Public Preferences for the Multifunctionality of Agriculture: National Survey of Registered Voters in the U.S.

Wanki Moon
Associate Professor
Department of Food and Resource Economics
Korea University
Seoul, Korea
Tel) 02-3290-3031
wmoon@korea.ac.kr

Introduction

The value of agriculture to our society is determined in principle by the prices that commodities (e.g., soybean, corn) command in markets. Yet, if agriculture produces goods and services that are not traded in markets, market mechanisms are likely to underestimate the value of agriculture and these goods and services will be underproduced. Known as the "multifunctionality of agriculture", such positive non-market benefits include national food security, rural amenities (attractive farm landscapes), recreational opportunities, maintenance of cultural heritage, viability of rural communities, and a broad range of ecosystem services (e.g., flood control, nutrient recycling, groundwater recharge, wildlife habitat, and atmospheric carbon dioxide sequestration) that agriculture produces with varying degrees of jointness with either market commodities or farmlands (Bergstrom, 1998; Burrell, 2001; Libby, 2002; Vatn, 2002; Abler, 2004; Batie, 2003;).

Multifunctionality in the U.S. Context

The concept of the multifunctionality can be largely attributed to European and East Asian agricultural models (most notably Switzerland, Norway, EU, Korea, and Japan) with their efforts to maintain flexibility in farm policies so as to be able to manage their agriculture from unconstrained competition (Potter and Burney, 2002; Vanzetti and Wymen, 2004). Yet, multifunctionality is emerging as an important issue in the U.S. because of its impact on two interrelated areas: (i) agricultural trade liberalization process taking place under the World Trade Organization (WTO) (Burrell, 2001; Paarlberg, Bredahl, and Lee, 2004; Blandford and Boisvert, 2002) and (ii) domestic farm policies.[1] The Uruguay Round Agreement on Agriculture (URAA)

[1] While the U.S. does not have an official position on the multifunctionality of agriculture, we can find some useful perspectives on this from the literature. Bohman et al (1999) examines the multifunctionality from the viewpoint of its role in trade negotiations and argue that it should not be used as a vehicle for protectionism. The study suggests

formally recognized the multifunctional functions of agriculture in 1994 by instituting the so called "green box" that allows unlimited amount of subsidies on policies that are decoupled from production.[2] Since then, there has been an on-going debate about the appropriate boundary of the green box policies: i.e., some nations view the current green box as too narrowly defined, whereas others consider it adequate to accommodate non-market commodities of agriculture. The recent ruling by the WTO that some U.S. cotton programs (direct payments and counter-cyclical payments) do not count as green box policies highlights such controversy.[3]

Evidence shows that the multifunctionality concept is already present in some domestic farm policies in the U.S. For example, the expansion of Environmental Quality Incentive Program (EQIP) and the creation of new Conservation Security Program (CSP) in the 2002 farm bill are considered recognition of the ecosystem services associated with agriculture (Dobbs and Pretty, 2004). Hellerstein et al (2001) also showed that public demand for open space and rural amenities were a main motivation behind the legislation creating the farmland conservation programs in most states in the U.S. In his effort to identify major paradigms impacting farm policy reform efforts, Josling (2002) considers the multifunctionality in competition with the

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that targeted policies that are decoupled from production would be more effective in inducing the supply of nonmarket goods and services of agriculture. Freshwater (2002) offers detailed explanations why there has been divergence in the extent that the U.S. and Europe embrace the multifunctionality concept.

[2] In an effort to reconcile differing positions of member nations on the multifunctional role of agriculture, the URAA designed a scheme classifying agricultural policies into one of the following boxes: (i) Amber Box referring to domestic support measures that distort production and trade, (ii) Blue Box representing all programs that would normally fall into the amber box but limit the production of farmers, and (iii) Green Box inclusive of programs that minimally distort trade and are decoupled from price/production. If agricultural policies are classified as Amber or blue box, they are subjected to reductions over time. Green box policies encompass public spending on environmental conservation, rural development, and research.

[3] An implication of this incidence may be that the size of trade-distorting commodity programs be reduced in the next farm bill while environmental conservation payments are expanded. See Alston and Sumner (2007) and Hudson et al (2005) for greater details about the cotton case.

market-oriented paradigm to replace the traditional paradigm of farm policies needing production-based subsidy.[4]

Apart from such role of the multifunctionality concept in WTO trade rules and domestic farm policies, Batie (2003) points to the growth in related research as evidence in support of the emerging importance of the multifunctionality in the U.S. Of particular pertinence is research addressing public preferences and valuation for the multifunctional benefits of agriculture. Three types of research are notable: (i) examining public preferences for farmland preservation programs (e.g., Kline and Wichelns, 1994; Johnston, Swallow, Bauer, and Anderson, 2003; Hellerstein et al, 2003), (ii) investigating the role of open space in determining housing prices using hedonic price models (e.g., Irwin, 2002; Wu, 2003; Wu, Adams, and Plantinga, 2004), and (iii) assessing the value of rural amenities directly using contingent valuation approach or voting records (e.g., Halstead, 1985; Beasley, Workman, and Williams, 1986; Ready et al, 1997; Kahn and Matsusaka, 1997).[5]

Research Objectives

When taken together, the above research present evidence that the public in some particular regions (Northeast and Pacific) in the U.S. value the non-market outputs associated with either market outputs or farmlands. This article attempts to extend this literature and provide further insights into public preferences for the multifunctional benefits of agriculture in the U.S. Specifically, using a database collected nationally from registered voters by American Farmland Trust (AFT), we examine voters' preferences for the multifunctional benefits of agriculture in relative to other social issues such as public education, military defense, or food

[4] Yet, he indicates that the multifunctional paradigm may be complementary to the market-orientated reform if the compensation for the multifunctional outputs is decoupled from price/production.

[5] These studies will be described in the section of "Valuing Multifunctionality."

safety. Further, we analyze willingness to pay for three non-market goods: (i) the protection of water source safety, (ii) the preservation of especially beautiful farmland, and (iii) the production of locally grown fruits and vegetables. The willingness to pay questions are composed of two parts: (i) binary questions probing whether or not respondents would be willing to pay for a non-market benefit, and (ii) payment card ranging from zero to over $250 presented only to respondents who expressed their willing-to-pay in the first step. Using these two sets of questions, we develop the following regression models: (i) binary models to identify factors shaping the probability of willingness-to-pay, and (ii) payment card interval data regression models determining the intensity of willingness-to-pay, using the sub-sample of respondents who were willing to pay in the first part. Of particular importance in these regression models is to analyze whether voters' preferences for the multifunctional benefits of agriculture differ across geographic regions (Northeast, Midwest, Central Plains, Mountain, West, Southwest, and South).

