, and prices across multiple markets. These effects may be difficult to identify. They also are likely to interact with amenity effects, making it impossible to quantify the effects of specific land-use regulations on individual properties.

It is important to note that scarcity effects do not apply directly to regulated properties, but rather to other properties in the same land market.

Net effects. With three possible types of effects, economic theory cannot tell us in any given situation whether a negative restriction effect will be greater than or smaller than potentially offsetting positive amenity effects. Nor can it provide an easy way to distinguish a negative restriction effect on restricted properties from the scarcity effects that may boost unrestricted property values. It may seem that, were it not for the introduction of a land-use regulation, a restricted property would be worth as much as nearby unrestricted properties. This, of course, is true only if the regulation does not increase the price of unrestricted properties through scarcity or amenity effects.

Ultimately, one must look at specific land values to know whether, for a particular land-use regulation or set of regulations, the net effect is positive, negative, or neutral.

I.B. Methodology

We examined land values in parts of Oregon over the past 40 years—beginning before Oregon's land-use planning system was in place. By comparing land value patterns for lands with and without development restrictions, and by comparing patterns in Oregon with those in similar areas in Washington State, we can see ways that Oregon's land-use planning system has affected property values. The data included samples of parcels in five counties (Lane, Jackson, and Baker in Oregon and Lewis and Kittitas in Washington). The data cover the period beginning in mid-1960s or the early 1970s (before the implementation of Oregon's land-use planning system) and continuing to the early 2000s. They provide a way to address the following questions:

- Did lands subject to Oregon's land-use regulations decline in value?
- Did the growth in value for lands with development restrictions differ significantly from that of lands without such restrictions?
- Did the growth in land values in Oregon counties differ from that in similar Washington counties (where similar land-use regulations did not exist during the period of observation)?

I.C. Summary of findings

Our analysis indicates that land values have generally risen since the introduction of Oregon's land-use planning system in 1973, both for rural lands zoned for farm and forest use, and for developable lands (both inside and outside of urban growth boundaries). Since 1973, the rate of change in land values in Oregon has been similar to that for similar counties in Washington.

The data indicate that, over the past 40 years, lands with the most stringent restrictions on development (e.g., lands zoned for exclusive farm and forest use) have increased in value at rates similar to lands without these restrictions. Indeed, the value of lands outside the urban growth boundary (UGB) in Lane County, Oregon grew slightly faster than that of properties inside the UGB. In Washington's Lewis and Kittitas counties, the reverse was true: the value of lands inside the nonbinding urban growth area (UGA) grew at a slightly higher rate than that of lands outside the UGA. There is no evidence of slower rates of increase for Oregon lands compared to Washington lands in our samples.

We found no evidence that Oregon's land-use planning system has caused generalized reductions in land value across rural Oregon, at least not enough to be evident in comparisons of average price levels and trends for a sample of properties. Losses in land value on the order of $5.4 billion a year (more than $5,000 per acre over a 25-year period) should be easily detectable in these data.[6] Moreover, Washington's rural land prices average less than $3,000 per acre. Using this value as a benchmark, reductions in Oregon land values of $5,000 per acre would imply negative land prices. Our data, however, indicate that Oregon land values have grown at least as fast as Washington's when comparing similar types of land and local economies.

From an economic perspective, these findings are consistent with the design of Oregon's land-use planning system. For example, the system is not intended to limit the amount of development that occurs, but rather to influence the location of development in ways that promote other land-use planning objectives. Oregon's land-use planning system requires urban growth boundaries to include a 20-year supply of vacant land at all times. Boundaries are expanded as needed to meet this requirement. To the extent that this process of UGB expansion is anticipated in land markets, we would not expect to see a generalized pattern of higher or lower land values among properties subject to these regulations.

In addition to these findings, our analysis indicates that some government programs may also be "capitalized" into land prices, which will have a positive effect on land values. Evidence suggests some effects of this kind due to U.S. farm support programs. In the case of tax reductions for specially assessed farm and forest lands in Oregon, we estimate that this program may have raised land values by as much as 14 percent on average.

I.D. Review of economic studies

Section III of this report summarizes empirical studies of the effects regulations and other government actions and programs have on private property values. These studies examined (1) effects of land-use regulations on the value of properties on which they are applied, (2) effects of amenities generated by land-use regulations on neighboring properties, and (3) effects of tax abatement programs on property values. We focused on peer-reviewed studies published in economics journals.

The results of our review support the hypothesis that land-use regulations can have net positive, neutral, or negative effects on property values. These findings are consistent

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[6] In Oregon, 25 million acres of land are zoned for agriculture or forestry use. The $5.4 billion annual figure suggested by Oregonians in Action implies that, on average, these 25 million acres are reduced in value by $220 per acre per year. Over 25 years, the cumulative reductions would total $135 billion or $5,500 per acre. Oregonians in Action seem to have taken this figure from language in an earlier property rights initiative, Oregon's Measure 7, which was approved by voters in November 2000 and subsequently struck down by the Oregon Supreme Court. That ballot title included an "Estimate of Financial Impact," stating: "Direct costs to the state are estimated to be $1.6 billion per year. Local government direct costs are estimated to be $3.8 billion per year." These estimates are likely based on the "single exemption" method rather than on valid estimates of reductions in value (see below, and Jaeger 2006, 2007).

with competing effects of regulations. A zoning regulation that limits development, for example, may lower the value of property on which it is applied. If the same restriction is also applied to neighboring properties, however, it may raise the first property's value due to one or more positive feedback effects (e.g., enhanced neighborhood amenities). Hence, these reciprocal effects may make the net effect positive.

Our literature review documents strong evidence that amenities such as open space can have positive effects on neighboring property values. Finally, evidence is found in this literature that farm subsidies and tax reductions from use-value assessment programs positively impact property values.

This economics literature is consistent with the overall findings of our data analysis presented in Section II, an analysis of land value data in Oregon and Washington.

II. Analysis of Land Value Data in Oregon and Washington

To look for evidence of effects of land-use regulations on property values in Oregon, we collected and analyzed a large variety of data. We compared price levels and trends for Oregon lands under different kinds of regulations. We examined market values for undeveloped properties both before and after statewide land-use regulations were implemented. We also compared these lands to similar lands and regions in Washington State where no similar land-use planning rules exist.

The Oregon sites include Lane, Jackson, and Baker counties. Lane and Jackson counties contain relatively large metropolitan areas (respectively, Eugene-Springfield, with a 2003 population of 197,000, and Medford-Ashland, with a 2005 population of 83,000). Both are located on the west side of the Cascade Mountains. In Washington, we analyzed data from Lewis County, also west of the Cascades, which includes the adjacent cities of Chehalis and Centralia.

East of the Cascades, we examined Baker County, Oregon, which includes Baker City (population 9,860). In eastern Washington we examined Kittitas County, which is similar in terms of climate and agriculture to Baker County.[7] Its largest city is Ellensburg, with a population of 16,914 in 2005. Recently, Ellensburg has experienced greater population growth than the cities in Baker County. Ellensburg's population grew 9.7 percent between 2000 and 2005, compared to a 1.6 percent population decline in Baker City.

The counties in Oregon were chosen to represent both the western and eastern portions of the state. Washington counties were chosen to be as similar as possible to the selected Oregon counties. In three of the five counties, personal income grew between 7 and 8 percent since 1972. One Oregon county's income growth was somewhat higher (Jackson), and one was somewhat lower (Baker). Some key county characteristics are summarized in Table 1 (page 7).

In Oregon, the legislation authorizing statewide land-use planning was passed in 1973 and implemented over the ensuing decade. In Washington, land-use regulations were adopted in 1990, following passage of the Growth Management Act. Regulations in Washington are more decentralized and much less stringent than in Oregon and, in some cases, have been enforced only in the past few years. Thus, our data span the periods before and after major land-use regulations were implemented in Oregon and include areas (in Washington) where weak constraints have begun to be enforced only recently.

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[7] The land base in both counties is dominated by agricultural uses, especially livestock and forage, as well as crops such as wheat, sweet corn and vegetables (Kittitas), and potatoes (Baker). The proportions of land in pasture, crops, and woodlands are similar. Baker County has a large number of very large grazing operations (more than 1,000 acres each). Net cash income per farm is similar in Kittitas and Baker counties. Kittitas County has a higher population density and a somewhat smaller share of its land in agriculture overall.

Table 1. Study sites and key characteristics

Region	County	Personal income growth rate 1972–2004 (%)	Population increase 1970–2005 (%)	City	Population
Western Oregon					
	Lane	7.6	57	Eugene-Springfield	190,757
	Jackson	9.0	107	Medford	63,154
				Central Point	12,493
Western Washington					
	Lewis	7.4	59	Centralia	15,340
				Chehalis	6,690
Eastern Oregon					
	Baker	5.8	9	Baker City	9,860
Eastern Washington					
	Kittitas	7.9	47	Ellensberg	16,700

For each site, we computed average per-acre market values at different points in time. For Lane, Jackson, and Kittitas counties, our data covered the period from 1965 to the early 2000s. For Baker County, the data begin in 1972, and for Lewis County in 1973.

At each point in time, average market values were computed for subsets of parcels. These subsets were defined according to current land-use regulations. In Lane, Lewis, and Kittitas counties, we calculated average market values for parcels inside and outside urban growth boundaries (UGB) or urban growth areas (UGA), as they are called in Washington. For Lane, Jackson, and Kittitas counties, we also computed average market values for parcels with different types of zoning (e.g., exclusive farm use, rural residential). The sample for Baker County includes only agricultural parcels, and we compared these parcels to similar parcels in Kittitas County. In the case of Lewis County, our final data point is for 2002, which, according to county officials, predated the recent move to begin enforcing the county's land-use regulations.

For each subset of parcels, we reported average land values and growth in land values over the entire time period. The growth in land values for each sample or subsample is reported relative to the average value in the initial year (e.g., an index of 200 percent means that the average property value has doubled since the base year).

These indexes of relative growth in land values were then compared across regulations (e.g., zoning classifications) and sites. Thus, we examined whether the regulations imposed subsequently had differential effects on property values. Or, put another way, if an individual purchased a parcel of land prior to 1972, was the change in its value since 1972 affected by the types of regulations implemented after 1972?

This analysis addresses a fundamental issue underlying Measure 37. Were property owners who purchased land prior to the adoption of current land-use restrictions adversely affected by the restrictions? In particular, did the value of their land depreciate, or appreciate at a slower rate, than that of other landowners who were not similarly restricted?

We also compared agricultural land values in Kittitas County and Baker County. The land-use regulations in Washington's Kittitas County were introduced at a later date, and they are much less restrictive in terms of residential housing construction than are those in Baker County. This comparison provides an opportunity to observe whether statewide land-use planning in Oregon has had an effect on property values overall compared to similar properties under different land-use policies.

Details of the data and data collection procedures for each county are described in Appendix A. Maps 1–5 (Appendix B) indicate the locations of our sample parcels for all five counties.

II.A. Results from data analysis

We examined the levels and trends in per-acre real (inflation-adjusted) land values for each county and each category of land. In addition, we computed price increases relative to the base year as a percentage of the base year's price. We then compared the growth in land values across types of regulations and across counties. By focusing on changes in land values, we could investigate whether increases in land value varied based on land-use regulations.[8] We also compared agricultural property values across sites. If land-use regulations produce large negative effects, land value trends should differ between Oregon and Washington.

Lane County, Oregon. After removing parcels for which only specially assessed values were available, 508 observations remained. Table 2 (page 9) shows the average real per-acre property value by year and by different selection criteria. The average property value (row 1) increased substantially during the 1965–1972 and 1972–1980 periods. Property values fell, on average, between 1980 and 1987, most likely as the result of the national recession that began in the early 1980s. The impacts of this economic downturn were especially strong and persistent in the Pacific Northwest. After 1987, average property values recovered, increasing during both the 1987–1995 and 1995–2002 periods.

Table 2 also reports average real property values for parcels inside and outside the current UGB and with alternative zoning restrictions. (Of course, these land-use regulations did not apply during the 1965 and 1972 periods.) These values follow the same basic pattern, rising in each period up to 1980, falling between 1980 and 1987, and rising in periods after 1987. These values are plotted in Figure 1 (page 9) and Figure 3 (page 13).

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[8] An economist would ask whether investors have acted to exploit differences in the rates of return on land investments, and whether this would eliminate any differences in risk-adjusted rates of return on land investments. Based on expectations about the future, this would be true on average if the investment market is efficient. Our analysis, however, considers whether investors were adversely affected—after the fact—by regulations adopted after the investment was made.

Table 2. Average real per-acre land values, Lane County, Oregon (in 2005 dollars)

Selection criteria	1965	1972	1980	1987	1995	2002
All parcels	550	2,767	6,202	4,889	8,340	10,975
(No. observations)	(95)	(95)	(73)	(55)	(95)	(95)
Inside UGB	1,360	10,022	26,358	24,649	26,517	32,724
(No. observations)	(12)	(12)	(8)	(12)	(12)	(12)
Outside UGB	433	1,718	3,721	2,007	5,712	7,830
(No. observations)	(83)	(83)	(65)	(48)	(83)	(83)
R-1 zoning (low-density,	1,266	7,909	25,515	19,240	19,875	27,224
residential (No. observations)	(8)	(8)	(4)	(4)	(8)	(8)
RR zoning (rural residential)	389	2,812	8,711	4,448	8,753	11,118
(No. observations)	(13)	(13)	(13)	(7)	(13)	(13)
E zoning (exclusive farm use)	504	1,511	1,948	1,250	5,038	7,311
(No. observations)	(55)	(55)	(55)	(29)	(55)	(55)
F zoning (exclusive forest use)	210	1,532	4,051	2,414	5,551	6,884
(No. observations)	(15)	(15)	(13)	(12)	(15)	(15)

Figure 1. Property values for representative parcels in Lane County (2005 dollars)
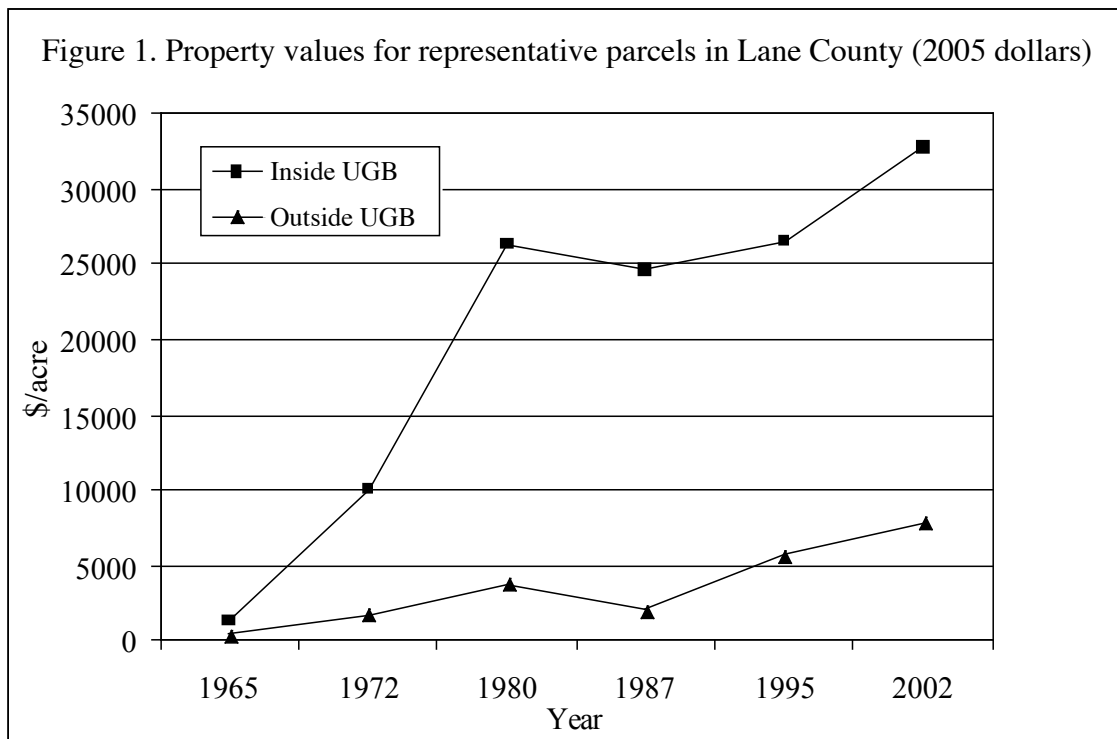
Starting with average values for parcels inside and outside the UGB in 1965 ($1,360 and $433 per acre, respectively), we tracked the growth in the parcels' value (Figure 1, page 9). These data show a large difference between real per-acre property values inside and outside the UGB. By 2002, this difference was $24,894 per acre. Thus, Figure 1 seems to imply that the UGB, by limiting development opportunities, has greatly reduced the value of parcels outside the boundary.

However, this conclusion is not necessarily warranted. While the current average value of land inside the UGB is higher than that outside, the same was true in 1965. The differences in values in 1965 cannot be due to the UGB, as it had not been designated at that time. They likely were due to locational advantages, particularly proximity to the city center. The average distance to the Eugene city center for our sample of parcels outside the UGB is more than twice that for those inside the UGB.

A comparison of values for properties inside and outside the UGB must control for these initial differences. One option is to look at the increase in the value of both sets of parcels relative to their own initial values (1965 or 1972). We can see whether the growth in land value differed for parcels inside and outside the UGB. Likewise, one can imagine an individual choosing between two parcels of land of equal value in 1965. One parcel would eventually be inside the current UGB and the other would be outside. In retrospect, how would these investments have fared? If the parcel inside the UGB appreciated by a greater percent relative to its initial value, this may be evidence that the UGB depressed property values for parcels outside the boundary, raised property values for parcels inside the boundary, or both.[9]

Figure 2 (page 11) graphs indexes of property values for parcels inside and outside the UGB. The line labeled "Inside UGB" shows the appreciation of parcels inside the UGB (Table 3, page 12); the line labeled "Outside UGB" reflects the appreciation of parcels outside the UGB (Table 3). The "Inside UGB" line ends slightly higher when the base value is for 1965. However, when the base is set using 1972 values, or an average of 1965 and 1972 values, the "Outside UGB" line ends higher. Thus, although lands inside the UGB had significantly higher values in all years than those outside the UGB, the relative values of the two sets of parcels stayed about the same.

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[9] To determine whether a property value is lower as the result of the UGB, we must compare its current value (with the UGB) to its value had the UGB never been designated. The latter is, of course, unobservable. The higher value development may not have been an option in either case, indicating that the UGB had no effect on property value.

Figure 2. Property values for representative parcels in Lane County
(index based on average 1965–1972 value)
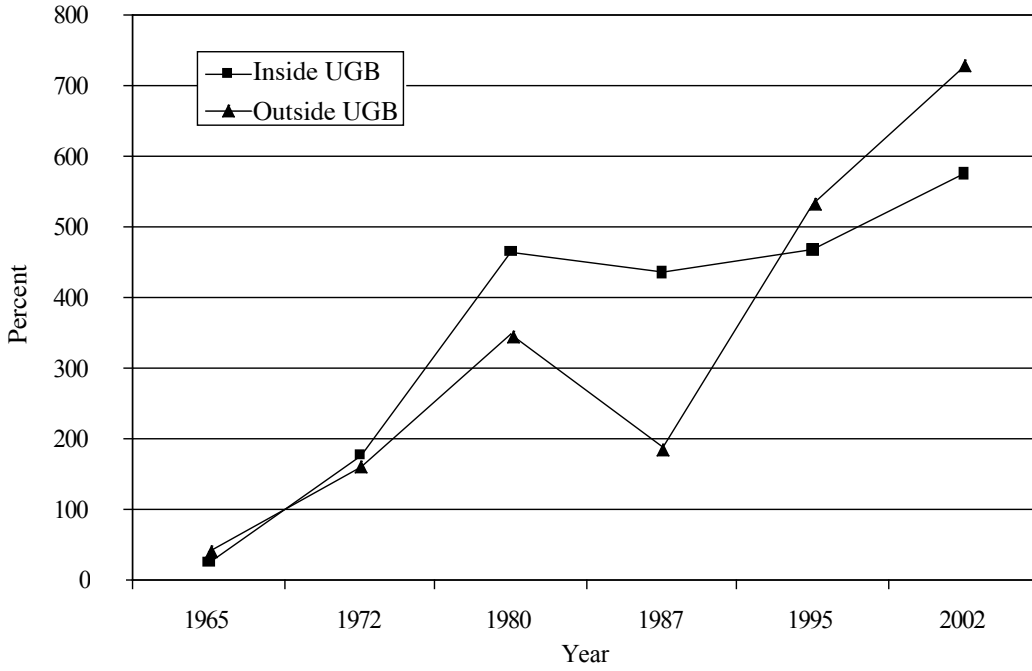
Table 3. Growth in real per-acre land values, Lane County, Oregon

Year	1965	1972	1980	1987	1995	2002
Value relative to 1965 (1965 value = 100)						
All parcels	100	503	1,127	889	1,516	1,995
Inside UGB	100	737	1,938	1,813	1,950	2,406
Outside UGB	100	397	859	463	1,319	1,808
R-1 zoning (low-density, residential)	100	625	2,016	1,520	1,570	2,151
RR zoning (rural residential)	100	724	2,242	1,145	2,252	2,861
E zoning (exclusive farm use)	100	299	386	248	999	1,449
F zoning (exclusive forest use)	100	729	1,928	1,149	2,642	3,276
Value relative to 1972 (1972 value = 100)						
All parcels		100	224	177	301	397
Inside UGB		100	263	246	265	327
Outside UGB		100	217	117	332	456
R-1 zoning (low-density, residential)		100	323	243	251	344
RR zoning (rural residential)		100	310	158	311	395
E zoning (exclusive farm use)		100	129	83	333	484
F zoning (exclusive forest use)		100	264	158	362	450
Value relative to 1965–1972 (1965–1972 average = 100)						
All parcels	33	167	374	295	503	662
Inside UGB	24	176	463	433	466	575
Outside UGB	40	160	346	187	531	728
R-1 zoning (low-density, residential)	28	172	556	419	433	593
RR zoning (rural residential)	24	176	544	278	547	695
E zoning (exclusive farm use)	50	150	193	124	500	726
F zoning (exclusive forest use)	24	176	465	277	637	791

Location relative to the UGB is a relatively coarse filter. High-density residential development is not necessarily permitted on all parcels within the UGB. Thus, we also evaluated the effects of different zoning classes. For the parcels in our sample, the highest density residential zoning category (a maximum of 14 single-family housing units per acre) was low-density residential zoning (R-1). Residential housing development is allowed on parcels zoned rural residential (RR), but at lower densities (in our sample, either 5- or 10-acre minimum lot size). Finally, exclusive farm use (E) and forest lands (F) zoning are very restrictive in terms of housing development. For example, dwellings may be constructed on EFU land only if they are directly related to the agricultural enterprise.

Figure 3 (page 13) graphs the average property values by zoning class and period (Table 2, page 9). Land with R-1 zoning has the highest average value in 2002, in large part because of its proximity to the city center. This is followed by land with RR zoning, E zoning, and F zoning.

Figure 3. Property values for representative parcels in Lane County by zoning classification
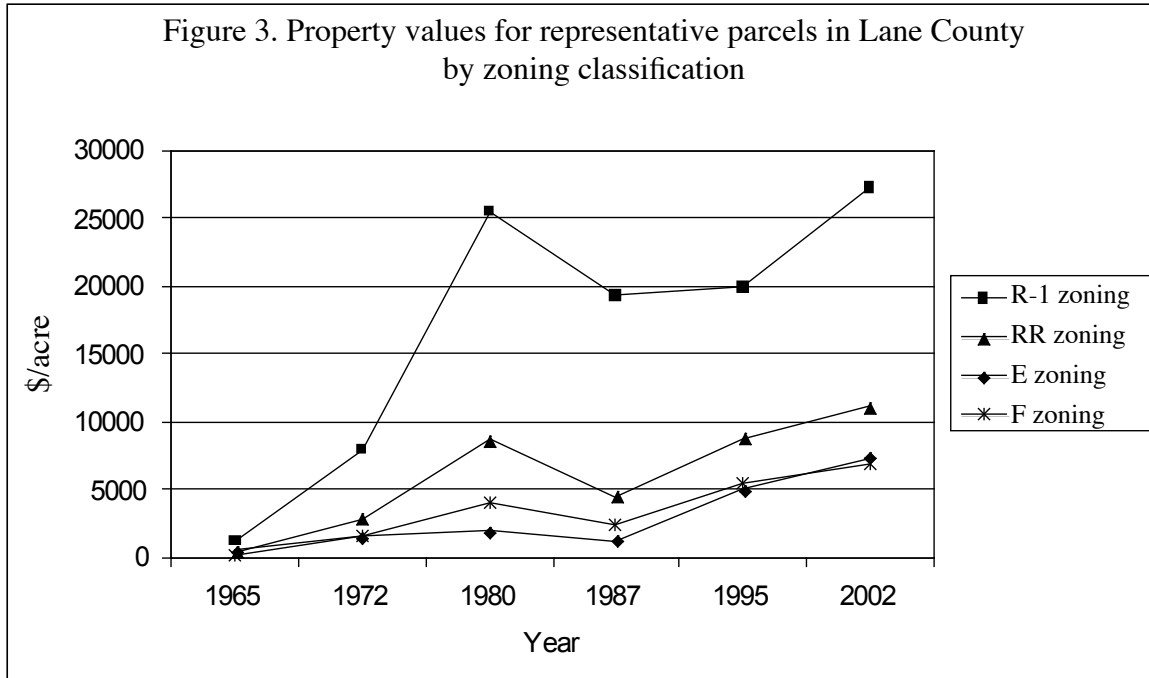
Figure 3 does not necessarily show that zoning restrictions have reduced property values. Land that eventually was zoned R-1 already had the highest average per-acre value in 1965 (Table 2): $1,266 per acre, compared to $389 per acre (RR), $504 per acre (E), and $210 per acre (F). Like parcels located inside the UGB, R-1 land tended to have locational advantages such as proximity to the Eugene city center.

We compared the growth in land values for each zoning designation relative to values prior to implementation of land-use regulations. For each subsample, we took the 1965–1972 average value as the base and computed the increase in value in each period relative to that base. Figure 4 (page 14) shows that the highest rates of appreciation were realized on land with F zoning. By 2002, the value of this land had grown about 200 percent more than land with the least restrictive zoning (R-1). A high growth rate was also seen on land with RR zoning. The lowest growth rate was on the developable lands (R-1 zoning).

