

Downzoning and Rural Land Markets:

A review of two recent studies in Maryland and New Jersey

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Executive Summary

Downzoning restricts the development of agricultural land by increasing the number of acres required for each housing unit. Downzoning has the potential to protect working landscapes from encroaching development, but there are concerns that this approach could cause serious harm to rural landowners through the reduction in property values. Two recent studies examined the effect of downzoning on agricultural land values in the mid-Atlantic region, reached differing conclusions, and have created confusion and uncertainty about the effects of downzoning. This project brought together a panel of experts who have extensive experience in property value studies, statistics, and environmental and resource economics to review the methods and conclusions of the two reports. The panel found serious errors in the research methodology of both reports, and believes there is little basis for the conclusions reached in the studies.

The first report, which we refer to as the Maryland study throughout the review, is titled “Downzoning: Does it Protect Working Landscapes and Maintain Equity for the Landowner?” The Maryland study was completed in December 2003 by a team of 8 co-authors, and was sponsored by the Maryland Center for Agro-Ecology. The second report, which we refer to as the New Jersey study, is titled “The Impact of Downzoning on Agricultural Land Value in New Jersey.” The New Jersey study was completed in November 2004 by Michael Samuels of Clarion/Samuels Associates and was sponsored by the New Jersey Farm Bureau. The Maryland study found downzoning to have no impact or a small positive impact on agricultural property values, while the New Jersey study found large negative impacts from downzoning. Given the weaknesses in the methodologies, we have little confidence in either finding.

Economic theory does not give a clear answer on whether downzoning should decrease or increase property values. First, downzoning can negatively impact property values because it puts a constraint on development opportunities. This negative impact could be large for properties with great development potential. However, downzoning could also have several positive impacts that offset the loss of development opportunities. The positive effects could include the enhanced environmental and landscape amenities valued by buyers, protecting a critical mass of farms in the local agricultural community, and the viability of non-development land uses, reduced burdens on local government services such as schools and roads, and reduced uncertainty about future land use. Which of these offsetting effects dominates is an empirical question, and the magnitude of the effects will vary between markets and individual properties within the same market.

The Maryland study employs a statistical approach to examine market transactions in 7 Maryland counties over more than 20 years. While we believe a large sample statistical study of market transactions is the best general approach, the approach in this study is too aggregate, fails to control for many other influences on land value, and simply does not use the best available statistical techniques. The BACI (Before-After Control-Impact) approach is flawed for estimating property value impacts, and as far as

we know, has rarely appeared in the literature for over 40 years. The authors' own literature review does not cite any studies using this technique. In addition, the Maryland study also includes a qualitative analysis based mostly on interviews with local government officials. While the interviews provide important background information on changing land use policy, the sample interviewed may not represent the full range of views and the respondents may have a vested interest in the policies. We find the interviews provide insufficient support for the numerous strong conclusions derived from this information.

The New Jersey study develops a methodology based on real estate appraisal methods rather than utilizing statistical analysis based on land market transactions. Although based on well established real estate appraisal methods that are reliable in well-established markets with comparable sales, the study develops its own methodology that extends appraisal methods to a hypothetical property with no comparable sales by making a series of tenuous assumptions and calculations. They provide no citations of previous studies that utilize similar approaches. Their method is unreliable and is likely to overestimate the negative effect of downzoning on property values. Many of the assumptions are tenuous and some are inconsistent. Furthermore, their calculations focus solely on obtaining estimates of the negative development effect, and make no attempt to estimate the size of the offsetting positive effects. Finally, the sales comparison approach is based on a very small sample of 3-4 transactions in each case study area making their reliability by most any statistical standard somewhat suspect.

The best approach for estimating the impact of downzoning on property values is a cross-sectional time-series hedonic price analysis. Hedonic price analysis is a regression based statistical approach that uses individual properties as the unit of observation utilizing a large sample of properties with different zoning that share a common real estate market. Hedonic price analysis is well established in the peer reviewed literature and is the approach most commonly employed in previous studies of zoning impacts. The regression model can control for the impact of location, individual property and neighborhood characteristics, other land use policies, and can be designed to allow the impact of zoning to vary based on key characteristics of the property (e.g. parcel size, location). Researchers should also control for endogenous zoning (in other words local zoning changes are likely to be stimulated by some of the same factors that affect property values) within the hedonic model. Hedonic price analysis is also being used more frequently by professional appraisers where it is often referred to as the mass appraisal method. There are also some emerging techniques to control for unobserved effects in property markets that may work quite well in this setting.

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Introduction

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Overall, the panel found very serious errors in the research methodology of both reports, and believes there is little basis for the conclusions reached in the studies. Both studies deviate from the published literature, and employ their own methodologies that do not employ the best available statistical and analytical techniques. A detailed review of each of the studies is contained in the sections that follow. The report concludes with a description of cross-sectional time-series hedonic price analysis, a technique that would draw far more reliable conclusions from the available data.

