

**The Economic Value of Mountain Views:
Some Preliminary Results**

by

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ABSTRACT: We use the contingent valuation survey method to measure the value of mountain views. We first use a willingness to pay approach to measure the amount citizens are willing to pay to improve mountain views through the removal of billboards. Then we use a willingness to accept approach to measure the value of mountain views by measuring the compensation required to allow wind generation windmills to be built. Both approaches look at perceived property rights as well as perceptions of the status quo. Overall this study provides insights to the debates surrounding land use in the mountains.

Introduction

The debate on land use in the southern Appalachian Mountains has been around for years. For example, should counties develop zoning ordinances? Should states designate highways as a scenic byway? Should billboards be removed or cell towers built? Should the county regulate the number of abandoned cars? In Watauga County, North Carolina groups formed to monitor land use. One of the groups called themselves the committee of 100. Partially, through their efforts a new section of Route 421 was designated a scenic byway. Another group identified themselves with the other side of the debate and had bumper stickers printed saying “No Zoning in Watauga County”.

To help understand the value of mountain views, we developed a contingent valuation survey to elicit both the willingness to pay (WTP) and the willingness to accept (WTA) for changes in the county’s view-shed amenities. The survey was mailed in the spring of 2005 to a random sample of 1200 Watauga County residents using the Dillman technique. In our case, we used a primary mailing, a post card reminder and a second mailing to all non-respondents of the first wave. In the end, we had 901 useable addresses and 389 responses giving us a response rate of 43 percent. In table 1, we report the means of the demographics. We find that the average age of our respondent was 56.5 years, while the average age for the county of all residents over 20 was 43.5. We find that the average income of survey respondents was \$60,470¹ and the average income in Watauga County from the 2000 census was \$50,300 in 2005 dollars. The average years of education for the respondents were 15 years and for the county it was 14 years. The percentage of male survey respondents was 60 percent where the county average is 49.8 percent male. The respondents, therefore, are more male, older, slightly more educated and have higher income than the population.

In addition, 81 percent of the respondents report they have a daily drive with a scenic view, while 59 percent report their residence has a scenic view. Seventy-nine percent of the respondents report they own a cell phone. Eleven percent of the respondents have retired to Watauga County and 33 percent report having ancestors who lived in Watauga County.

In section one, we provide some insights as to how people perceive property rights and mountain-view amenities. In section two we report the results of the WTP for the removal of billboards. In section three, we report the results of the WTA for building electrical wind mills. We then provide a bivariate probit analysis of both the WTP and WTA studies in section four. In section five, we conclude with policy implications.

Section One: Opinions on Mountain Views

In table 2, we report opinions about land use in Watauga County. We find that 67 percent either agree or strongly agree that land use zoning should be used in Watauga County while only 42 percent either agree or strongly agree that land owners should use their land any way they want. In addition, we find that 97 percent either agree or strongly agree that mountain views are an important part of the quality of life and 92 percent agree or strongly agree that ridge laws that prevent buildings on the top of mountains are important. Further, we find that only 26 percent agree or strongly agree that Route 421 should not have been designated a scenic byway while only 10 percent agree or strongly agree that abandon cars do not harm the landscape. Lastly, we find that 60 percent agree or strongly agree that electrical generation windmills should be allowed in Watauga County and 51 percent agree or strongly agree that cell towers harm the mountain viewshed.

To further explore people's opinion about land use, we analyze level of agreement using the ordered logit technique. We report the results in table 3. We find that when a respondent reports that they own a home with a view, it increases the likelihood that they are of the opinion that ridge laws are important. Individuals with a home with a mountain view also are more likely to find that cell towers harm the mountain landscape and that mountain views are an important for quality of life in Watauga County. We also find that when respondents report they have a daily drive with a mountain view they are more likely to be in favor of zoning ordinances and ridge laws. These respondents are also less likely to believe land owners should be able to use their land any way they want. In addition, respondents who report daily drives with views, also report that cell towers and abandon cars damage mountain views and that mountain views are an important to the quality of life in Watauga County. They also are more likely to answer that Route 421 should be designated as a scenic byway and that electrical generation wind mills should not be allowed in Watauga County.