Figure 4. Property values for representative parcels in Lane County (index based on 1965–1972 values)
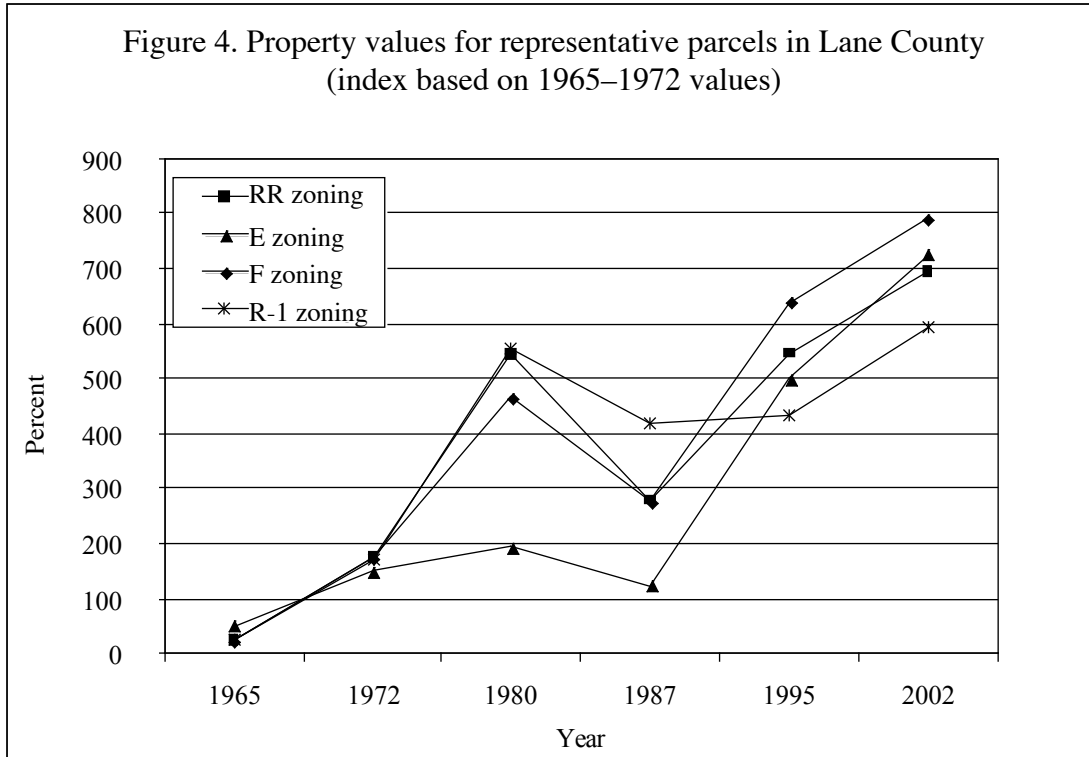
Jackson County, Oregon. After removing parcels zoned for commercial and industrial uses, 164 observations remain for the Jackson County analysis. Average per-acre property values for 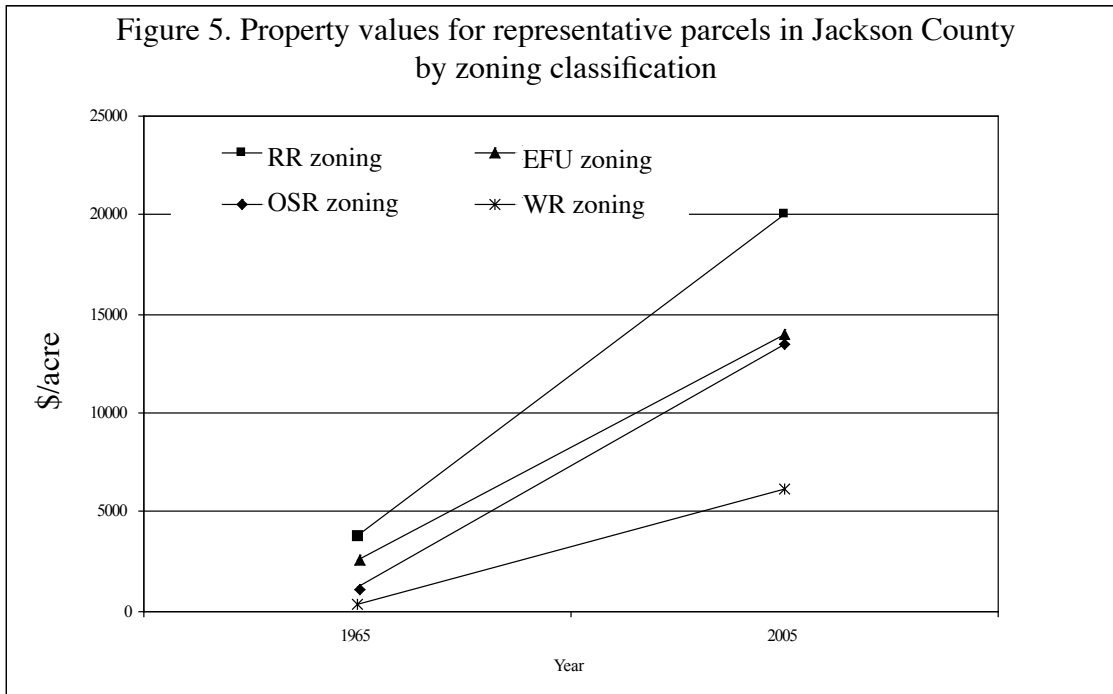1965 and 2005, and the annual growth rate over this period, are reported in Table 4 (page 15). For the entire sample, the average property value increased from $2,227 per acre in 1965 to $13,219 in 2005, an average annual growth rate of 4.55 percent. This increase is considerably lower than that in Lane County over the 1965–2002 period.

We were unable to analyze the effects of the Medford UGB because only one of the parcels in our sample is located within it. However, we did examine effects of different zoning classes. Parcels in our sample are zoned in one of four ways: exclusive farm use (EFU), open space reserve (OSR), woodland resource (WR), and rural residential (RR). Residential housing development is highly restricted on parcels with EFU, OSR, and WR zoning, especially in the case of OSR and WR zoning. Residential housing development is allowed on parcels with RR zoning with minimum lot size requirements. For the parcels in our sample, the requirement is either a 2.5- or 5-acre minimum.

Average property values by zoning class and year are shown in Table 4 and graphed in Figure 5 (page 15). As expected, parcels with the least restriction on residential housing construction have the highest average values in 2005. However, the growth in average land values over the 1965–2005 period was greatest for parcels with OSR and WR zoning (Table 4). The average value of parcels with OSR and WR zoning relative to their 1965 value was 1,160 percent and 1,602 percent, respectively. For RR and EFU parcels, the 2005 value was about 530 percent of the 1965 value. Thus, properties with OSR and WR zoning appreciated more by 2005 than properties with RR and EFU zoning (Figure 6, page 16). A similar result was found in Lane County.

Table 4. Average real per-acre land values, Jackson County, Oregon (2005 dollars)

| | Year | | 2005 value relative to 1965 (1965 = 100) | Annual growth rate (%) |
	1965 ($)	2005 ($)		
All parcels	2,227	13,219	594	4.55
(No. observations)	(82)	(82)		
EFU zoning (Exclusive farm use)	2,625	13,992	533	4.27
(No. observations)	(54)	(54)		
OSR zoning (Open space reserves)	1,163	13,489	1,160	6.32
(No. observations)	(8)	(8)		
WR zoning (Woodland reserve)	385	6,170	1,602	7.18
(No. observations)	(13)	(13)		
RR zoning (Rural residential)	3,796	20,036	528	4.25
(No. observations)	(7)	(7)		

Figure 5. Property values for representative parcels in Jackson County by zoning classification

Figure 6. Property values for representative parcels in Jackson County (index based on 1965 value)

(Chart: X-axis "Year" with points at 1965 and 2005; Y-axis "Percent" ranging 0 to 1600; legend: RR zoning (■), EFU zoning (▲), OSR zoning (◆), WR zoning (✳). Label "per a... (2005 dollars)" near 600 level. Lines rise from ~100 at 1965 to: WR ~1600, OSR ~1170, and RR/EFU ~540 at 2005.)
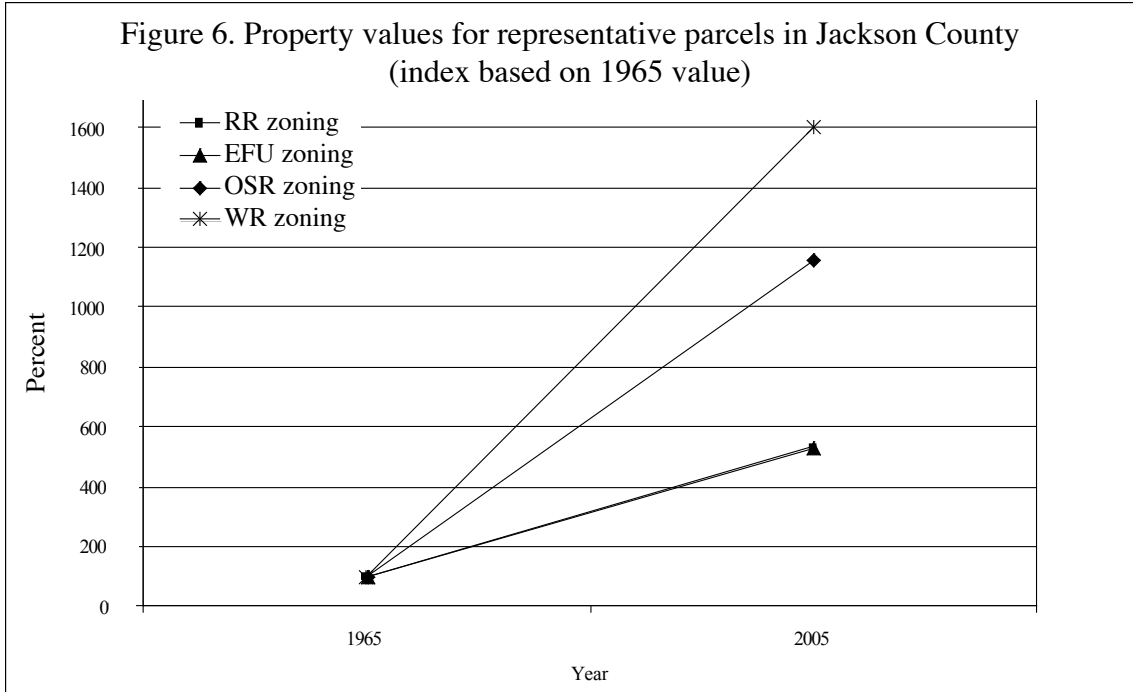
Lewis County, Washington. The western Washington county that is most similar to Lane and Jackson counties is Lewis County. In Lewis County we have 595 observations for 119 parcels at 5 intervals between 1973 and 2002. Average property per-acre values for selected years are reported in Table 5 and graphed in Figure 7 (page 17).

Land values rose during each period between 1973 and 2002, increasing to 349 percent of their initial values. Growth was very slow during 1987–1997, the same period during which Lane County property values fell 3 percent annually.

Table 5 also reports average values for parcels inside and outside the Urban Growth Area (UGA). Washington's UGAs are similar in concept to Oregon's UGBs, with two important differences. First, UGAs were not introduced until the early 1990s, compared to the mid-1970s for Oregon's UGBs. Second, Lewis County began enforcing these restrictions after our most recent sample year (2002). As a result, we can consider this to be a site without binding land-use regulations for our purposes. Thus, the distinction between inside and outside the UGA provides only an indication of the distance to the nearest city (e.g., Centralia or Chehalis).

The growth in land values both inside and outside the UGA is shown for Lewis County in Table 5. The data indicate similar rates of growth in both zones, with the increase since 1973 being 349 percent overall. Parcels closer to town (inside the UGA) appreciated somewhat more than those outside the UGA (389 percent versus 293 percent).

Table 5. Average real per-acre land values, Lewis County, Washington (2005 dollars)

Selection criteria	1973	1980	1987	1997	2002
			Year		
All parcels	2,337	4,516	7,158	7,266	8,152
(No. observations)	(119)	(119)	(119)	(119)	(119)
Inside UGA	2,604	5,051	8,125	9,080	10,129
(No. observations)	(46)	(46)	(46)	(46)	(46)
Outside UGA	1,962	3,669	5,542	5,332	5,752
(No. observations)	(73)	(73)	(73)	(73)	(73)
Value relative to 1973 (1973 value = 100)					
All parcels	100	193	306	311	349
Inside UGA	100	194	312	349	389
Outside UGA	100	187	282	272	293

Figure 7. Property values for representative parcels in Lewis County, Washington
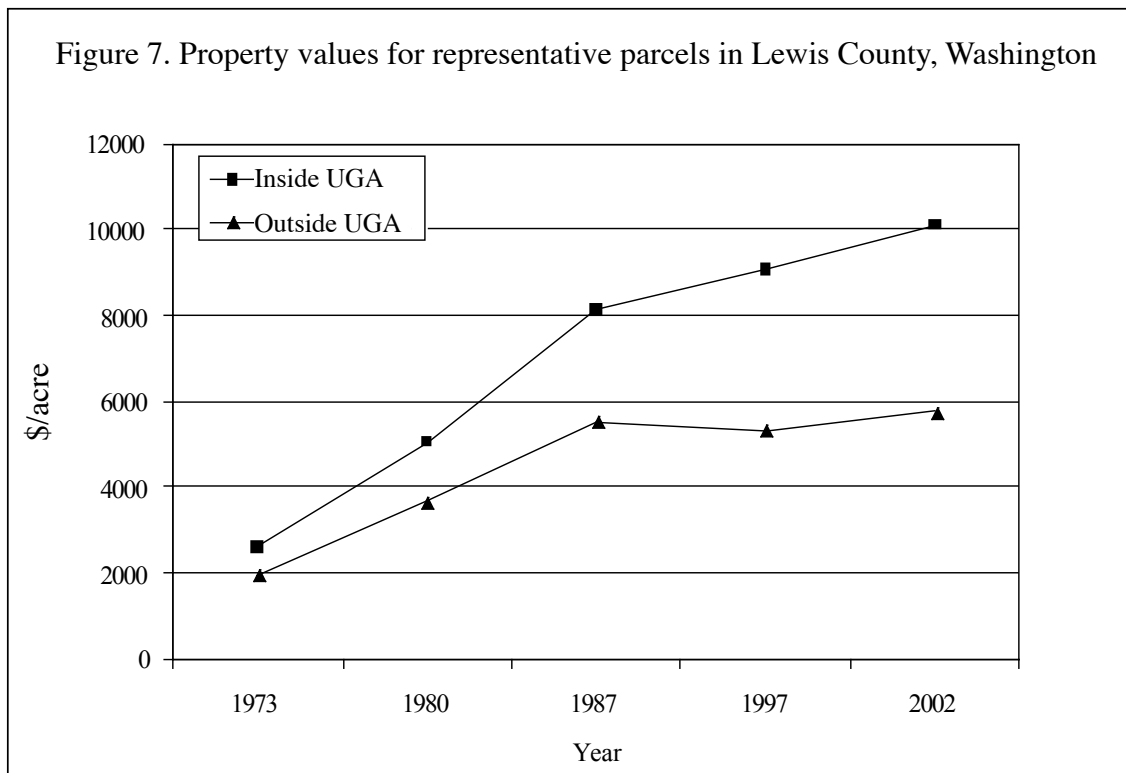
Kittitas County, Washington. As a second comparator county in Washington, we chose Kittitas County because it is similar agriculturally to Baker County and has a city that has experienced growth similar to Eugene-Springfield. In Kittitas County we had 462 observations after eliminating one parcel zoned for industrial uses. Average per-acre property values are reported in Table 6 (page 19). The values follow a pattern similar to that in Lane County. Property values rose during the 1965–1972 and 1972–1980 periods, fell during the 1980–1987 period, and rose again during the 1987–1995 and 1995–2002 periods. In contrast to Lane County, property values recovered more slowly in Kittitas County. The average property value in 2002 was only 4 percent higher than the 1980 value, compared to a 77 percent difference in Lane County. Table 6 also reports average values for parcels inside and outside the Ellensburg Urban Growth Area (UGA) and for parcels with zoning that permits high- and low-density development. The same pattern of rising, falling, and rising property values is seen in each case.

The Ellensburg UGA was established in 1997 and expanded in 2005. According to the city's 2006 Comprehensive Plan, the UGA does not seem to constrain the total amount of development.[10] Table 6 and Figure 8 (page 20) show that the average value of parcels inside and outside the UGA is similar, although they diverge by about 35 percent in 2002. Because the average parcel values inside and outside the UGA are equal in 1965 ($1,045 per acre), the returns to holding either type of parcel are those portrayed in Figure 8.

The zoning regulations applied in Kittitas County are much less restrictive than those in Oregon with respect to residential housing development. Among the parcels in our sample, 39 have A-20 agricultural zoning, which imposes a minimum lot size of 20 acres for each residential dwelling. (One smaller lot may be split off the parent lot provided certain criteria are met.) Twenty-three parcels are zoned for commercial agriculture, and one is zoned forest and range. Both types of zoning impose the same restrictions on residential development as A-20 zoning. Five parcels have A-3 agricultural zoning, which requires a minimum lot size of 3 acres. The remaining 9 parcels are zoned for residential and suburban use, which allows higher densities. We combined the three types of parcels with 20-acre minimum lot size requirements to form a low-density category. The parcels with A-3, residential, and suburban zoning were combined to form a high-density category.[11]

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[10] For example, the Comprehensive Plan states that, "Much of the land within the UGA but outside the city limits is now either undeveloped or sparsely developed, reflecting the community's interest in converting it from low-intensity use to urban use over time."

[11] Alternatively, we could have included parcels with A-3 zoning in the low-density category. This alternative definition of categories did not seem to affect the results.

Table 6. Average real per-acre land values, Kittitas County, Washington (2005 dollars)

	Year					
	1965	**1972**	**1980**	**1987**	**1995**	**2002**
All parcels	1,045	1,731	3,085	2,249	2,463	3,219
(No. observations)	(77)	(77)	(77)	(77)	(77)	(77)
Inside UGA	1,045	1,826	2,709	2,005	2,513	4,306
(No. observations)	(11)	(11)	(11)	(11)	(11)	(11)
Outside UGA	1,045	1,715	3,147	2,289	2,454	3,038
(No. observations)	(66)	(66)	(66)	(66)	(66)	(66)
Low-density zoning	930	1,554	2,811	2,007	2,136	2,785
(No. observations)	(63)	(63)	(63)	(63)	(63)	(63)
High-density zoning	1,562	2,524	4,318	3,337	3,934	5,170
(No. observations)	(14)	(14)	(14)	(14)	(14)	(14)
Commercial agriculture	1,302	1,877	3,629	2,466	2,497	3,177
(No. observations)	(23)	(23)	(23)	(23)	(23)	(23)
Value relative to 1965 (1965 value = 100)						
All parcels	100	166	295	215	236	308
Inside UGA	100	175	259	192	241	412
Outside UGA	100	164	301	219	235	291
Low-density zoning	100	167	302	216	230	300
High-density zoning	100	162	277	214	252	331
Commercial agriculture	100	144	279	189	192	244
Value relative to 1972 (1972 value = 100)						
All parcels		100	178	130	142	186
Inside UGA		100	148	110	138	236
Outside UGA		100	184	134	143	177
Low-density zoning		100	181	129	137	179
High-density zoning		100	171	132	156	205
Commercial agriculture		100	193	131	133	169
Value relative to 1965–1972 (1965–1972 average = 100)						
All parcels	75	125	222	162	177	232
Inside UGA	73	127	189	140	175	300
Outside UGA	76	124	228	166	178	220
Low-density zoning	75	125	226	162	172	224
High-density zoning	76	124	211	163	193	253
Commercial agriculture	82	118	228	155	157	200

Figure 8. Property values for representative parcels in Kittitas County, Washington by location inside and outside the UGA
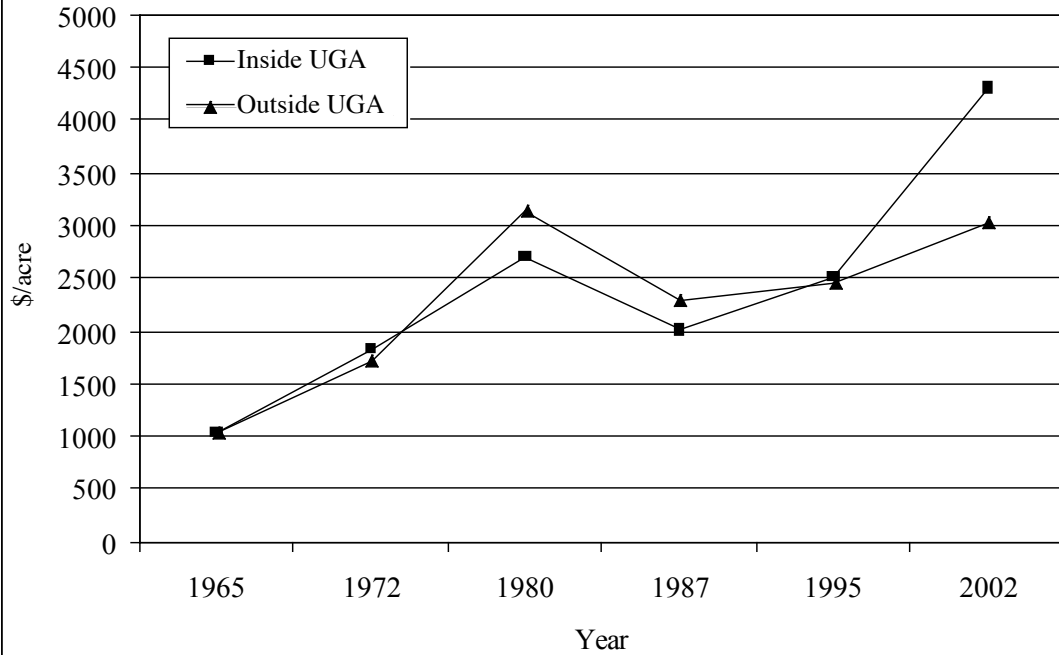

Figure 9. Property values for representative parcels in Kittitas County, Washington by low-density and high-density residential zoning
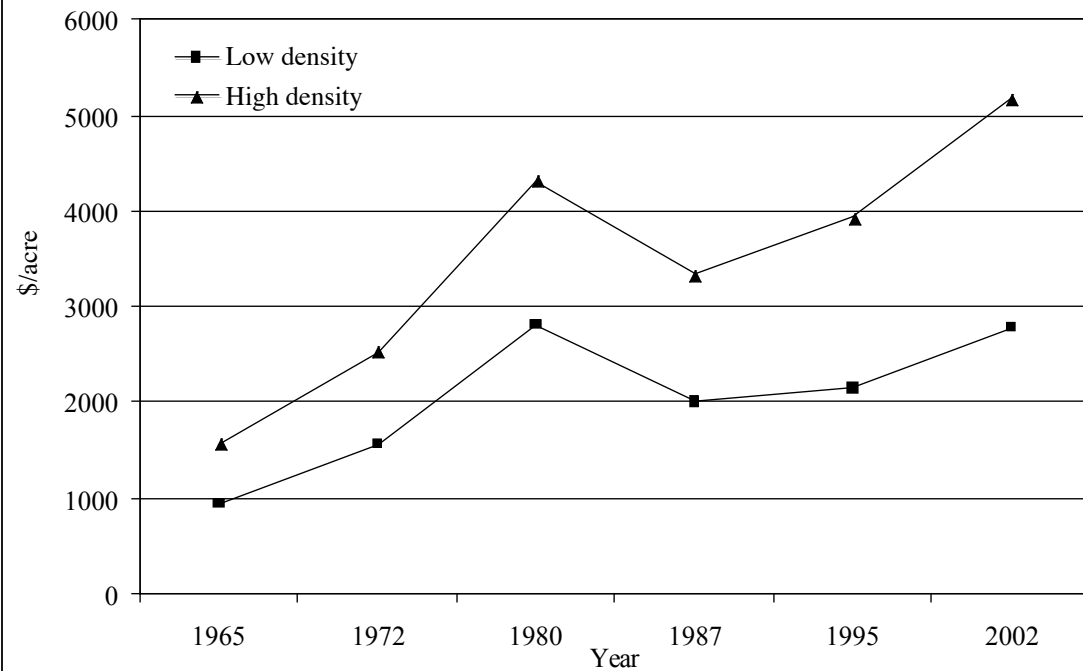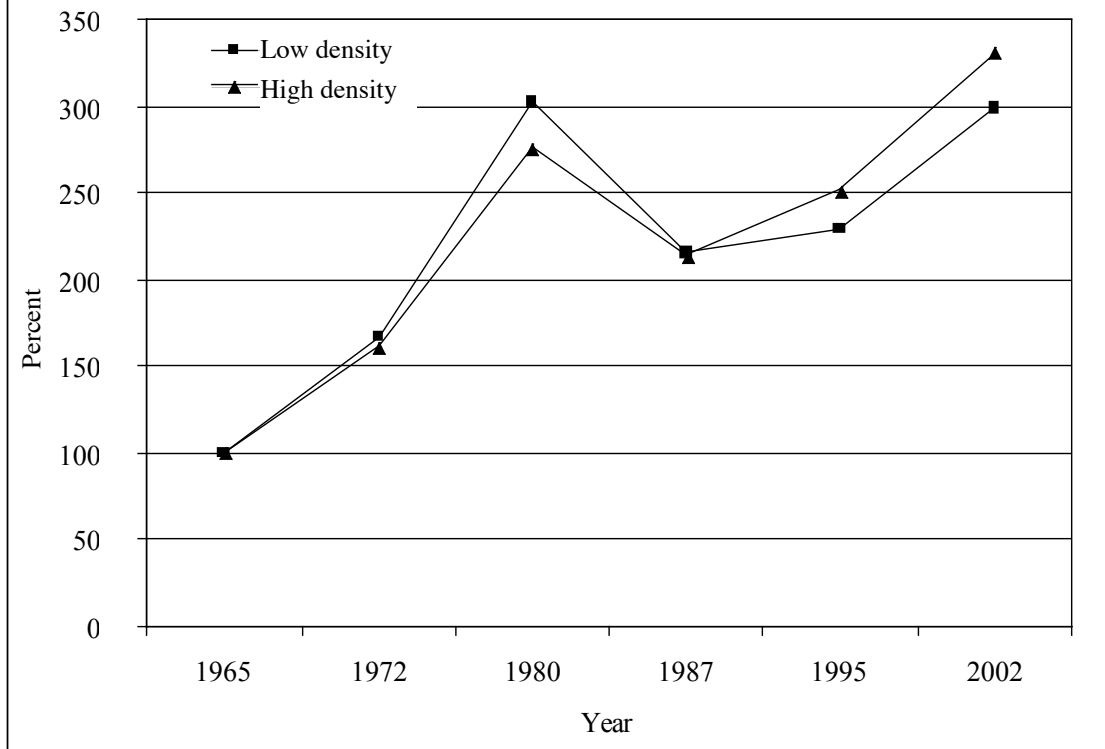
Figure 10. Property values for representative parcels in Kittitas County, Washington (index based on 1965 value)

The growth in value for parcels with low- and high-density zoning is indicated in Table 6 (page 19). For a given period, there is little difference in growth rates. However, Table 6 and Figure 9 (page 20) show a considerable difference in initial property values. The average value for parcels that eventually had low-density zoning was $930 per acre in 1965, compared to $1,562 per acre for parcels that came to have high-density zoning. As in Lane and Jackson counties, this difference likely is the result of locational advantages of the latter parcels. Over time, the gap between the values of low-density and high-density parcels widened slightly (Figure 9). As in the other counties, this difference should not be interpreted as evidence that zoning adversely impacts land values. The growth in value for all subsamples (relative to their initial value) is nearly identical (Figure 10).