We organize the article as follows. The next section provides further details about the concept of multifunctional agriculture and reviews key issues related to operationalizing and valuing this concept to farm policies and WTO trade talks. The third section describes the AFT survey instrument design and administration processes, followed by descriptive data analyses and regression analyses including dichotomous and payment card interval models. Finally, we provide concluding remarks and suggestions for future research on valuing the multifunctionality role of agriculture.

Economics of Multifunctionality

US farm policy is in a major transition fundamentally fueled by interconnected internal and external forces. Internal forces are characterized by two needs: (i) to reform the structure of the farm bill which is currently oriented toward major grain commodities and linked to

production levels, and (ii) to provide incentives to farmers to protect environmental resources and supply ecosystem services associated with agriculture (Antle, 1999; Smith; 2006; Antle and Stoorvogel; 2006; Mercier and Smith, 2007; Doering and Outlaw, 2007). These two needs were addressed partially through the 1996 and 2002 farm bills, particularly by initiating payment decoupled from actual production and conservation programs on working agricultural landscapes. Externally, two seemingly contrasting forces (i.e., neo-liberalism and multifunctionality of agriculture) are at work concurrently to reconfigure the future of agriculture and farming around the globe (Josling, 2003; Potter and Tilzey, 2005; Potter, 2006). Neo-liberalism is manifested in the efforts to liberalize agricultural trade as advocated by World Trade Organization (WTO), the principal institution disciplining domestic farm policies as well as making and governing trade rules.

Emerging as a paradigm competing with and/or complementing the neo-liberalism, the multifunctionality of agriculture explicitly recognizes the intangible benefits that people receive from agriculture and underlines the need for instituting a framework or mechanism that would coordinate farm, rural, environmental/ecological, and trade policies in order to ensure an optimal supply of such goods and services. The concept of multifunctional agriculture is similar to the European Model of Agriculture (EMA) that emphasizes the need for policies/programs that reduce negative environmental effects of agriculture, promote the sound management of the countryside, and maintain marginal producers in farming (Potter, 2004). While some researchers prefer 'post-productivism' as a term representing the above concept primarily due to its explicit recognition of the directional change in policy compared to 'productivism' focusing on market commodities (Mather, Hill, and Nijnik, 2006), it is synonymous with the multifunctionality of agriculture.

The multifunctional role of agriculture causes controversies in academic, trade, and policy circles because of the possibility of market failures: i.e., nonmarket goods (bads) are under (over) provided in the absence of government intervention. A divergence between private and public value of agriculture will result in a socially suboptimal agricultural sector in terms of its size, what it produces, and how it is produced. In short, markets do not reveal the strength of the demand for the multifunctional benefits of agriculture, potentially causing market failures and distorting societal resource allocation.

Operationalizing the Multifunctionality Concept

A number of problems arise when attempting to operationalize the above theoretical models to the design of trade rules and domestic policies with respect to the multifunctional concept. OECD (2001) provides an analytical framework to deal with such problems. In particular, the framework asks three main questions: (i) is there a strong degree of jointness between market and nonmarket outputs? (ii) is there some market failure associated with the noncommodity outputs? and (iii) is government action required or are there better alternatives? The framework emphasizes the significance of identifying the sources of jointness and whether the jointness is directly related to production intensity so as to determine the more efficient supplier of the multifunctional benefits: i.e., agricultural and non-agricultural sources.

The degree of jointness between market and nonmarket outputs should be established empirically attribute by attribute.[6] For example, while national food security is to a great extent jointly produced with market outputs, farmland amenities are produced jointly only to a certain point beyond which they have little to do with the quantity of market outputs. In addition, some nonmarket outputs (e.g., recreational opportunities, open space, cultural heritage) may be related

[6] See Abler (2001) for more detailed treatment of jointness between market and nonmarket outputs.

to farmlands or rural landscapes rather than the size of market outputs (Irwin et al, 2003). Under such circumstances, the policy measures aiming at the optimal supply of the nonmarket goods should be related to farmlands or rural landscapes rather than farm production. When there is little jointness between market and nonmarket outputs, policies targeting nonmarket goods should be decoupled from the level of market production accordingly (Bladford and Boisvert, 2002).

Yet, there is a possibility that traditional policies linked to production/price may be more efficient in accomplishing the goal of ensuring optimal supply of nonmarket goods and services of agriculture than policy measures targeted at specific multifunctional outputs when there are substantial transaction costs associated with targeting (Vatn, 2002). Transaction costs include costs involved in designing and implementing the policies and monitoring the results as well as costs to farmers such as learning about the program, deciding whether to apply for payments, and complying with audits and other reporting requirements (Abler, 2004).

In addition, potential interdependence in production (cost complementarity) among various components of the multifuncitonality should be examined to determine optimal policies targeting specific set of multifunctional outputs. For example, Brunstad, Gaasland, and Vardal (2005) show that there is complementarity in production between landscape preservation and food security, indicating that it would be more efficient to support land-extensive production techniques than production intensity.

Figure 1 summarizes the above discussion and depicts four broad types of linkages: (i) public policy impacts on agriculture; (ii) transaction costs associated with targeted policies, (iii) jointness between nonmarket outputs and either market outputs, or farmlands, or rural

communities, or family farms, and (iv) interdependences within the multifunctional outputs both in production (cost complementarity) and consumption (substitution possibility).[7]

Valuing Multifunctionality

Previous section identified key issues (i.e., jointness, targeted policies, complementarity in production, transaction costs) in connection with applying the multifunctionality concept to domestic farm policies and WTO trade liberalization talks. A critical requirement that underpins all these four research topics is reliable information on public preferences and demand for the nonmarket goods and services of agriculture. The absence of such information would invalidate any in-depth analysis of the four research topics.

However, valuing the multifunctional benefits of agriculture is difficult for the following two primary reasons: (i) specifically defining the multifunctional benefits to be valued (Paarlberg, Bredahl, and Lee, 2002; Blanford, Boisvert, and Fulponi, 2003), and (ii) the lack of information that most members of the public have regarding what ecosystem services working agricultural landscapes provide and the functions they performs for society. The first problem is further complicated by the possibility of bundling of several different multifunctional outputs, and the difficulty of defining the geographic scope of the good/service to be valued. Lee, Paarlberg and Bredhal (2005) raise further issues such as determining whether to estimate marginal or total social value, unit of measurement, and time frame.