Individuals with ancestors from Watauga County are more likely to agree that electrical generation wind mills should not be allowed in the county. These same individuals are also less likely, however, to agree that zoning and ridge laws should be used, and that Route 421 should have be designated a scenic byway. They are also less likely to agree that cell towers or abandon cars harm mountain landscapes and that mountain views are important to the quality of life in their county. Lastly, residents with ancestors in Watauga County are more likely to agree that land owners should be able to use their land as they see fit.

Individuals who have retired to Watauga County are less likely to agree that land owners should use their land any way they want. Respondents with more education are also less likely to agree that land owners should use their land any way they see fit and more likely to agree that Route 421 should have been designated a scenic byway. Lastly, older individuals are more likely to agree that zoning is important and less likely to agree that land owners should use land any way they want. Older individual also agree that ridge laws are important.

In the next set of tables, 4, 5 and 6, we summarize the opinions of the usefulness and impact on mountain views of cell phone towers, billboards and electrical generation wind mills. We find that 46 percent of respondents find that billboards provide somewhat useful information and 42 percent use billboards to make decisions on where to shop and eat when they visit other locations. Yet around 80 percent either find that billboards are somewhat harmful to very harmful to the mountain views of Watauga County.

When it comes to cell phone towers we find that the vast majority, 91 percent, find that the cell phone service is somewhat useful to very useful. Yet 67 percent feel that cell towers are somewhat harmful to very harmful to mountain views. A majority also feel that wind energy is a clean energy that should be pursued. Yet 64 percent feel that electrical generation wind mills will harm mountain view-sheds. This series of tables show respondents tend to find that billboards, cell phone towers, and wind electrical power are all useful. They also feel that all do harm the mountain-view amenities, suggesting that tradeoffs need to be made. In the next two sections, we analyze

contingent valuation questions on both the WTP and WTA for changes in mountain-view amenities.

Section 2: Willingness to Pay for Billboard Removal

Theory

Consider a resident's utility function who receives utility from both a consumption good, z and a scenic view amenity, $x(q)$, where q represents quality of the scenic amenity that can be affected by the presence of billboards. Then a resident maximizes her utility, $u(x(q),z)$, subject to a budget constraint $y=px+z$ where the price of z is normalized to one. Solving for the indirect utility function yields $v(p,y,q)$ where p represents the price of the scenic amenity and y is income. From Roy's identity the Marshallian demand function is $x(p,q,y)$.

The willingness-to-pay, WTP, for the scenic view amenity is found when,

$$1) v(p^0, q^0, y) = v(p^1, q^1, y - \text{WTP}),$$

where p^0 is the current price, q^1 is the improved quality and WTP is the willingness-to-pay equivalent variation.

In our case, the CV question for bill board removal follows a dichotomous choice framework. The variable **Yes** is a qualitative variable equal to one if the respondents answered yes to the CV question:

“The State of North Carolina through the Highway Beautification Act has suggested removing billboards along roads. The federal government has mandated that when billboards are removed land owners need to be compensated for lost income from billboards. Suppose Watauga County wants to remove billboards to improve mountain views. Suppose that to implement the removal of billboards county residents must pay \$A to compensate land holders for the removal of billboards.” Are you in favor of this proposal?

YES NO DON'T KNOW

One problem that arises when estimating dichotomous choice CV questions is what to do with 'Don't Know' responses. We follow the conservative approach and code all 'Don't Know' responses as "No" responses (Groothuis and Whitehead 2002, Caudill and Groothuis 2005). This becomes our variable that we label **Yes1**.

Another problem that has arisen with contingent valuation method surveys is hypothetical bias (Whitehead and Cherry, 2004). Hypothetical bias exists if respondents are more likely to say that they would pay a hypothetical sum of money than they would actually pay if placed in the real situation. Since economic values are based on actual behavior, hypothetical bias leads to economic values that are too high. One method that is used to mitigate hypothetical bias is the certainty rating. For those respondents who say that they are willing to pay we ask: "On a scale of 1 to 10 where 1 is "not sure at all" and 10 is "definitely sure", how sure are you that you would make the one-time donation of \$A?" Following their recommendation only respondents whom answer greater than 7 are coded as a yes response. We identify this variable as **Yes2**.