**Comparison of Lane and Jackson counties with Lewis and Kittitas counties**.
Overall, the growth in land values for the Washington samples is lower than that for the
Oregon samples (Tables 3–6). Indeed, for lands affected by land-use restrictions (outside
the UGB, EFU zoning), property values appreciated faster in these Oregon counties
than in the Washington county between 1972–1973 and 2002. For all parcels, the Lane
and Jackson county samples rose to 397 percent and 416 percent of their 1972 values,
respectively.[12] The increase in Lewis County was somewhat lower (349 percent of its
1973 value). When we consider lands outside the UGB/UGA, especially those lands
restricted under Oregon's farm zoning, we find that the lands in the Lane and Jackson
county subsamples rose more (456 and 533 percent) than those in the unrestricted areas
of Lewis County (293 percent).

The most striking similarity between these Oregon and Washington counties is that
land values inside and outside the urban growth boundaries/areas have risen at about the
same rate over the past 40 years. In Figures 10 (page 21), 11, and 12 (page 23), we see
similar patterns in Kittitas, Lane, and Lewis counties, the three locations with data for
lands inside and outside the urban areas. In the two Washington counties, lands inside the
UGA have appreciated slightly more in recent years than land outside the UGAs. In Lane
County, however, the average value of lands outside the UGB has grown slightly more.

Figure 11. Values for representative parcels in Lane County, Oregon
(index based on 1972 value)

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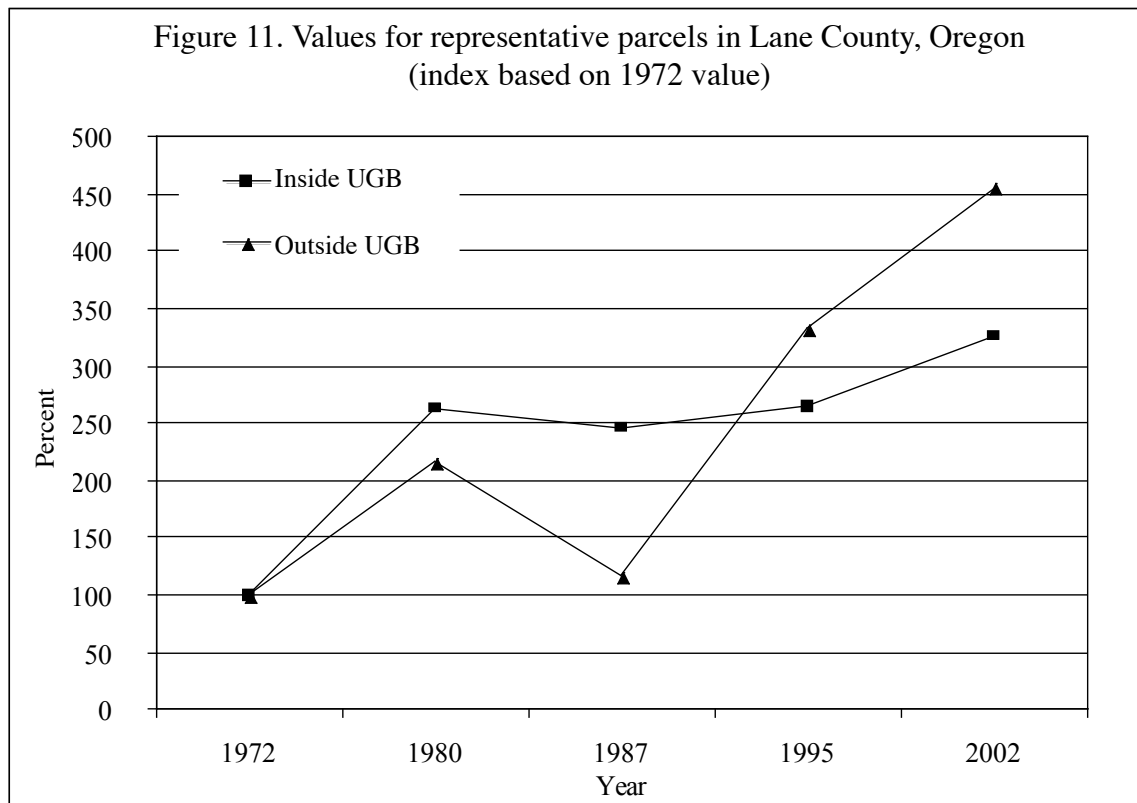
[12] In Jackson County, we estimated the 1972 value by assuming a constant growth rate between our 1965
and 1972 estimates of land values.

Figure 12. Property values for representative parcels in Lewis County, Washington (index based on 1973 value)
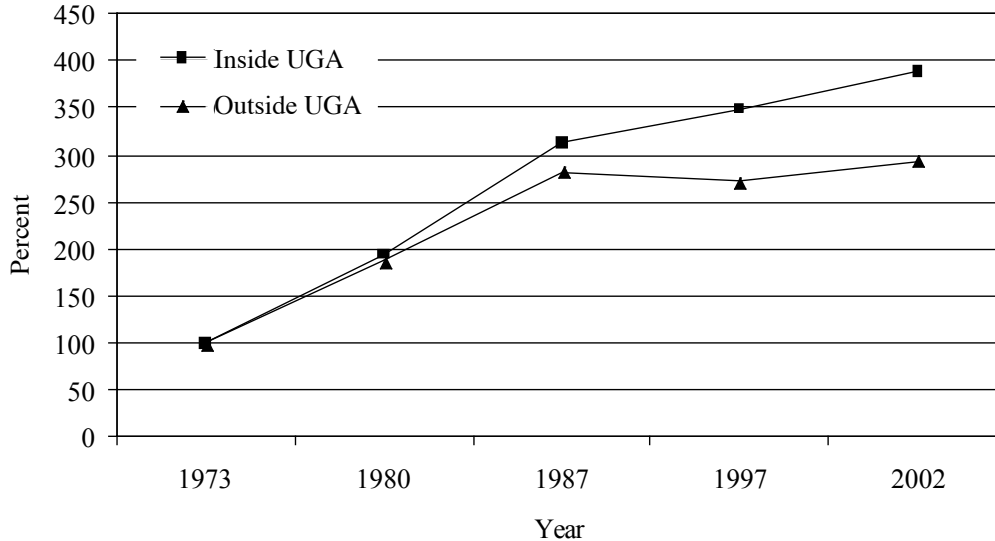
Baker County, Oregon. Turning to eastern Oregon, we used 264 observations for Baker County to compute average per-acre agricultural land values for six periods (1972–1976, 1977–1981, 1982–1986, 1987–1991, 1992–1997, 1998–2002). These data are from appraiser's records and reflect a different sample of parcels in different years (see Appendix A). Average property values increased from the first period to the second period and then declined for the next two periods (Table 7). Property values then rose and fell again by the final period.

Table 7. Average real per-acre land values, Baker County, Oregon (in 2006 dollars)

	1972–1976	1977–1981	1982–1986	1987–1991	1992–1996	1998–2002
All parcels	1,762	2,494	1,197	956	1,956	1,864
(No. observations)	(63)	(79)	(34)	(42)	(19)	(17)
Parcels <100 acres	2,527	3,338	2,503	1,568	2,588	2,114
(No. observations)	(28)	(44)	(8)	(16)	(10)	(11)
Parcels <64 acres	3,008	3,714	2,800	1,701	3,040	2,339
(No. observations)	(14)	(27)	(4)	(10)	(5)	(5)
Value relative to 1974 (1972–1976 average = 100)						
All parcels	100	142	68	54	111	106
Parcels <100 acres	100	132	99	62	102	84
Parcels <64 acres	100	123	93	57	101	78

Some of the Baker County properties have large agricultural acreages. The average sample parcel is 473 acres. To facilitate comparisons with Kittitas County, which included parcels between 10 and 64 acres, we computed average property values for Baker County parcels smaller than 100 acres, and also for parcels between 10 and 64 acres. As shown in Table 7 (page 23), average per-acre property values rise as acreage falls. In some cases, per-acre values more than double for very small parcels. This phenomenon is seen with both land values and housing prices, and there are several explanations for these apparent "volume discounts."

We computed annual growth rates in property values, assuming the midpoint of the period represents the year of the observation (see the above discussion). Some relatively large changes in land values were found. For example, in Baker County the average value of parcels smaller than 64 acres fell by about 40 percent between 1982 and 1989, but then increased by a greater amount between 1989 and 1994.

Comparison of Kittitas and Baker counties. For Baker County, we have data on agricultural land parcels. We were unable to determine the zoning applied to these parcels. However, given that land-use regulations in Oregon are applied with a high degree of consistency across the state, it is likely that these parcels are zoned for exclusive farm use, with strict restrictions on residential construction. In contrast, regulations concerning residential development are much less restrictive in Kittitas County. To facilitate a comparison between agricultural land values in Kittitas and Baker counties, we focused on those Kittitas County parcels zoned for commercial agriculture, and compared them to parcels in Baker County between 10 and 64 acres.

Average land values and annual growth rates for commercial agriculture parcels in Kittitas County are reported in Table 6 (page 19).[13] The results are presented in Figures 13 and 14 (mean values and median values, respectively, page 25). Both mean (average) and median (midpoint) values are presented because, given the small and varying sample of parcels for Baker County, the trends in mean and median values could differ depending on the spread of land values in any given year.

Average property values in Baker and Kittitas counties are remarkably similar over the 1974–2000 period. Based on the mean values (Figure 13), the trends are also very similar, despite a slight difference between the end points. Farmland in Kittitas County seems to have increased slightly more in value than that in Baker County. By contrast, the general trends in median values are nearly identical (Figure 14). Neither sample showed an upward or downward trend between 1974 and 2000.

These results suggest that the more permissive land-use regulations in Kittitas County have not elevated agricultural property values relative to those in Oregon, where regulations are more restrictive. The finding is strengthened by the fact that Ellensburg has recently experienced higher population growth than the cities in Baker County.

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[13] The land value estimates for 1972 and 1980 in Kittitas County were used to estimate values for 1974 by assuming a constant annual growth rate over the period from 1972 to 1980.

Figure 13. Growth in mean agricultural land values,
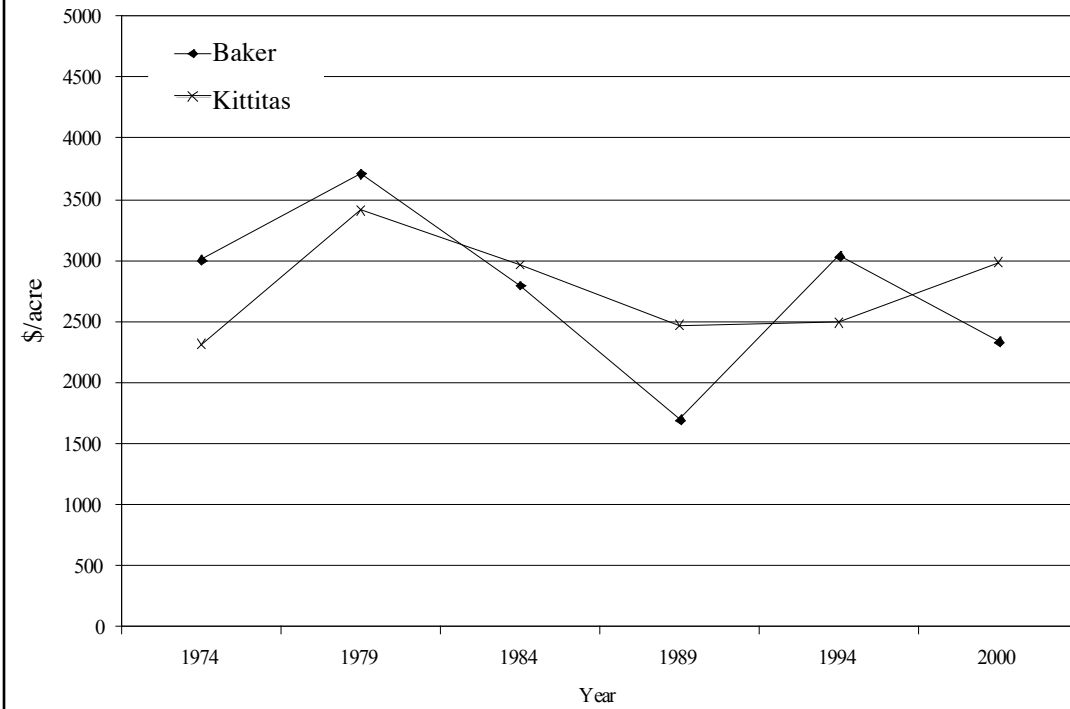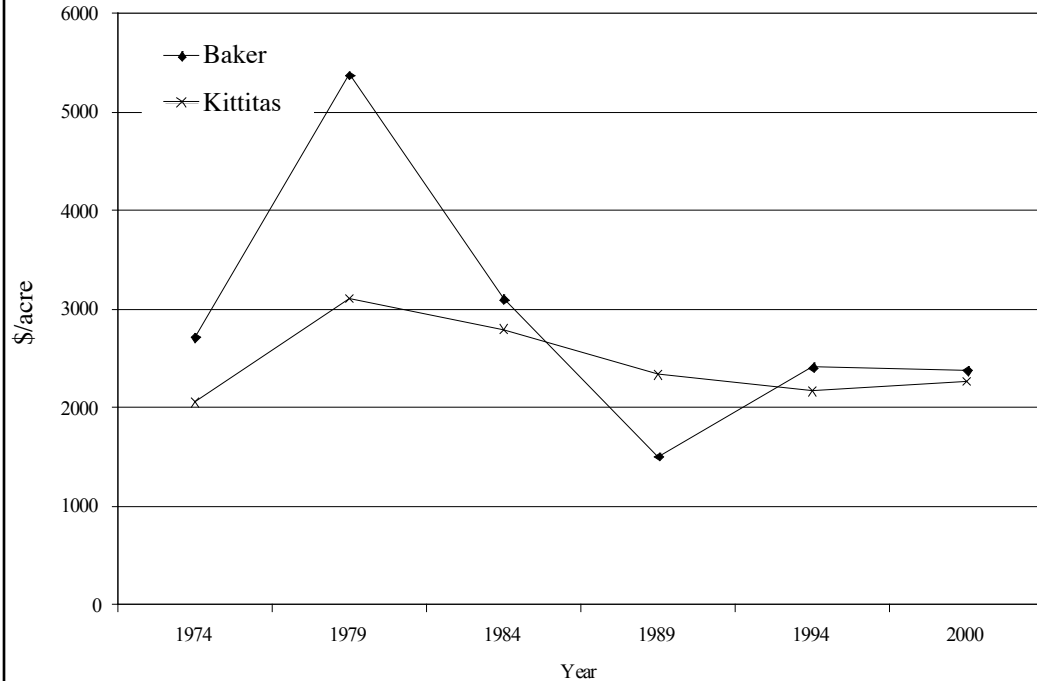Baker County, Oregon and Kittitas County, Washington

Figure 14. Growth in median agricultural land values,
Baker County, Oregon and Kittitas County, Washington

For comparison, we can look at estimates of overall patterns in farm real estate values produced by the USDA Economic Research Service.[14] These aggregate estimates of average per-acre farm real estate value indicate that Oregon farmland has increased in value at rates comparable to those in neighboring states and at higher rates than the national average. Similar to the results based on individual parcels, these aggregate estimates of farm real estate values do not suggest any systematic reduction in Oregon land values since the implementation of Oregon's land-use planning system.

II.B. Effects of property tax reductions on land values

The effects of land-use regulations on property values should be considered in the context of other government actions that may affect property values. Land values generally are positively affected, for example, by proximity to roads and other publicly provided infrastructure. Government services such as police, fire, and schools also are generally associated with higher land prices.

In addition, land values may be affected by specific government programs such as farm subsidies or property tax reductions (see also Runge et al. 1996 for more examples and detail). Some of these benefits are likely to be at least partially reflected (capitalized) in market prices for land. If they are sufficiently generous, they could alter both the level and trends in land prices. We considered the effects of property tax reductions and their potential magnitudes in Oregon. We provide estimates of the potential effects on land values that will depend, in part, on landowners' expectations that these government programs will continue.

The 1973 Oregon legislature passed several laws mandating special tax assessments for eligible farm and forest lands.[15] The effect was to reduce property taxes for these lands. In a study by the American Land Institute, Richmond and Houchen (2007) conclude that, as a result of this program, farm and forestland owners have received property tax reductions totaling $4.8 billion (in current dollars) between 1974 and 2004.

Of this total, $3.8 billion was received by agricultural land owners and $1.8 billion by forestland owners. In the case of specially assessed agricultural lands, Richmond and Houchen estimated an average tax reduction in 2003–2004 of $5.84 per acre for lands with an average market value of $1,027 per acre (in 2006 dollars). On this basis, and using a real interest rate of 4 percent, the capitalized value (share of land value attributable to the tax reductions) could be as much as $146 per acre, or 14.2 percent of the market value for Oregon overall. These estimates vary considerably by county, ranging from 5.1 percent to 29.2 percent (see Table 8, page 17).

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[14] These estimates are based on agricultural census data and can be found at http://www.ers.usda.gov/data

[15] Some of Oregon's farmland tax benefit legislation dates from the 1960s and was applied to zoned farmland in 1967. The farmland tax policy, however, was introduced with Senate Bill 101 following passage of the land-use planning system with Senate Bill 100.

Table 8. Specially assessed farmland tax reductions and their estimated effects on market land value

County	Taxable assessed value of farmland ($)	Assessed value without special assessment* ($)	Effective tax reduction (%)	Rural tax rate (%)	Average market value per acre ($)	Potential share of land value due to tax reduction** (%)
Baker	51,225,651	231,705,980	77.9	1.08	408	13.8
Benton	64,585,447	222,655,051	71.0	1.28	4,386	10.9
Clackamas	81,326,672	923,318,491	91.2	1.36	10,638	20.4
Clatsop	3,974,445	45,375,592	91.2	1.12	4,643	15.3
Columbia	9,906,850	68,063,388	85.4	1.10	3,589	10.1
Coos	25,316,902	62,281,708	59.4	1.15	2,826	5.1
Crook	35,516,630	143,878,647	75.3	1.27	267	16.8
Curry	17,370,810	86,250,600	79.9	0.77	2,941	10.4
Deschutes	14,951,192	165,555,417	91.0	1.31	3,787	7.8
Douglas	45,168,354	271,087,245	83.3	0.90	1,729	9.9
Gilliam	65,539,275	118,830,174	44.8	1.21	181	12.8
Grant	23,936,828	159,492,892	85.0	1.39	276	19.0
Harney	58,389,839	174,607,581	66.6	1.15	228	10.1
Hood	44,009,806	108,768,254	59.5	1.14	9,889	8.0
Jackson	24,230,283	281,873,975	91.4	1.21	3,174	11.8
Jefferson	36,749,730	133,604,637	72.5	1.56	685	12.6
Josephine	11,691,280	89,889,232	87.0	0.70	4,039	14.6
Klamath	110,309,145	289,567,951	61.9	0.96	875	8.3
Lake	64,474,066	244,926,037	73.7	1.28	425	17.9
Lane	71,753,384	214,899,323	66.6	1.04	4,128	5.4
Lincoln	3,959,840	57,667,495	93.1	1.10	3,578	29.2
Linn	162,529,282	607,552,794	73.2	1.19	1,310	28.3
Malheur	120,351,330	415,357,672	71.0	1.13	418	15.2
Marion	206,266,590	1,051,601,738	80.4	1.17	6,791	12.4
Morrow	78,981,710	269,609,272	70.7	1.46	286	24.4
Multnomah	85,427,130	160,993,497	46.9	1.22	10,643	7.5
Polk	94,008,233	363,636,703	74.1	1.04	3,387	11.9
Sherman	55,497,160	115,584,740	52.0	1.69	323	17.3
Tillamook	24,108,883	87,718,078	72.5	0.98	3,792	12.9
Umatilla	227,026,715	627,049,031	63.8	1.29	502	19.3
Union	53,201,581	190,968,626	72.1	1.01	525	13.4
Wallowa	32,205,990	252,779,558	87.3	1.20	451	22.4
Wasco	94,021,650	188,454,408	50.1	1.41	400	10.8
Washington	70,859,630	837,158,870	91.5	1.46	10,649	21.6
Wheeler	20,891,193	81,043,043	74.2	1.53	287	12.3
Yamhill	63,043,308	404,820,442	84.4	1.26	5,474	12.8
Oregon	2,252,806,814	9,766,506,878	76.9	1.21	1,027	14.2

Based on 2003–2004 tax data reported in Richmond and Houchen (2007).

*Estimate of market value subject to Measure 50, which caps annual growth of assessed property values.

** When annual tax reduction benefits are capitalized into land value at 4 percent real interest rate. Uncertainty about the continuation of these programs and other factors may result in smaller effects.

II.C. Interpretation of the data analysis

The purpose of this study was to examine whether land-use regulations have affected property values in Oregon. To address this question, we analyzed estimates of real market values of undeveloped properties in three Oregon counties and two Washington counties. The data cover the period from before the implementation of statewide land-use regulations in Oregon up to the present. Two types of comparisons are made. First, we compared property values across locations relative to the UGB or UGA and across different types of zoning. Second, we compared agricultural land values across sites with different regulations.

The first type of comparison revealed differences in current property values inside and outside of the UGB (or UGA) and by zoning class. In general, average property values are higher close to cities, where there tend to be fewer restrictions on residential housing construction. In some cases, there are large differences in average property values.

At first glance, one might conclude that land-use regulations reduced property values outside the developable areas, or that they raised property values where development is permitted. However, a more careful analysis suggests that this conclusion is not warranted because similar differences in average property values existed before regulations were implemented. Most likely, these original differences were due to attributes of the parcels that help explain their eventual regulatory status.

For example, a parcel located far from a city center would have had a relatively low value in 1965 because development opportunities were limited. Such a parcel is also more likely to have been later zoned for agricultural or forest uses. In contrast, parcels later zoned for residential uses are likely to have been candidates for residential development even before the zoning was enacted. Thus, they had higher original property values. Indeed we found similar differences in property values inside and outside the UGA in Lewis County, Washington. These differences likely were related to the distance to the city center, rather than to land-use regulations, since Washington's growth management plans had not yet been enforced in Lewis County in 2002, the last year of our data.

We considered whether patterns of growth in average property values differed across different types of zoning and land-use regulations. In effect, we compared the growth in the value of parcels that were eventually subject to *different* land-use regulations. Of particular interest is whether more restrictive regulations resulted in lower rates of growth in land values.

Overall, our findings provide no evidence to support this claim. In Lane County, we found that the growth in value of the average parcel inside the UGB was similar to that of the average parcel outside the UGB. When using 1965 as a base year, the value of properties inside the UGB grew slightly faster, but when using 1972 as a base year, the value of properties outside the UGB grew faster. Moreover, the lands outside the UGB in Lane and Jackson counties grew faster than lands outside the UGA in both Washington counties, Lewis and Kittitas.

When we examined differences across zoning classes, a more precise indicator of the restrictions on development, we also found no clear differences. The increase in value for parcels with forest zoning, which is highly restrictive, was higher than that for parcels

where residential construction is permitted. Moreover, parcels with relatively low-density zoning had larger increases in value than did parcels with high-density zoning. Similar results were found in Jackson County, where parcels with forest zoning had the highest rate of increase in value. In Kittitas County, there was little difference in the growth of parcel values between areas with low- and high-density zoning.

Our comparison of property values across zoning types and in location related to the UGB/UGA yielded insights into how different types of regulations affect changes in property values through time. However, it does not address the question of how property values are affected overall by the given suite of land-use regulations. Our comparison of agricultural land values across sites with different type of regulations was designed to address this issue. We considered whether land values differ between sites with different regulatory structures and for different types of land (agricultural, forest, near cities, far from cities). We also considered how the levels and growth rates of land values *with* a land-use regulation program (Oregon) compare to those in a setting *without* a land-use regulation program (Washington).

The results failed to reveal effects of land-use regulations on property values overall. There is remarkably close correspondence between average agricultural land values in Kittitas County and Baker County over the period 1974–2000, and the growth in these values did not differ significantly over this period. This is true even though population growth in Ellensburg has been greater than in Baker City (the two largest cities in these counties), and restrictions on residential housing construction are much less stringent in Kittitas County. Given these differences, one might expect upward pressure on land prices in Kittitas County and downward pressure on prices in Baker County. Evidence for neither effect was found in these data.

Our findings are consistent with the underlying design of Oregon's land-use planning system. This system is not intended to limit the amount of development that occurs, but rather it is intended to influence the *location* of the development that does occur, and to make the location and concentration of that development consistent with various land-use planning goals. Among those goals is an interest in concentrating development within urban growth boundaries rather than allowing dispersed and fragmented developments. Sprawl or scattered development can raise the costs of public services and infrastructure and produce adverse effects when incompatible land uses (e.g., farming and residential) are mixed.

