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FOR CLIMATE CHANGE POLICIES:
EUROPEAN EVIDENCE

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**The Generational Divide in Support for Climate Change Policies:
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W. Kip Viscusi* and Joni Hersch**

Abstract

This article examines age variations in support for climate change policies in a sample of over 14,000 respondents to a 1999 Eurobarometer survey. There is a steady decline with age in whether respondents are willing to incur higher gasoline taxes to protect the environment and in the amount of gasoline taxes they are willing to pay. This relationship remains even controlling for demographic characteristics and country of residence. This article examines whether age or factors correlated with age explain the age-related decline in willingness to pay. There are age-related differences in information about environmental risks, information sources about the environment, perceived health risks from climate change, and degree of worry about climate change. However, even taking these factors into account does not eliminate the age variation in willingness to pay for a gasoline tax to protect the environment.

Key words: global warming, climate change, willingness to pay, gasoline taxes

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1. Introduction

The risks of climate change pose long-term hazards for society. The long-term nature of these risks requires that any effective policies must be sustained policy efforts for which the benefits will not be immediate.¹ Because of the long-term character of climate change risks and the likely delay before there will be a payoff from policy initiatives, the degree to which different members of society will benefit directly from climate change policies will decline with age, with younger persons benefiting more from policies as they anticipate longer periods of exposure to problems associated with ongoing climate change. The possibility that there will be intergenerational differences in support for climate change initiatives has been noted in the literature but the empirical basis has not been explored in detail.² In Hersch and Viscusi (2004) we examine the determinants of willingness to pay more for gasoline if doing so would protect the environment. We found substantial differences by age in willingness to pay. Here we examine in greater detail the role of age-related factors such as risk perceptions and different information sources relied upon by different age groups.

¹ For a general discussion of alternative policies to address climate change problems, see Aldy, Stavins, and Barrett (2003), Schelling (1997), Barrett (2003), and Stewart and Weiner (2003).

² For a discussion of the intergenerational conflicts raised by climate change policies, see von Amsberg (1995).

The extent to which there will be intergenerational differences in preferences for climate change initiatives will hinge on the source of these preferences. If the primary impetus for contributing to climate change policies is a bequest value with respect to future generations, then age-related differences may not be stark. One would expect greater age-related differences in preferences if support for climate change initiatives stems from individual use values, whereby the individuals themselves expected to benefit from policies that mitigate adverse environmental effects that arise from climate change. Similarly, option values in which people thought that there was some probability that they would undertake activities that would be affected in a favorable way by climate change policies would also decline with age.

To examine these issues we use data from a 1999 Eurobarometer survey of European citizens. The focus on Europe makes possible an assessment of how information relating to climate change and support for climate change policies is reflected within countries that supported the Kyoto Protocol. Whereas the European Union ratified this international treaty that sought to reduce greenhouse gasoline emissions, the United States did not.

The Eurobarometer data provides a quite diverse sample, with respondents from 15 countries. After accounting for missing data, the sample consists of over 14,000 individual respondents. The Eurobarometer survey includes detailed information and precise questions pertaining to the individuals' willingness to pay higher gasoline taxes if doing so would protect the environment. Gasoline is the product most associated with global warming. The gasoline tax mechanism has a variety of attractive features in that it provides a concrete and meaningful payment mechanism for respondents. The data set

also includes information on the extent of the respondents' environmental knowledge, their information sources, their perceived risks of global warming, and their support for policy initiatives, making it possible to explore possible age-related determinants of political support for policies to curb climate change.

Section 2 introduces evidence on the extent to which respondents are willing to support policies to address global warming. As the empirical results demonstrate, the willingness to incur higher gasoline taxes is quite modest, even within Europe, perhaps in part because gasoline prices there are already much higher than in the United States. However, what is of greatest interest is that there are strong age-related variations in the willingness to pay higher gasoline taxes to protect the environment.