Literature Review

Both studies utilize a literature review as part of their analysis. The New Jersey study does a better job of establishing a theoretical basis for the study by considering academic publications and reaches sounder conclusions from the literature review, whereas the Maryland study does a much better job of identifying previous empirical studies that are overlooked by the New Jersey study. Most importantly, neither study uses the literature review to adequately inform their statistical and quantitative work. In addition to simply reviewing results, the literature review should establish the accepted methodology, and the analytical part of the research should either follow the literature or justify why an alternative approach is preferred. In this section, we briefly summarize the literature to provide context for our reviews. Most of the research cited in our summary is reviewed by the Maryland and New Jersey studies, although our perspective may be somewhat different. The detailed reviews of the studies contain some additional comments on the literature reviews that are specific to a particular study.

Plantinga, Lubowski, and Stavins (2002) study the effects of potential land development on agricultural land prices, and this paper is heavily emphasized by the New Jersey study. This paper develops a theoretical model of the determination of agricultural land prices based on the uncertainty and irreversibility of the conversion to urban/suburban use. This theoretical model in the paper motivates the empirical work, which estimates the contribution to land values of potential conversion for counties in the 48 contiguous states. The authors of the paper estimate results that seem quite plausible. When ranked by the share of land value that is due to potential development, New Jersey has the highest share, 82%. On the other hand, Maryland's share is only 29%. Nevertheless, Maryland has the seventh highest share. The New Jersey report partially attributes the different results in the two studies being evaluated here to the fact that Maryland's share is too small to estimate reliably with the Maryland data. However, a 29% average share in the state should be large enough that it could be detected in those counties with significant development pressure.

Hardie, Narayan and Gardner (2001) investigate the influence of farm and nonfarm factors on real estate values in the mid-Atlantic region. They use a simultaneous equation model of farm and house prices to jointly determine farmland prices. Their empirical model is estimated with data on real estate prices, farm returns, household income, and other factors influencing local returns from farming and development using county level data for 230 counties in 6 mid-Atlantic states (including New Jersey and Maryland), in 1982, 1987, and 1992. The paper finds that farmland values are more responsive to non-farm factors such as development potential than factors that impact the profitability of agricultural operations. One of the more important findings in the paper is that farmland prices rise more quickly than house prices as counties become more urban.

The Plantinga, Lubowski and Stavins (2002) and Hardie, Narayan, and Gardner (2001) papers are important because they establish that development value is the most important factor determining farmland prices within the region. Overall, development values are more important in New Jersey where a larger proportion of the state is

urbanized, but development values are still very large in Maryland, particularly in the Baltimore-Washington area west of the Chesapeake Bay. These studies suggest that the negative impact of downzoning on property values from development restrictions could be significant. However, they are not micro-level studies that specifically examine downzoning. Empirical studies of downzoning's impact on property values in agricultural areas include Henneberry and Barrows (1990), Vaillancourt and Monty (1985), and two unpublished studies that look at Maryland (Applied Data Resources 1996, Resource Management Consultants 1991). Both of the published studies use regression analysis similar to the models described at the beginning of the last section of this report.

Henneberry and Barrows (1990) examine the negative and positive effects of exclusive agricultural zoning in Wisconsin using a regression model on 120 parcels that span exclusive agricultural and non-agricultural zones by allowing the effects of the explanatory variables to vary between the two types of zoning. They find negative effects on property values for smaller parcels close to urban areas, and positive effects for large parcels, further from urban areas that have lower development potential. While the Henneberry and Barrows paper is a relatively simple study with a small data set, the results make sense and it provides a good foundation for researchers examining similar issues. It is important to note that they were studying a relatively rural area where the "urban" areas supplying development pressure were Beloit and Janesville, Wisconsin, small cities with populations of about 50,000. Janesville was experiencing some population growth during the study period, while Beloit was losing population. A similarly designed study with development pressure from New York, Philadelphia, Baltimore and Washington may have dramatically different results.

Vaillancourt and Monty (1985) look at the effect of agricultural preservation zoning instituted in Quebec (Canada) in the late 1970s using a regression model. They do not allow the effect of zoning to vary based on location and parcel characteristics, so their model simply gives an average impact of zoning across all properties. Their regression model uses data on over 1200 vacant land sales in rural areas surrounding Montreal, and the results show that agriculturally zoned land sold for 15-30% less than unzoned land.

In addition to the study reviewed in the following section, there have been two unpublished studies that have examined the impact of downzoning on agricultural land values in Maryland. Resource Management Consultants (1991) charted the average price of agricultural land sold each year in 6 counties that downzoned. Their report contains no statistical tests and does not control for individual property characteristics. From their charts, there is no visible decrease in average land values after downzoning. While the report is interesting and suggests that downzoning may not impact property values, it is impossible to draw any significant conclusions from very small samples with no property specific controls or formal statistical tests.