Given the design of Oregon's land-use planning system, one would expect some landowners to experience negative effects while others experience positive effects. This might occur, for example, if land development does not expand equally in all directions toward the urban growth boundary. If development pressures, for example, are more concentrated on the west side of town than on the east side of town, landowners just outside the UGB on the west side of town may be negatively affected by the existence of the UGB. At the same time, some landowners who are inside the UGB on the east side of town may be positively affected by their inclusion within the UGB. When land-use regulation creates both positive and negative effects in this way, the average effect for a sample of parcels within the regulated group may be nil.

Consistent with that possibility, in both Oregon and Washington, properties both inside and outside the UGB (or UGA), in both eastern and western parts of the state, generally have increased in value at roughly similar rates. Properties inside the UGB have higher per-acre values today, but they also had higher per-acre values in the 1960s before land-use regulations were adopted. In general, the difference in value occurred because lands closer to urban areas are more desirable than those farther away. In other words, the adoption of UGBs may have led to advantages for some landowners over others, but their overall effect may have been to institutionalize the realities that existed before UGBs were adopted.

Evidence of a sharp decline in land value between "just inside" and "just outside" the UGB could still arise, even in some situations where the UGB does not constrain the amount of developable land, only the location of that development. This may occur along some portions of the UGB and not others, in cases where the UGB does not match the pattern of expanding development pressures. It may also reflect other differences between lands inside and outside the UGB, such as access to public services and infrastructure, or the amenities associated with being near open space.

III. Review of Economic Studies:
Effects of Land-use Regulations on Property Values

This section summarizes and evaluates economic studies conducted over the past several decades to examine the effects of regulations and other government actions and programs on property values. These studies considered the economic effects of: (1) regulatory programs generally, (2) regulatory programs in Oregon, (3) restrictions on neighboring properties that generate amenities, and (4) tax abatement and farm subsidy programs. More detailed summaries are included in Appendix C. Overall, these studies support the view that:

- Regulatory restrictions have a mix of negative and positive effects on the value of regulated lands.
- Restrictions on neighboring parcels often have positive amenity effects on property values.
- Tax benefit and subsidy programs positively influence property values.

A. Effects of land-use restrictions

Numerous empirical studies have examined how land-use restrictions affect property values. Economic theory suggests that regulations have a complex set of negative and positive effects on private property values and that the *net* effect of regulatory restrictions cannot be known in advance. The results of recent empirical studies support this theory.

Several studies have examined land regulations designed to preserve open space and other environmental amenities and have found that these types of restrictions can positively affect property values. A study of the New Jersey Pinelands Protection Act (Beaton 1991) found that the number of vacant parcels in the most restricted areas declined after imposition of growth controls. However, following the law's enactment, previously improved properties within the Pinelands region had significantly higher values than properties outside, likely as the result of amenity effects.

A study of growth management policies in the Chesapeake Bay region (Beaton and Pollock 1992) found no adverse effects of development controls on vacant properties. Vacant and residential properties with good access to population and employment centers increased in value following the adoption of restrictions.

Finally, a study of lakefront property in northern Wisconsin (Spolatro and Provencher 2001) concluded that stricter limits on the density of development had positive net effects on property values. The authors concluded that amenity effects outweighed losses from restrictions on development.

Studies of development of agricultural lands have yielded more mixed results. A study of agricultural land values in Wisconsin (Henneberry and Barrows 1990) concluded that agricultural zoning was associated with higher values for larger farmland parcels at some distance from the urban center. The same zoning was associated with lower values in the case of smaller parcels relatively close to the urban center. In a study of agricultural zoning in suburban Minneapolis, Gleeson (1979) found a strong association between agricultural zoning and lower property values.

A number of recent studies have examined the effects of conservation easements on the value of agricultural land. Nickerson and Lynch (2001) studied a voluntary farmland preservation program in Maryland, which involves the purchase of development rights on agricultural land. Using a sample of properties with and without easements, they found no significant effects of easements on property values. Lynch et al. (2007) repeated the analysis with an expanded data set and two alternative methods for measuring the effects. With one approach, they found significant negative effects of easements on property values; with the other, no effects were found.

Anderson and Weinhold (2005) examined a sample of 131 agricultural properties in south central Wisconsin, 19 of which have development restrictions. They found no significant effect of these restrictions on property values, similar to the finding of Nickerson and Lynch (2001). However, when they limited the sample to vacant parcels (that is, excluding ones with existing development), they found negative effects. Property owners may be less able to capture amenity benefits from vacant parcels where no development is allowed compared to parcels with development restrictions and pre-existing structures.

The results of these studies of conservation easements might logically be extended to regulatory programs. For the reasons discussed, stringent restrictions on land use may not adversely affect land values where there is strong demand for properties with open space amenities. Indeed, it is possible that the market would allocate land uses in the same fashion regardless of whether lands were restricted through voluntary easements. Mandatory regulations designed to achieve the same conservation objective might provide the same protection and greater positive feedback from amenity effects by providing greater protection from potentially conflicting land uses. Thus, it is possible that regulatory restrictions would produce a smaller negative (or larger positive) effect on property values than would voluntary conservation easements.

B. Oregon studies

The most detailed study of the effects of land-use regulations on property values in Oregon was conducted by Netusil (2005). To comply with Planning Goal 5 of Oregon's statewide land-use planning system, the City of Portland adopted environmental overlay zones to protect environmentally sensitive areas. To varying degrees, properties within these zones are subject to restrictions on development. Netusil examined whether there are price differences between properties inside and outside the environmental zones, while controlling for other factors that influence value. Because environmental zoning limits development opportunities but also increases environmental amenities, we cannot predict the net effect in advance. Netusil found positive, neutral, and negative effects of zoning, depending on location. No evidence was found that negative effects are more likely with more stringent zoning.

A number of studies have examined the impacts of Oregon's urban growth boundaries on property values. In theory, if a UGB constrains the amount of developable land, developable parcels inside the boundary should sell for more than restricted parcels outside, all else being equal. Knapp (1985) tested this proposition using a sample of properties in the Portland metropolitan area. Overall, the results provided evidence of the

expected difference in property values inside and outside the UGB. Additional research on the effects of the Salem UGB is summarized in Knapp and Nelson (1988). Significant differences between property values inside and outside the UGB were found.

The authors concluded that, "UGBs have had significant effects on land values consistent with economic theory." However, they do not seem to have considered the possibility of reverse causality: that the urban growth boundary was drawn to include higher value lands and to exclude lower value lands. Their observations were of property sales that occurred shortly (between 1 and 4 years) after the designation of the UGBs. To the extent that UGBs are drawn to include land with high development values and exclude land with low values, one would expect to find a relationship between property prices and location relative to the UGBs. Moreover, even if the causality runs in the direction assumed by the authors, these studies do not shed light on whether a UGB reduced property values outside the UGB, increased property values inside the UGB, or both. A price differential measured at one moment in time simply reveals a difference in *relative* prices, not whether land prices have gone up or down.

Phillips and Goodstein (2000) used data from 37 western cities, including Portland, to investigate the effects of land-use regulations on median housing prices. The authors measured the stringency of regulations using an index of zoning and other growth controls. They found some evidence that regulations have increased housing prices in Portland, although the effects are small.

C. Effects of restrictions on neighboring properties

A parcel's value may be affected by regulations applied to neighboring parcels. For example, development restrictions on surrounding properties may generate open space amenities that raise a property's value. These types of effects have been extensively documented. The majority of the studies use the "hedonic price method." This statistical technique decomposes an observed price into the implicit values assigned to each characteristic of the item sold. It often is applied to property prices. In this case, results indicate how much of the total value of a property can be attributed to structures, undeveloped land, land uses on neighboring properties, and so on. More details on the hedonic price method are provided in Appendix C (page 49).

Earnhart (2006), Smith et al. (2002), and Irwin and Bockstael (2001) estimated positive effects on neighboring property values of development restrictions that provide open space amenities. For example, Earnhart found that in Lawrence, Kansas, values were $8,700 higher for properties located next to permanently protected open space. Geoghegan (2003) documented similar effects for an agricultural preservation program in Maryland. Ready and Abdalla (2005) found that proximity to agricultural lands could have both positive and negative effects on property values, with the negative effects in this case arising from animal operations.

Acharya and Bennett (2001) found that property values were affected by the mix of surrounding land uses, and that landscapes with multiple uses tended to reduce property values. Other studies focused on the effects of particular uses such as forests (Thorsnes 2002) and wetlands (Doss and Taff 1996). The use of wetlands is strongly influenced by

regulations. In a study of Portland, Oregon, Mahan et al. (2000) found large premiums paid for housing near wetlands.

D. Tax abatement and agricultural subsidy programs

Economists have long recognized that taxes and subsidies applied to land affect the market price of real property. In other words, taxes and subsidies are "capitalized" into the value of the land (see the discussion in Appendix C, page 49 for more details). Everything else being equal, the lower the current and expected future level of taxation, the higher the property values will be; by the same token, the higher the current and expected future level of taxation, the lower property values will be. The reverse is true for subsidies.

Empirical studies on tax abatement programs have found that these programs positively affect property values. Not surprisingly, however, given the wide diversity in the design of state programs, results varied widely. For example, a study of the Michigan program concluded that slightly less than 10 percent of the total agricultural land value in the state was attributable to the tax abatement program (Anderson and Bunch 1989). Similarly, a study of a farm in Illinois concluded that use-value assessment contributed approximately $1,000 to the capitalized per-acre value of the agricultural land (Chicoine, Sonka, and Doty 1982). On the other hand, a study in New York found no significant relationship between participation in the tax abatement program and property value (Vitaliano and Hill 1994).

Another influence on agricultural land values has been U.S. agricultural policies. The federal farm programs include price supports for grains, oilseeds, fiber, dairy, and sugar, as well as income support for producers of these commodities. The programs are complex and have changed over time. In recent years, there has been a trend toward more "market-oriented" programs in which payments are detached from production decisions.[16] Studies have shown that farm programs tend to increase agricultural returns and land values (Lence and Mishra 2003, Roberts et al. 2003, Weersink et al. 1999). However, there are considerable regional differences in the impacts of farm payments on agricultural land values (Barnard et al. 1997). In part, this is due to differences in suitability for growing eligible crops. Relative to other parts of the country, such as the Midwest, Oregon is not a large producer of these crops. Barnard et al. (1997) found that direct payments to farmers under the federal programs account for between 0 and 14 percent of agricultural land values in Oregon.

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[16] See, for example, the U.S. Department of Agriculture, Economic Research Service website (http://www.ers.usda.gov).

IV. Conclusions

Our analysis may surprise observers who witnessed the passage of Measure 37 in Oregon and the subsequent filing of thousands of Measure 37 claims based on the belief that land-use regulations have had large systematic and negative effects on property values.

Our analysis indicates that land values have generally risen since the introduction of Oregon's land-use planning system in 1973. This trend has been true for rural lands zoned for farm and forest use as well as for developable lands inside and outside urban growth boundaries. Based on data for samples of parcels in three Oregon counties and two Washington counties, land values in Oregon have increased at rates similar to those for lands in similar counties in Washington. This has been true for farmland, for lands inside urban growth areas, and for lands outside urban growth areas. Based on our Oregon data, growth rates for land values inside and outside urban growth boundaries have been similar since the implementation of Oregon's land-use planning system in 1973. Values for lands zoned for exclusive farm or forest use have risen at rates similar to, or higher than, lands zoned for residential use.

These results are consistent with other economic studies and with economic reasoning, as well as with the design of Oregon's land-use planning system.

First, many studies have found that land-use regulations can have significant effects on property values. In many cases the net effects of regulations are positive, while in other instances there may be no effects or negative effects (See Appendix C, and also Runge et al. 1996). Our results, which show no general reduction of market value for lands under restrictive land-use regulations, are consistent with these other findings.

Second, our results are consistent with one key aspect of Oregon's land-use planning system—the requirement that cities maintain a 20-year supply of vacant land within their UGBs. As populations grow, cities are expected to expand the boundaries of their UGB continually to maintain this 20-year buffer. Thus, the UGB does not necessarily impose a binding constraint on the amount of development, but instead is aimed at controlling its location and minimizing the amount of fragmented and dispersed development. It is noteworthy, for example, that although there are more than 2,000 Measure 37 claims in areas surrounding Portland's UGB, there are an estimated 28,000 acres of vacant land inside the UGB (Jaeger and Plantinga 2007).

Although our results suggest that the average landowner was not adversely affected by regulations, the situation could be different for a particular landowner. For example, landowners with properties located just outside the UGB may have fared worse under regulations than they would have without regulations. On the other hand, some landowners may have done better with land-use regulations than without (e.g., those with properties just inside the UGB, but less desirable than other locations for reasons such as distance to downtown, elevation, etc.).

More generally, some landowners may experience negative "restriction effects" that outweigh the positive "amenity effects" or "scarcity effects," while at the same time other landowners experience the opposite. Thus, as markets respond to amenity and scarcity effects, it is quite possible that a regulation that imposes no overall constraint on the

amount of land developed will constrain some landowners from taking advantage of real opportunities for higher value uses. This situation also can arise in part because of the diversity of land characteristics, particularly the presence of open space near parcels just inside or outside the UGB.

Third, the perception that landowners have been denied large financial gains as a result of land-use regulations may be due in part to differences in land values that existed prior to the introduction of land-use regulations. Indeed, our analysis suggests that current differences across zoning types or location relative to the UGB do not reflect systematic adverse effects of land-use regulations. Rather, our data provide evidence that these differences in property values existed prior to the enactment of regulations. When these initial differences are accounted for, the growth rates in land values have been similar over the past 30 years for the different categories. Thus, the relationship between the per-acre values of lands near cities (inside the UBG) and those farther from cities (outside the UGBs) has remained largely the same. This seems to be the case when comparing land values in Oregon in the pre-1973 and post-1973 periods, and it also is true when comparing trends in Oregon with trends in Washington for similar counties.

In many cases, perceived opportunities for financial gain (those that seem to be blocked by a land-use regulation) would not exist if not *for* the land-use regulation (Jaeger 2006). For example, land-use regulations can create potential opportunities for some landowners because the regulations have restricted opportunities for others. Regulations can affect the scarcity of land in the marketplace and protect and preserve amenities such as open space surrounding a specific property. As a result, while it may seem that the regulation is denying a landowner an opportunity, in reality it may be creating the opportunity.

This confusion could be reduced by recognizing the fundamental distinction between (a) the effect of enacting and enforcing a land-use regulation on *many* properties, and (b) the effect of removing a land-use regulation from *one* property (see Jaeger 2006, Jaeger and Plantinga 2007). The latter often seems to provide a landowner with a large windfall, and this observation often is interpreted as evidence that land-use regulations generally reduce the values of affected properties. Indeed, if a land-use regulation has actually increased property values, an exemption for an individual property often will allow additional gains for that particular landowner.

In addition, our analysis found that government programs such as Oregon's special tax assessments for farmlands are likely to be "capitalized" into land prices, raising them by as much as 14 percent on average.

The two components of this study—the analysis of Oregon and Washington data and the review of economic literature—seem to reinforce our understanding that land-use regulations and other government actions affect property values in complex and interconnected ways. The economics literature includes studies that identified both positive and negative effects. Some studies examined cases where regulations restricted individual landowners from actions that would increase their property's value, but where positive reciprocal effects outweighed the effect of the limitation. Finally, the evidence from Oregon is consistent with these perspectives, offering no evidence to support the view that land-use regulations have systematically reduced property values in Oregon.

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Appendix A. Data and Data Collection Methods

We began by assembling data for Lane County. We then applied the same procedure in Jackson County (Oregon) and in Lewis and Kittitas counties (Washington). The data for Baker County are from the records of a private land appraiser, and were obtained by the American Land Institute (see Richmond and Houchen 2007) and are described separately.

The data collection procedure for Lane, Jackson, Lewis, and Kittitas counties is described in detail below. In each of these counties, a sample of vacant parcels was selected based on the following general approach. First, map areas in and around the major city of interest were identified. Next, all currently (or recently) vacant parcels in these map areas were identified by using county assessor databases (parcels where the value of improvements was zero). In order to limit extreme effects for very large or very small parcels, a minimum and maximum parcel size was added as a selection criterion (e.g., between 3 and 20 acres). If this size range did not produce a large enough sample, the upper bound of the size range was raised until an adequate sample size was achieved (e.g., more than 100 parcels).

Lane County, Oregon. Property values for undeveloped land were obtained from the Lane County Assessor's Office in Eugene. We decided to use the county assessor's estimates of real market value (RMV) instead of individual sales data.[17] Assessors' data provides repeated observations for the same set of parcels over time, and several county assessors indicated that the assessed values were reasonably accurate measures of average market sale prices.

To construct the sample, we selected all properties in RLID (Lane County's online database, available at http://rlid.org) that met the following criteria:

- Between 3 and 20 acres
- Assessed improvements had a zero value
- Located in and around the Eugene-Springfield area (see Map 1, page 44)
- Had a General Land Code indicating agriculture, vacant, or timber
- Did not have characteristics that likely would prevent residential construction (e.g., public land, unbuildable, marginal, waterfront, sand and gravel, etc.)

By choosing only parcels larger than 3 acres, we omitted parcels that likely were part of a subdivided property and, thus, were unlikely to have had the same acreage in 1965.

The sample of properties was then matched to deed cards in the Lane County Assessor's Office. Deed cards that showed the same acreage between 1965 and 2002 were identified. A large proportion of the properties were eliminated at this stage, as many parcels had been subdivided or enlarged during this period. The sample was further reduced to avoid selecting parcels close to each other and to eliminate "split-code" parcels. The latter parcels are assessed at different rates and under different accounts, which makes tracking them through time difficult.

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[17] Individual sales data are very time consuming to collect, and there are many obstacles to verifying that the recorded amount of the sale represented a true "arms-length" market transaction at the time of the recording date.

For the remaining sample of properties, we obtained assessed real market values for 1995 and 2002 from the RLID database. Real market values for 1987, 1980, 1972, and 1965 were obtained from microfilm cards or tax rolls. A small percentage of the sample was eliminated at this stage because the records were missing or the properties were designated as "non-assessable."

The final sample of 100 parcels was merged with information on current (2006) zoning and location within or outside the current UGB. As well, the Property Subclass for 1980 and 1987 was recorded from the deed records. For these years, the assessed values for some properties reflected preferential tax assessment for agricultural and forest lands (special assessed value, SAV) rather than real market value, and these observations were omitted. This "special assessment" is identified by Property Subclass codes between 500 and 699. In recent years, both RMV and SAV are computed and reported by county assessors, so specially assessed lands could be included by reporting their real market value.

Jackson County, Oregon. We started with the Jackson County Assessor data available from smartmap.org. Tax lot data were used to construct a sample of parcels located in and around Medford (Map 2, page 45), the largest city in the county. Similar to Lane County, the criteria used to select the parcels included: (1) zero improvements, (2) parcels with 3 or more acres, and (3) lack of characteristics that would prevent residential construction. A 20-acre maximum was not applied, as in Lane County, because the resulting sample would have been too small. Parcels between 3 and 360 acres were included, with an average size of 38 acres.

Selected parcels were examined using the Jackson County Front Counter Application (http://web.jacksoncounty.org/fca/). Deed cards were used to eliminate properties with acreage changes over time. Real market values back to 1987 were recorded using online records. Problems were encountered at this stage with missing and incomplete records, as well as parcels that appeared to have received special assessment.

At the Jackson County Assessor's office in Medford, an attempt was made to use tax roll data for years before 1987, but the microfilm was organized in a way that rendered this approach infeasible. Instead, paper records were used to obtain appraisal information for selected years between 1965 and 1980. In some cases, no appraisal was available for the year of interest, in which case an appraisal from the closest year was substituted. As with some of the electronic data, a large number of records were missing or incomplete, and it was not clear whether parcels had received special assessment in some years. Unlike in Lane County, we were unable to determine specially assessed properties from the Property Subclass codes.

A sample of 88 properties was developed for the years 1965, 1972, 1980, 1987, 1995, and 2005. For 1965 and 2005, the RMV of the properties is clearly reported. Unfortunately, for the other years, it was difficult to differentiate between RMV and SAV. Also, there were multiple cases in which the reported real market values and special assessment values appeared to be transposed. As a result, we focused our analysis only on the 1965 and 2005 property values.

Lewis County, Washington. In Lewis County we obtained a tax roll database file from the Lewis County Assessor's Office. This database was used to identify a sample

of parcels located in and around the Chehalis-Centralia area (Map 4, page 47), the two largest cities in the county. Parcels were eliminated if the building value exceeded zero. Parcels between 1 and 40 acres were retained, with an average size of 9.4 acres. Parcels that had been subdivided or had undergone significant acreage changes over time were eliminated. For each parcel, real market values for 1973, 1980, 1987, 1997, and 2002 were recorded from digital archives at the Lewis County Assessor's Office in Chehalis. Current zoning information was derived from the tax roll database file. The Assessor's office noted that enforcement of land-use regulations under Washington's Growth Management Act has begun only recently in Lewis County, so these zoning codes were not binding as of 2002.

Baker County, Oregon. Data on sales of agricultural land parcels in Baker County were assembled from a private appraiser's records by Richmond and Houchen for the period 1972–2002. In the original data set, prices were assigned to portions of parcels based on soil class. The average per-acre price for the entire parcel was provided (or could be computed). We extracted the latter figures, as they most closely matched the data from other sites.

In some cases, the Richmond and Houchen data provided repeated sales observations for the same parcel, but the time intervals were irregular. As a result, we could not consistently track the same set of parcels. However, we used the data to gain insight into average agricultural parcel values in given years. For Baker County, there were 264 observations, with as many as 25 observations in one year and none in others.

Kittitas County, Washington. Similar to our approach in Lewis County, we obtained tax roll data files from the Kittitas County Assessor's Office. These files were used to select parcels located in and around Ellensburg (Map 3, page 46), the largest city in the county. Parcels were eliminated if the building value exceeded zero. Parcels between 3 and 41 acres were retained based on their 2002 size (although one parcel was 63 acres in all periods prior to 2002). The average size was 23 acres. Parcels that had been subdivided over time or that had undergone significant acreage changes were eliminated. For each parcel, real market values for 1965, 1972, 1980, 1987, 1995, and 2002 were recorded from paper records. In cases where real market value data were not available for the targeted year, the next closest year available was used. Current zoning information was derived from GIS layers obtained from the City of Ellensburg and Kittitas County.

Data adjustments. Our analysis focused on land parcels that could potentially be developed for residential housing. Thus, we omitted parcels that are currently zoned for industrial or commercial use. In Lane, Jackson, and Kittitas counties, this eliminated five, six, and one parcel, respectively.

Property values were adjusted for inflation using the national Consumer Price Index (CPI) to convert prices to their 2005 dollar equivalents. This adjustment allowed us to compare dollar values in different years by making the purchasing power of one dollar the same in each period. The CPI reflects price changes for a basket of goods representative of U.S. consumption patterns. This is the appropriate index to use because landowners are presumably interested in the market value of their land (and the willingness of a potential buyer to purchase it) in terms of a broad range of goods and services that might be bought with the proceeds from a sale.