To explore the source of the age-related differences in willingness to pay, we examine the roles of information and perceived risks in Section 3. Do people in different age groups have the same extent of knowledge of environmental issues? Do the perceived risks of global warming vary substantially by age? The evidence presented in this paper shows that while there are systematic age differences, they are not as stark as the willingness to pay disparities.

The respective role of the different determinants of willingness to pay values is examined using regression analysis to control for demographic characteristics as well as information sources and perceived risks. As shown in Section 4, environmental risk information and risk beliefs each affect willingness to pay amounts in the expected manner. However, as is observed in the concluding Section 5, even after controlling for these and other influences there is an intergenerational gap, with older respondents less

willing than younger respondents to pay more for gasoline that would be less harmful to the environment.

2. Willingness to Pay Measures

Before describing the key variables of interest, we begin with an overview of the data set. We use the Eurobarometer 51.1: Environmental Issues and Consumer Associations, April-May 1999 survey.³ Since 1970, the administrators of the Eurobarometer survey have undertaken a survey twice a year in each of 15 European Union countries.⁴ There are about 1,000 respondents in each of the 15 represented countries. While the total sample size of Eurobarometer 51.1 is 16,144, we eliminated observations that were missing data on key variables leading to a sample size of 14,503 individual observations for our analysis.

The Eurobarometer survey includes information on demographic characteristics. Our interest here is in age differences, which are reported in this survey in bands of 10 years, ages 15-24, 25-34, 35-44, 45-54, 55-64, and age 65 and older. The regressions of Section 4 also control for sex, marital status, education, and income, as well as variables for perceptions of urban problems such as traffic congestion and whether the respondent checked emissions in their car, which were influential variables found in Hersch and Viscusi (2004). More important, it also includes detailed perception and preference information pertaining to the risks of climate change and awareness of environmental issues.

³ Melich, Anna. Eurobarometer 51.1: Environmental Issues and Consumer Associations, April-May 1999 [computer file]. Brussels, Belgium: INRA (Europe) [Producer], 1999. 2nd ICPSR version. Ann Arbor, MI: Inter-University Consortium for Political and Social Research, 2001.

⁴ Our analysis will actually include 17 countries, in that we will analyze Ireland and Northern Ireland as separate entities, as well as analyzing East Germany and West Germany separately. The other countries included in the analysis are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, The Netherlands, Portugal, Spain, Sweden, and the United Kingdom. Norway did not participate in the survey considered here, though Norway does participate in some Eurobarometer surveys.

Our key outcome variable is willingness to pay a higher price for gasoline. The product most closely associated with global warming is gasoline, or what the survey referred to as “petrol.” The willingness to pay questions are in two parts. First, the survey ascertained whether the respondent would be willing to pay more for petrol if doing so would protect the environment. In particular, for a series of products including petrol the survey asked: “For which, if any, of the following products and services would you be prepared to pay a little more now so that they are less harmful to the environment?” If the respondent indicated a willingness to pay more for petrol, the survey ascertained how much more: “Would you be prepared to pay 10 percent more, 20 percent more, or 30 percent more for it?”⁵

Using these questions, as well as other information, we construct three different variables as measures of the respondents’ willingness to pay for gasoline. First, we formulate an indicator variable for whether or not the subject is willing to pay more for petrol if doing so would protect the environment. Second, we analyze the percentage price increase that the respondent is willing to pay. Third, in conjunction with the actual price per liter of gasoline in the respondents’ countries, we construct the absolute additional amount per liter that the respondent is willing to pay for gasoline.

The survey’s focus on gasoline prices has a number of attractive properties from the standpoint of being a meaningful willingness to pay question. First, paying more for gasoline is a credible payment mechanism that is more concrete than would be responses

⁵ There were some additional issues regarding the construction of variables. Willingness to pay percentage amounts were coded based on the mid points of the ranges. The survey also had an additional possible response of being willing to pay more than 30 percent for petrol, though only 0.4 percent of respondents fell into this group. For concreteness we will assign a 40 percent value to these people, but in the regression analysis using a 2-limit Tobit approach, we will estimate the percentage willingness to pay amounts without imposing any specific upper bound. The fuel price data came from GTZ Fuel Price Surveys (1998, 2000), available at <http://www.internationalfuelprices.com>.

with respect to hypothetical interview money. The danger from purely hypothetical questions is that the willingness to pay responses may reflect general support for the environment as opposed to specific support for this policy initiative. Such influences are known as embedding effects.⁶ Gasoline is a well-defined commodity for which there is substantial awareness of prices and the opportunity costs involved of paying more for gasoline.