Applied Data Resources (1996) used regression analysis to examine the impact of the RC-2 (1 house per 50 acres) and RC-4 (1 house per 5 acres) zoned land in Northern

Baltimore County. Their regression results find that zoning had no statistically significant impact on unimproved sales prices in the area. However, it is important to note that they also did not find statistically significant impacts from the size of the parcel, and location variables such as distance to the Baltimore beltway. Time was the only factor they found to have a statistically significant impact on price. The lack of a relationship between parcel size and location and land prices raises serious questions about the accuracy of their model. Without knowing more details about how the data were compiled and the analysis conducted, it is difficult to know exactly what, if any, problem existed. However, virtually every published study on factors affecting rural property values, regardless of zoning, finds parcel size and location to have strong impacts. If their model is unable to detect the effect of these factors, it raises doubts about whether they can conclude anything about less obvious and more uncertain factors such as zoning.

Review of the Maryland Study

The title of this report, “Downzoning: Does It Protect Working Landscapes and Maintain Equity for the Landowner?” suggests that it will examine two questions. Does downzoning protect working landscapes? Does downzoning lower land values? Three general methodologies are used to examine one or both of these questions: a survey of the literature, a survey of individuals involved with the issue, and statistical analysis. The statistical analysis only examines the second question about land values, and that is also the question asked by the New Jersey study and the emphasis of this review.

The question of whether downzoning protects working landscapes is addressed in the literature review and interviews, but the study generally treats the idea that downzoning protects farms as a self-evident fact rather than an open research question. It should be acknowledged that other researchers are investigating exactly the opposite hypothesis, that downzoning contributes to urban sprawl. For example, McConnell, Walls, and Kopits (2005) suggest that zoning limits may cause low-density, sprawling development and find, using Maryland data, that it is one contributor. Irwin and Bockstael (2004) find (again using Maryland data) that the restriction on minimum lot size implied by zoning regulations has a positive and significant effect on the timing of development. This runs counter to preserving farmland. In fairness to the authors, we note that these recent local studies were published in the peer-reviewed literature shortly after the release of the Maryland study, but the view that zoning could contribute to sprawl has been around for a while and should be acknowledged.

At times, the tone of the report more closely resembles an advocacy document than a research report. Examples include statements such as “The future of our rural lands is of inestimable importance.” The paragraph on the Oregon Land Use Act clearly states its goals without critically evaluating the results that followed. It would be worth acknowledging that in November 2004, 61% of Oregon voters passed an initiative requiring that compensation be paid for any adverse effects of the policies. In the discussion of the 1998 American Farmland Trust study, they say that 90% of the respondents said they experienced no loss in property values from zoning. Such survey responses are meaningless without knowing what fraction of the respondents were actually subject to zoning regulations and/or significant development pressure. This was a nationwide survey, and unlike high income coastal states such as New Jersey and Maryland, development pressure is still relatively light for the majority of the nation’s farms. The Plantinga (2002) study finds less than 10% of the value of U.S. agricultural land nationwide is due to its development potential compared to 30% and 80% in Maryland and New Jersey respectively. A more balanced presentation is appropriate.

The literature review is spread through a few chapters and interspersed with a great deal of discussion of the national scene and detailed explanation of local policies in Maryland. While the background information is interesting, much of it is ancillary to the primary research question. The authors do a good job citing relevant published and unpublished empirical studies, but should provide more discussion of their methods and,

as mentioned above, draw a connection between these methodologies and their own statistical work. The following sections focus on the interviews and statistical analysis.

The interviews

The county interviews provide a rich background for understanding land use policy on the local level in Maryland. It is clear that there have been a number of complex and innovative land use policies that go well beyond zoning changes. For example, tradable development rights have been implemented in several jurisdictions. The report thoroughly reviews the complexity of local policies, and the interviews with local officials explain the historical and political context of policy changes.

This section of the report provides valuable background that can and should be utilized in designing the statistical analysis and interpreting its results. However, it is unclear how the interviews provide any objective evidence for or against the specific research questions. In order to draw objective conclusions about the effect of policies with a qualitative, interview approach, it is critically important that the interviews encompass the full range of individuals directly impacted by the policies. Although the report does not provide a full list of everyone interviewed, it appears that most interviews were with local government officials directly involved in the design and implementation of local land use policies. While this is adequate for background information, many of the respondents have a vested interest in the success of the policies. The interviews do not include any developers, homebuilders and others who are directly impacted and may have changed their actions as a result of development constraints.

Given the way the interviews were designed and reported, we don't believe it is appropriate to draw any conclusions about the research questions from the background information they provide. However, most of the final conclusions in the report were based on local government insights in the county interviews. Furthermore, the four specific conclusions drawn from local government interviews sometimes conflict with each other and often stray from the initial research questions and venture into policy recommendations and advocacy. For example, Conclusion 2 states:

“While downzoning has been shown to have no impact on property values, other measures should be used as a complement to downzoning to mitigate perceived inequities between private rights and the public good. Among these measures are transferable development rights, purchase of development rights, the use of tax credits, leveraging, installment purchase agreements and State purchase and donation programs.”

Since transferable development rights are sold, their price approximates an equilibrium price and not all farmers sell their rights, the fact that there is a positive price indicates that farmers only are willing to sell them if they are compensated for the value of the development rights. However, the authors' conclusion is that there is no loss in property value from restricting development rights, so these other policies that compensate landowners mitigate “perceived inequities” rather than compensate for actual losses.