Randall (2002) echoes that valuing multifunctionality is a much more complicated task when compared to the usual valuation exercises faced by environmental economists because the values of multifunctionality are "particular, contextual, and must be estimated on a national or continental scale, but implemented farm by farm." He further suggests that people tend to

[7] While interdependence in production is relevant in optimal policy design, interdependence in demand is applicable in designing valid valuation scheme for multiple multifunctional outputs.

overvalue individual components of a whole complex non-market good and adding up these values will exceed the value when the good is measured as a whole. In light of this potential bias, he proposes a strategy for valuing multifunctionality at a continent level.[8]

Empirical Research in Europe

Despite such conceptual and practical difficulties associated with measuring the value of multifunctional benefits of agriculture, there have been respectable amount of efforts at a national scale in Europe. For example, Drake (1992) used contingent valuation methods to estimate the Swedes' willingness to pay to preserve the agricultural landscape and found that Swedish people were willing to pay 78 ECU per person annually. Brouwer and Slangen (1998) estimated the public benefits of agricultural wildlife management (peat meadow) in Netherlands and showed that visitors were willing to pay 84 Dutch guilders per household annually, while non-visitors were willing to pay 53 Dutch guilders. Consequently, 70 percent of a household's total WTP consists of a value that is not related to any past or present use of the amenities involved.[9] [10] More recently, Kallas, Gomez-Limon, and Arriaza (2007) reported the existence of a significant demand for the multifunctional agriculture in Spain with the demand heterogeneous across socio-economic characteristics.

Aside from Europe, evidence is presented that Australian public (particularly urban dwellers) are willing to pay to maintain rural populations, demonstrating a positive nonuse (existence) value associated with rural communities (Bennett, Buren, and Whitten, 2004). Oh (2003) estimated the nonmarket value of rice production in Korea using multiple valuation

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[8] The strategy involves using contingent valuation to value the whole good as well as local and particular component goods, and utilize the value of the whole good an upper bound to the sum of all the local values.

[9] Such a value is called "nonuse value and first introduced by Krutilla (1967) in his seminal paper entitled "Conservation Revisited".

[10] See Hall, McVittie, and Moran (2004) for a comprehensive review of literature addressing public preferences and valuation of the multifunctional agriculture in Europe and U.S.

methods. He showed that its combined nonmarket value including food security, farmland amenities, flood control, purification of water and air, and ground water recharge was $ 8.75 billion, 98 percent of national gross revenue of rice, and 51 percent of agricultural GDP.

Empirical Research in the U.S.

With regard to the U.S. agriculture, there have been some studies at the state or county level. For example, Halstead (1984) showed that residents in Massachusetts were willing to pay $28-$60 and $70-$176 to avoid low-density and high-density development (residential development on agricultural land), respectively. Kline and Wichelns (1994, 1996) showed that residents in Rhode Island support farmland conservation programs and that environmental reasons are most important followed by local food concerns, preservation of rural communities and slowing development. Ready et al. (1997) showed that consumers in Kentucky were willing to pay a positive amount of money for keeping horse farms and demonstrated that these farms have non-use value. Whereas these studies used nonmarket valuation methods including stated and revealed preference techniques to measure the demand for the multifunctional role of agriculture, Kline and Wichelns (1994) and Kahn and Matsusaka (1997) used referenda voting records on farmland conservation programs in the Northeast region and various environmental propositions in California, respectively.

However, there has been little systematic effort to measure public preferences or economic value for the nonmarket goods and services of agriculture at the national level in the US. The only exception is research by Variyam, Jordan, and Epperson (1990) investigating public attitudes toward governmental involvement in agriculture and policies to protect small farms using a national survey, although their study was not designed to place economic value on farm policies or nonmarket goods and services of agriculture.

AFT National Survey of Registered Voters

We use American Farmland Trust (AFT) survey data to analyze public preferences for the multifunctional benefits of the U.S. agriculture and assess the value that the public places on such benefits. The primary purpose of the AFT survey was to gain insights into public knowledge of and support for agriculture, food, multifunctional benefits, and farm programs/policies. The survey was administered by the research center at the Northern Illinois University in June 2001 using telephone interview. The center specializes in economic and behavioral science survey research. The sample is drawn from registered voters nationally and Table 1 compares the socio-demographic profiles of the respondents to the U.S. census data. There are notable differences between the sample and US census in the education, ethnic background, and homeownership rate. The percentage of respondents with bachelor's degree in our sample (39.3 %) is significantly higher when compared to the U.S. census (24.4 %). Ethnic origin of Hispanic background is only 5.9 % compared to the 12.5 % in the U.S. census. About 75 % of the survey respondents owned a house, while the rate was 66.2 % in the U.S. census. Other demographic profiles were comparable between the U.S. census and our sample.

The AFT survey is based on a 10-page instrument that addresses an array of issues pertinent to farm economies and policies. Three major sections are relevant for the purposes of this article:[11] (i) measuring voters' concerns about selected public policy issues such as gasoline prices, homeland security, education, meat and poultry safety, GM foods, and farmland preservation programs, (ii) measuring public attitudes toward amenities, recreational opportunities, and wildlife habitat associated with rural/farmlands, and (iii) eliciting willingness-to-pay (WTP) for three types of non-market benefits of agriculture: (a) to help farmers protect

[11] The AFT survey instrument is available upon request.

the sources of drinking water,[12] (b) to help protect especially beautiful farmland,[13] and (c) to protect local production of fruits and vegetables.[14]

With respect to the willingness to pay section, the AFT survey design lacks detailed information that a typical contingent valuation survey would provide (e.g., description of the product, and how and where the product would be provided). In particular, a full-blown contingent valuation survey would clearly define a baseline scenario and depict hypothetical changes/deviations in terms of enhanced benefits or deteriorated conditions of the good that are caused by public policy under consideration. The detailed description of potential changes would allow researchers to derive marginal willingness-to-pay for incremental changes in the quality or quantity of the good that is associated with a policy change. Therefore, the AFT survey is designed to elicit behavioral intentions for generally defined multifunctional goods, but not to elicit accurate marginal willingness-to-pay estimates. Nevertheless, the AFT survey contains information useful in probing an array of issues in relation to how the public perceives various multifunctional.

Descriptive Analysis of AFT Data

This section provides a descriptive data analysis for variables of relevance to our study including (i) perceived importance of the multifunctionality relative to various other public policy issues, and (ii) willingness-to-pay for three types of multifunctional agriculture.

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[12] Strictly speaking, this is the case of nonmarket bads (water pollution) and consumers are essentially being asked whether they would be willing to subsidize farmers to reduce such bads. One can argue that farmers should be held responsible for such external diseconomies, as are other industrial sectors. The result will be higher production costs and reduced amount of agricultural outputs. However, most countries collectively treat farming differently from other sectors and exempt farmers from paying penalties for pollutions.

[13] Obviously, this good is not specifically defined and one of the reasons why we call this AFT survey design as "attitudinal willingness to pay" in the next paragraph.

[14] This is not a nonmarket good in the sense that consumers can find local fruits and vegetables at farmers markets and they can express their support for local farming by paying premium for such goods. That is, private markets may exist for local fruits and vegetables in some areas. Nevertheless, asking public willingness to pay extra taxes to support local farming is legitimate to the extent that local fruits and vegetables are not available.