Real (i.e., inflation-adjusted) property values were normalized on parcel size to obtain per-acre values. The average per-acre value for each year was then computed. In the case of Baker County, a lack of observations prevented us from obtaining an average per-acre value for each year. Therefore, we computed averages using observations from multiple years. These periods covered 1972–1976, 1977–1981, 1982–1986, 1987–1991, 1992–1996, and 1998–2002. For Baker County, we used the midpoint of the period to represent the "year" of the observation (e.g., 1974 for 1972–1976).
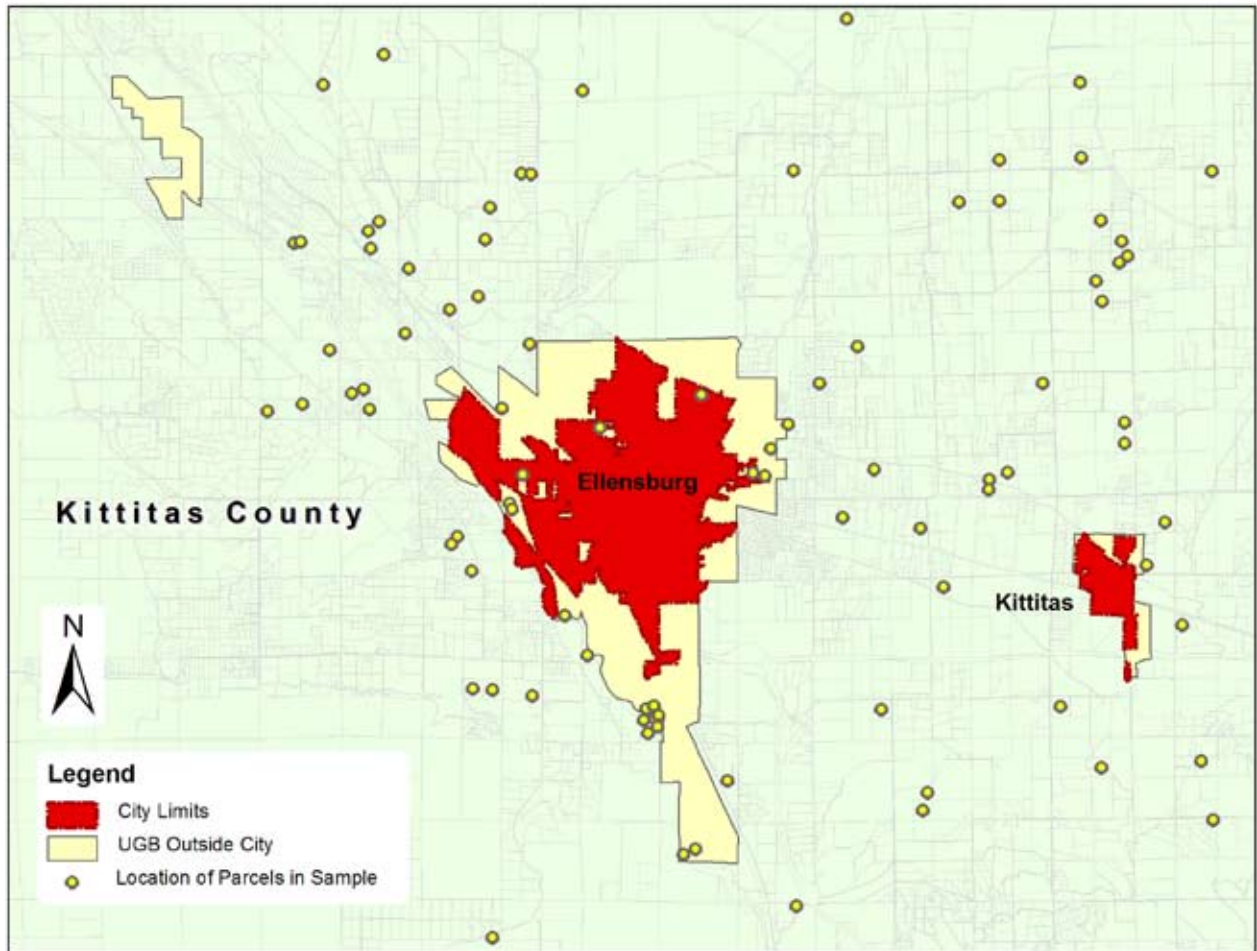
Appendix B. Maps

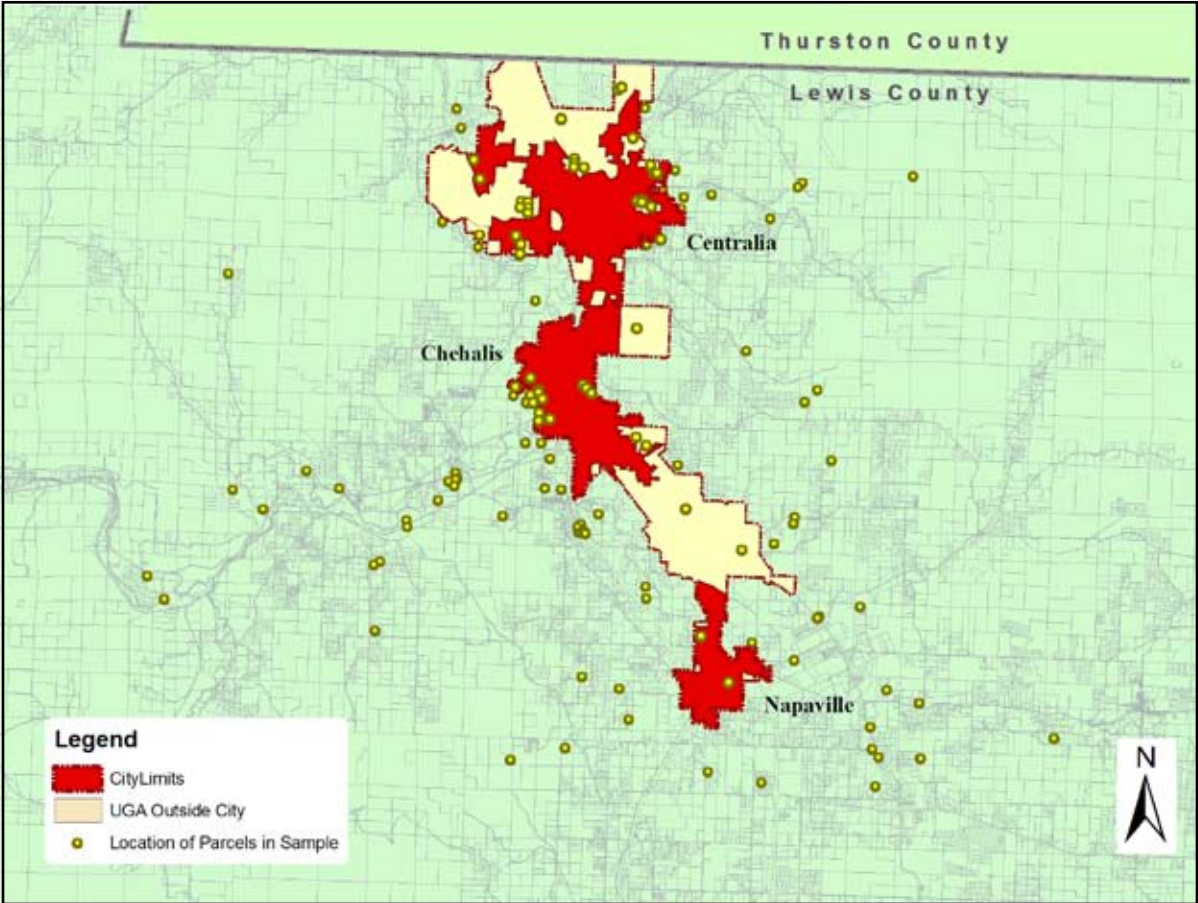**Map 1. Location of Lane County, Oregon parcels.**
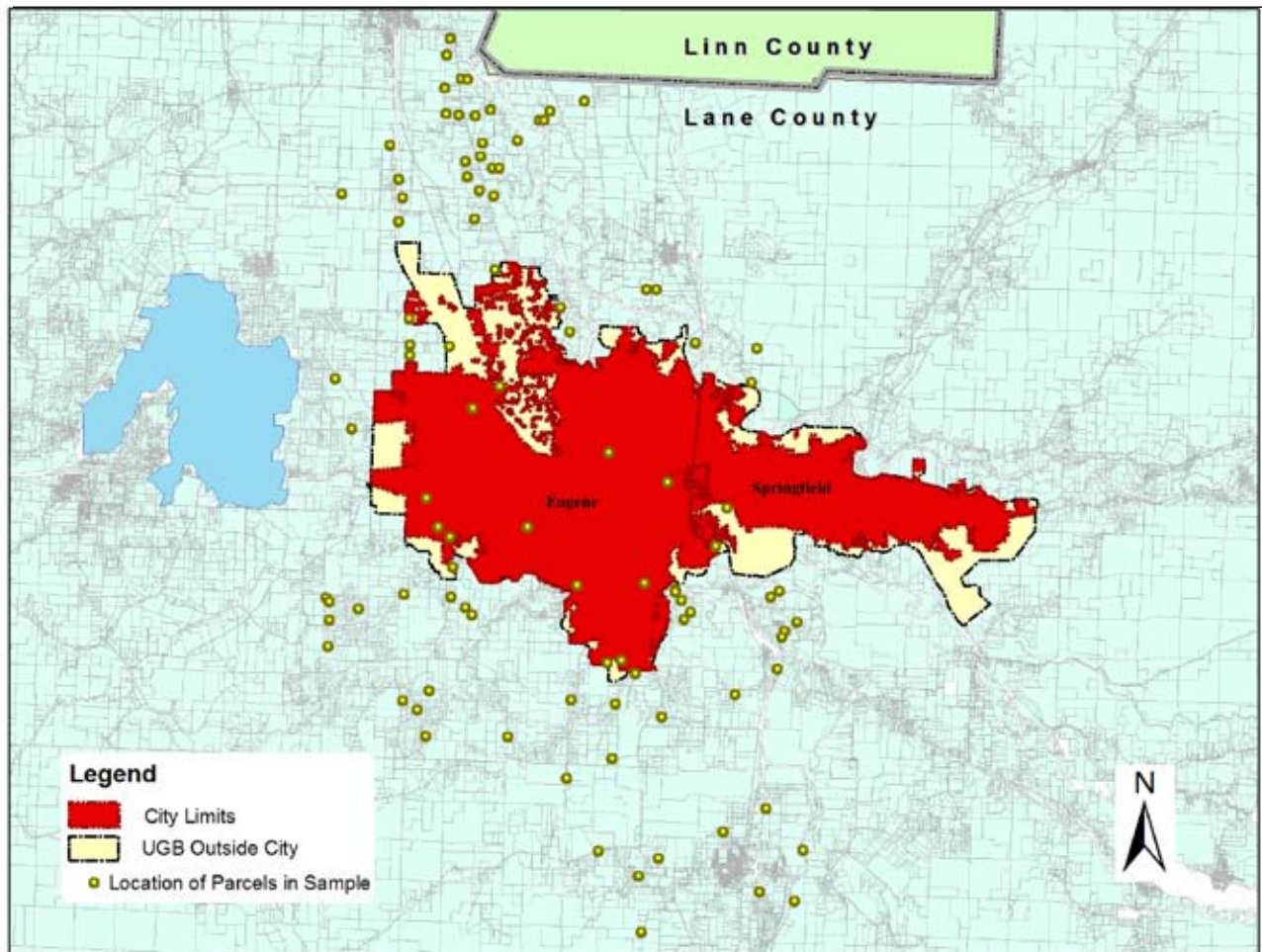
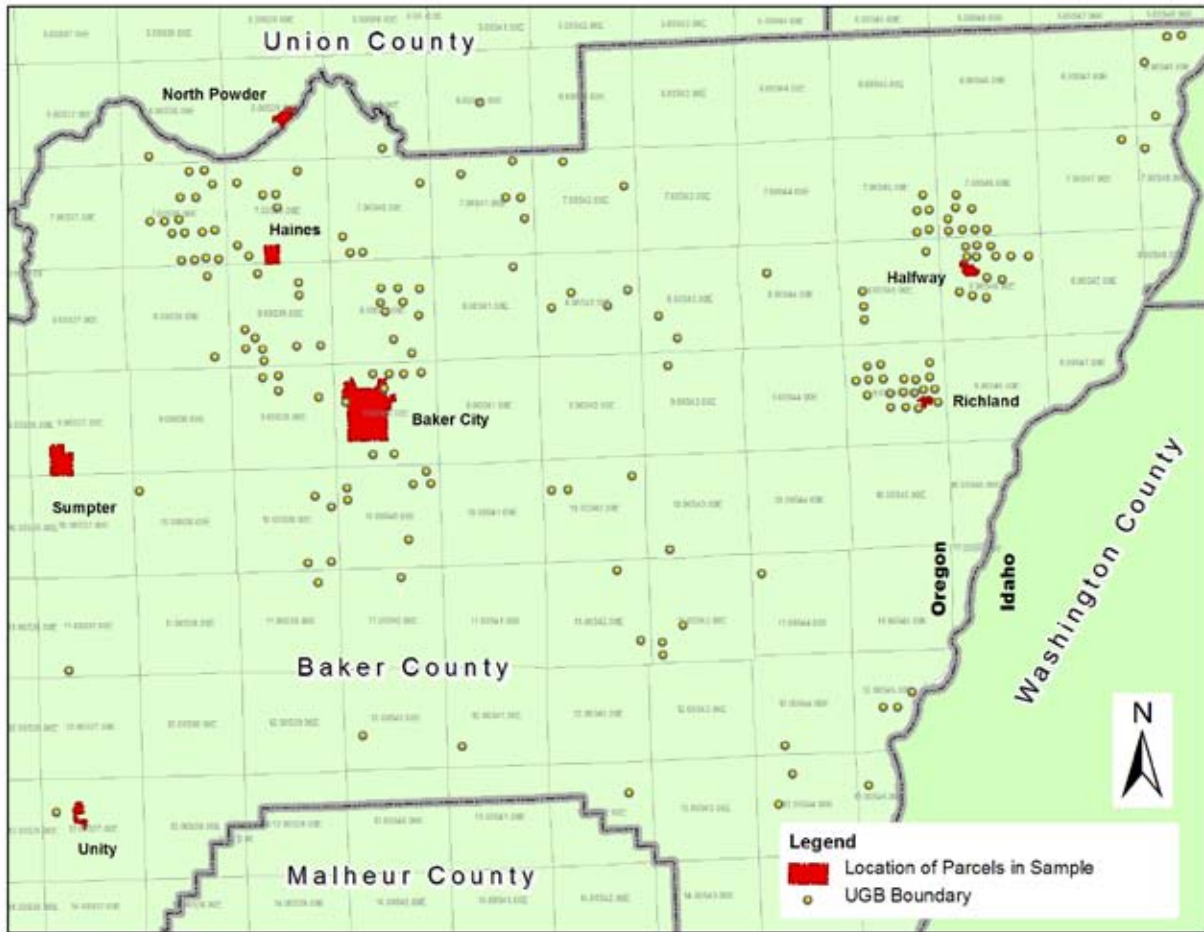**Map 2. Location of Jackson County, Oregon parcels.**
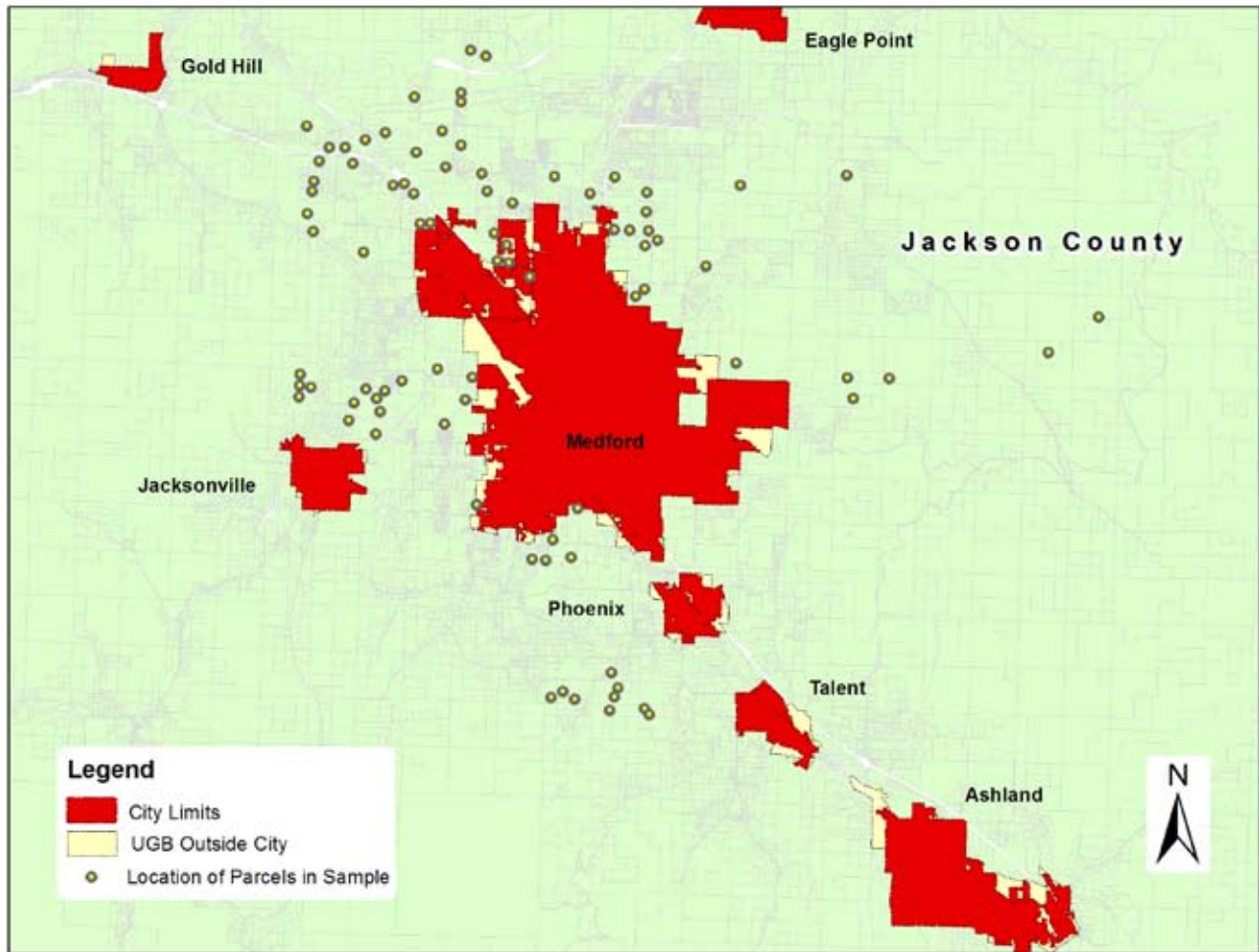
Map 3. Location of Kittitas County, Washington parcels.

Map 4. Location of Lewis County, Washington parcels.

Map 5. Location of Baker County, Oregon parcels.

Appendix C. Review of Relevant Economic Literature

This appendix presents a review of the recent economics literature on land-use regulations, agricultural subsidies, and use-value assessment. We focus on how these policies affect private property values.

An earlier study by Runge et al.[18] reviewed empirical studies on the effects of government actions on land and property values. The Runge et al. review covered studies through 1995 on the effects of agricultural policies, zoning and urban land-use restrictions, transportation route locations, and locations of amenities and disamenities. Our review includes analyses of land-use regulations and agricultural subsidies completed after the Runge et al. review, as well as a few earlier papers not included in Runge et al. Runge et al. did not consider studies on use-value assessment, and we tried to review all relevant studies on this topic. We reviewed only studies published in peer-reviewed economics journals. Thus, we omit "gray literature" studies such as unpublished theses, working papers, and government reports.

A list of the studies reviewed is provided in Table C-1 (page 52). The first set of studies (Section I) considers the effects of land-use regulations on property values. Studies in subsection I.A. examine the effect of regulations on the value of the property to which the regulation is applied. The regulations include restrictions on the development of agricultural and forest land, as well as restrictions on the type of urban development allowed (e.g., zoning that prohibits commercial development).

In general, land-use regulations reduce a property's value because they prohibit what might otherwise be profitable uses of the property. However, regulations also increase property values through the provision of amenities—either amenities generated on the property itself, from neighboring properties that also are regulated, or both. These studies tried to measure the net effect of these regulations. Overall, the studies found that land-use regulations have significant effects on property values. In many cases, the net effects are positive. In other instances, there are no effects or negative effects.

The studies in subsection I.B. examined how property values are affected by amenities and disamenities generated on neighboring properties. We focused our review on studies that evaluated amenities typically created or preserved by land-use regulations—farmland, open space, and wetlands. The studies in I.B. measured the benefits (or costs) of regulations that spill over to neighboring properties, but do not measure costs imposed on regulated properties. In the large majority of cases, these studies indicated positive effects of land-use regulations on neighboring properties.

Studies in Section II examined how agricultural rents and land values are affected by farm subsidies. As expected, studies have found that subsidies raise rents and land values, although the effects vary by crop and region. As well, there is evidence that government payments are not fully reflected in land rents, possibly because they induce changes in farm practices that in the aggregate affect input and output prices.

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[18] Runge, C.F., M.T. Duclos, J.S. Adams, B. Goodwin, J.A. Martin, and R.D. Squires. 1996. Government Actions Affecting Land and Property Values: An Empirical Review of Takings and Givings. Cambridge, MA: Lincoln Institute of Land Policy, Research Paper.

A number of studies, reviewed in Section III, examined the effects of use-value assessment on property values. Under use-value assessment, property tax assessment for farmland is based on the value of land in its current agricultural use, rather than on the land's market value, which may be considerably greater if more profitable future development opportunities exist. Several studies found evidence that the tax advantages of use-value assessment are reflected in property values. Others found that, while in theory use-value assessment should delay development of farmland, the empirical evidence for this effect is mixed. Overall, the studies concluded that the incentives provided by use-value assessment are insufficient to prevent the development of farmland.

In the final section of this appendix, we review several other studies that examined the determinants of property values but did not directly consider effects of regulations, subsidies, or use-value assessment. One study considered how farmland values are affected by the residential housing market. Two others examined effects of property taxes and fiscal policies on property values.

Property prices and the hedonic price method

To make this review more accessible to noneconomists, we offer the following discussion of the theoretical basis for property prices and the hedonic price method, which is applied in the majority of studies reviewed. In a competitive market, the price of property equals the present discounted value of the stream of rents generated by the property and captured by its owner. The rent on a property equals the revenues generated by the property over a given period of time (e.g., 1 year) minus costs. The costs include out-of-pocket expenses and opportunity costs (e.g., the market value of the owner's labor).

As an example, suppose an agricultural parcel can generate $10,000 in rent each year. If this annual rent is expected in perpetuity and money can be invested in an alternative asset at 5 percent, then the parcel would sell in a competitive market for $200,000 ($10,000 ÷ 0.05). Two hundred thousand dollars is the present discounted value of a perpetual stream of $10,000 annual payments when the alternative rate of return is 5 percent. Economists would say that the rent stream is "capitalized" into the price of the parcel.

More generally, the rent generated by property can be thought of as the net benefit that accrues to the owner of the property. That is, the property may provide monetary returns, such as $10,000 in rent, as well as nonmonetary benefits. Nonmonetary benefits may include amenities produced on the property as well as on neighboring properties. These benefits will also be capitalized into property prices in a competitive market provided they can be captured by the property owner. For example, the price of a residential property adjacent to open space will reflect the advantage to the owner of the associated amenities, such as a view or the absence of neighbors.

The hedonic price method is a statistical technique used to decompose prices of property (and other goods) into the implicit values assigned to each characteristic of the property. The method often is applied to housing prices. One can think of a house as a bundle of attributes—a certain amount of living space, a certain number of bedrooms

and bathrooms, and so on. The attributes may also include nonmonetary goods such as proximity to open space.

To understand the essence of the hedonic price method, consider two houses that are identical in all respects except that the first house is closer to a park than the second. Assuming that proximity to parks is an amenity, the first house should sell for more than the second and the difference in their prices should exactly equal the market value of being closer to the park. The hedonic price method involves regression analysis applied to data on a large number of properties to determine the price of each attribute. In the above example, this would be the price one would have to pay in a competitive market to be one unit of distance closer to the park (holding all other housing attributes constant). In a similar fashion, the method can be used to identify the effects of land-use regulations and other policies on property prices.

Table C-1.

Recent economic studies of the effects of land-use regulations, agricultural subsidy programs, and use-value assessment on private property values

I. The effects of land-use regulations on private property values

I.A. Net effects of land-use regulations on property values

The Effect of Farmland Preservation Programs on Farmland Prices. Nickerson, Cynthia J. and Lori Lynch. American Journal of Agricultural Economics, May 2001, 83(2): 341–351.

An Analysis of Minimum Frontage Zoning to Preserve Lakefront Amenities. Spalatro, Fiorenza and Bill Provencher. Land Economics, November 2001, 77(4): 469–481.

Implicit Prices of Wetland Easements in Areas of Production Agriculture. Shultz, Steven D. and Steven J. Taff. Land Economics, November 2004, 80(4): 501–512 .

Capitalization of Exclusive Agricultural Zoning into Farmland Prices. Henneberry, David M. and Richard L. Barrows. Land Economics, August 1990, 66(3): 249–258.

Housing Prices, Externalities, and Regulation in U.S. Metropolitan Areas. Malpezzi, Stephen. Journal of Housing Research, 1996, 7(2): 209–241.

The Effect of Environmental Zoning and Amenities on Property Values: Portland, Oregon. Netusil, Noelwah R. Land Economics, May 2005, 81(2): 227–246(20).

Growth Management and Housing Prices: The Case of Portland, Oregon. Phillips, Justin and Eban Goodstein. Contemporary Economic Policy, July 2000, 18(3): 334–344.

Neighborhood Composition and Residential Land Prices: Does Exclusion Raise or Lower Values? Cervero, Robert and Michael Duncan. Urban Studies, Special Issue, February 2004, 41(2): 299–315.

Could Zoning Have Increased Land Values in Chicago? McMillen, Daniel P. and John F. McDonald. Journal of Urban Economics, 1993, 33: 197–188.

Land Values in a Newly Zoned City. McMillen, Daniel P. and John F. McDonald. The Review of Economics and Statistics, February 2002, 84(1): 62–72.

Growth Controls and Land Values in an Open City. Brueckner, Jan K. Land Economics, 1990, 66(3): 237–248.

I.B. Positive effects of land-use regulations on neighboring properties

The Amenity and Disamenity Impacts of Agriculture: Estimates from a Hedonic Pricing Model. Ready, Richard C. and Charles W. Abdalla. American Journal of Agricultural Economics, May 2005, 87(2): 214–326.

Measuring Benefits from Farmland: Hedonic Pricing vs. Contingent Valuation. Ready, R.C., M.C. Berger, and G. Blomquist. Growth and Change, Fall 1997, 28: 438–58.

Environmental Amenities and Agricultural Land Values: A Hedonic Model Using Geographic Information Systems Data. Bastian, Chris T., et al. Ecological Economics, March 2002, 40(3): 337–349.

The Problem of Identifying Land Use Spillovers: Measuring the Effects of Open Space on Residential Property Values. Irwin, Elena G. and Nancy E. Bockstael. American Journal of Agricultural Economics, August 2001, 83: 698–704.

Capitalization of Open Spaces into Housing Values and the Residential Property Tax Revenue Impacts of Agricultural Easement Programs. Geoghegan, Jacqueline. Agricultural and Resource Economics Review, April 2003, 32(1): 33–45.

Treating Open Spaces as an Urban Amenity. Smith, V.K., C. Poulus, and H. Kim, 2002, Resource and Energy Economics, 24(1/2): 107–129.

Using Contingent-Pricing Analysis to Value Open Space and Its Duration at Residential Locations. Earnhart, Dietrich. Land Economics, February 2006, 82(1): 17–35.

Combining Revealed and Stated Preference Methods to Value Environmental Amenities at Residential Locations. Earnhart, Dietrich. Land Economics, February 2001, 77: 12–30.

Valuing Open Space and Land-Use Patterns in Urban Watersheds. Acharya, G. and L.L. Bennett. Journal of Real Estate Finance and Economics, 2001, 22(2/3): 221–238.

The Value of a Suburban Forest Preserve: Estimates from Sales of Vacant Residential Building Lots. Thorsnes, Paul. Land Economics, August 2002, 78(3): 426–441.

The Influence of Wetland Type and Wetland Proximity on Residential Property Values. Doss, Cheryl R. and Steven J. Taff. Journal of Agricultural and Resource Economics, July 1996, 21(1): 120–129.

Valuing Urban Wetlands: A Property Price Approach. Mahan, Brent L., Stephen Polasky, and Richard M. Adams. Land Economics, February 2000, 76(1): 100–113.

II. The effects of agricultural subsidies on private property values

The Impacts of Different Farm Programs on Cash Rents. Lence, Sergio H. and Ashok K. Mishra. American Journal of Agricultural Economics, August 2003, 85(3): 753–761.

The Incidence of Government Program Payments on Agricultural Land Rents: The Challenges of Identification. Roberts, Michael J., Barrett Kirwan, and Jefferey Hopkins. American Journal of Agricultural Economics, August 2003, 85(3): 762–769.

Noncash Income Transfers and Agricultural Land Values. Taylor, Mykel R. and Gary W. Brester. Review of Agricultural Economics, Winter 2005, 27(4): 526–541.

The Effect of Agricultural Policy on Farmland Values. Weersink, Alfond, Steve Clark, Calum G. Turvey, and Rakhal Sarker. Land Economics, August 1999, 75(3): 425–439.

Evidence of Capitalization of Direct Government Payments into U.S. Cropland Values. Barnard, C.H., G. Whittaker, D. Westernbarger, and M. Ahearn. American Journal of Agricultural Economics, 1997, 79(5): 1642–1650.