By comparison, previous survey questions pertaining to willingness to pay have been defined less precisely. For example, the World Values Survey that was the subject of research by Israel and Levinson (2004), as well as other researchers, asked respondents the extent of their agreement with the statement, “I would buy things at 20 percent higher than usual prices if it would protect the environment.” Unfortunately, this question does not specify which prices would be increased, so that the payment mechanism is not as concrete as would be an increase in gasoline prices.⁷

Table 1 summarizes the age variations in the responses to the different willingness to pay measures. In every case, the relatively low willingness to pay values suggest that respondents took these questions as a meaningful expression of willingness to pay, as opposed to a more general sign of support for the environment with no financial consequences. Perhaps in part due to the existence of already high gasoline prices in the European Union, only a minority of the respondents indicated a willingness to pay more for gasoline.

⁶ For description of these influences, see Kahneman and Knetsch (1992).

⁷ Other examples of willingness to pay questions can be found in Israel (2004) and Dunlap, Gallup, and Gallup (1993). Berk and Fovell (1999) explore willingness to pay measures for climate change policies using a sample of Los Angeles residents.

These willingness to pay amounts differ substantially. Notably, there is a steady decline in willingness to pay amounts with age. The bottom row of the table reports mean values for the pooled age 15-64 results. In every case, the mean values for those age 15-64 are higher and significantly different from those age 65 and over. In the case of the percentage of respondents who are willing to pay more for gasoline to protect the environment, those aged 15-24 are twice as likely to express such willingness as those 65 and over. In terms of the percentage amount more that the respondents are willing to pay, those aged 15-24 are willing to pay 2.8 percent more, as compared to 1 percent more for those 65 and over. Note that for these calculations, all those who did not express a willingness to pay more for gasoline received a zero value for the percent more that they were willing to pay.

The final two columns in Table 1 summarize the total cents more per liter that the respondent is willing to pay for gasoline. The third column in Table 1 provides the cents per liter that the respondent is willing to pay, conditional on being willing to pay a nonzero amount. These values exhibit only modest age variations, ranging from 9.1 cents per liter for those age 65 and over to a peak value of 12.5 cents per liter for those age 25-34. The observed differences are starker for the final column of results that reflect sample wide averages in willingness to pay including those responding they would pay zero amounts. Whereas those 65 and over are willing to pay an average of 1 cent per liter, the age 15-64 average is 2.3 cents and the value for those age 25-34 is 2.7 cents.

3. Information and Risk Beliefs

Particularly among those age 65 and above there is a pronounced age-related decline in willingness to pay a higher gasoline tax to protect the environment. If these

age-related differences can be traced to age-related factors such as shorter life expectancy, the prospects for changing their degree of political support are not bright. However, if the shortfall can be traced to a lack of information about the risks of global warming, then informational policies potentially could muster broader support for climate change initiatives.

The Eurobarometer survey includes a series of questions that can be used to establish measures of the respondent's informational bases and perceived threat from climate change. These questions are all in the form of self assessments rather than tests of knowledge that can be compared to objective reference points.

One set of questions pertains to the individuals' self assessments of whether he or she is informed about environmental risks. The particular question used in this analysis asked respondents how well they were informed about "major environmental problems, like holes in the ozone layer, global warming, the disappearance of forests, etc." We define an indicator variable equal to one for those who respond that they were very well informed or fairly well informed about these major global environmental problems, and zero otherwise.