Relative Importance of Multifunctionality

The AFT survey instrument includes two sets of questions permitting us to measure public concern/interest in the multifunctionality of agriculture relative to other policy issues. The first set of questions is asked about gasoline prices, unemployment, homeland security, public education, meat and poultry safety, pesticide residue on food, pesticide contamination of drinking water, genetically modified foods, and farmland preservation. They are measured with a four-point scale: (1) very concerned, (2) somewhat concerned, (3) not too concerned, (4) not at all concerned. Respondents are presented each policy concern individually in a random order to prevent ordering effects.

The mean ratings of each variable are shown in Table 2. Respondents showed the highest level of concern for the quality of public school education in their community (m=1.556). The threat of rising gasoline prices received the second highest level of concern (m=1.687). Next, a set of policy objectives strictly relating to agricultural and food policies received similar levels of support including concern for pesticide residues on produce (m=1.987), rapid farmland development (m=1.992), and meat and poultry safety (m=1.994).[15] The policy objectives that received the least amount of concern include the threat of nuclear attack on the United States (m=2.532) and rising level of unemployment (m=2.144).

Of these variables, the threat of the over-development of agricultural lands best represents the demand for multifunctional agriculture. The concern for farmland preservation ranks relatively high among the listed policy objectives, and its mean rating is very similar to the food safety issues for produce, meat, and poultry. The second set asks whether respondents are

[15] The result that respondents were more concerned about rapid farmland development than meat and poultry safety is somewhat intriguing given that food safety involves direct use value, while farmland preservation has indirect or nonuse values. Yet, this result may be possible if respondents have a high degree of trust on the integrity of US food system and Food and Drug Administration (FDA).

in favor of increasing expenditures, decreasing expenditures, or expenditure staying at the present level for the purpose of addressing public policy issues facing our society.[16]

Table 3 shows the percentage of choosing "increasing expenditure" for each policy issue. Nearly 80 percent of the respondents were in favor of increasing expenditure for public education, while less than 38 percent were so for military purposes. There were three items related to the multifunctionality of agriculture and the percentage of choosing the category of "increasing expenditure" was in the following order: farm preservation (51.3 %), Farm wetlands (42.1 %), and Habitat on farms (38.1 %).[17] Table 4 presents the ranking order based on mean ratings and shows that it is consistent with the ranking based on the percentage of choosing the category of "increasing expenditure".

Willingness-to-Pay for Multifunctionality

The above analyses indicate that substantial proportion of the U.S. public considers the multifunctionality of agriculture as an important social issue that the government should be engaged in to support its maintenance and/or enhancement by using public funds. The AFT survey include questions asking whether respondents would be willing to pay any additional property or sales taxes for three multifunctional attributes of agriculture: (i) to help farmers to achieve safe drinking water, (ii) to help protect especially beautiful farmland, and (iii) to protect local production of fruits and vegetables. Table 5 shows the exact questions asked to voters for each attribute. Table 6 summarizes the distribution of responses across the three attributes.

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[16] This list includes strong military defense, effective treatment for cancer victims, maintaining good wildlife habitats on farms and ranches, minimizing use of chemical pesticides, disposing livestock waste safely, effectively educating children in public schools, protecting wetlands on farms and ranches, keeping productive farmland being converted into housing or commercial developments, finding economical ways to use corn or other crops as sources of fuel to produce power.

[17] These questions were asked without presenting information on budget constraints. Hence, the result should be interpreted in relative terms among the public issues considered.

Respondents were most willing to pay additional taxes to keep drinking water safe with about 58 % saying 'Yes' followed by 50 % for preservation of local production, and 41 % for farmland preservation.

Given the information on the percentage of respondents who said yes to the binary WTP questions, the subsequent issue of interest is how much these respondents would be willing to pay for the multifunctional agriculture. The AFT survey used payment card format to elicit WTP from the U.S. public. Table 7 shows the distribution of responses to the WTP questions. The mean WTP for each variable was calculated using the midpoints for each category: $16.81 for the prevention of water source contamination, $12.42 for the protection of locally produced fruit, and $10.92 to preserve especially beautiful farmlands. The highest public interest/willingness-to-pay for the protection of water sources is consistent with the finding by Kline and Wichelns (1996) that protecting groundwater was the most important reason behind farmland and open space preservation decisions for residents in the state of Rhode Island.

This ranking of the average amount of additional tax that the respondents were willing to pay is in the same order as with the responses to the binary questions (58 %, 50 %, and 41 %). That is, the general public values the protection of water source safety most highly followed by local production of vegetables and fruits and preservation of beautiful farmland. A plausible reason for this result is that, while all three attributes are goods not traded in organized markets, water source safety represents a good that includes primarily direct use value and may have the most immediate effect on consumers' welfare (e.g., health hazard due to unsafe drinking water), whereas farmland preservation may represent a good that potentially involves a large portion of nonuse values.

Regression Models for Willingness to Pay

Given the considerable support that the U.S. public renders to the multifunctional attributes, our study develops regression models to identify individual characteristics driving such support. In consideration that the willingness-to-pay questions in the AFT survey were asked in two parts, our study proceeds first to estimate dichotomous regression models depicting the probability of willingness to pay. Subsequently, using only the sub-sample (i.e., the respondents who were willing to pay extra taxes), the payment card regression models analyze the factors shaping the intensity of willingness-to-pay additional taxes for the multifunctional benefits of agriculture.[18]

Explanatory Variables

Following previous studies (Beaskey, Workman, and Williams, 1986; Drake, 1992; Brower and Slangen, 1998), we hypothesize that individual characteristics including attitudes, political orientation, geographic regions of residence, and socio-demographics will play a role in explaining both the probability and intensity of willingness to pay. While we include the same set of explanatory variables in both parts, we examine whether these variables have differential effects between the probability and sub-sample models. Table 8 presents descriptions and summary statistics for the variables that are used in the empirical models.

A composite index of attitudes toward multifunctionality (Att_Multi) is constructed from three question items asking of the value of (i) scenic beauty, (ii) recreational opportunities, and (iii) wildlife habitat. Voters were given four options: not at all valued, slightly, moderately, and highly. The AFT survey includes a question on political orientation with the following five

[18] Since our paper does not compute predicted WTPs from the payment card models, sample selectivity bias is not an issue here. We are simply restricting our attention to analyzing the behaviors of the sub-sample (respondents who reported WTPs greater than zero) in terms of factors affecting their WTPs. If research goals include the computation of mean WTPs from the estimated models, two-stage models that take into account selectivity bias (e.g., Heckman's sample selection model) would be more appropriate.

options given to respondents: (1) very conservative, (2) somewhat conservative, (3) moderate, (4) somewhat liberal, and (5) very liberal. Our study uses responses to this question as a measure of political orientation (Liberal). Using a question that asks voters whether they visited farms or ranches in the past year, a dummy variable (FarmVisit) was created.