Arguing that the government should compensate for “perceived” losses to reduce political opposition to downzoning is a policy advocacy position, not an objective conclusion that can be drawn from their research. In addition, Conclusion 3 states, “In those jurisdictions where downzoning appeared to be successful, there was development pressure occurring within the county that helped establish a value for agricultural lands...” If development pressure “establishes a value for agricultural lands,” it is hard to argue that land values are not affected by reducing development rights.

The statistical analysis

The question of whether downzoning “maintains equity for the landowner,” is best addressed through a statistical analysis of a large number of market transactions. To its credit, the Maryland study assembles a rich dataset and emphasizes the statistical approach. Unfortunately, the Before-After Control-Impact (BACI) and LOESS regression statistical methodologies they utilize have severe flaws in this application, and are not the best available statistical methods for assessing the impact of downzoning on property values. There is also a notable lack of connection between the statistical analysis and the rest of the report. The literature review, county interviews, and background research provide valuable information that should inform the design of the statistical research. However, in this case, there are a number of significant inconsistencies between sections of the report:

- There is no connection between the literature review and the statistical analysis. None of the studies discussed in the literature review utilize the BACI study design. Why do the authors not follow the regression based statistical techniques that are already established in the property value literature? Since they are taking a different approach, the report should contain a justification for this approach, and a criticism of the techniques in previous studies. The authors describe their approach, but fail to reconcile it with the existing literature on the issue.
- The summary of chapter 2 (page 11) contains a lengthy list of factors that affect land prices in addition to zoning, and emphasizes the need to control for the “context of the land.” The importance of controlling for other factors is why most previous studies used a regression approach. The BACI statistical approach does not control for this context. As discussed later in this review, the nearest neighbor approach is not sufficient to control for these effects.
- In the county interviews in chapter 3, the authors discuss the numerous land preservation policies (e.g. tradable development rights, conservation easements, etc.) enacted in the counties in addition to downzoning. The use of these policies has increased over time, and is correlated with the adoption of downzoning. In Calvert County (one of the downzoned counties used for the statistical analysis), the report states that “a landowner can do just as well selling a development right as opposed to selling a portion of the farm for development.” Despite the detailed description of these policies and their local significance, the report’s statistical analysis does not control for the adoption of any land use policies except downzoning.

Maryland Property View is an excellent data set. The criteria used to select transactions for the statistical analysis is critically important. Many of the criteria used in the report (e.g. only arms-length transactions) are reasonable, but some of the criteria are overly restrictive. In particular, we feel that restricting the sample to parcels only in the agricultural zone is overly restrictive. They should include large parcels in rural residential zones as many of these properties have development and agricultural potential. This would increase their sample size and would provide control groups in addition to agricultural zones in other counties. The 20 acre minimum restriction may eliminate parcels likely to be used for development, so the authors should consider properties down to the minimum sizes impacted by downzoning. If part of the justification for the downzoning was to discourage development but parcels that are subject to development are not considered, this could influence the results. Given that the study period is more than 20 years, it is surprising that there are not more sales, and a larger sample size would help the statistical analysis. Several counties average about 3 sales per year, and this may be an indication that the screening is too stringent.

BACI (Before-After Control-Impact) design is a common statistical approach in ecological research, but has not been regularly used to study property values for decades. BACI was popular in the 1950s in transportation research. The interest then was in the effects of highways on property values. Researchers would examine the real estate sales of an area where a new highway was opened both before and after the highway was opened. These mean values would then be compared with the means in a control area away from the highway. Among the better known of such studies was by Adkins (1959) for three cities in Texas and Bone and Wohl (1959) in Massachusetts. In the years that followed, interest waned in such studies because improvements in computer capabilities and statistical methods allowed more refined techniques such as hedonic estimation.

BACI is essentially a comparison of the difference between means before and after an event. For example, an ecological researcher might observe a characteristic (e.g. soil moisture, the occurrence of an organism) over time for 2 sample plots, before and after some event that disturbs ecological conditions (a clearcut, hurricane, etc.). Key to this analysis is that the researcher observes the same sample plot in the before/after scenarios. In this study, the observations are property sales, and although the before/after sales take place within the same county, the before/after observations are different properties with very different characteristics. The attempts the authors make to control for these impacts (controlling for linear trend and nearest neighbor) are insufficient, and there really isn't an adequate solution within the BACI statistical framework, because the research question is far from a controlled experiment. In addition to random variation in the characteristics of observed properties, one would expect the zoning changes themselves (and time) to have an impact on the types of properties that are sold and thereby come into the before and after samples.

The time trend control is poorly designed. First, the paper assumes a linear growth in $\log(\text{price}/\text{acre})$, but that is not typical of land markets. In another inconsistency within the report, an earlier section describes multi-year periods of stagnant land prices followed by periods of rapid price appreciation which directly conflicts with their

statistical assumption of constant growth in land prices. The time trend would be better controlled for by using annual dummy variables that allow the degree of appreciation to vary between years.