As the age group mean values reported in Table 2 indicate, roughly half of each age group considers themselves to be well informed about global environmental risks. The age group 65 and above has 47 percent who consider themselves to be well informed, as compared to 54 percent for the pooled age groups 15-64. Within this younger age band, the degree to which people are well informed does not vary greatly by age, as it ranges from 52 percent for those 55-64 to 56 percent for those 15-24.

Being aware of environmental problems does not necessarily mean that people believe that problems pose a risk to them. The first measure of risk belief is the extent to which respondents believed that climate change would affect their health. This measure reflects a combination of perceived climate change problems and their personal vulnerability to these problems. Those who thought that climate change would affect their health a lot received an indicator variable value of one; otherwise this variable equaled zero. As the data in the second to last column in Table 2 indicate, roughly two-fifths of all age groups perceive a risk to their health. Those age 65 and over are significantly less likely to perceive a health risk, but the 3 percentage point difference with those age 15-64 is not substantial.

The final risk perception question analyzed is the extent to which individuals are worried about the risks of global warming. The particular wording of the question used in the survey asked respondents whether they were “very worried, somewhat worried, not very worried, or not at all worried” about a series of nine possible problems. Respondents who indicated that they were very worried about “global warming (greenhouse effect)” received a value of 1 for the variable that we will call “very worried about global warming.”

Those age 65 and over express lower degrees of worry about global warming than do the other age groups. As the data in the final column of Table 2 indicate, 33 percent of those age 65 and over express concern with respect to global warming, or just over 4 percentage points less than those age 15-64. This measure of risk beliefs rises then falls with age, reaching a peak of 40 percent among those age 35-44. Once again, these

differences as well as the other pattern in Table 2 are not as pronounced as are the willingness to pay differences.

People in different age groups rely on different information sources. Respondents were asked, “When you are looking for information on the environment, which of the following sources do you use?” followed by a list of nine sources such as newspapers and magazines, television, and friends. Use of newspapers or studies by environmental groups, for example, could affect not only the extent of one’s knowledge but also the willingness to spend funds to address environmental risks. Table 3 reports usage of sources for environmental information for two age groups, those age 65 and above and those age 15-64. Three-fourths of the population uses television as an information source, with somewhat greater usage by those age 65 and above. However, for every other category for which there are statistically significant differences, those age 15-64 are more likely to use that information source. The differences are particularly great for use of the internet, books, and information from environmental organizations.⁸ Overall, those age 65 and above draw on 2.3 information sources as compared to 2.7 for those under 65. Thus, both the number of sources used and the composition of the sources relied upon differ by age.

4. Willingness to Pay Regression Estimates

To distinguish the influences on willingness to pay of age versus factors correlated with age it is instructive to consider regression estimates for the two willingness to pay questions in the Eurobarometer survey. To estimate the dichotomous choice of whether respondents are willing to pay more for gasoline to protect the

⁸ Some of these effects could, of course, be endogenous. Those with greater interest in environmental problems could seek out more information.

environment we report probit regression estimates for which the coefficients have been transformed to reflect marginal probabilities. The percentage more that respondents are willing to pay for gasoline poses two econometric issues, the many responses at the lower bound of zero and the unbounded category of possible responses, which was “over 30 percent.” The double bounded Tobit estimates for the gasoline tax percentage addresses each of these concerns. We report Tobit coefficients that are the unconditional marginal effects of each variable.

For both of these willingness to pay measures, Table 4 reports estimates by age group with and without risk perception variables and the indicator variables for different information sources. Each equation also includes an extensive set of additional characteristic variables and country indicator variables. Specifically, all equations control for income, education, indicator variables for gender and marital status, and country of residence. The equations controlling for risk perceptions and information sources reported in columns 2 and 4 also control for whether the respondent is worried about urban problems and check emissions. The urban problem variable provides a control for whether willingness to pay stems from other environmental concerns other than global warming. The checking emissions variable, which does have a significant positive effect (not reported in table), provides a consistency test for the willingness to pay measure. The omitted age group indicator is for age 65 and over so that all age coefficients are relative to this group.