The geographic regions of the voters were captured with seven regions: Northeast, Midwest, South, South Central, Central Plains, Mountain, and West. The Northeast region is used as a reference and dropped from the empirical model. The survey elicits information on the types of residences of the voters depending on their degree of urbanization: urban, suburban, and rural. Urban is used as a reference and dropped from the empirical model. Education enters the models as a dummy taking the value of one if voters are college graduates. Ethnic background is measured with three categories including White, African American, and Others. White is used as a reference and dropped from the regression model. Other socio-demographic profiles including income and age are included as continuous variables.

Probit Models

Voters' decision whether or not to pay extra taxes for the multifunctional benefits of agriculture can be conceptually modeled using the McFadden's random utility framework and the standard probit procedure can be used to estimate the dichotomous regression models representing registered voters' decisions on whether to pay extra taxes for the three types of multifunctional benefits.

Table 9 presents parameter estimates and summary statistics for the three models. Two statistics are presented to evaluate the overall fit of the three Probit models: (i) LR tests show that all three models have a statistically significant explanatory power with $p < 0.001$, and (ii) percentage of correct prediction indicate that the estimated models correctly predict the actual

observations ranging from 62.5 % (local production of fruits and vegetables) to 64 % (safe drinking water).

As expected, the composite index of attitudes toward multifunctionality (Att_Multi) had a strong impact across the three types of multifunctional benefits. This result indicates that when respondents have a positive attitude toward scenic beauty, recreational opportunities, or habitat for wildlife associated with agriculture, they are more likely to be willing to pay extra taxes to preserve the multifunctional benefits of agriculture. Political orientation (Liberal) also had strong impacts on the three models: i.e., liberals were predisposed to value the multifunctionality of agriculture more than conservatives and pay extra taxes to support farmers. This result is consistent with Variyam, Jordan, and Epperson (1990) who reported that Democrats and Independents were more likely to favor farm support policies. FarmVisit had a statistically significant effect only on the preservation of especially beautiful farmland, but not on the safe drinking water and local production of fruits and vegetables: i.e., if voters visited farms or ranches in the past year, they were more likely to be willing to pay extra taxes to preserve amenities associated with farmland.

The Probit models include two sets of variables (geographic regions and degree of urbanization) that may shed light on the role that accessibility to rural or farmlands plays in determining voters' willingness to support the multifunctional benefits. Geographic regions had a noticeable and statistically significant impact on the probability of willingness to pay. In particular, voters living in Central Plains, Midwest, or Mountain were significantly less likely to be willing to support farmers for the provision of various multifunctional benefits when compared to those living in Northeast region. These results may be attributed to the relative abundance of agricultural land, or more generally open space in such regions. Consistent with

the present results, Variyam, Jordan, and Epperson (1990) showed that the public from the Northeast tended to be more supportive of a governmental role in agriculture.

Using probit regression estimates, Figure 2 simulates the differences in the probability of expressing willingness-to-pay for the preservation of farmlands by two variables: political orientation and geographic regions. The horizontal axis represents political orientation and shows that liberals (scale=5) are about 18 % more likely to pay extra taxes than conservatives (scale=1). The impact of geographic regions is displayed by vertical differences among the five lines. For example, voters in Midwest were about 10 % less likely to be willing to pay extra taxes compared to those in Northeastern region. The difference is most highlighted between voters in Central Plains and Northeast: i.e., only 20 % of conservative respondents living in Central Plains were willing to pay extra taxes, while more than 50 % of those in Northeast were so.

The degree of urbanization variables (Suburban and rural) had negative signs mostly across the three Probit models, indicating that voters in such areas are less likely to support the multifunctionality of agriculture when compared to those living in urban areas. These two variables, however, were not statistically significant. Socio-demographic characteristics including ethnic background, age, and marital status exerted a significant influence on the probability of willingness to pay. In particular, blacks and other ethnic groups tended to support the multifunctional agriculture (water safety and local production, but not preservation of farm) more than Whites. Age was negatively associated with willingness to pay for water safety and local production: i.e., the older the voters, the less likely to pay extra taxes to subsidize farmers. Education was significantly and positively related to the probability of willingness-to-pay for keeping sources of drinking water safe.

Payment Card Models

Given that the AFT survey used payment card format to elicit the amount of willingness-to-pay, the questions generates value responses in the form of intervals rather than point estimates, and midpoints of the intervals can be used as the dependent variable in ordinary least square (OLS) regression. However, in consideration of the fact that expected values within the intervals are not necessarily equal to the interval midpoints, Cameron and Huppert (1989) proposed maximum likelihood (ML) procedure for estimating WTP valuation equations measured with interval data. The model underlying the ML estimator is given by the system (Stewart, 1983):

(1) $W_i^* = \mathbf{X}\boldsymbol{\gamma} + \varepsilon_i$, and where,

$$W_i = \Omega_{j-1}, \text{ if } \Omega_{j-1} \leq W_i^* < \Omega_j, \quad i = 1, 2, 3.....n; j = 1, 2, 3.....7.$$

W_i^* is the unobserved true WTP; $\mathbf{X}$ is a vector of individual-specific socioeconomic and attitudinal variables defined earlier; W_i is grouped observed WTP; and $\boldsymbol{\Omega_j}$ represents observed threshold values for each WTP category. The likelihood function depicting the above model is given by,

(2) $$L = [\ \Phi\ (\ \Omega_j - \mathbf{X}\boldsymbol{\gamma}\ )/\sigma) - \Phi(\ \Omega_{j-1} - \mathbf{X}\boldsymbol{\gamma}\ )/\sigma\ )\ ]^{Dij}.$$

Where, D_{ij} is one if W_i^* falls in the jth category and zero otherwise. We use this interval data model to identify individual characteristics driving the intensity of voters' willingness-to-pay for the multifunctionality of agriculture.

Table 10 presents parameter estimates and summary statistics for the three payment card models representing (i) protection of drinking water sources, (ii) preservation of farmland, and (iii) local production of fruits and vegetables, respectively. Likelihood ratio (LR) tests indicate that the explanatory variables collectively explain a significant portion of the variations in all of

the three dependent variables (X^2 – value: 90 (p =0.001), 64 (p = 0.005), and 86 (p = 0.001)), respectively.

The composite index for attitudes toward multifunctionality was not significant in explaining the amount of willingness-to-pay for the three benefits from agriculture. This result indicates that more positive attitudes toward the multifunctional benefits of agriculture do not directly translate into larger amounts of willingness-to-pay for such benefits. This is in contrast to the Probit model result that the index was strongly associated with the probability of willingness-to-pay. Therefore, positive attitude motivates people to commit to pay an unspecified amount of additional taxes, but among the voters who were willing to pay, it does not necessarily lead to a larger size of additional taxes. This result may be due to the general nature of the definitions of the three multifunctional goods considered in this study: i.e., while attitudes are clearly important in voters' decision whether or not to pay extra taxes, the lack of specific information about the goods may have caused difficulty for voters to articulate their economic preferences in terms of monetary amount. Political orientation (Liberals) had positive signs, but was not significant in determining the amount of additional taxes in all of the three models. In sum, attitude and political orientation play an important role in determining the probability of willingness to pay, but are inconsequential in shaping the amount of additional taxes.