In addition, nearest neighbor matching is a poor control for location impacts. The only location characteristic it might adequately control for are distances from urban centers or other key locations. However, one would expect that time and downzoning would result in large land parcel transactions for development purposes taking place further and further from population centers over time. If this were true, the after parcels might be consistently further from urban centers than before parcels and skew the analysis. There are no statistical tests to rule out this possibility or even compare the basic characteristics of the before and after samples. Furthermore, location impacts are complex and may be based more on adjacencies than distance. In other words, if one were to take a matching approach, it is not clear that nearest neighbor is the best criterion for matching similar properties. For example, a 20 acre property adjacent to a busy highway is likely to have more in common with a 50 acre parcel next to the highway that is 10 miles away, than a 200 acre parcel that is 1 mile away from both the highway and the initial property. Finally, the matching approach greatly reduces the sample size, a substantial weakness acknowledged by the authors who consider the nearest neighbor analysis only an ancillary analysis because the small sample size greatly reduces the power of their statistical tests.

The second statistical methodology utilized is LOESS regression. They use LOESS to produce smoothed time trend graphs of average property values, and there are not statistical tests associated with the analysis. The graphs are featured in the body of the report and referred to as regression analysis. This is unfortunate, because the graphs are visually deceptive, and LOESS is not the type of regression analysis with which most people are familiar and that we recommend in the final section. We do not feel the LOESS regressions provide any useful insight to the research question.

LOESS regression fits simple models (linear or low-degree polynomials) to localized subsets of the data using weighted least squares. For each data point (year in the current study, apparently) the regression uses weights that decrease with distance measured in time. In order to understand the model that generated the results, one would need to know more information such as: the “bandwidth,” the amount of data used for each sub-regression; the degree of the polynomials; and the specific weighting function. Without this information, it is difficult to evaluate the estimation. The jaggedness of the graphs suggests a narrow bandwidth with little smoothing.

Generally LOESS is data-intensive, needing large datasets so that there are many observations near each point. This is not the case here as there are very few sales in each county in a given year. It is also prone to outliers which may be the case here. The graphs provided are misleading because the vertical axis (cost per acre) is plotted on a logarithmic scale. One tends to look at the graphs as representing actual appreciation or depreciation without adjusting for the log scale. The log scale (where the \$900 gap between \$100 and \$1000 has the same vertical distance as the \$90,000 gap between

\$10,000 and \$100,000) hides the unstable and imprecise nature of the estimates. When one controls for the log scale, the variations in the cost per acre seem far too high, and sometimes the results seem contrary to the reports conclusions. Since the researchers only present their results graphically, the calculations here are very rough but they are indicative. In Calvert County in 1999 at the time of the downzoning, the price index is roughly \$12,500 per acre. By about 2001, it had fallen to less than \$3,000 per acre. During the same period, prices in Charles County went from roughly \$1,150 to about \$1,075 per acre. Visually, they appear to be similar decreases because the difference is obscured by the log scale. Surprisingly, page 37 of the report states, “Since the downzoning action, land costs in both counties (Charles and Calvert) have been relatively constant.” The report authors seem to be deceived by their own graph, as they report a roughly 75% (\$9,000) drop in per acre land values in Charles to be similar to a 5-10% (less than \$1000) decrease in Calvert county over the same period. We do not believe the LOESS results are credible or useful, but this just indicates that the graphs must be approached with great care.

Summary

The panel finds the Maryland study’s analysis to be insufficient to support their conclusion that downzoning has no negative impact on property values. Some of the more significant shortcomings include:

- The literature review is disconnected from the rest of the report, and fails to inform and support the analysis sections.
- The interviews did not include the full range of individuals impacted by downzoning, and do not provide any objective evidence towards zoning impacts on property values.
- The criteria applied to include properties in the statistical analysis appear to be overly restrictive, limiting the sample size and possibly skewing the results.
- The BACI statistical analysis does not control for many property characteristics (e.g. parcel size, location) that impact land values. Because some of these characteristics are likely to be correlated with zoning, this could lead to incorrect estimates of the downzoning impact.
- LOESS regression is a poor statistical technique for this application, and produces visually deceptive graphs that are heavily relied upon in the study conclusions.

Review of the New Jersey Study

The New Jersey study is titled “The Impact of Downzoning on Agricultural Land Value in New Jersey.” The New Jersey study was completed in November 2004 by Michael Samuels of Clarion/Samuels Associates in cooperation with the New Jersey Farm Bureau. Their methodology includes a literature review, a review of State Agriculture Development Committee (SADC) appraisals, an analysis of tax assessor valuation practices, and two models developed by Clarion/Samuels Associates (Sales Comparison and Income Approaches).

The literature review provides a solid theoretical base for the paper. They are correct to use the Plantinga (2002) paper to demonstrate that development value is exceptionally high, and argue that the negative impacts from downzoning are likely to be greater in New Jersey than other states. They discuss the possibility of positive property value impacts from downzoning found in other studies, but they fail to account for these affects in their quantitative analysis in following sections. The major problem with the literature review is the absence of previous micro-level empirical studies, in particular failing to discuss Henneberry and Barrows (1990) is a major oversight. The final paragraph of the review does contain a paragraph of criticizing the Maryland study which appeared a year earlier. Their review of the Maryland study quotes a few sentences that they feel describes the New Jersey situation. Interestingly, the quote is describing the Henneberry and Barrows (1990) paper they overlook in their own review, and refers to the possible positive impacts from downzoning which is overlooked in their quantitative models.