III. The effects of use-value assessment on private property values

Agricultural Property Tax Relief: Tax Credits, Tax Rates, and Land Values. Anderson, John E. and Howard C. Bunch. Land Economics, February 1989, 65(1): 13–22.

Effectiveness of Use-Value Assessment in Preserving Farmland: A Search-Theoretic Approach. Tavernier, Edmund M. and Farong Li. Journal of Agricultural and Applied Economics, December 1995, 27(2): 626–635.

Land Taxes in Agriculture: Preferential Rate and Assessment Effects. Wunderlich, Gene. American Journal of Economics and Sociology, April 1997, 56(2): 215–228.

Use-Value Property Tax Assessment: Effects on Land Development. Anderson, John E. Land Economics, August 1993, 69(3): 263–269.

Use-Value Assessment Tax Expenditures in Urban Areas. Anderson, John E., and Marlon F. Griffing. Journal of Urban Economics, 2002, 48:443–452.

Evaluating the Effectiveness of Use-Value Programs. Ferguson, Jerry T. Property Tax Journal, June 1988, l: 157–164.

Development Rights and the Differential Assessment of Agricultural Land: Fractional Valuation of Farmland Is Ineffective for Preserving Open Space and Subsidizes Speculation. Blewett, Robert A. and Julia I. Lane. American Journal of Economics and Sociology, 1988, 17(2): 197–205.

The Effect of Farm Property Tax Relief Programs on Farm Financial Conditions. Chicoine, David L., Steven T. Sonka, and Robert D. Doty. Land Economics, November 1982, 58(4): 516–523.

IV. Other studies

The Joint Influence of Agricultural and Non-farm Factors on Real Estate Values: An Application to the Mid-Atlantic Region. Hardie, I.W., T.A. Narayan, and B.L. Gardner. American Journal of Agricultural Economics, 2001, 83: 120–132.

New Evidence on Property Tax Capitalization. Palmon, Oded and Barton A. Smith. Journal of Political Economy, October 1998, 106(5): 1099–1111.

Property Tax Limits, Local Fiscal Behavior, and Property Values: Evidence from Massachusetts under Proposition 2½. Bradbury, Katharine L., Christopher J. Mayer, and Karl E. Case. Journal of Public Economics, 2001, 80: 287–311.

I. The effects of land-use regulations on private property values

I.A. Net effects of land-use regulations on property values

The Effect of Farmland Preservation Programs on Farmland Prices
Nickerson, Cynthia J. and Lori Lynch. American Journal of Agricultural Economics, May 2001, 83(2): 341–351

This study tests how the price of a farmland parcel is affected when a permanent easement is applied to the property. The study focuses on the voluntary farmland preservation program in Maryland, which involves the purchase of development rights on agricultural land. The objective of the study is to determine how easements affect property values.

The authors present a standard theoretical argument that easements should reduce farmland prices. The price of farmland, or any asset, in a competitive market equals the present discounted value of the stream of rents accruing to the asset. A profit-maximizing owner will always choose the highest possible rent stream. In the case of farmland, the owner will keep the land in its current agricultural use until the time when development becomes more profitable. Thus, the farmland price will reflect near-term rents from agriculture and future rents from development. Since these future development rents exceed future agricultural rents (by construction), it follows that an easement prohibiting future development must reduce the parcel's price.

The authors examine a data set on sales of 224 farmland parcels, 24 of which have permanent easements. These parcels were sold between 1994 and 1997 and are found in three Maryland counties (Calvert, Carroll, Howard). Summary statistics reveal that the price per acre for preserved parcels is $3,761, on average, and $8,998, on average, for unpreserved parcels. These prices are adjusted by net of the assessed value of structures (e.g., a house) on the property. The authors estimate a hedonic equation that controls for size, soil quality, distance to cities, and other factors. The authors also control for selection bias—namely, there may be a systematic tendency for some parcels to be enrolled in the voluntary easement program. Despite the large difference in the mean values reported above, the authors find no significant effects of preservation status on sales prices in the basic model. With an alternative specification that includes the interaction among preservation status and other explanatory variables, some coefficients are significantly different from zero. However, the authors test and fail to reject the hypothesis that all of these coefficients are jointly equal to zero.

The authors offer two explanations for the lack of a significant effect of easements on farmland prices. First, they suggest that buyers may not expect the preservation program to last forever, implying that development will be permitted at some future time. Second, some buyers may not be primarily interested in the rent stream from agriculture, but rather value the opportunity to own a farm near an urban area.

The significance of this study is that it suggests that development restrictions may not reduce farmland prices if buyers place sufficiently high value on farmland amenities. It is likely that the enjoyment of these amenities will be greater if the owner is also allowed to live on the property. This study does not control for the presence or absence of a house.

An Analysis of Minimum Frontage Zoning to Preserve Lakefront Amenities
Spalatro, Fiorenza and Bill Provencher. Land Economics, November 2001, 77(4): 469–481

This paper analyzes two competing effects from minimum frontage zoning. If lakefront owners prefer low-density development, then minimum frontage zoning will increase the associated amenities for existing residents. On the other hand, if lakefront development is relatively insensitive to frontage, minimum frontage zoning will restrict the subdivision of property, limiting potentially valuable development opportunities. A theoretical model is presented, and data from Wisconsin lakes are used to estimate these competing effects.

The theoretical model demonstrates the development and amenities effects of minimum frontage zoning. First, assuming no amenity effects and no zoning, the authors argue that the price per unit of lakefront rises initially as frontage increases (when frontage is very small, an additional unit of frontage is highly valued) and then falls for high frontage values, as the marginal value of frontage decreases. When zoning is introduced (with no amenity effects), the price schedule is shifted down relative to the no-zoning case. This effect is caused by the restriction on division of properties. The price schedule with zoning is discontinuous, with price jumps at points where subdivision of the property becomes possible (e.g., at 200 feet of frontage with 100-foot minimum frontage zoning). Zoning, however, creates amenities that shift up the price schedule. Which of these effects dominates is tested empirically.

The empirical model used arms-length property sales data from Vilas County and several adjacent towns in Oneida County, Wisconsin, from 1986 to 1995. All observations in the data set are of undeveloped properties. The unit price of frontage is specified as a function of the amount of frontage, property size, current state of development, location, and regulation. The model assumes 200-foot minimum frontage zoning on all properties. As such, dummy variables for properties with frontage greater than 200 feet or 400 feet are included to capture jumps in the price function.

The model was estimated separately with data for each year, and the average of the results is presented. In most years, frontage has a positive and significant effect on property values. It is found that owners prefer properties near public rather than private lakeshore. Lakeshore in small tracts generally is preferred to lakeshore in large tracts when there is no 200-foot rule. This result is surprising, as owners are expected to place value on the absence of development around them. The authors suspect that this result may be due to omitted variable bias. A lake may be heavily developed because of features not captured by the model. As expected, the authors find a price jump at 400 feet when a 200-foot rule is imposed. As well, both negative development effects and positive amenity effects of minimum frontage zoning are confirmed for properties with lakefront between 200 feet and 400 feet. On average, the model predicted prices under the 200-foot rule to be 21.5 percent greater than the observed price under less stringent state frontage standards.

This study examines the competing development and amenity effects of zoning in a relatively simple setting. It finds evidence that positive amenity effects outweigh losses from restrictions on development.

Implicit Prices of Wetland Easements in Areas of Production Agriculture
Shultz, Steven D. and Steven J.Taff. Land Economics, November 2004, 80(4): 501–512

This study investigates the effect of wetland easements on agricultural land values in North Dakota. The implicit prices of wetlands and wetland easements have proved difficult to quantify in previous hedonic studies in North Dakota and other areas with production agriculture. The authors suggest that problems with the data may be the obstacle.

This research presents a hedonic model of agricultural land prices. It uses data on 236 agricultural land sales between 1995 and 2002 in North Dakota, as well as data on site-specific land use, soil productivity, and hydrologic condition data. Three counties in North Dakota are represented that contain some of the highest concentrations of wetlands and waterfowl breeding habitat in the United States. Gross revenue was used as an indicator of the parcel's productivity and is expected to have a positive effect on the sale price. The option value for future nonagricultural development was not considered because the probability of such conversion is extremely low. The parcels were distinguished by the presence or absence of wetlands easements and whether the wetlands are permanent or temporary (a temporary wetland is dry part of the year). (Note that parcels with wetlands also have land used for agricultural production). Wetlands and easements are expected to have a negative effect on price. The authors also estimate two alternative models: one that does not distinguish between wetlands with and without easements and one that does not distinguish between permanent and temporary wetlands.

The results show that permanent wetlands (with and without easements) have negative and statistically significant effects on price. Permanent wetland acreage is worth 60 percent of the value of agricultural land in the same area. Easements reduce the agricultural land value by 39 percent. This effect is much smaller than the results from previous studies suggest (60 percent). However, temporary wetlands, with or without easements, have a positive, though statistically insignificant, effect on prices. To explain these results, the authors suggest that temporary wetlands may still be suitable for agricultural production and not visible during the dry season. As well, they point out that sellers are not legally required to disclose to the buyer the existence of an easement applied on the parcel. This may explain the insignificant effect of easements in the case of temporary wetlands.

The key finding in this study is that wetlands easements reduce agricultural land values when the wetlands are permanent but not when they are temporary. A potential weakness of the study is that it does not account for the proportion of a land parcel occupied by wetlands, which is surely an important factor affecting price.

Capitalization of Exclusive Agricultural Zoning into Farmland Prices
Henneberry, David M. and Richard L. Barrows. Land Economics, August 1990, 66(3): 249–258

Previous studies on agricultural zoning suggest that zoning decreases land values due to the loss of development opportunities. The authors argue that whether zoning has a positive or a negative effect should depend on the characteristics of parcels. Four

price effects of zoning are identified: (1) development—zoning may reduce land values by restricting development opportunities; (2) externality—zoning may increase land values by limiting negative externalities from farm operators from nearby nonagricultural land; (3) neighborhood certainty—zoning may ensure that future land-use patterns are compatible with agricultural production, thereby raising land values if farm operators tend to be risk averse; and (4) tax—the effects of zoning on property taxes is unclear since it depends on how land values are affected. This paper seeks to identify which of these effects dominates.

For a hedonic price analysis, the records of 140 farmland parcels sold in either 1980 or 1981 in Rock County, Wisconsin are chosen. Twenty of the parcels were developed after the transactions. These parcels are used in a discriminant analysis to identify which of the remaining 120 parcels have high development potential. Hedonic price models are then estimated with observations of 89 parcels with high agricultural potential, among which 60 are zoned and 29 are nonzoned. The independent variables include the productivity of the land, accessibility, and neighborhood characteristics.

The results indicate that the net price effect of zoning depends on the zoning classification, parcel size, and distance to the urban area, taken together. To illustrate this point, the authors report that a 100-acre parcel 11 miles from the nearest city would sell for $25.62 more per acre as zoned land than as nonzoned land. A 160-acre parcel 9 miles from the nearest city would sell for $43.44 more per acre as zoned land. And, when a parcel is 260 acres and 5 miles away from the nearest city, the value of a zoned parcel is $6.88 per acre more than a nonzoned. Alternatively, a 40-acre parcel located 6 miles from the nearest city would sell for $687 more per acre if not zoned for agricultural use.

This study attempts to identify different effects of agricultural zoning. It reveals that, depending on the characteristics of parcels, the net effects of zoning may be positive. This effect was found, in particular, for large farmland parcels somewhat removed from urban areas.

Housing Prices, Externalities, and Regulation in U.S. Metropolitan Areas
Malpezzi, Stephen. Journal of Housing Research, 1996, 7(2): 209–241

In this study, the authors attempt to measure the costs and benefits of housing market regulations. Several questions are investigated: (1) Does more stringent regulation raise housing prices? (2) Are more stringent regulations associated with lower external costs or higher benefits? (3) Do some cities have excessively stringent regulations?

In a simple demand and supply framework, the author shows that regulations are expected to raise housing prices because they restrict the number of housing units in order to diminish associated externalities. Using Population Census data on a large cross-section of cities, an empirical investigation is conducted to measure these effects on housing and rental prices. As well, the effects of regulations on tenure choice (own v. rent), commuting times, segregation, and neighborhood quality are also estimated.

The equilibrium prices of rental or owner-occupied housing are specified as functions of income, demographic characteristics, topographical characteristics, and regulations. Prices are measured as median house values and contract rents in each city, reported in the 1990 Census. The regulations include measures of rent controls, land-use restrictions

and zoning, infrastructure policies, and building and subdivision codes. The author argues that since the model controls for inter-city differences in demand (e.g., with the income variable), the regulations variables should measure supply-side effects on prices. In the other models, the dependent variables (tenure choice, commuting time, segregation, and neighborhood quality) are specified as functions of rental price, housing price, income, demographic and topographic characteristics, and regulations.

In the rental price model, population change and the level and change in income have significant effects. None of the regulations variables is significant. In the housing price model, income growth has a positive and significant effect. As well, regulations are found to raise house prices in two of three cases. An index of state regulations and a rent control dummy variable have positive and significant effects, while a second regulatory index has a negative and significant effect. Heavily regulated cities were found to have less home ownership. Regulations were not found to significantly affect segregation or neighborhood quality. Finally, state regulations were found to shorten commuting times, although the effects were small.

This paper examines effects of regulations on housing and rental prices as well as potential benefits of regulations. The key finding is that regulations tend to increase housing price and lower home ownership rates, while having small or no effects on commuting times, neighborhood quality, and segregation. The major challenge with studies of this type is that they involve highly aggregated data. As a result, it is difficult to explain the variation in the cross-section and to interpret the results.

The Effect of Environmental Zoning and Amenities on Property Values: Portland, Oregon
Netusil, Noelwah R. Land Economics, May 2005, 81(2): 227–246

The author examines the effects of environmental zoning on housing prices in Portland, Oregon. There are two levels of environmental zoning in Portland: environmental protection zoning (p-zone) and environmental conservation zoning (c-zone). P-zone allows current structures and development to be maintained but prohibits increasing the footprint of a house, adding decks, or changing vegetation. C-zone is less stringent, as it allows development if alternatives have been considered. The effect of either type of zoning on housing prices is uncertain since environmental zoning both limits development opportunities and increases environmental amenities.

In a hedonic model, the sale price of a property is specified as a function of structural, neighborhood, environmental, and regulatory attributes. This study uses the arms-length transactions prices of single-family residential properties sold between 1999 and 2001 in Multnomah County. Undeveloped parcels are not included. The study area is divided into quadrants by location. Two ways of entering the zoning variables are considered. One model includes interaction variables to reflect the environmental zoning effects, including combined effects of p-zone and c-zone, in each quadrant. The other replaces environmental zoning dummy variables with variables that interact lot size with environmental zoning in each quadrant and variables that capture the effect of environmental zoning on oversized lots.

For the first model, p-zone has a negative effect in the northwest quadrant and a positive effect in the northeast, but has no statistically significant effects in other quadrants. A combination of p-zone and c-zone has significant and positive effects in the northeast and southeast. C-zone has statistically significant and positive effects in the north and negative effects in the southwest. The results also show that only in the southeast are sale prices affected by the amount of property with an environmental zone, and that environmental zoning effects are not equal across quadrants. More tree canopy has a positive effect on house prices, and other neighborhood amenities (golf courses, trails, etc.) have statistically significant effects on sale prices. For the second model, it was found that increasing lot size increases housing prices more if there is environmental zoning.

This is a very detailed hedonic study of the effects of zoning in the Portland metropolitan area. The significance of the study is that it measures the net effects of regulations—both the negative effect from restricting development and the positive effect from generating neighborhood amenities. It finds that the net effect can be positive or negative.

Growth Management and Housing Prices: The Case of Portland, Oregon
Phillips, Justin and Eban Goodstein. Contemporary Economic Policy, July 2000, 18(3): 334–344

This paper investigates the impact of Portland, Oregon's, urban growth boundary (UGB) on housing affordability. In theory, since the UGB constrains the amount of land available for urban growth and, thus, promotes infill development, it raises land prices and population density. However, its effect on housing prices is ambiguous. Higher land prices induce housing developers to substitute capital for land, which mitigates increases in the price of housing. Based on data from the 1990s and earlier studies of the Portland housing market, the authors conclude that the UGB has increased land prices and housing densities. The effect on house prices, however, is less clear. Although data show that the median housing price in Portland increased by 69 percent from 1991 to 1996, the price level in 1996 was still lower than that in similarly sized western cities. This study examines whether rising house prices are due to the UGB or a growing regional and national economy.

A hedonic model is estimated with data on 1996 median housing prices in Portland and 36 other major western cities. The authors control for factors affecting housing demand and supply, including population, income, climate, construction costs, and the rate of recent price appreciation as a proxy for speculation. To measure the effects of regulations, the authors include a variable for the number of municipalities within the city, with the expectation that more municipalities imply less stringent regulations. The argument is that when there are many municipalities, each will assume it cannot influence the price of land and, therefore, will not restrict development in order to convey rents to current owners of land. The authors also include the regulation index developed by Malpezzi (1996). The index is measured in 1990, before the time period in this study. To reflect strong effects from the UGB, the authors increase Portland's value of the index

from its 1990 value of 19 to the highest possible value of 30, while keeping the index for other cities unchanged.

Two versions of the model were estimated—one included a variable for speculative effects and one omitted this variable. In the two models, median income and construction costs have positive and significant effects on housing prices. In the model without a speculative effect, regulations are found to have a positive and significant effect on prices. To simulate the effects of removing the UGB, the authors lower the regulation index for Portland from 30 to its original value of 19. The predicted median housing price falls between $15,246 and $21,503 depending on the version of the model used. The implication is that the UGB has increased housing prices by between 10 and 15 percent, which the authors view as a relatively small change.

This paper tries to measure the effects of Portland's UGB on housing prices using a cross-sectional data set of western cities. The UGB is crudely represented in the hedonic model. As well, the analysis does not account for the fact that if the UGB encourages the substitution of capital for land, the median house in Portland may be a very different commodity compared to median houses in other western cities.

Neighborhood Composition and Residential Land Prices: Does Exclusion Raise or Lower Values?
Cervero, Robert and Michael Duncan. Urban Studies, Special Issue, February 2004 41(2): 299–315

This paper argues that zoning and fiscal policies have led to exclusion in urban land markets. The authors use land-use and racial composition as outcome proxies for local zoning policies and test their effects on residential land values in a hedonic regression.

The study area is Santa Clara County, California. The county has a lack of affordable housing, a long average commute time, and low-density development. The authors obtain property sales data for in 1999 and impute unit land prices associated with single-family and multifamily residential parcels. In the hedonic price model, explanatory variables are included for neighborhood land-use characteristics reflecting zoning outcomes; neighborhood sociodemographic characteristics, which are partly a product of zoning; accessibility; and municipality and time effects. The neighborhood and household characteristics might be endogenous, and instrumental variable regression was used to address this problem.

Measures of neighborhood land-use attributes are included to proxy for zoning policies. The land-use mix is measured with an index based on shares of land in different activities within a 1-mile buffer around the parcel. These activities include single-family housing, multifamily housing, retail, services, and so forth. Additional measures are included for retail and single-family residential uses and for the jobs–housing balance. Neighborhood sociodemographic attributes are assumed to proxy in part for zoning policy outcomes. Variables are included for racial mix and income in the neighborhood surrounding a parcel.

Most of the coefficient estimates are statistically significant and consistent with expectations. The results indicate that the land-use mix and the jobs–housing balance have significant effects on land values. A single-family house in a neighborhood with

the greatest diversity of land uses sells for $8.70 more per square foot than a house in a single-use neighborhood. In contrast, a single-family house in a neighborhood with the greatest racial diversity sells for $5.14 less per square foot than a house in a racially uniform neighborhood.

This paper examines how land-use and racial attributes of neighborhoods, taken to be indicators of zoning policies, influence land values. The authors find evidence that land-use and racial diversity have significant effects on land prices.

Could Zoning Have Increased Land Values in Chicago?
McMillen, Daniel P. and John F. McDonald. Journal of Urban Economics, 1993, 33: 197–188

This paper examines the effects of zoning on land values in 1920s Chicago. At the time, Chicago's Zoning Commission claimed that zoning would improve welfare by separating incompatible land uses. This paper derives a necessary condition for zoning (of the type used in Chicago) to increase land values and then conducts an empirical analysis to find whether this condition was satisfied. The authors find that it was not satisfied and conclude that zoning—of the type practiced in 1923—could not have increased land values.

The theoretical model assumes that there are two types of land use: residential and nonresidential. Due to high commuting costs, nonresidential land (including work and commercial locations) may have positive effects on nearby housing prices. It may also generate negative externalities due to incompatible uses. Nonresidential values may be similarly affected by proximity to residential uses. The objective for the social planner is to maximize the value of land by choosing the proportions of a street block to put into residential and nonresidential uses. The authors also solve for the competitive market solution and show that it may not correspond to the social optimum if private owners ignore externalities. They then ask whether block-level zoning, under which a block could be entirely assigned to residential use (the type of zoning used in Chicago) could increase land values relative to the competitive solution. They show that for block-level zoning to increase land values, the residential land value when all land on a block is residential must be higher than the existing land value.

To test whether this condition is satisfied, the authors assemble data for 1921, prior to the enactment of zoning. They regress the log of front-foot land value for each land use (residential, nonresidential) on explanatory variables (distance to the central business district (CBD), transportation access, etc.) and the proportion of residential land in a block. The authors control for a selection problem arising from the relatively higher value of land for residential uses and for the endogeneity of the proportion of residential land in a block.

The results indicates that increasing the proportion of residential land in a block does not affect residential land values on the south side of Chicago. As well, on the north side, there is a premium associated with being the first resident of a block. Neither of these results are consistent with the condition that converting a block entirely to residential use results in higher land values than those of nonresidential or mixed uses.

The main implication of these results is that the type of zoning used in Chicago in 1923—block-zoning, which the authors refer to as a "blunt instrument"—could not have increased land values. However, this does not imply that the land-use patterns generated by the competitive market were optimal. Moreover, they suggest that mixed uses were preferred—in particular, the disamenities of living near businesses were outweighed by access to employment and shopping.

Land Values in a Newly Zoned City
McMillen, Daniel P. and John F. McDonald. The Review of Economics and Statistics, February 2002, 84(1): 62–72

This paper examines the impact of zoning on land prices. The introduction of zoning in Chicago in 1923 offers a natural experiment to identify how zoning affects the relative growth rates in values for residential and commercial land.

The experiment is described by the authors as follows:

> Suppose we were to observe a sample of otherwise identical parcels of land, all of which are initially unzoned. A new ordinance is adopted under which some parcels are zoned residential and others are zoned commercial. If we know land values before and after the new ordinance, then the difference in the land-value growth rate between residential and commercial parcels provides a clean measure of residential zoning's effect relative to commercial zoning. Of course, if no parcels remain unzoned, we cannot determine whether growth rates are higher overall after the zoning ordinance than would have purveyed under the new law. But if the zoning ordinance is necessary to eliminate unwanted intrusions of commercial land into residential areas, we should find that land-value growth rates are relatively high in areas that are zoned exclusively residential.

The authors use data on land values in Chicago in 1921 (before zoning) and 1924 (after zoning), along with information on initial land use, zoning, and accessibility. The authors control for selection bias—in particular, the possibility that blocks with high land-value growth rates are more likely to be zoned residential—and then compared changes in land values across zoning classifications.

The results indicate that residential zoning increased relative land values (residential minus commercial land-value growth rates) by 19.5 percent. As well, residential zoning increased relative land values by 18.4 percent in mixed-use blocks and 47.7 percent in commercial blocks. In sum, residential zoning led to higher land values than did commercial zoning.

The authors find that the Chicago zoning policy raised the growth rate of relative land values. However, since the authors cannot observe the 1924 land value without zoning, changes in the price level attributable to zoning cannot be estimated.

Growth Controls and Land Values in an Open City
Brueckner, Jan K. Land Economics, 1990, 66(3): 237–248

Previous studies have found that growth control raises housing prices in the communities where they are imposed and lowers the value of undeveloped land near the city. This paper develops a formal dynamic model based on the framework of Capozza and Helsley (1989) to illustrate the effects of urban growth control.

The author effectively summarizes the analysis and key results in the introduction to the paper:

> Building on the framework of Capozza and Helsley (1989), the model focuses on the land development decision (conversion from rural to urban use) of a landowner operating with perfect foresight in a dynamic open-city environment. The time path of urban land rents in the model in part reflects the presence of a negative population externality (a large population lowers the city's quality of life and reduces the rent that urban land commands). After deriving the optimal date of rural–urban conversion (the date that maximizes land value), the analysis considers the effect of an unanticipated growth control regulation, which delays conversion at each location. The model's population externality is, of course, the key factor in the analysis. Given the externality, a slowing of population growth due to the control raises land's rent in urban use at every date and location as consumers pay a premium to live in a smaller city. For land that is already developed, imposition of the control raises all future rents and therefore increases the value of the land. This corresponds to the amenity effect of growth controls that has been identified in the literature.

The control's impact on the value of undeveloped land is, however, not as straightforward as the literature would suggest. The impact is the net effect of two changes: first, the control delays the date at which urban rents can be earned, which lowers value; second, the control raises urban rents by lowering the city's population growth path, which raises value. Since the second of these effects may dominate, growth controls can raise the value of undeveloped land in some locations, in contrast to the literature's implicit assumption to the contrary. The analysis attempts to pinpoint the locations of undeveloped land that benefit from the imposition of a control.

The key finding is that growth controls may raise the value of undeveloped land by reducing the population externality and, thereby, raising future development rents which are capitalized into the value. The paper also considers efficient growth controls and concludes that mild controls are likely to raise total land values, but stringent ones may reduce total land values relative to the unregulated case.

I.B. Positive effects of land-use regulations on neighboring properties

The Amenity and Disamenity Impacts of Agriculture: Estimates from a Hedonic Pricing Model

Ready, Richard C. and Charles W. Abdalla. American Journal of Agricultural Economics, May 2005, 87(2): 214–326.

This paper examines the effect of local amenities and disamenities of agricultural land. Agricultural land provides positive amenities in the form of open space, but may also generate negative effects, especially if associated with animal operations. Because intensive animal production tends to be associated with large farms, hedonic studies need to account for positive and negative impacts of agricultural land to avoid biased results. This model also controls for the effects of zoning on house prices.