Compared to those in urban areas, voters living in suburban areas were likely to pay smaller sizes of extra taxes for the protection of water safety and local production of fruits and vegetables. Voters living in Midwest, South Central, Central Plains, or Mountain were predisposed to pay higher additional taxes to preserve some multifunctional benefits of agriculture when compared to those in Northeast. This result is interesting given the Probit

model result that voters in such areas were less willing to pay additional taxes. That is, when we examine only those who already committed to pay, the amount of additional taxes is significantly greater in such regions compared to the Northeast region. Therefore, consumers who reside in the agriculturally abundant regions and at the same time value the multifunctionality of agriculture are likely to be stronger supporters than those in the Northeast region.[19]

Variables representing ethnic groups also had opposite direction of impacts between the probability and sub-sample models: i.e., while black and other ethnic groups were more likely to say 'Yes' to the binary questions, the amount of additional taxes that these groups were willing to pay was significantly smaller than those of whites. In contrast to the insignificant effects on the probability of willingness-to-pay, income was strongly associated with the amount of additional taxes that voters were willing to commit to. This result indicates that voters took into account of their budgets in determining how much additional tax they would be willing to pay, demonstrating internal consistency of the AFT willingness-to-pay survey.

Concluding Remarks

The concept of the multifunctional agriculture has grown out of European and East Asian models in their systematic efforts not to subject agriculture to a liberalized trade regime. Yet, it is exerting an increasing influence on farm policies in the U.S. The initiation of various environmental and farmland conservation programs in recent years attests to the growing role of

[19] Respondents who reside in Midwest, South Central, Central Plains, or Mountain may have greater likelihood of being connected to production agriculture than those in the Northeast region and may have expressed larger amounts of willingness to pay for the multifunctional benefits of agriculture out of strategic reason to benefit themselves. Even when they have little or no connection, they may have an incentive to inflate their WTP in the hope of bringing more public tax money to their regions. The AFT data do not have information either to test whether respondents have a connection to production agriculture or to identify potential strategic bias associated with regional affiliation. This problem is also discussed in Bennett et al (2004). Any future research valuing the multifunctional agriculture should incorporate a design that can test such potential strategic bias associated with geographic regions.

the multifunctionality in shaping U.S. farm policies, particularly concerning the supply of ecosystem services (Antle and Valdivia, 2006; Antle and Stoorvogel; 2006). On the other hand, the collapse of the Doha Round agricultural trade talks in mid-2006 illustrate how elusive it is to liberalize agricultural trade.[20] While the 1994 URAA initiated green box system to incorporate the nonmarket functions of agriculture into formal trade rules, there has been on-going controversy over the appropriateness of the boundary of the green box. Knowledge of public preferences and valuation of the non-market goods and services associated with agriculture could be of assistance in resolving such controversy and determining optimal set of policies and in advancing WTO agricultural trade liberalization talks.[21]

Our study used AFT survey data to shed light on how registered voters perceive multifunctional attributes and to assess the value they place on them. Descriptive data analysis demonstrates that the registered voters consider the multifunctionality of agriculture as an important social issue. For example, they perceive the preservation of farmland more important than other public issues such as meat and poultry safety, rising unemployment, or the threat of nuclear attack. Further, about 53 percent of the respondents were in favor of increasing government expenditures to support the preservation of farmland.

Regression analyses show that individual characteristics including attitude, political orientation, geographic regions, and demographics determine the probability of willingness to pay additional taxes intended to motivate farmers to provide the multifunctional benefits of agriculture. However, when we use the sub-sample of registered voters who expressed their

[20] The trade talks collapsed primarily because member nations were reluctant to reduce trade barriers and domestic subsidies. The multifunctional role of agriculture appears to underlie such reluctance.

[21] In fact, information on public demand for nonmarket functions of agriculture is only the first step toward determining optimal government intervention. As discussed earlier, subsequent information on jointness, transaction costs of targeted policies, possibility of nonagricultural supply, and interaction in production among the multifunctional outputs are required for such determination.

willingness to pay extra taxes, a different set of factors proved to be relevant in determining the WTP magnitude: i.e., attitude and political orientation did not have a significant effect any longer, while income emerged as an important variable. More importantly, the direction of the impacts of geographic regions and ethnic background reversed between the probability and sub-sample models. These results underline that it is important to separate the two decisions (whether or not to pay extra taxes and how much to pay) in contingent valuation studies.

The analysis emphasizes that geographic regions are pertinent in determining people's behavior with respect to the multifunctional benefits of agriculture. Respondents living in Central Plains, Mountain, or West were generally less likely to appreciate the multifunctional benefits of agriculture when compared to those in Northeast region. However, when limiting the analysis to the sub-sample who was willing to pay for the multifunctionality, we have a divergent result: i.e., voters in the agriculturally abundant regions are likely to pay a significantly higher amount of additional taxes to support farmers for their supply of various multifunctional benefits to our society. This result has two implications: (i) it is critical to draw a geographically balanced sample when valuing the multifunctionality of agriculture, and (ii) the preferences of voters may diverge quite substantially even within a region (e.g., agriculturally abundant region).

In conclusion, this study indicates that a significant portion of the U.S. public is in favor of supporting farmers for the provision of various non-market outputs associated with agriculture, hinting that it would be worthwhile to attempt to assign monetary values on them. Further, this study presented insights into the factors shaping the public's willingness to pay extra taxes for three broadly defined multifunctional attributes including protection of water source safety, preservation of especially beautiful farmland, and locally grown fruits and vegetables. Yet, there

are a number of other nonmarket outputs that should be included to achieve a holistic valuation of the multifunctionality of agriculture.

The large number of nonmarket outputs defines the truly unique economic characteristic associated with the multifunctional agriculture. Consequently, the most critical issue in holistically valuing these multiple number of goods is how to effectively incorporate potential interdependencies in consumption (complementarity and substitution) among them into valuation design (the box far right in Figure 1 represents this interaction). This issue has been addressed theoretically and empirically in terms of multi-component environmental valuation projects (Hoehn and Randall, 1989; Hoehn, 1991). Randall (2002) conceptually discussed similar issues specifically in light of valuing the multifunctional agriculture. Overall, these studies point to upward biases arising from individual valuation and summation (IVS) of multiple benefits of an environmental program primarily because of two reasons: (i) not considering substitution effects on geographically separated multifunctional goods, and (ii) people's psychological tendency to overvalue part of a whole good and undervalue the whole. Research is needed to identify and measure these potential interactions in demand for the multifunctional outputs of agriculture. The resulting information can be useful in designing a valid valuation scheme for the multifunctionality at a national scale.