Unfortunately, the series of quantitative estimates that follow are not as strong as the literature review. At best, their estimates may be considered upper-bound estimates of the negative property value impacts from downzoning because of their singular focus on the development effect. Although based on well established real estate appraisal methods that are reliable in well-established markets with comparable sales, the New Jersey study develops its own methodologies that extend these methods in questionable ways. They provide no citations of previous studies that utilize similar approaches. Our evaluation is that their methods are unreliable and likely to overestimate the negative effect of downzoning on property values. The following sections provide a detailed assessment of each of the New Jersey studies’ quantitative techniques.

Review of SADC Appraisals

Although interesting, this analysis is of limited value because the purchase of development rights programs it analyzes involve the complete elimination of development rights whereas downzoning restricts but does not totally remove development rights. The study correctly notes that the percentage loss in property values from PDRs would only be an upper-bound of downzoning impacts. However, we do not find these results convincing even as an upper-bound estimate.

In addition to the lack of comparability to downzoning, this analysis suffers from the use of appraisals rather than actual purchase prices. The easements involved in purchase of development rights programs are difficult to appraise because there are few comparable sales, and traditional appraisal techniques are ill-suited to partial interests in property. A number of recent media reports, for example a 2003 *Washington Post* series (Stephens and Ottaway 2003) have found that appraisals of conservation easements and development rights are inflated and have resulted in excessive payments and tax credits for some landowners. Two empirical studies of actual land sales in Maryland (Nickerson and Lynch 2001; Michael 2004) have found modest negative impacts from the presence of conservation easements that are lower than what is typically estimated in appraisals for the Maryland Department of Agriculture for similar programs.

There may be some potential to obtain market like estimates of these values by analyzing accepted and rejected offers (the offer prices are based on the appraisals). It appears that the authors only present data from accepted offers but it isn't clear. Further analysis of this data would be interesting, but it would be tangential to the downzoning questions due to the other concerns noted above.

Assessor Valuation Practices

This approach relies on the common empirical finding of a negative relationship between price per acre and the size of the lot. They use local tax assessor estimates of this relationship for their case studies. Their next step is to assume that the value of a tract of land is the sum of the value of the individual building lots that make up the land parcel, and this is where the approach can go wrong. This assumption is logically inconsistent with the empirical finding that price/acre is decreasing as acres increase that they use as the basis for the first step in their calculation. In other words, if their assumption that the value of land is the sum of the value of the lots is true, then it must follow that the relationship between price per acre and lot size is linear. The analysis is not valid, because only one of the two critical assumptions on which it is based can be true.

Sales Comparison Approach

This approach is similar to the Assessor Valuation Practices. The difference is that a Clarion/Samuels appraiser uses the sales comparison approach to estimate the value of a small lot (e.g. 3 acres) and large lot (e.g. 10 acres) within the case study area. As a result, it suffers from the same logical inconsistency of simultaneously assuming that 1) price/acre decreases in lot size, and 2) the value of large parcels is the sum of the value of small lots.

The problems are compounded by uncertainty about the sales comparison themselves. Values are estimated based on small samples of 3 to 4 properties in each area, and no information is given about how or why specific properties were selected, so the selection method is a black-box for the reader. This heavy reliance on the subjective assessment of the researchers to select comparables is undesirable in an objective

research report. Furthermore, it appears that the comparable sales were for lots with houses rather than vacant land. Usually sales comparisons would use comparables that were as similar as possible to the parcel being considered. This would mean vacant land sales of approximately 50 acres. Comparables for the hypothetical property with the downzoning would be more difficult to find since the hypothetical zoning doesn't exist.

Nearby communities where larger lot zoning does exist appeared to be excluded from several case studies, although these areas would probably offer the closest comparable sales. For example, the Franklin Township case study ignores the Pineland Zoning area with larger minimum lot sizes, and Monroe Township contains a variety of different zones but they only look at sales within a single zone. There is also a lack of discussion of public amenities or community open space within developments. For example, the Hillsborough Township case study discusses 2 developments, one of which has 1.25 acre lots that are significantly less than the 3 acre minimums in the current zoning. How is it that the Country Classics subdivisions builds homes on lots that are less than half the size required by zoning regulations? This suggests some type of cluster development with community space that adds value to the private lots even if it isn't part of the individual 1.25 acres. Without more information it is hard to conclude much, but it raises questions about the method of selecting comparables.

Income Approach

This process attempts to model calculations a developer might make in evaluating a 50 acre parcel for development. While this might provide a rough estimate of the maximum willingness-to-pay of one player in a market, it is not the same as a market price which results from the interaction of all potential buyers and sellers. Depending on the particular situation, a developer may be able to buy for less than this value or another type of buyer could have higher values for non-development uses. The calculations also depend on the same small sample of 3-4 transactions used in the Sales Comparison Approach to estimate the price of a small lot which raises the same issues discussed above.