Thus we estimate two CV specifications for each of our yes variables they are:

$$2) P(\text{Yes}) = \beta_0 + \beta_1 A + \beta_2 \text{Income},$$

and

$$3) P(\text{Yes}) = \beta_0 + \beta_1 A + \beta_2 \text{Income} + \beta_3 \text{Education} + \beta_4 \text{Age} + \beta_5 \text{Gender} \\ + \beta_6 \text{Ancestor} + \beta_7 \text{Homeview} + \beta_8 \text{Driveview} + \beta_9 \text{Retire},$$

where $P(\text{Yes})$ is the probability of a yes. In table 7, we report the results of both specifications. In column one, we report the results of the specification that includes only income and tax payment. We find that the tax payment negatively affects the likelihood of a yes response and income positively affects the payment suggesting the improvement of mountain views from billboard removal is a normal good. Using the Cameron Technique, we estimate the WTP for billboard removal is \$109 per household.

In the second column, we report the specification that includes a richer set of explanatory variables. We find that income becomes insignificant once you include education, age and other explanatory variables. Therefore income might have served as a proxy for education in the basic specification.

In the second specification, education is found to increase the likelihood of a yes response. In addition those who report a home with a view and a drive with a view are more likely to say yes to the removal of billboards. We also find that those who moved to Watauga County after they retire are more likely to say yes. Those who have ancestors in Watauga County, however, are less likely to answer yes to the CV question. In some senses, the above results support the Tiebout hypothesis where individuals move into the area with a mix of local amenities they prefer. Overall, the results suggest that households perceive that the mountain-view amenity would be improved through the removal of billboards. In the next section we explore how residents feel wind mill generation influences the mountain-view amenity.

Section 3: Willingness to Accept for Electrical Generation Windmills

Theory

Consider a resident's utility function who receives utility from both a consumption good, z and a scenic view amenity, $x(q)$, where q represents quality of the scenic amenity that can be affected by the presence of billboards. Then a resident maximizes her utility, $u(x(q),z)$, subject to a budget constraint $y=px+z$ where the price of z is normalized to one. Solving for the indirect utility function yields $v(p,y,q)$ where p represents the price of the scenic amenity and y is income. From Roy's identity the Marshallian demand function is $x(p,q,y)$.

The willingness-to-accept, WTA, for the lowering the quality of a scenic view amenity is found when,

$$4) v(p^0, q^0, y) = v(p^0, q^2, y + WTA),$$

where p^0 is the current price, q^2 is lowered quality and WTA is the willingness-to-accept compensating variation for lowering scenic view quality.

In our case the CV question for the windmill proposal is:

Suppose, to generate Green electricity, windmill generators are to be built on four ridge tops throughout Watauga County. To compensate individuals in the county for accepting windmills, electric utility bills would be reduced by \$A each month per household. Suppose that this proposal, approving the electrical payment reduction and allowing electrical windmills to be built, is on the next election ballot. . How would you vote on this proposal?

FOR AGAINST DON'T KNOW

One problem that arises when estimating dichotomous choice CV questions is what to do with Don't Know responses. Once again we follow the status quo approach

and code all Don't Know responses as "No" responses (Groothuis and Whitehead 2002). This becomes our variable that we label **Yes1**.

In Table 8 we report the results of the WTA specifications. The specifications are

$$5) P(\text{Yes}) = P(\text{Yes Windmills}) = \eta_0 + \eta_1 B + \eta_2 \text{Income} + \varepsilon_2$$

and

$$6) P(\text{Yes Windmills}) = \eta_0 + \eta_1 B + \eta_2 \text{Income} + \beta_3 \text{Education} + \eta_4 \text{Age} \\ + \eta_5 \text{Gender} + \eta_6 \text{Ancestor} + \eta_7 \text{Homeview} + \eta_8 \text{Driveview} + \eta_9 \text{Retire} + \varepsilon_2$$

We find that as the payment, A , increases residents are more likely to be for the proposal. Income is also found to be negative and significant suggesting that mountain views are normal goods. Following the Cameron and James technique we find that the WTA for allowing windmills is \$10.77 per month per household.