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Table 1. Demographic composition of Registered Voters and US Census

Variable	**Sample (%)**	**2000 US Census (%)**
High school graduates	93.5 %	80.4 %
Bachelor's degree	39.3 %	24.4 %
Persons 65 years old and over	19 %	12.4 %
Female	51.6 %	50.9 %
White	78.2 %	75.1 %
African American	9.8 %	12.3 %
Hispanic	5.9 %	12.5 %
Asian	1.7 %	3.6 %
Native American	1.7 %	1.0 %
Other	1.4 %	5.5 %
Homeownership rate	74.9 %	66.2 %

Table 2. Mean Ratings of the Perceived Importance of Various Policy Objectives

Variable	**Mean**	**Std. Dev.**
Public education quality	1.556	0.899
Rising gas prices	1.687	0.914
Pesticide residue on produce	1.987	1.011
Rapid development of farmland	1.992	1.052
Meat and poultry safety	1.994	1.061
The consumption of genetically modified foods	2.094	1.143
Water source safety in agriculture	2.118	1.130
Rising unemployment	2.144	1.143
The threat of nuclear attack on the United States	2.532	1.163

Note: 1 = Very concerned; 2 = somewhat concerned; 3 = not too concerned; 4 = not at all concerned

Table 3. Percentage of choosing (1) in favor of increasing expenditure

Variable	Percent of favoring increase (%)
Public education	80.5
Cancer treatment	72.8
Corn power	68.5
Farm preservation	52.8
Minimize agrochemicals	47.9
Manure disposal	43.9
Farm wetlands	43.3
Habitat on farms	39.1
Military defense	38.4

Note: 1 = increasing expenditure; 2 = expenditure staying at the present level; 3 = decreasing expenditure

Table 4. Mean values of opinions about expenditures on public policy issues

Variable	Mean	Std. Deviation
Public education	1.24	.523
Cancer treatment	1.30	.506
Corn power	1.39	.629
Farm preservation	1.60	.708
Minimize agrochemicals	1.65	.700
Manure disposal	1.67	.664
Farm wetlands	1.68	.666
Habitat on farms	1.73	.663
Military defense	1.75	.677

Note: 1 = increasing expenditure; 2 = expenditure staying at the present level; 3 = decreasing expenditure

Table 5. American Farmland Trust (AFT) Survey Questions for Binary Willingness to Pay

Types of Multifunctional Benefits	Question Wording
Safe Drinking Water	To keep drinking water safe, some local governments help farmers use practices that prevent polluted water from their fields getting near public wells and reservoirs. Would you be willing to pay any additional property or sales taxes to help farmers to achieve safe drinking water in this way?
Protection of Farmland	In some parts of this country, citizens have agreed to tax themselves extra each year to keep especially beautiful farmland from being developed. Would you be willing to pay any additional property or sales taxes to help protect especially beautiful farmland?
Local Fruits and Vegetables	In some parts of this country, citizens have agreed to tax themselves extra each year to keep from being developed farmland that produces fruits and vegetables sold locally. Would you be willing to pay any additional property or sales taxes to help protect farmland that produces locally sold fruits and vegetables?

Table 6. Distribution of Responses for Binary Willingness to Pay Questions

	Water Source Safety		**Farmland Preservation**		**Local Production**	
Response	Freq.	%	Freq.	%	Freq.	%
Yes	1293	58.3	909	41	1113	50.2
No	841	38.0	1188	53.6	1020	46
Total	2134	96.3	2097	94.6	2133	96.3
Don't Know	75	3.4	109	4.9	74	3.3
Won't Say	7	.3	10	.5	9	.4
Total	2216	100	2216	100	2216	100

Table 7. Distribution of Responses to WTP Questions

	Water Source Safety		**Farm land Preservation**		**Local Production**	
Response	Freq.	%	Freq.	%	Freq.	%
Less than $1	66	3.0	47	2.1	68	3.1
Less than $5	125	5.6	77	3.5	108	4.9
Less than $10	87	3.9	74	3.3	87	3.9
Less than $20	99	4.5	64	2.9	89	4.0
Less than $50	161	7.3	102	4.6	144	6.5
Less than $100	138	6.2	107	4.8	117	5.3
Less than $250	107	4.8	62	2.8	65	2.9
Other response	214	9.7	162	7.3	173	7.8
Total	997	45.0	695	31.4	851	38.4
Don't know	287	13.0	206	9.3	255	11.5
Won't say	9	.4	8	.4	7	.3
Total	1293	100	909	100	1113	100

Note: Other response includes all illogical or unusual answers, such as "Whatever it takes" or "Take money from other taxes."

Table 8. Description of Variables and Summary Statistics

Variable Name	Description	Mean	Standard Deviation
Att_Multi	A composite index of attitudes toward multifunctionality (1=Not at all valued; 4=Valued highly)	3.059	0.765
	Scenic Beauty	3.129	1.009
	Recreational Opportunities	2.712	1.140
	Habitat for Wildlife	3.346	0.993
Liberal	Political Orientation (1=very Conservative; 5=very liberal)	2.752	1.271
Visit	1 if visited farm or ranches; 0= otherwise	52.9 %	
Geographic region	Northeast	13.9 %	
	Midwest	13.9 %	
	South	27.3 %	
	South Central	13.7 %	
	Central Plains	3.6 %	
	Mountain	14.1 %	
	West	13.6 %	
Urbanization	Urban	28.0 %	
	Suburban	40.0 %	
	Rural	31.0 %	
Sociodemographics			
Education	1 if had college education; 0=otherwise	37.1 %	
Income	Annual Income ($)	44112	31885
Age	Actual Age (years)	47.6	17.2
Race	White	78.2 %	
	Black	9.8 %	
	Others	3.1 %	
Marital Status	1 if married; 0=otherwise	54.8 %	
Gender	1 if male; 0=otherwise	48.3 %	

Table 9. Estimation results for binary questions: Probit estimates.