An additional (and perhaps more important) problem with this approach is the string of questionable assumptions upon which the calculations are built. There are assumed values for a single family house (and lot) on a lot with the original acreage and another house (and lot) on a lot with the downzoned acreage. There were houses on the smaller size lot in the county, but there was a tremendous range in values. Apparently, they arbitrarily picked a price to use. There were not enough sales on the larger lot size, according to the report, so they assumed a house price. Then they assumed that the ratio of the lot value to the sales price was constant for both types of houses and calculated the lot value, although there is no theoretical or empirical justification given for such a strong assumption. If you assume a larger house on the larger lot, then a larger lot was worth more than the smaller one. However, in Monroe Township they assume that the house values on large and small lots were identical, and as a result they amazingly estimate the same value for a lot that is double in size. Obviously, if one sells half as many lots for the same price per unit, there is going to be a large reduction in the total value of sales.

In summary, this approach uses made-up property values for large lot homesites, then applies a series of calculations based on unjustified assumptions (such as constant ratio of home value to lot value) and rough estimates of development costs.

Summary

The panel believes the New Jersey study's methodology is insufficient to support their conclusions, and is likely to overstate the negative impact of downzoning on property values. Some of the more significant shortcomings include:

- The literature review is good, but fails to show any peer reviewed studies that extend standard appraisal techniques in a manner similar to this report.
- The SADC appraisals examine purchases of development rights that are not comparable to downzoning, and the development rights appraisals themselves are of questionable accuracy.
- The methodology focuses exclusively on estimating the negative development effect, and makes no provisions for estimating possible positive impacts from zoning.
- Many of the key assumptions in the analysis are questionable. In particular, several of the study's methodologies simultaneously make the contradictory assumptions that 1) the value of the large parcel is the sum of the value of the lots into which it can be subdivided (implying a constant relationship between price per acre and parcel size) and 2) the price per acre of undeveloped land is decreasing with parcel size as found in most empirical studies of property values.
- Estimates are based on a small sample of 3 properties selected by the appraiser, and the criteria used to select the properties are not transparent.

A Different Approach – Hedonic Price Analysis

The best approach for estimating the impact of downzoning on property values is a cross-sectional time-series hedonic price analysis. Hedonic price analysis is a regression based statistical approach that uses individual properties as the unit of observation utilizing a large sample of properties with different zoning that share a common real estate market. Hedonic price analysis is well established in the peer reviewed literature and is the approach most commonly employed in previous studies of zoning impacts. The regression model can control for the impact of location, individual property and neighborhood characteristics, and other land use policies. Rather than simply comparing two areas with different zoning, the hedonic model can simultaneously incorporate data from a wide range of different zones which allows for much larger data sets and more precise estimates of zoning impacts. Hedonic price analysis is also being used more frequently by professional appraisers where it is often referred to as the mass appraisal method.

A simple hedonic regression model would pool data on undeveloped land sales across multiple counties and zones within the same overall market. Developed parcels could also be used, but should be analyzed as a separate sample rather than pooled with undeveloped sales. The most straightforward regression model would use $\ln(\text{price/acre})$ as the dependent variable and the following explanatory variables:

- Size of parcel
- Distance based location variables – such as distance to central business districts, highway interchanges, parks or other significant environmental amenities
- Type of Zoning (different zones could be controlled for with a set of 0/1 indicator or dummy variables)
- Land quality (e.g. soil quality, slope, type of cover such as forest, pasture, etc.)
- Time trend (indicator variables for each year rather than a linear trend)

Following the lead of Henneberry and Barrows (1990), the regression could be designed to allow the impact of zoning to vary based on key characteristics of the property (e.g. parcel size, location). This approach follows the idea that the impacts of zoning will vary for different landowners. For example, landowners closer to urban areas may have greater development value and have a greater negative impact from downzoning, whereas those landowners located further from urban areas may have smaller negative impacts and substantial positive impacts from limiting nearby development. If data are available, repeat sales analysis similar to that of Palmquist (1982) and Parsons (1992) could be used to better control for property specific characteristics. Although even a simple hedonic regression as described above is superior to the methods used in the Maryland and New Jersey studies, researchers should be careful of potential problems with hedonic estimation such as missing data on important property characteristics and the possibility of endogenous zoning (in other

words local zoning changes are likely to be stimulated by some of the same factors that affect property values) within the hedonic model. The following paragraphs describe some of these issues and techniques that can be employed to correct them.

As discussed above, the researcher may not have data available on all the characteristics that influence the value of the properties. This does not have to be a problem unless the omitted characteristics are correlated with the variable(s) of interest. Unfortunately, such correlations frequently exist and may bias the coefficient estimates. In controlled experiments, the researcher would control for such conditions in doing the experiment. Generally such controlled experiments are not possible in economics. Regressions are a means of controlling statistically for the variables that are important but are not the primary interest of the research. If the data are not available on those variables, other strategies have to be developed. Recently there has been considerable interest in economics in the use of “natural experiments.” A natural experiment attempts to mimic a controlled experiment as closely as possible. The researcher tries to find observations that are as similar to each other as possible, but where some have and some have not been “treated” (i.e., differ in the variable of interest).