In the second specification income remains negative and significant suggesting that income was not a proxy for education or other excluded variables. In this specification we find ownership of a home with a view and retiring to Watauga County both lowered the likelihood of being in favor of the proposal. Both of these results support the hypothesis that individuals whom retire to Watauga County and those whom buy house with views value the mountain-view amenities higher. These results are the same as with the bill board proposal.

Individuals with ancestors in Watauga County, however, are less likely to be in favor of windmills. This result is counter to the billboard proposal, where individuals were less likely to be in favor of removing bill boards. These results suggest that

respondents with ancestors in the county favor the status quo. In the next sections, we analyze both the WTP and the WTA proposals using a bivariate probit analysis

Section 4: Bivariate Probit

In the previous two sections, we have measured the values of changing mountain views using both the WTP and WTA approach. In this section, we analyze if there is some unmeasured characteristic that influences both the WTP for billboard removal and the WTA to allow electrical generation wind mills in Watauga County. We use the bivariate probit techniques to analyze both decisions.

In equation 7 and 8, we report the bivariate probit specifications we use in our analysis. The first specification uses only income and offers as explanatory variables. The second uses the same specification as in the above analysis.

$$7) P(\text{Yes Billboards}) = \beta_0 + \beta_1 A + \beta_2 \text{Income} + \varepsilon_1$$

$$P(\text{Yes Windmills}) = \eta_0 + \eta_1 B + \eta_2 \text{Income} + \varepsilon_2$$

$$\rho(\varepsilon_1 \varepsilon_2)$$

and

$$8) P(\text{Yes Billboards}) = \beta_0 + \beta_1 A + \beta_2 \text{Income} + \beta_3 \text{Education} + \beta_4 \text{Age}$$

$$+ \beta_5 \text{Gender} + \beta_6 \text{Ancestor} + \beta_7 \text{Homeview} + \beta_8 \text{Driveview} + \beta_9 \text{Retire} + \varepsilon_1$$

$$P(\text{Yes Windmills}) = \eta_0 + \eta_1 B + \eta_2 \text{Income} + \beta_3 \text{Education} + \eta_4 \text{Age}$$

$$+ \eta_5 \text{Gender} + \eta_6 \text{Ancestor} + \eta_7 \text{Homeview} + \eta_8 \text{Driveview} + \eta_9 \text{Retire} + \varepsilon_2$$

$$\rho(\varepsilon_1 \varepsilon_2)$$

The parameter, ρ , show if there is some unmeasured characteristic that makes the likelihood of voting yes to one of the decisions influence the likelihood of voting yes on the other decision.

In both specifications we find that the ρ statistic is positive and significant. These results suggest that respondent's decision on both the WTA and WTP questions have some unobserved characteristic that influences both choices.

Section 5: Conclusions

In our study we find that individuals value mountain views. We find that the majority of respondents desire some regulation to protect the view shed. For example the majority are in favor of ridge laws and zoning. We also find that individuals are willing to pay on average \$109 per household to remove all billboards in Watauga County. Citizens would also need to be compensated \$11 per month per household to allow electrical generational wind mills on four ridge tops in Watauga County. In addition we find that individuals who buy homes with views, and who retire to Watauga County have different preferences than individuals whom have ancestors in the county when it comes to changes in the view shed. Lastly, we find that both the WTA and WTP decisions are correlated suggesting the two decisions depend upon some unobserved characteristic. Future analysis of the data set will attempt to measure the aggregate WTP and WTA on a county wide basis.

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Table 1 Means of Variables

Variable	Mean
Age	56.5 years
Income	\$60,470
Education	14.97 years
Male	.60
Drive with View	.81
Home with View	.59
Ancestor from Watauga	.33
Retire to Watauga	.11
Own Cell Phone	.79

n=353

Table 2 Opinions about Land Use

	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
Zoning	43.4%	23.3%	11.1%	13.4%	8.5%
Cell Tower	17.0%	34.2%	30.1%	9.8%	9.0%
Landowner	21.6%	20.3%	33.7%	19.8%	4.6%
Scenic Byway	10.5%	14.4%	23.4%	37.8%	13.9%
Ridge Law	71.2%	21.6%	3.3%	1.3%	2.5%
Mountain View	70.2%	26.5%	1.3%	0.3%	1.8%
Windmills Electrical	19.0%	40.6%	14.4%	8.2%	14.7%
Abandon Cars	3.6%	5.9%	20.8%	66.8%	2.8%