The study uses data on single-family home sales in Berks County, Pennsylvania, between 1998 and 2000. Housing prices are assumed to be related to housing structural characteristics, zoning, and neighborhood features. The zoning variables indicate whether the parcel is zoned for residential, agriculture, commercial/industrial, multiple use/village, or conservation. Measures of surrounding land uses are included. These include the acres of different types of open space and residential land within 400 meters of the house and between 400 and 1,600 meters from the house. Disamenity effects are captured by measures of proximity to animal production, mushroom production, landfills, sewage treatment plants, roads, and airports. The proximity measures were constructed in a way that allows the disamenity to decrease with distance to the house. Other measures were developed to test whether the disamenity effects from agriculture vary with the scale of the operation, the species housed in the facility, and whether the farm has a detailed conservation management plan.

Most of the estimated coefficients for housing and location characteristics are significantly different from zero and have signs consistent with expectations. Publicly owned forested open space has the highest amenity effect of all land uses within 400 meters. Between 400 and 1,600 meters, large-lot residential properties and commercial sites have the highest positive impact on house prices. Open space with easements provides a positive amenity to the neighborhood; however, its effect is smaller than that of open space without easements. All of the local disamenities have negative effects on house prices, with the exception of sewage treatment plants. High-traffic roads are found to have the smallest negative impact, perhaps because accessibility provided by the road partially offsets its disamenity. Animal production operations have negative and statistically significant effects on house prices. For instance, the value of a residential house declines by 5.8 percent when a poultry operation is located within 800 meters. Among the zoning variables, only the coefficient on multiple use/village is significantly different from zero. The result indicates that houses with this zoning have higher prices than land zoned for residential. Other types of zoning do not produce significant price differences.

This paper uses a very detailed data set to quantify the effects of surrounding land uses on housing prices, and demonstrates that effects can be positive or negative. It also quantifies effects of zoning on housing values.

Measuring Benefits from Farmland: Hedonic Pricing vs. Contingent Valuation
Ready, R.C., M.C. Berger, and G. Blomquist. Growth and Change, Fall 1997, 28: 438–458

This study investigates the amenity effect of farmland. Farmland may provide use values for nonfarm residents, such as scenic views, wildlife habitat, and outdoor recreation, as well as nonuse existence values from knowing that farm families can continue in their chosen profession. The existence value cannot be estimated by the hedonic price method but can be measured using stated preference techniques. This paper uses both contingent valuation and hedonic analysis to evaluate amenity value of horse farms for Kentucky residents.

In the theoretical model, the authors assume that households maximize their utility by choosing housing location and firms minimize costs by choosing a location for their business. Individuals and firms are free to move across markets. Household utility is a function of wage, housing price, and amenities. A firm's cost is affected by wage, population, and amenities. Equilibrium is achieved when no individual or firm wants to move. By jointly solving the utility function and the cost function, the implicit price of farmland amenities can be expressed as a function of population, the marginal effect of farmland amenity on equilibrium rent, and the marginal effect of farmland amenity on equilibrium wage.

For the hedonic model, household-level data were obtained from the 1980 Population Census for more than 253 counties in Kentucky. Hedonic housing and wage equations were estimated separately and were used to calculate the implicit prices of amenities related to horse farms. The housing equation includes variables measuring reported house values, structural and location features, climate conditions, and amenity levels. The wage equation includes variables measuring reported income, household characteristics, climate conditions, and amenity levels. Most estimates in the two equations are statistically significant. The result suggests that people would be willing to accept a lower wage, but not pay a higher housing price, to have horse farms in their county. The estimated implicit price of one horse farm for the average Kentucky resident is $0.43.

The contingent valuation survey, conducted in Kentucky, was designed to ask nonfarm dwellers whether they would accept a government program with different levels of funding to support horse farms. Under the program, money paid to farm owners would come from gamblers at racetracks instead of from households directly. The dependent variable is willingness to pay (WTP) for the program. The independent variables include the number of farms lost without the program in the county and the funding level. Based on the current average level of 142.3 farms in a Kentucky county, WTP to avoid one lost farm is $0.49. To avoid 25 percent loss, it is $24.84, and to avoid 75 percent loss, it is $681.

This paper shows that horse farms in Kentucky generate positive externalities for local residents that justify the farmland preservation program in the state.

Environmental Amenities and Agricultural Land Values: A Hedonic Model Using Geographic Information Systems Data
Bastian, Chris T., et al. Ecological Economics, March 2002, 40(3): 337–349

This study estimated the impact of amenities provided by agricultural lands on agricultural land prices in Wyoming. Farmland prices could rise when the land provides recreational opportunities, wildlife, and open space, reflecting a household's demand for homes with rural amenities.

The authors use appraisal data for land sales transacted between 1989 and 1995 in Wyoming. GIS data are used to specify the detailed characteristics of each parcel. The explanatory variables for the hedonic analysis include parcel size, agricultural productivity, elk and fish habitat as indicators of amenities, distance to the nearest town, a time trend, and a view diversity index calculated as the proportion of the view area occupied by different land types that can be seen from the property. All the variables except the parcel size are expected to have a positive impact on farmland value. The hedonic model is estimated with alternative functional specifications.

The regression results show that most estimates are consistent with the expectations. The presence of elk habitat has a positive effect on land values statewide. However, elk habitat may decrease land values in some regions. A possible explanation is that in some areas elk may damage crops and fences while generating minimal hunting fees due to elk habitat on public lands. The presence of trout is a statistically significant factor contributing to a higher land price. View diversity is highly valued. The results suggest that people prefer a diverse landscape, which may indicate diversity of wildlife habitat in the area. As expected, the land value per acre decreases when being further away from a town, or having low agricultural productivity.

This paper uses GIS data to quantify the amenity attributes of farmland and finds that the presence of outdoor recreation opportunities and open spaces increases agricultural land prices. The significance of this study is that it shows how private amenities are capitalized into farmland prices.

The Problem of Identifying Land Use Spillovers: Measuring the Effects of Open Space on Residential Property Values
Irwin, Elena G. and Nancy E. Bockstael. American Journal of Agricultural Economics, August 2001, 83: 698–704

This paper proposes an empirical model to examine the effects of private open space on residential housing prices. It confronts two identification problems. First, it recognizes that the residential value of parcel *i* depends on the development status of its neighbors. Whether the neighbors' parcels are developed depends on their residential value, which is determined, in part, by the development status of parcel *i*. This implies that open space on neighboring parcels is endogenous. The second problem is related to spatial correlation. The factors that cause parcels to be more or less valuable often are spatially correlated. If some of these factors are omitted from the model, and are correlated with open space variables, some relevant variables will be omitted. Both identification problems result in biased coefficient estimates.

The hedonic study used arms-length single transactions of owner-occupied residential properties data from 1995 through 1999 in Maryland. The authors estimate the model ignoring the endogeneity problem and then re-estimate it using instrumental variable regression to eliminate the endogeneity. The explanatory variables include structural, location, and neighborhood characteristics. In order to measure the impact of open space, the authors used the percentage of open space in the area surrounding the parcel. Three types of open space are considered in the empirical model: privately owned developable, privately owned protected, and public open space. The first type is assumed to be endogenous, and the third type is exogenous. Since privately owned protected open space may be endogenous, the authors estimate two separate models, one treating it as a separate exogenous variable and another including it with the privately owned developable open space and treating it as endogenous.

In the basic model, most estimates are significantly different from zero and consistent with expectations, with the exception of privately owned developable open space. Its coefficient is negative and not significantly different from zero. The model is re-estimated using instrumental variables to eliminate the endogeneity of the private open space variables. The results show, as expected, that private open space has positive and significant effects on housing prices. A test is also done that reveals evidence of spatial autocorrelation in the model's error terms.

This paper shows that the estimates in the hedonic model examining the effect of open space on housing values may be biased if the model ignores endogeneity problems. They find that open space is important for homeowners in the study area and that the amenity effects of open space vary by the type of open space.

A related paper is Irwin, E.G. 2002. The Effects of Open Space on Residential Property Values. Land Economics 78(4): 465-480. This paper presents estimates of the value of preserving open space.

Capitalization of Open Spaces into Housing Values and the Residential Property Tax Revenue Impacts of Agricultural Easement Programs
Geoghegan, Jacqueline. Agricultural and Resource Economics Review, April 2003, 32(1): 33–45

This study develops a hedonic model to estimate the capitalization of nearby open space into the sale prices of residential properties purchased through an agricultural preservation program in Maryland. Open space is expected to increase neighboring values of residential parcels, and permanent open space is expected to have a larger effect on housing prices than private open space, which may be developed at some future time.

The data consists of arms-length transactions that occurred between 1993 and 1996 in three Maryland counties. In the hedonic model, the sale prices are specified as a function of structural housing and neighborhood characteristics, location, and indices constructed to measure the amount of preserved and developable agricultural, forest, and recreational open space. The indices were calculated for open space within 100-meter and 1,600-meter buffers to capture the different types of benefits provided by open space (e.g., views versus recreational opportunities). The author controlled for the potential endogeneity of the open space measures, arising from the fact that development decisions

on a given property affect the value of the property as well as the value and development of the surrounding properties contained within the 100-meter and 1,600-meter buffers. Instrumental variables are used to control for this endogeneity.

Permanent open space within the larger buffer is found to raise sale prices in Calvert County. This effect is found for the small and large buffers in the case of Howard County, while no significant effects are found in Carroll County. In all three counties, there is no evidence that having private forest or agricultural land in the neighborhood increases land values. The reason for this result could be the uncertainty related to future development of the land and negative externalities from agricultural production.

The key result from this study is evidence of positive amenity effects on neighboring properties from an agricultural preservation program in Maryland.

Treating Open Spaces as an Urban Amenity
Smith, V. Kerry, C. Poulus, and H. Kim. Resource and Energy Economics, 2002, 24(1–2): 107–129

This paper estimates the different effects of permanent and developable open space on housing values in the surrounding area. In the case of developable open space, potential home buyers may have different expectations regarding the nature of future development. For instance, some buyers may expect the open space to be developed into a way that generates negative externalities. As such, the price effect of developable open space should be lower than that of permanent open space.

The study area is northern Wake County, North Carolina. Residential property transactions (exclusive of undeveloped land sales) from 1980 to 1998 were used in a hedonic price study. House prices were adjusted to account for appreciation over time. There are two reasons for focusing on this study area. First, there is a newly built "loop roadway." It was under discussion in the late 1960s, designated in the early 1970s, and partially completed by 1998. This area has also experienced rapid population growth. These changes may alter residents' expectations regarding the future landscape and help to explain the effect of land use on house prices.

The independent variables include the usual measures of housing and neighborhood characteristics. Variables for distance to and adjacency to open space are developed. Permanent open space includes publicly owned open space and private golf courses. Developable open space includes vacant land and agricultural and forest land.

Most of the estimates are consistent with expectations. There is statistical evidence for the negative effect of distance to vacant land and golf courses, as well as positive effects of being adjacent to them. Comparing the two, golf courses were found to provide higher amenity values than vacant land at all distances. The results also indicate that people do not want to live close to I-540, and the farther away the better. This reflects the disamenity of construction and noise. Some estimates have counterintuitive signs. Proximity to public open space does not add value to houses. Since public open space is permanent during the study period and it provides apparent amenities, this result is counter to expectations and results from other studies.

This study shows that most open space is important for local residents and that it raises house prices to a greater degree when future development is less likely.

Using Contingent-pricing Analysis to Value Open Space and Its Duration at Residential Locations
Earnhart, Dietrich. Land Economics, February 2006, 82(1): 17–35

This paper estimates the value of open space for nearby residents using contingent valuation and conjoint analysis. A survey is designed to mimic hedonic-pricing analysis. Respondents who are recent home buyers are asked to state their willingness to pay (WTP) for each of two identical houses with different levels of adjacent open space, and then to give WTP for each of two identical houses with different probabilities that the open space would be developed. The paper used the difference between the two values to measure the marginal WTP for open space and its expected duration.

The survey respondents were residents of Lawrence, Kansas in 1999. The simulated housing market included only privately owned single-family dwellings within the city limit. The adjacent open space amenity is land in prairie. Along with WTP for different houses, information on the respondents' socioeconomic characteristics was collected.

The results show that if prairie is adjacent to a house and has no chance of being developed, the house value is higher by $8,700, on average, relative to the case in which development has already occurred. If the prairie has a 50 percent chance of being developed, the house value increases by only $3,000 on average. In relative terms, the increases are 7 and 3 percent, respectively. The results indicate that not everyone is willing to pay for open space. One hundred out of 189 respondents have zero marginal WTP in the 50 percent development case, and 47 have zero marginal WTP in the no-development case.

The author considers the possibility that some people may have negative marginal WTP for open space, indicating that they would pay a positive amount to have development rather than prairie adjacent to their house. The analysis is repeated using a Tobit model of WTP that accounts for censoring at zero. The average WTP figures drop to $5,066 in the no-development case and $118 in the 50 percent development case.

This paper provides evidence of positive amenity effects from restricting development.

Combining Revealed and Stated Preference Methods to Value Environmental Amenities at Residential Locations
Earnhart, Dietrich. Land Economics, February 2001, 77: 12–30

Using a combination of hedonic and conjoint methods, this study tries to answer the following questions: What is the value of a natural feature associated with a housing location? What is the value of marsh restoration? The assumption for both analyses is that house owners choose their housing location to maximize utility.

To obtain stated preference data, the author conducted a survey in Connecticut in 1996. This produced 105 complete responses. The respondents live close to coastal marshes (Pine Creek Marsh and Ash Creek Marsh) and were surveyed within months of an actual house purchase. The hypothetical survey asked homeowners to choose from a set of housing alternatives. Each choice set included three housing alternatives, each distinguished by an associated environmental amenity: a land-based amenity, a water-based amenity, or no amenity.

In the hedonic analysis of housing prices, the explanatory variables include structural, neighborhood, household, and environmental features. The information about house sales transactions is obtained from tax assessors and used as the revealed preference data.

Models were estimated with the revealed preference data, the stated preference data, and a combination of the two. The estimation with the revealed preference data shows that a water-based amenity is preferred to no feature, while people are indifferent between the land-based feature and no feature. Marsh restoration increases local residents' utility. The results using stated preference data only indicate that water-based and land-based features are preferred to no feature. Although both disturbed and restored marsh lowers residents' utility, only the negative effect of disturbed marsh is statistically significant. Therefore, the author concludes that the results still indicate the utility improvement with restored marsh.

Likelihood ratio tests reveal that the revealed and stated preference datasets are not compatible, but the effects of some parameters may be comparable. Results from the estimation with the combined data suggest that both natural features are preferred to no feature, forest is better than open space, and the marsh restoration increases local residents' utility.

The conclusion of this study is that natural features and marsh restoration increase utility, and the inclusion of the revealed preference data improves the estimation. Based on the revealed preference data, the benefits from water-based amenities are between $6,137 and $7,924, representing between 2.5 and 3.2 percent of the average house price. Restored marshes generate benefits equivalent to 16.6 percent of the average price. Benefits estimates using the stated preference data are even higher.

Valuing Open Space and Land-use Patterns in Urban Watersheds
Acharya, G. and L.L. Bennett. Journal of Real Estate Finance and Economics, 2001, 22(2/3): 221–238.

The paper investigates the effects of environmental amenities on housing prices. The main objective of this paper is to determine whether precisely measured environmental variables better represent amenity effects than aggregate measures.

The study area is New Haven County, Connecticut, which covers a range of rural, suburban, and urban development patterns. The data set includes house sales between 1995 and 1997 from the Multiple Listing Service and data from the 1990 Population Census. To represent spatial properties of the landscape, the authors develop measures of the diversity and richness of land uses, development levels, and open space. Twenty-six distinct land uses are represented. Open space variables measure the percentage of the area surrounding a property—alternatively within a radius of ¼ mile or 1 mile—in land uses classified as open space. The diversity index measures whether the surrounding area is dominated by a few or many land uses and how evenly the uses are distributed. The relative richness variable measures the percentage of the total number of land uses represented in the area. The richness variable is also interacted with population density to indicate the level of development. Other variables include location and neighborhood demographic characteristics, travel time to work, and a dummy variable for view.

Two models were estimated. The first used only aggregate indicators of whether the house is located in a rural, suburban, or urban area. The second model used the more detailed set of variables to describe land-use patterns in the surrounding area. The results of the first model indicate that broad categories cannot adequately describe the price effects of surrounding land uses. In the second model, statistical results suggest that the percentage of open space in the neighborhood significantly and positively influences house values. Similar coefficients on the alternative open space measures were estimated. The coefficient on the diversity measures has a negative sign and is statistically significant. This result indicates that people prefer a more homogeneous pattern of land use around their residence; this result does not give information about the specific kind of land use preferred. The effects of richness vary depending on population density. The estimated elasticity effect of richness is 0.0045 in a densely populated area and -0.0008 in a low-population area.

The average housing price is \$127,681 in the study area. The results indicate that a 1 percent increase in open space adds \$75 to the house price, and a 1-unit increase in richness lowers the house value by \$85. The authors conclude that people generally dislike heterogeneous landscapes surrounding their residences, they prefer open space, and they may like some types of land use more than others.

This paper provides evidence that housing values are influenced by the mix of land uses surrounding the property.

The Value of a Suburban Forest Preserve: Estimates from Sales of Vacant Residential Building Lots
Thorsnes, Paul. Land Economics, August 2002, 78(3): 426–441

This paper used hedonic price analysis to estimate the market value of proximity to forest preserves. The data include sale prices of vacant building lots and houses.

The study area consists of three single-family developments in the Grand Rapids, Michigan, metropolitan area. This area has several permanent forest preserves. Building lots and houses vary in terms of their view of and access to the preserves. Separate models are estimated for lot and house prices. Data on these dependent variables are obtained from the tax assessor's office. Independent variables include house or lot characteristics and neighborhood attributes. Variables are included to measure whether houses or lots are adjacent to or near a forest preserve.

Hedonic models were estimated separately for each subdivision with either housing sale price or vacant lot sale price as the dependent variable. Bordering a forest preserve was found to have a positive and significant effect on lot prices in all three subdivisions. The premium in this case ranged from \$5,800 to \$7,000 per lot. Being across the street from a preserve has a negative effect on lot sizes in one of the subdivisions. Bordering a preserve positively influenced house prices in two of the three subdivisions, and being across the street from a preserve had a positive and significant effect in one case. For houses, the premium associated with bordering a preserve ranged from \$7,900 to \$8,900.

This paper quantifies the effects of preserved forest on lot and house prices.

The Influence of Wetland Type and Wetland Proximity on Residential Property Values
Doss, Cheryl R. and Steven J. Taff. Journal of Agricultural and Resource Economics, July 1996, 21(1): 120–129

This paper examines how different types of wetlands affect housing values in the surrounding neighborhood. The effects may vary because different types of wetlands support different kinds of wildlife, have different visual properties, and provide different amounts of flood control.

The authors evaluate assessed values (as opposed to sales prices) of single-family houses in Ramsey County, Minnesota, which includes the city of St. Paul and its surrounding area. Only houses within 1,000 meters of a wetland are included. Wetlands are divided into four categories: forested, scrub-shrub, open water, and emergent vegetation. Proximity to the wetland is measured as the straight-line distance from each house to the nearest wetland type. The square of the distance to each wetland type was also included.

A hedonic price model was estimated by regressing house values on structural and location characteristics and the wetlands distance variables. Except for the squared distance to a forested wetland, all the other estimates are statistically significant. The results indicate that people prefer to live close to all types of wetlands except for forested ones. Price declines as distance increases. Tests show that all the wetlands variables have different coefficients. Among all wetlands types, emergent vegetation adds the most value to houses when it is located within 300 meters of the property. Using the mean house value in the study area ($104,956), moving 10 meters toward emergent vegetation increases house value by $136. The figures for open water, scrub-shrub, and forested are $99, $145, and -$145, respectively.

Other versions of the model were estimated, including ones that included houses with wetlands located beyond 1,000 meters. In these cases, scrub-shrub and open water are preferred to forested and emergent vegetation wetlands. The authors emphasize that marginal willingness to pay estimates do not capture the total value to society of wetlands.

Wetlands are often protected by land-use regulations. This study shows that in most cases they raise the value of surrounding properties.

Valuing Urban Wetlands: A Property Price Approach
Mahan, Brent L., Stephen Polasky, and Richard M. Adams. Land Economics, February 2000, 76(1): 100–113.

This paper uses hedonic price analysis to estimate the amenity value of different types of wetlands in Portland, Oregon. The authors also attempt to recover the willingness-to-pay function of residents using second-stage hedonic analysis.

The study area is the portion of Multnomah County within the Portland urban growth boundary. Residential property sales data are obtained for the period 1992 to 1994. Wetlands were divided into eight categories according to visual aesthetics and shapes. To measure the effects of wetlands on house prices, the authors measured the size of, distance to, and type of the nearest wetland and distances to wetlands of all other types. Besides wetlands variables, the authors measured structural, neighborhood, and other environmental characteristics of properties. No regulatory variables were included.

Two versions of the model were estimated. Model I assumes that prices are affected by the characteristics of the nearest wetland, whereas model II assumes prices depend on the distance to wetlands of any type. For model I, all structural and neighborhood variables are statistically significant. As expected, wetland size has positive effect on house prices, and distance has a negative effect. The coefficients for wetland types are not all statistically significant, suggesting that wetland types may not be important to local residents. When using the mean house value ($122,570) and initial distance of 1 mile as the base, increasing the nearest wetland of any type by 1 acre adds $24.39 to the house value. Moving 1,000 feet closer to a wetland of any type increases house prices by $436.17.

With model II, the size of the nearest wetland has a positive and significant effect. Relative to the base, moving 1,000 feet closer to an open water areal wetland increases house values by $991. Moving 1,000 feet closer to an open water linear wetland, an emergent vegetation linear wetland, or a scrub–shrub areal wetland reduces house values by $1,250, $823, and $217, respectively. The other four types of wetlands have no significant effect in the second model. In both models, the distance to a lake or stream has a significant and negative effect on house price, but the coefficients on distance to park and river are not significant. In general, people like to live closer to wetlands, but the wetland type does not seem to matter.

The second-stage hedonic analysis used segmented markets to overcome the identification problem and estimate the willingness-to-pay function for the size of the nearest wetland. Independent variables include household income and other characteristics, number of occupants per residence, and dummy variables for market segments. The results are counterintuitive, suggesting a positive slope for the demand curve. These results point to the inherent difficulties of second-stage estimation.

The significance of this study is that it demonstrates that wetlands, which often are preserved through land-use regulations, increase the value of houses in the surrounding area.

II. The effects of agricultural subsidies on private property values

The Impacts of Different Farm Programs on Cash Rents
Lence, Sergio H. and Ashok K. Mishra. American Journal of Agricultural Economics, August 2003, 85(3): 753–761

This study develops theoretical and empirical models to investigate how different types of government payments affect farmland rents.

The theoretical model assumes that all farmers face the same input and output prices and have identical production functions. Assuming that profits depend on crop prices, environmental conditions, government payments, and costs, and that the farmer's objective is to maximize profits, the authors show that the equilibrium farmland rent depends on the acres planted by the farmer, the total number of acres planted in the county, crop prices, output levels, and government payments. The rent equals the annual net value of farmland to its owner.

The empirical model is based on the equilibrium land rent function derived in the theoretical model. The authors use data for three counties in Iowa during the period 1996–2000. Government payments are disaggregated into four categories: deficiency payments (DEF), payments associated with market losses (MLA), production flexibility contract payments (PFC), and Conservation Reserve Program (CRP) payments. Other variables used to explain land rents are acreage-weighted corn and soybean crop revenues.

Crop revenues have a positive and statistically significant effect on land rents. The MLA and PFC payments have positive impacts on land rents, increasing rents by approximately 85 cents for each dollar in payments. The coefficient on the CRP payment is economically and statistically insignificant. The surprising result is that the DEF payment has a negative effect and is statistically significant. The authors could not explain the reason for the counterintuitive result. The empirical model is also estimated without disaggregating government payments. The results indicate that, in total, government payments increase farmland rent by 13 cents per dollar in payments.

This study finds that different types of government payments affect farmland rents differently. Overall, government payments increase farmland values.

The Incidence of Government Program Payments on Agricultural Land Rents: The Challenges of Identification
Roberts, Michael J., Barrett Kirwan, and Jefferey Hopkins. American Journal of Agricultural Economics, August 2003, 85(3): 762–769

This paper examines the extent to which government payments are capitalized into (or the incidence of government payments on) farmland rents. Prior to the 1996 Farm Bill, direct government payments to farmers were linked to commodity prices and involved certain restrictions that often limited flexibility in terms of crops planted. In 1996, the new program used lump-sum Production Flexibility Contract (PFC) payments. Thus, after 1996 government payments had two components: payments coupled with commodity prices and decoupled PFC payments. The rent on an acre of farmland equals revenues net of variable costs. Only under restrictive conditions will coupled payments be fully capitalized into farmland rents. Otherwise, these payments will alter production decisions and affect commodity prices, offsetting to some extent the effects of the government payments on rents. Since decoupled payments are not tied to current production decisions, they tend to be fully reflected in rents.

The authors use a hedonic price model to quantify the incidence of government payments. Data on cash rents are taken from the 1992 and 1997 Agricultural Census. In the basic specification, rents are a function of the net return from agricultural production and government payments. The error term measures expectation errors (for agricultural returns and payments) and unobserved factors. The authors estimate a large number of models, which vary according to the independent variables included and the data sample used.

The results show that the incidence estimates are not stable across regions, suggesting that unobserved heterogeneity may still affect the estimation results. The estimates with the 1997 data show that land rents increase by $0.33 to $1.55 for each dollar in

government payments. This is a smaller effect than estimated with the 1992 data. The authors conclude that their strongest estimates imply an incidence of between $0.34 and $0.41 per dollar of payments.

This study finds that farm payments significantly influence farmland rents in the U.S. However, because the payments can influence production decisions and alter commodity prices, there is no one-to-one relationship between payments and rents.

Noncash Income Transfers and Agricultural Land Values
Taylor, Mykel R. and Gary W. Brester. Review of Agricultural Economics, Winter 2005, 27(4): 526–541

This paper studies the effect of U.S. sugar policy on land values in Montana. To increase the return to agricultural production, governments usually either use direct cash transfers or increases in the price of agricultural products. Due to the U.S. sugar policy, the U.S. sugar price has been kept above world prices since 1982.

The study uses a hedonic land price model. The factors considered to affect land price include parcel size, sugar beet price, expected cash receipts from crop sales, soil quality, parcel location, and population density. The land value data were obtained from appraisers during the 1986 to 1999 period in 15 counties. Proximity to a sugar beet processing facility is expected to have a positive effect on land value because sugar beets are produced in 12 counties, while there are only two sugar beet processing plants. Expected sugar beet prices and expected per-acre cash receipts from crop sales are expected to increase land value.