An early example of such a natural experiment is Black (1999). Sandra Black was interested in how important better schools were to parents. This question had previously been addressed by estimating what effect, if any, schools test scores had on residential property values. The previous studies regressed real estate sales prices on the characteristics of the houses and neighborhoods including a measure of school quality. The problem is that better schools are frequently associated with better neighborhoods, but not all the important attributes of neighborhoods are observable. The coefficient on the school quality may be capturing not only the value of school quality but also the value of unobserved neighborhood traits. Black used 175 neighborhoods, each of which was internally fairly homogeneous with respect to all traits except that an attendance district boundary transected it. The differences between neighborhoods could be large, as long as the individual neighborhoods were homogeneous. She regressed the price of houses on the characteristics of the structures, a series of dichotomous variables for the neighborhoods, and the test scores in the attendance districts. By limiting the observations to be close to district boundaries, she was controlling for unobservable neighborhood characteristics. She found significant, positive values for school quality, but the estimates were about half the size of those she obtained using the standard techniques. This demonstrated that correlated unobservable neighborhood characteristics could have a large effect on the results and should be controlled for. A similar methodology has been applied by Holmes (1998) to industry location decisions.

With rural land the problems of unobservable traits of the neighborhood or region of the state may be even more of a problem than in urban areas such as Black’s. Both the levels and the changes in the value of those unobservable characteristics may affect the estimated coefficients on the downzoning variables of interest. Since the correlation could be positive or negative, the bias in the coefficients could be in either direction. One possibility that we propose is to utilize the natural experiments that are available in the data. It appears that in most of the counties where downzoning took place there were

agriculture zones and rural zones or similar differentiated zones. Properties near the dividing line between the two zones are probably subject to the same general influences. If the downzoning affects only the agricultural zone or affects the two zones differentially, there is a natural experiment. These natural experiments would be within a county. If necessary because of data limitations, the natural experiment could be for properties on either side of a county boundary, although one would need to control for tax and expenditure differences between the counties as well as the downzoning differences. The complexity of the downzoning policies and their timing would be greater than Black faced, but there should be opportunities to control for the unobservable characteristics and improve the estimates.

A third extension of the research would allow for the possibility that the zoning itself was endogenous. In other words, the characteristics of the property might affect whether or not it was included in the area to be downzone. This is a problem in evaluating many social programs. For example, in evaluating the success of job training programs, one can compare the success of participants to those who do not participate. If participation is completely random, this is fine. However, if choosing to participate is not random (the more typical case) then comparing the success of participants to non-participants confounds two effects: the training and the characteristics that lead to choosing the training. Now it is easy to control for the observable characteristics that affect the participation decision, but once again the unobservable characteristics are likely to be important. In this example, the treatment, which is endogenous, is job training. In the land zoning issue, the treatment is downzoning. We would like to know the effect of downzoning on the lands that are downzoned, but it is difficult to isolate that effect, particularly in cross-sectional analysis.

Most of the work addressing these issues has used one of two techniques: matching estimators and instrumental variable estimators. Because of the limitations on data in rural areas, the search for instruments may not be successful. Matching techniques such as propensity score might be more successful. Propensity score matching matches each treated property to the untreated properties that are most similar, where “similar” means closest in the probability of being downzoned. The logic here is related to the logic in the natural experiments described above.

One advantage in the current instance is that there are observations over time. If there were repeat sales of properties, it would be possible to implement a difference in differences estimator, which is closely related to the repeat sale estimator, a technique that has been used widely since the 1980s. A difference in differences estimator tracks both the treated and the untreated, both before and after the treatment. This would allow estimation of the effect of treatment on the treated. However, as described above, there are probably not enough repeat sales. Instead, it may be possible to combine the time-series, cross-section hedonic estimation with some form of matching to refine the estimates and approximate a difference in differences estimator.

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Appendix: The Panel of Reviewers

The three person panel consisted of Dr. Jeffrey Michael, Dr. Raymond Palmquist, and Dr. George Parsons, and is uniquely qualified to provide a rigorous, independent, and accessible review of this important public policy issue. All three have extensive expertise in property value studies, economics, and statistical methods, and have experience with rural land markets within the mid-Atlantic region. None of the panelists have received previous funding from the Maryland Center for Agro-ecology or the New Jersey Farm Bureau, and they are not employed by institutions that contribute funding, board members, or are otherwise connected to the sponsors of the previous studies.

Dr. Jeffrey Michael is Associate Dean of the Honors College and Associate Professor of Economics at Towson University. As the junior member of the panel, he served as a reviewer, coordinated the panel and the overall synthesis of the panel's findings into the final report. The two senior panelists took a leading role in the technical review of the studies and the description of an alternative methodology in the final section. Dr. Raymond Palmquist is Professor of Economics at North Carolina State University and is widely considered to be one of the world's leading experts in property value studies. Dr. George Parsons is Director of the Marine Studies Program and Professor of Economics at the University of Delaware where his well-regarded work in environmental economics has included property value studies within the region.