We should have land **zoning** in Watauga County. SA A D SD DK

Cell towers harm the mountain landscape in Watauga County. SA A D SD DK

Landowners in Watauga County should be able to use their land any way they want. SA A D SD DK

The new Route 421 from the Blue Ridge Parkway to Boone should not have been designated as a **scenic byway**. SA A D SD DK

The **ridge law** preventing tall buildings on top of mountains is important for Watauga County. SA A D SD DK

Mountain views are an important part of the quality of life in Watauga County. SA A D SD DK

Electrical generation wind mills should be allowed in Watauga County. SA A D SD DK

Abandoned cars do not harm the landscape of Watauga County. SA A D SD DK

Table 3 Determinants of Opinions of Land Use: Ordered-Logit

	Zoning	Cell Tower	Land Owner	Scenic Byway	Ridge Law	Mt View	Electric Wind Mills	Abandon Cars
Intercept1	-2.72** (14.06)	-3.55** (27.98)	1.13** (3.20)	-1.02** (2.31)	-0.74 (0.89)	-0.01 (0.00)	-0.08 (0.02)	-0.93 (1.42)
Intercept2	-1.25* (3.08)	-1.63** (6.26)	2.47** (14.79)	-0.17 (0.07)	1.50** (3.43)	3.35** (15.10)	2.18 (9.45)	0.24 (0.11)
Intercept3	-0.31 (0.19)	0.50 (0.60)	4.36 (42.55)	1.50** (4.98)	2.88** (9.90)	5.17** (17.05)	3.40** (21.84)	1.88** (6.30)
Income	0.003 (0.03)	-0.006* (3.04)	-0.013 (0.17)	0.003 (1.19)	0.003 (0.53)	-0.003 (0.72)	-0.007* (3.30)	-0.009** (5.13)
Home View	0.36 (2.34)	0.86** (14.37)	-0.15 (0.53)	-0.21 (0.89)	0.60** (4.86)	0.49* (3.50)	-0.159 (0.44)	-0.32 (1.47)
Drive View	0.96** (11.50)	0.79** (7.42)	-1.13** (16.37)	-0.88** (.43)	0.88** (7.38)	0.75** (5.42)	-0.592* (3.79)	-1.19** (14.62)
Ancestor	-1.41** (33.11)	-0.67 (8.34)	1.19** (26.89)	0.82** (12.29)	-0.87** (10.31)	-1.04** (15.71)	-0.498 (1.92)	0.72** (7.84)
Retire	-0.011 (0.00)	0.35 (1.02)	-0.57* (2.61)	-0.09 (0.04)	-0.67 (1.89)	-0.28 (0.43)	-0.50 (1.92)	0.32 (0.55)
Age	0.017** (5.41)	0.012* (2.90)	0.006 (0.98)	0.004 (0.44)	0.019** (4.71)	-0.003 (0.14)	0.095 (1.56)	-0.028** (11.71)
Education	0.058* (3.32)	0.042 (1.98)	-0.11** (13.78)	-0.08** (6.25)	0.001 (0.00)	0.04 (0.04)	0.05 (61.25)	0.01 (0.08)
LLR	91.36**	57.47**	104.13**	48.70**	38.48**	39.72**	15.92**	51.47**
Sample Size	341	339	357	320	363	366	306	351

Table 4: Opinions about Billboards

	1	2	3	4	5
Provide Useful Information	14.9%	22.5%	46.3%	7.8%	8.3%
Harmful to Mt Views	9.4%	8.9%	32.5%	18.3%	30.9%
Use to Make Decisions	27.2%	16.2%	42.4%	6.8%	7.3%

B1. Do you feel **billboards provide useful information** to tourist and residents?

1 2 3 4 5
 (Not At All Useful) (Somewhat Useful) (Very Useful)

B2. Do you feel that billboards are **harmful to the mountain views**?

1 2 3 4 5
 (Not At All Harmful) (Somewhat Harmful) (Very Harmful)

B3. Do you **use billboards to make decisions** on where to shop and eat when you visit other locations?