The results in columns 1 and 3 in Table 4 indicate that the age 65 and over group has a significantly lower willingness to pay measure relative to all other groups. For the discrete response, people in other age brackets have a 0.05 to 0.09 higher probability of

being willing to pay a gasoline tax even after including extensive controls for other demographic influences. Although not all of the age category coefficients are significantly different from one another, there is a steadily declining pattern by age for both sets of results.

The steepest decline in both the probit and Tobit estimates is for those age 65 and above relative to the age 55-64 group. The drop-off in the estimated effect by moving into that age group is of roughly the same magnitude as the observed drop between the age groups 15-24 and 55-64. Thus, the effects of the age variable are not proportional to remaining life expectancy.

The equations in columns 2 and 4 in Table 4 add measures of risk belief, risk knowledge, and risk information. Each of the willingness to pay measures increases if the person expresses worry about global warming, is informed about environmental problems, or believes that climate change will affect their health a lot.

Many individual information sources also have incremental effects on willingness to pay even after accounting for these risk belief variables. In terms of magnitude, the strongest influences are the positive coefficients for books, information provided by environmental organizations, and the internet. These are all sources that those age 65 and above use at a lower rate than this in younger age groups. Information sources used extensively by the oldest age group—television and radio—have comparatively minor effects.

Nevertheless, even after controlling for this diverse set of risk perceptions and informational factors, the pronounced age variations remain and are reduced in magnitude by only a modest amount. Differences in demographic background, personal

characteristics, knowledge, and beliefs do not account for the intergenerational gap in willingness to pay.

5. Conclusions

Given the long time lag before any climate change initiatives can produce demonstrable policy results, there has long been speculation in the literature that support for climate change policies may differ substantially across the population based on individual age. To examine whether there are important intergenerational differences in support for global warming policies, this article examined a large sample of respondents to the 1999 Eurobarometer survey. The detailed data available in the survey makes it possible to analyze both the overall levels of environmental risk information and willingness to pay for environmental initiatives while controlling for background factors that may influence these outcomes.

The respondents' willingness to pay for higher gasoline taxes to address environmental problems revealed stark age-related differences. For each of the measures of willingness to pay considered, there was an overall drop-off in the willingness to pay value with age. Those over age 65 were half as likely to be willing to pay more for gasoline and, on average, were willing to pay just over one-third as much as were people aged 15-24.

A possible explanation for the willingness to pay differences is that there are age-related differences in environmental risk information and concern about environmental risks. Sources of environmental risk information also differ by age. Younger age groups were more likely to avail themselves of almost every form of available information sources, ranging from drawing upon newspaper articles to reading reports from

environmental groups. While there were in fact unambiguous age-related differences in environmental risk information and risk beliefs, these influences did not account for a great deal of the age-related variation in willingness to pay.

What these results suggest is that the concrete support that people may exhibit for climate change policies cannot be traced solely to a disinterested bequest motive with respect to future generations. Younger age groups may believe that they will personally benefit more from climate change policies. In addition, their children will also benefit to a larger extent, since they are likely to be younger as well, so that concerns with respect to the next generation will reap a longer-term benefit for younger respondents than for older respondents. For countries such as the United States, for which there is going to be a substantial growth in the percentage share of the age 65 and over population, there may be a decline in the overall country's political support for climate change policies unless they can be characterized in a manner that better addresses the concerns of the older segments of the population.

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Table 1
Willingness to Pay for Petrol that is Less Harmful
to the Environment, by Age Group

Age Group	Percentage Who are Willing to Pay More	Percent Amount More Willing to Pay	Cents More per Liter Willing to Pay if Positive	Cents More per Liter Willing to Pay
15-24	22.1	2.8	11.8	2.6
25-34	21.2	2.8	12.5	2.7
35-44	19.4	2.3	11.7	2.3
45-54	18.3	2.1	10.7	2.0
55-64	16.4	1.6	9.5	1.6
65+	10.9	1.0	9.1	1.0
All age 15 - 64	19.7*	2.4*	11.5*	2.3*

* Asterisks indicate statistically significant differences between the age 15-64 and age 65+ age groups, 5% level, two-tailed test.