Most coefficient estimates have signs consistent with expectations and are statistically significant. For a $1.00 per ton sugar beet price increase, the value of sugar-producing land rises by $7.58, and the value of non-sugar-producing cropland rises by $3.85. In the latter case, the effect represents an increase in the option to produce sugar beets. If cash receipts increase by $10, the per-acre land value would increase by $7.60. Without domestic price supports, the price received by the producer would drop from the current level of $23.34 per ton to $14.95 per ton (the world price of sugar). This would reduce the value of sugar-producing and non-sugar-producing cropland by 9.1 and 4.6 percent, respectively. If the sugar-producing industry ceased to exist in this region, land values could be reduced by 32 percent.

Land values are re-estimated using an asset pricing model without sugar beet production. The authors suppose the production will exist to perpetuity, and they compare two scenarios: (1) sugar beets/malting barley rotation, (2) feed barley/malting barley rotation. In the study region, without sugar beet production, land value could decrease by $529 per acre, a larger reduction than the $220.58 per-acre decline predicted by the hedonic model.

This study investigates the effect of U.S. sugar policy on the value of land in Montana's sugar production region. Both the asset pricing model and hedonic analysis indicate declines in land values without price supports.

The Effect of Agricultural Policy on Farmland Values
Weersink, Alfond, Steve Clark, Calum G. Turvey, and Rakhal Sarker. Land Economics, August 1999, 75(3): 425–439

The authors estimate the separate effects of government payments and market returns on farmland prices. They also investigate whether these two income sources are discounted by farmland owners at the same rate. For farmland owners, one income source may be more stable than the other, implying different effects on farmland prices. If government payments are discounted more than market returns, the capitalization of government payment would be less than the capitalization of market returns.

In theory, the asset pricing model indicates that the current nominal land value equals the present value of total future returns to the land net of costs. Suppose the only components of farmland income are market returns and government payments. The current nominal land value is the sum of expected government payments and expected market returns discounted with (in general) different factors. Each discount factor is equal to the nominal interest rate plus a risk premium minus the income growth rate.

The authors test whether these discount factors are the same using annual observations of direct government subsidies, income from farm operations, and land values in Ontario, Canada for the period 1947 to 1993. The data show that government payments have been relatively stable over most of the study period, and land values changed dramatically during the 1970s and 1980s.

The hypothesis that government payments and market return are discounted at the same rate is rejected. The results show that the discount rate for government payments is 0.986, which is greater than that for market returns (0.857). This finding suggests that government payments are viewed as a more stable source of income by farmland owners in Ontario. Land values are relatively unresponsive to changes in both income sources. A 1 percent increase in government subsidies, for instance, increases land values by 0.63 percent.

Evidence of Capitalization of Direct Government Payments into U.S. Cropland Values
Barnard, C.H., G. Whittaker, D. Westernbarger, and M. Ahearn. American Journal of Agricultural Economics, 1997, 79(5): 1642–1650.

The paper examines the effect of government payments on farmland prices, under the assumption that landowners expect government payments to continue. The dataset used in the study includes per-acre tract-level cropland values for 1994, 1995, and 1996.

In a hedonic model of cropland values, the explanatory variables include the average county-level annual direct government payment, an index reflecting development pressures and accessibility, agricultural productivity, average farm size, per-capita payroll for recreation industries in the county, and state-level regulations. The dependent variable is the value of cropland per acre. The model was estimated separately for each of 20 Land Resource Regions covering the contiguous U.S.

The results show that the development index and the presence of intensive crops have positive and significant effects on farmland values in all regions. In some cases, the signs of the coefficients on farmland size, soil, and climate variables are not consistent with expectations. In many regions, government payments have a positive and significant

effect on farmland values. In the Corn Belt, the elimination of government payments is estimated to reduce cropland values by 30 percent (a $445 per-acre reduction from the mean cropland value of $1,480). In other regions, the percentage reduction in cropland value from elimination of government payments ranges from 12 to 69 percent. (In the region including western Oregon, the effect is 16 percent).

A second (nonparametric) model was estimated that included variables for longitude, latitude, population density, and the ratio of direct government payment to gross cash farm income. Population density is divided into two levels to differentiate influences from urban and rural populations. The ratio of government payment to gross income is also divided into two levels to distinguish lands that are highly dependent on government programs from those that are not.

The nonparametric estimation showed that the highest degree of capitalization of government payments is 50 percent, although most areas of farmland in the U.S. have low levels of capitalization.

The results of the two models indicate that there is wide variation across the U.S. in the degree of capitalization of government payments into cropland values.

III. The effects of use-value assessment on private property values

Agricultural Property Tax Relief: Tax Credits, Tax Rates, and Land Values
Anderson, John E. and Howard C. Bunch. Land Economics, February 1989, 65(1): 13–22

This study investigates how tax credits and tax rates affect farmland values in Michigan. To reduce taxes on farmland, Michigan uses a "circuit-breaker" program. To qualify for the program, a farmer's income must exceed a certain threshold level. Eligible farmers may either claim the general homestead property tax credit on their state income taxes, or enroll their land into a farmland preservation program and forego development opportunities in order to receive property tax reductions.

The theoretical model assumes that current farmland value equals the present value of the farm's income stream added to its potential housing income stream after the development. The model indicates that for a given level of housing income stream, the higher the farm income stream, the lower the capitalization effect of the property tax reduction program. And, holding the farm income stream constant, the capitalization effect will be higher with greater development potential for farmland. The authors expect that when the future income stream does not change, the capitalization effect would be greater with a higher tax rate, lower interest rate, lower income threshold level, and higher percentage of nonfarm income to the land.

A county-level empirical model is estimated to capture the interaction between land values, tax rates, and tax credits. The model is a system of three simultaneous equations. Besides the three variables of interest, other explanatory variables include land value, farm income, urbanization pressure, program participation rate in the county, and agricultural intensity. Urbanization pressure is calculated as "the real value of new construction as a percentage of property value in the county." County-level data are collected from 82 Michigan counties for 1980 to 1983.

Most estimates are statistically significant and consistent with theory. Tax credits and tax rates are positively related to each other and to land value. When urbanization pressure gets higher, tax credits decrease while tax rates increase. Tax credit rises with higher farm income. Land value has a positive relationship with tax credit and urbanization pressure. On average, property tax credits account for 8.33 percent of farmland value. Combined tax reductions pay for 80 to 90 percent of farmers' property tax liability, increasing the land's value by nearly 10 percent.

This study finds that the tax reductions provided by the "circuit-breaker" program are capitalized into farmland values. On the other hand, farmland values are found to be relatively insensitive to property tax rates, suggesting offsetting effects of the services provided by higher tax revenues and the higher tax payments by landowners.

Effectiveness of Use-Value Assessment in Preserving Farmland: A Search-Theoretic Approach
Tavernier, Edmund M. and Farong Li. Journal of Agricultural and Applied Economics, December 1995, 27(2): 626–635

This paper develops a model to analyze the effectiveness of use-value assessment in preserving farmland. Under use-value assessment, farmland is assessed for property tax purposes according to its use in agricultural production, instead of its highest and best use as would be determined by the market. Because of development pressures, the market value of farmland at the urban fringe is likely to be higher than its current use value. Use-value assessment is used to reduce property taxes on farmland and provide incentives for farmland preservation. This study finds that use-value assessment does not have simple effects on a landowner's incentive to preserve farmland.

The theoretical model assumes that farmers are risk neutral and seek to maximize the present value of expected income. When the offer price from a potential developer equals the landowner's reservation price, the parcel is converted. However, it is assumed that not all offer prices are observed by farmers. Rather, each offer price is a random draw from a known distribution.

The model shows that use-value assessment delays conversion. The reason is that a lower tax raises farm income, which increases the reservation price. As a result, the average waiting period before conversion will be longer. Clearly, use-value assessment is more effective for farmland preservation when the conversion delay is longer. The difference between the average waiting periods with and without use-value assessment is determined by three elements: (1) tax rate, (2) the difference between market value and use value of farmland, and (3) the distribution of the offer price. The authors show that the effects of tax rates and differences in value (1 and 2) on the effectiveness of use-value assessment cannot be determined in general. That is, whether changes in these factors make farmland preservation more likely depends on the underlying conditions. Although the effectiveness of use-value assessment will increase with a higher average offer price, the impact of increasing the variance of the offer price distribution—which increases the chance of a high offer price—on the effectiveness of use-value assessment is indeterminate.

To further analyze the effectiveness of use-value assessment, the authors use a numerical example with farmland value data from New Jersey. They used the average farmland value as the mean offer price. In order to investigate the effectiveness of use-value assessment under different conditions, they estimated mean waiting periods with different levels of the tax rate and standard deviations for the offer price distribution. The results indicate that with use-value assessment, the reservation price is higher at all tax rate levels than the reservation price without. There is an optimal tax rate that maximizes the mean waiting period. Thus, at this tax rate, use-value assessment is the most effective.

The analysis identifies farm income and the distribution of the offer price as important factors that affect the effectiveness of use-value assessment. The effectiveness varies with differences in the tax rate and the uncertainty of offer prices.

Land Taxes in Agriculture: Preferential Rate and Assessment Effects
Wunderlich, Gene. American Journal of Economics and Sociology, April 1997, 56(2): 215–228

This paper considers how changes in property taxes influence the value of agricultural land. The real property tax is a substantial portion of the total return to agricultural land, especially for land subject to high development pressure. In order to prevent the development of agricultural lands, preferential tax assessment often is used. In this case, property taxes are assessed on the value of the parcel in its current agricultural use rather than on its market value, which will reflect future returns to development. The author reviews national surveys by the USDA in 1992 and 1993 that show that there is a relatively large tax reduction when a parcel changes to preferential status ($2.72 per acre in 1992, $5.17 in 1993). However, in the aggregate, the differences between taxes paid on preferential and nonpreferential parcels (between $0.65 to $0.81 per acre) are small.

When a parcel with preferential assessment is developed into a nonfarm use, the change in the property tax is large. However, previous studies have shown that property tax incentives are small compared to the revenue from development and that preferential tax assessment has no significant effect in preventing farmland conversion. The authors suggests that tax preference programs are likely to be effective only when there are long-term contracts between landowners and local governments with severe penalties attached to developing land.

In most cases, preferential tax assessment applies to land but not to buildings and improvements. On the other hand, property taxes are applied to all of these assets. The author suggests that this may limit the effectiveness of preferential tax assessment in terms of preventing development. Were the preferential assessment to also apply to buildings and improvements, there would be additional incentives to retain land in agriculture.

This paper discusses the effect of preferential tax assessment on agricultural land values. The author shows that use-value assessment can affect agricultural land values, but argues that it may do little to prevent the development of farmland. To improve the effectiveness of preferential tax assessment programs, the government should try to establish long-term contracts with severe penalties and use a less complicated administrative procedure.

Use-Value Property Tax Assessment: Effects on Land Development
Anderson, John E. Land Economics, August 1993, 69(3): 263–269

This paper develops a theoretical model to investigate the effect of the use-value assessment on the timing of development, which fundamentally affects the value of property. The author also examines how use-value assessment affects the development decision when there is uncertainty and development is irreversible.

The model assumes that the value of agricultural land has two components: the discounted net income stream from agricultural production prior to development, and the discounted net income stream after development. The discount rate is the sum of the interest rate and the tax rate. The landowner is assumed to maximize the value of the land by choosing the time of development. The results indicate that at the optimum the marginal benefit of waiting one more period (the growth rate in the value of developed property) equals the opportunity cost of waiting (foregone interest plus an expression for the value of the farming use relative to the developed use).

With the use-value assessment, the property tax is based on the discounted net income stream from agricultural production (the first component), instead of the market value of the land. As a result, use-value assessment reduces the total property tax on agricultural land. It is shown that under land value maximization, use-value assessment causes development to be delayed. This delay effect is greater when the divergence between use-value and developed value is larger and when the level of property taxation is higher. The author also proves that when the difference between the values of the developed and undeveloped land is small, a higher tax rate delays development and a smaller tax rate speeds development. It is also proved that an increase in farm income delays development, holding other factors constant. How the change in the income stream from the developed land affects the timing of development depends on the tax and interest rates.

Following Capozza and Sick (1990), the author incorporates uncertainty and irreversibility (of development) into the model by adding a term representing the uncertainty premium into the farming income stream. The premium reflects the fact that were the income stream from developed land to be low in the future, the landowner would not be able to return the developed land back to agricultural production. Although the option value for the undeveloped land increases the farmland value, the author's results indicate that development will still be delayed by use-value assessment.

The author proves that the use-value assessment lowers the property tax on agricultural land at the urban fringe and delays land development. The effectiveness of use-value assessment in preventing development depends on the property tax rate and the difference between the use value and the market value of the land.

Use-Value Assessment Tax Expenditures in Urban Areas
Anderson, John E. and Marlon F. Griffing. Journal of Urban Economics, 2002, 48: 443–452

The authors of this paper examine spatial variation in the difference between the market value and use value of agricultural land. They provide a basis for estimating the foregone tax revenues (or expenditures) from use-value assessment of farmland.

In theory, the value of agricultural land has four components: the value of accessibility, the cost of conversion, the expected future rent increase, and the agricultural land rent. Conversion costs and agricultural rents are assumed to be invariant with respect to location. However, the value of accessibility and the expected future rent increase should decline with distance to the central business district (CBD). As such, the difference between the market value and use value of the land should decline as one moves farther away from the CBD and eventually approach zero.

In an empirical analysis, the authors regress the logarithm of the difference between the market value and use value of the land on a constant and the distance between the agricultural land and a nearby metropolitan area. The estimation is conducted separately for two study areas in Nebraska, Lancaster County and Sarpy County, which are part of the Lincoln and Omaha metropolitan areas, respectively. The market and use values of agricultural land were obtained from the local tax assessor's office. In Lancaster County, the assessor capitalizes the net income from crops and livestock to estimate the use value. In Sarpy County, the assessor uses the sale prices of agricultural land in adjoining counties to estimate use value.

The results show that the coefficient estimates are statistically significant. In Lancaster County, the difference between the market value and use value is $987.69 per acre for a parcel 3 miles from the CBD, $444.48 at 10 miles, $140.93 at 20 miles, and $89.01 at 24 miles. In Sarpy County, the difference is $6,385.70 per acre at 6 miles, $4,343.44 at 10 miles, $1,657.28 at 20 miles, and $1,023.71 at 25 miles. The greater difference between the two values in Sarpy County reflects the fact that Omaha is a larger city than Lincoln.

Evaluating the Effectiveness of Use-Value Programs
Ferguson, Jerry T. Property Tax Journal, June 1988: 157–164.

This paper evaluates the effectiveness of use-value assessment, which lowers property taxes for agricultural land, in preserving farmland. In an empirical analysis, the author uses time-series data on farmland acreage to test whether the conversion of agricultural land changes after the implementation of use-value assessment.

Data are obtained for four counties in Virginia between 1920 and 1980. The dependent variable is the percentage of total land in a county occupied by farms, and it is regressed against a time trend (the number of 5-year intervals since 1920) and the square of this variable. Models are estimated separately for each county. In 1974, the use-value assessment program was implemented in Virginia. The author argues that if use-value assessment is effective, the trend should be different in the 5-year interval after 1974. Thus, the data for the period between 1920 and 1970 are used in the estimation. The author estimates the farm acreage in 1980 (with the model) and compares it with the actual percentage.

The results show that there is no significant change in the time trend of farm acreage in three counties, but there is a change in the trend in one county. The author concludes that use-value assessment, by itself, cannot lower the development pressure on agricultural land.

In order for the results of this study to be valid, one has to believe that the factors determining farm acreage over time can be adequately represented with a simple time trend model. It is likely, however, that this relationship is much more complex and changing through time in fundamental ways. If so, this study is of limited value.

Development Rights and the Differential Assessment of Agricultural Land: Fractional Valuation of Farmland Is Ineffective for Preserving Open Space and Subsidizes Speculation
Blewett, Robert A. and Julia I. Lane. American Journal of Economics and Sociology, 1988, 17(20): 197–205

This paper investigates the effectiveness of differential tax assessment at preserving farmland. Under differential assessment, property taxes are assessed on the value of land in agricultural production and, thus, property taxes are lower on farmland at the urban fringe. The reduced tax burden is a form of compensation for farmland owners and can provide an incentive for delaying development of farmland.

In a theoretical model, the authors assume that land rent is independent of the land uses of surrounding parcels and that income from agricultural production on farmland is constant over time. The value of farmland equals the sum of the discounted rural use value and discounted urban use value. The discounted net benefit of urban use is the difference between the two use values. With growing development pressures, the discounted net benefit of urban use increases through time with the rising urban use value, and farmland is converted once the discounted net benefit of urban use is positive. With differential assessment, the rural use value increases due to the lower property tax, but the development is not prevented as long as the urban use value grows.

An empirical analysis is used to test whether use-value assessment slows down farmland conversion. Data are obtained on farmland in 92 Indiana counties for the periods 1954–1959 and 1964–1969. Use-value assessment was implemented in 1963. Empirical models are estimated for the two time periods separately. The percentage decline in farmland acreage in a county is regressed on percentage changes in population, property taxes per acre, and the number of farmers over 65 years of age. The authors expect the percentage change in the property tax to have a positive effect on the dependent variable before the implementation of use-value assessment, and a negative effect afterward. (Note: It makes sense that the effect will be lessened with use-value assessment, but the authors do not explain clearly why it should be negative.)

Holding other factors constant, the results show that use-value assessment may slow the conversion of farmland in Indiana. The percentage change in property taxes has a positive and significant effect before the implementation of preferential assessment, while its effect is negative and statistically insignificant after implementation.

The Effect of Farm Property Tax Relief Programs on Farm Financial Conditions
Chicoine, David L., Steven T. Sonka, and Robert D. Doty. Land Economics, November 1982, 58(4): 516–523.

This paper analyzes the impact of tax relief programs (use-value assessment and circuit-breaker programs) on the financial conditions of farmers and landlords. Both

programs are designed to reduce property taxes to provide incentives for the preservation of agricultural land. Use-value assessment involves assessment for property taxes based on value in current farmland use rather than market value. Circuit-breaker programs provide for state income tax credits or refunds for property taxes in excess of a given percentage of total farm household income.

The authors use a simulation approach to investigate how different tax relief programs affect the financial condition of a hypothetical farm over a 10-year period. The hypothetical farm is assumed to have a cash grain operation in east-central Illinois with half of the 600 acres of agricultural land farmed and the other half leased. The initial financial condition of the farmers and landlords is based on commercial farm data for east-central Illinois. Crop yield variability is derived from 13 years of individual farm data for a sample of east-central Illinois farms. Price variability is based on 1973–1978 crop prices. The average yields and prices are initially set at the 1978 level, and the initial farmland value is assumed to be $3,300 per acre. The annual crop price and input cost inflation are assumed to be 7 and 14 percent, respectively, and the tax rate is assumed to be constant during the simulation.

The results show that the circuit-breaker program is not effective for the farmer because property taxes as a percentage of farming income never exceed the qualification level for joining the program. Compared to a property tax of $34.22 per acre with the market-value assessment, the use-value assessment lowered the property tax to $21 per acre and the annual tax relief was $3,913. Since the use-value assessment improves the financial condition of farmers, the agricultural land value rises. The capitalized net rents with the market-based assessment and use-value assessment are $10,731 per acre and $11,773 per acre respectively. For the landlord with no nonfarm income, the circuit-breaker program reduces the property tax by 50 percent and provides 33 percent more tax relief than does the use-value assessment. The tax relief programs increase the average after-tax income by $2,000 to $3,000.

The authors also apply the simulation model with double the initial land value to study the effect of the tax relief programs on agricultural land at the urban fringe. They find that although the tax relief programs have a positive effect on the farmer's and landlord's financial situation, the effects are too small to prevent the conversion of agricultural land.

IV. Other studies

The Joint Influence of Agricultural and Non-farm Factors on Real Estate Values: An Application to the Mid-Atlantic Region
Hardie, I.W., T.A. Narayan, and B.L. Gardner. American Journal of Agricultural Economics, 2001, 83: 120–132.

The purpose of this paper is to explain farm values in terms of both agricultural returns and nonfarm values (residential use of the land in this study). The authors extend existing models by considering the simultaneity in the determination of prices for farmland and housing. The results quantify how higher housing prices affect farmland values, and vice-versa.

The underlying theory for the paper derives from the Capozza–Helsley model. The current agricultural land value is the discounted present value of future rents for farm use plus future rents for nonfarm use after conversion net of conversion cost. This establishes the dependence of agricultural land prices on the value of land in nonfarm use. The optimal time to develop land is when the development rent equals the sum of the agricultural rent and annualized conversion cost. As such, the agricultural rent will be an implicit component of the developed land value. The theory establishes that the prices for agricultural and developed land are determined jointly. The implication is that factors (such as population density or regulations) that have direct impacts on developed land values will affect agricultural land values indirectly (and vice-versa).

The empirical model consists of simultaneous equations for farmland and residential land prices. In the theoretical model, agricultural rent and household income are assumed constant over time and space, and housing is homogenous. The empirical model relaxes these assumptions. The empirical model also replaces developed land prices with housing prices. The theoretical model also assumes perfect foresight in terms of future rents, taxes, and conversions costs. The regression model uses only current values and thus does not attempt to explain changes in land prices over time.

Data were assembled for 230 counties in the mid-Atlantic region for the years 1982, 1987, and 1992. Variables to explain farmland and housing prices were measured as county medians or averages (examples include farm production expenses, median income, and the average age of houses) or were entered as dummy variables (in the case of state dummies). An index of distance to major cities weighted by the city's population is used to capture development pressure. Since the effect of population on housing price will be larger when income is higher, the authors also interacted income and population.

Most of the coefficient estimates are statistically significant and consistent with expectations. Increases in output prices and machinery value and decreases in input prices raise farmland value. However, farmland price is much more sensitive to residential housing values than to farm income factors. Results indicate that the median housing value is significantly affected by population and income but not by farmland price.

This study quantifies how factors affecting residential housing values are transmitted to farmland values. Conversely, it shows that farmland values have little influence on housing values.

New Evidence on Property Tax Capitalization
Palmon, Oded and Barton A. Smith. Journal of Political Economy, October 1998, 106(5): 1099–1111

The authors examine the capitalization of property taxes into property values in Texas. In theory, the current property value equals the present value of net benefits generated to homeowners. The discount factor equals the net user cost of housing (the appropriate real, net of expenses, after-income tax discount rate) plus a term for property taxes. If taxes are fully capitalized into property values, the property tax term should simply equal the property tax rate (assuming it is expected to remain constant over time). In effect, property taxes increase the rate at which future net benefits are discounted.

If property taxes are not fully capitalized, then the property tax rate will have a partial impact on the discount factor. This provides the basis for the empirical test in this paper.

The empirical model consists of two functions: (1) a hedonic function with the market price of the house as the dependent variable, and structural and location characteristics as independent variables, and (2) a function for the discount factor as described above. The second model is estimated under the assumption that net user cost (the first component of the discount factor) equals 3 percent.

The authors use housing market data in 1989 for properties from 50 subdivisions in Houston, Texas. Although all of the subdivisions have similar demographics and identical public services, the tax rate used by municipal utility districts (MUD) to finance public service varies substantially. The reason for using this dataset is that the variations in tax rates and public services are likely to be correlated. To avoid potential bias in the parameter estimates, the capitalization effect of the tax rate must be isolated from the public service effect. The authors also suspect possible correlation between the tax rate and neighborhood quality. Therefore, separately, they estimate another model that includes three additional variables indicating neighborhood quality.

The result shows that about 60 percent of the property tax is capitalized. This is not full capitalization, but it is much higher than what Yinger et al. (1988) predicted (15 to 30 percent) with similar assumptions regarding net user cost. As the authors suspect, the tax rate is correlated with neighborhood characteristics. The coefficients of tax rate are 0.617 and 0.639, respectively, in the models with and without neighborhood characteristics (the estimates are statistically significant).

To investigate the capitalization effect of property taxes, this paper uses a dataset in which the study area has subdivisions with the same public service but different tax rates. The empirical results indicate that property taxes are not fully capitalized into property values.

Property Tax Limits, Local Fiscal Behavior, and Property Values: Evidence from Massachusetts under Proposition 2½
Bradbury, Katharine L., Christopher J. Mayer, and Karl E. Case. Journal of Public Economics, 2001, 80: 287–311

This paper uses models of public spending and house prices to investigate the capitalization of Proposition 2½, passed in Massachusetts in 1980, into property values. Proposition 2½ places a cap on the effective property tax rate and the nominal annual growth rate in the tax, as well as allowing residents to vote to override the Proposition. Lower taxes may raise property values, but a town with barriers to raising taxes may provide a lower level of public services, therefore becoming less attractive for potential home buyers. The paper explores how tighter local government budgets under Proposition 2½ reduce public expenditures. Then, the paper investigates how house prices are affected by the reduction in public expenditures.

The house price model assumes that households choose house locations by comparing local amenities, public services, and tax rates. Thus, the house price is a function of these factors and the housing stock. There are three endogenous variables in the house price

model: changes in school spending, changes in nonschool spending, and single-family housing permits.

In the public spending model, public expenditures are explained by residents' preferences, costs of public services, and local government budgets. Since education is a major part of public spending in a community, the spending model is estimated separately for school spending and nonschool spending. There are two endogenous variables in the public spending model: change in number of students and change in population. The constraints of Proposition 2½ did not bind in all communities. To reflect the extent to which the Proposition 2½ restricted a community's public spending, the authors use dummy variables to divide communities into three groups: constrained, unconstrained, and constrained with override. A community is constrained if it reached the levy limit without passing overrides in 1989. The authors suspect that the dummy variables measuring the constraint could be endogenous, because whether Proposition 2½ binds in a community may reflect the voters' choice of public spending before Proposition 2½. However, excluding these dummy variables does not significantly change the estimation.

The model is estimated with community level data from 1990–1994. The results of the spending model indicate that Proposition 2½ significantly constrained local spending in some communities, with most of its impact on school spending. School spending experienced the slowest growth in constrained communities. The results from the housing price model suggest that school spending had a significant impact on house prices, while nonschool spending did not. In general, the communities constrained by Proposition 2½ increased their school spending less than did unconstrained communities, and reducing school spending significantly affected house prices in a negative way.