1 2 3 4 5
 (Never) (Some of the Time) (All the Time)

Table 5: Opinions about Cell Phone Towers

	1	2	3	4	5
Provide Useful Service	2.5%	6.3%	24.4%	25.2%	41.6%
Harmful to Mt Views	13.4%	18.9%	39.7%	16.1%	11.7%

B4. Do you feel cell phone coverage provides useful service for cell phone owners such as convenience and safety?

1 2 3 4 5
 (Not At All Useful) (Somewhat Useful) (Very Useful)

B5. Do you feel that cell phone towers are harmful to the mountain views?

1 2 3 4 5
 (Not At All Harmful) (Somewhat Harmful) (Very Harmful)

Table 6: Opinions about Electrical Generation Wind Mills

	1	2	3	4	5
Clean Energy – Pursued	5.8%	5.8%	22.5%	18.1%	48.0%
Harmful to Mt Views	15.1%	20.8%	42.2%	12.6%	9.3%

B6. Do you feel electrical that generation wind mills are a **clean energy** source that should be pursued in the future?

1 2 3 4 5
 (Should Not Be Pursued) (Should Be Pursued)

B7. Do you feel that electrical generation wind mills are harmful **to the mountain views**?

1 2 3 4 5
 (Not At All Harmful) (Some What Harmful) (Very Harmful)

Table 7: Determinants of Willingness to Pay for Billboard Removal

Variable	Yes1	Yes1	Yes2	Yes2
Intercept	-0.0132 (0.00)	-2.46 (8.836)	-.1858 (0.51)	-3.46** (13.97)
Tax payment	-.00347** (25.54)	-.00392** (25.80)	-.00474** (35.64)	-.00557** (37.20)
Income	0.0065* (3.82)	-.001 (0.09)	0.0083** (5.50)	-.0009 (0.04)
Education		0.11** (8.36)		0.14** (12.09)
Age		0.005 (0.27)		0.001 (0.01)
Male		0.09 (0.12)		0.38 (1.85)
Drive with View		1.16** (8.66)		1.57** (11.53)
Home with View		0.49* (3.25)		0.64* (4.90)
Ancestor in Watauga		-1.22** (17.14)		-1.33 (16.82)
Retired to Watauga		0.99** (4.57)		0.75* (2.43)
Log likelihood Ratio	32.17**	103.24**	49.52**	130.52**
Willingness to Pay	\$109.50		\$66.70	

n=353

Table 8: Determinants of Willingness to Accept Electrical Windmills

Variable	Yes1	Yes1
Intercept	0.574 (5.45)	1.001 (1.844)
Electrical Bill Reduction	0.014* (3.73)	0.017** (5.17)
Income	-.007** (4.08)	-.009 (5.73)
Education		0.03 (0.72)
Male		0.08 (0.10)
Drive with View		0.02 (0.00)
Home with View		-0.485** (3.69)
Ancestor in Watauga		-0.57** (4.80)
Retired to Watauga		-0.82** (3.95)
Log likelihood Ratio	8.99**	25.51**
Willingness to Accept	\$10.77	

Table 9: Bivariate Probit of WTP and WTA

Variable	Billboard Yes	Windmills Yes	Billboard Yes	Windmills Yes
Intercept	.085 (0.52)	.361** (2.23)	-1.22** (2.75)	.577 (1.18)
Electrical Bill Reduction		.0086** (2.05)		.0111** (2.34)
Tax payment Billboard	-.00228** (5.52)		-.00229** (5.28)	
Income	.0035 (1.63)	-.0042** (1.98)	-.001 (0.38)	-.005** (2.21)
Education			.052** (2.32)	.009 (0.42)
Age			.0036 (0.64)	-.0013 (0.26)
Male			.046 (0.28)	.045 (0.29)
Drive with View			.665** (2.84)	.102 (0.49)
Home with View			.236 (1.35)	-.314** (1.97)
Ancestor in Watauga			-.645** (3.64)	-.335** (2.01)
Retired to Watauga			.599** (1.95)	-.490* (1.94)
P	.156* (1.74)		.170* (1.65)	
Log likelihood	-435.9		-399.9	

n=334

¹ Income tends to have the most item non-response of all demographic questions. Following Whitehead (1994) we impute 18 missing wage values using a wage equation.