Table 2
Climate Change and Environmental Risk Beliefs, by Age Group

Age Group	Very Well Informed or Fairly Well Informed about Major Global Environmental Problems	Climate Change will Affect Health a Lot	Very Worried about Global Warming
15-24	56.0	38.3	36.3
25-34	54.6	40.5	37.8
35-44	54.4	40.0	40.0
45-54	54.4	38.2	37.4
55-64	52.3	39.3	35.9
65+	47.4	35.8	33.4
All age 15-64	54.4*	39.3*	37.6*

* Asterisks indicate statistically significant differences between the age 15-64 and age 65+ age groups, 5% level, two-tailed test.

Table 3
Environmental Information Sources by Age

	Under 65	65 and older
Percent using source:		
Newspapers & Magazines	65.1	59.0*
Radio	38.9	40.8
Television	75.0	77.5*
Government Publications	10.7	9.2*
Environmental Organizations	16.3	9.0*
Books	17.6	8.1*
Internet	10.0	1.2*
Research Centers	6.0	3.0*
Friends	30.5	23.3*
Total number of sources	2.7	2.3*

* Asterisks indicate statistically significant differences between the age 15-64 and age 65+ age groups, 5% level, two-tailed test.

Table 4
Regression Estimates of Willingness to Pay for Petrol
Less Harmful to the Environment^a

	(1) Willing to pay more (0 – 1) ^b	(2) Willing to pay more (0 – 1) ^c	(3) Percent more willing to pay ^b	(4) Percent more willing to pay ^c
Age 15-24	0.094* (0.017)	0.083* (0.017)	1.281* (0.175)	1.088* (0.170)
Age 25-34	0.086* (0.014)	0.078* (0.014)	1.262** (0.147)	1.124* (0.143)
Age 35-44	0.073* (0.014)	0.060* (0.014)	1.025* (0.150)	0.837* (0.145)
Age 45-54	0.060* (0.014)	0.051* (0.014)	0.804* (0.155)	0.664* (0.149)
Age 55-64	0.054 * (0.015)	0.048* (0.015)	0.666* (0.160)	0.564* (0.154)
Very worried about global warming		0.030* (0.007)		0.331* (0.083)
Informed about environmental problems		0.025* (0.007)		0.269* (0.081)
Climate change will affect health a lot		0.021* (0.007)		0.291* (0.082)
Newspapers and magazines		0.029* (0.007)		0.391* (0.089)
Radio		-0.005 (0.007)		-0.063 (0.083)
Television		0.022* (0.008)		0.193* (0.096)
Government publications		0.023* (0.011)		0.325* (0.121)

(continued on next page)

	(1)	(2)	(3)	(4)
	Willing to pay more (0 – 1) ^b	Willing to pay more (0 – 1) ^c	Percent more willing to pay ^b	Percent more willing to pay ^c
Environmental organizations		0.044* (0.010)		0.559* (0.104)
Books		0.051* (0.010)		0.646* (0.099)
Internet		0.042* (0.012)		0.533* (0.124)
Research Centers		0.003 (0.013)		0.072 (0.154)
Friends		0.029* (0.007)		0.388* (0.081)
Observations	14,503	14,503	14,503	14,503

Absolute value of z statistics in parentheses. * significant at 5%

a. Columns 1 and 2 estimated by probit, columns 3 and 4 estimated by Tobit. Probit coefficients report marginal effects, Tobit coefficients report unconditional marginal effects.

b. Additional variables included in regressions reported in columns 1 and 3 are income, education, and indicator variables for male, married, and country.

c. Additional variables included in columns 2 and 4 are income, education, indicator variables for male, married, and country, as well as indicator variables for whether respondent is very worried about urban problems and whether respondent checks emissions.