	Water Safety		Preserving Farm		Local Production	
Variable	Estimates	t-statistics	Estimates	t-statistics	Estimates	t-statistics
C	0.1607	0.534	-0.6294**	-2.067	0.3484	1.157
Att_Multi	0.2182***	5.146	0.3888***	8.664	0.2716***	6.339
Liberal	0.1457***	5.797	0.1143***	4.514	0.0987***	3.844
FarmVisit	0.0082	0.126	0.1371**	2.079	0.0816	1.270
Geographic Region						
Midwest	-0.1357	-1.125	-0.2292*	-1.894	-0.2382*	-1.985
South	-0.0872	-0.791	-0.1528	-1.388	-0.1288	-1.181
South Central	-0.1589	-1.309	-0.2212*	-1.814	-0.1852	-1.535
Central Plains	-0.3845**	-2.133	-0.8910***	-4.487	-0.7802***	-4.120
Mountain	-0.2048*	-1.693	-0.3320***	-2.723	-0.3755***	-3.131
West	-0.1290	-1.058	-0.1948	-1.590	-0.2018*	-1.665
Urbanization						
Suburban	-0.0664	-0.863	-0.0249	-0.319	0.0603	0.794
Rural	-0.1203	-1.458	-0.0134	-0.160	-0.0016	-0.020
Education	0.1558**	2.253	0.0547	0.778	-0.0369	-0.539
Income	-0.0118	-0.803	-0.0043	-0.286	-0.0228	-1.547
Age	0.0019	1.034	-0.0047**	-2.442	-0.0051**	-2.684
Ethnic Background						
Black	0.2787**	2.473	0.1232	1.117	0.2149*	1.953
Others	0.1469	1.411	0.0384	0.368	0.2277**	2.216
Marital Status	-0.1975**	-2.960	-0.2320***	-3.436	-0.2098***	-3.170
Gender (Male=1)	-0.1317*	-2.120	-0.1004	-1.589	-0.3122***	-5.055
# of Observations	1811		1742		1807	
Log-L Value	-1150		-1110		-1166	
Log-L Value (β=0)	-1200		-1196		-1246	
X^2-Value	98 (p = 0.000)		171 (p = 0.000)		159 (p = 0.000)	
Correct Prediction	64 %		63.8 %		62.47 %	

Note: Northeast, Urban, and White are the reference group for Geographic Region, Urbanization, and Ethnic Background, respectively. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

Table 10. Estimation results for Payment Card Willingness-to-Pay: Sub-sample model.

	Water Safety		Preserving Farm		Local Production	
Variable	Estimates	t-statistics	Estimates	t-statistics	Estimates	t-statistics
C	-3.3644	-0.209	-3.7410	-0.203	-1.6216	-1.6216
Att_Multi	3.7482*	1.652	3.4891	1.232	-0.4461	-0.4461
Liberal	2.1446*	1.626	1.9117	1.295	1.1530	0.964
FarmVisit	2.8322	0.849	-1.1080	-0.282	2.8032	0.880
Geographic Region						
Midwest	9.3390*	1.596	15.249**	2.202	7.1899	1.289
South	-7.8323	-1.510	0.5189	0.086	-10.945	-2.295**
South Central	15.087**	2.547	13.521*	1.999	5.8548	1.079
Central Plains	0.5336	0.045	27.770*	1.720	20.324	1.574*
Mountain	-1.3190	-0.229	10.904*	1.634	-1.1447	-0.208
West	4.0646	0.660	7.4297	1.059	4.2912	0.758
Urbanization						
Suburban	-6.3432*	-1.651	-1.9231	-0.426	-5.7342*	-1.599
Rural	-0.9075	-0.211	-2.2887	-0.439	0.4711	0.118
Education	5.2178	1.492	5.5169	1.366	4.6299	1.397
Income	2.7364***	3.598	2.0211***	2.320	2.8428***	4.089
Age	-0.3831***	-3.712	-0.3167***	-2.634	-0.1556***	-1.636
Ethnic Background						
Black	-10.934	-2.194*	-13.211	-2.288**	-8.1579	-1.795*
Others	-13.162	-2.481**	-22.707	-3.624***	-18.16	-4.004***
Marital Status	2.9908	0.870	11.879**	2.973	2.2533	0.705
Gender (Male=1)	1.1128	0.345	0.2694	0.072	-0.7573	-0.252
# of Observations	690		466		595	
Log-L value	-1607		-1090		-1408	
Log-L value (β=0)	-1652		-1122		-1451	
X^2 – value	90 (p =0.001)		64 (p = 0.005)		86 (p = 0.001)	

Note: Northeast, Urban, and White are the reference group for Geographic Region, Urbanization, and Ethnic Background, respectively. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

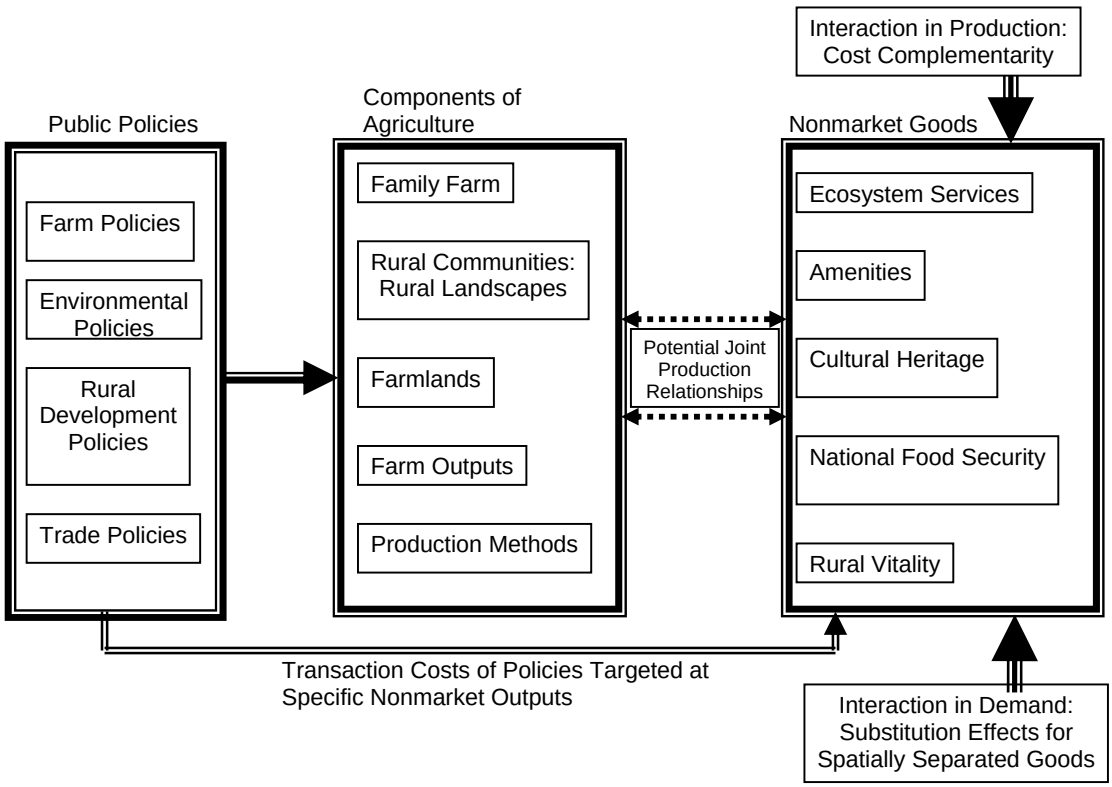

Figure 1. Potential joint relationship between nonmarket outputs and rural landscapes, or farmlands, or farm outputs, or family farms and interdependence in production and consumption among nonmarket outputs

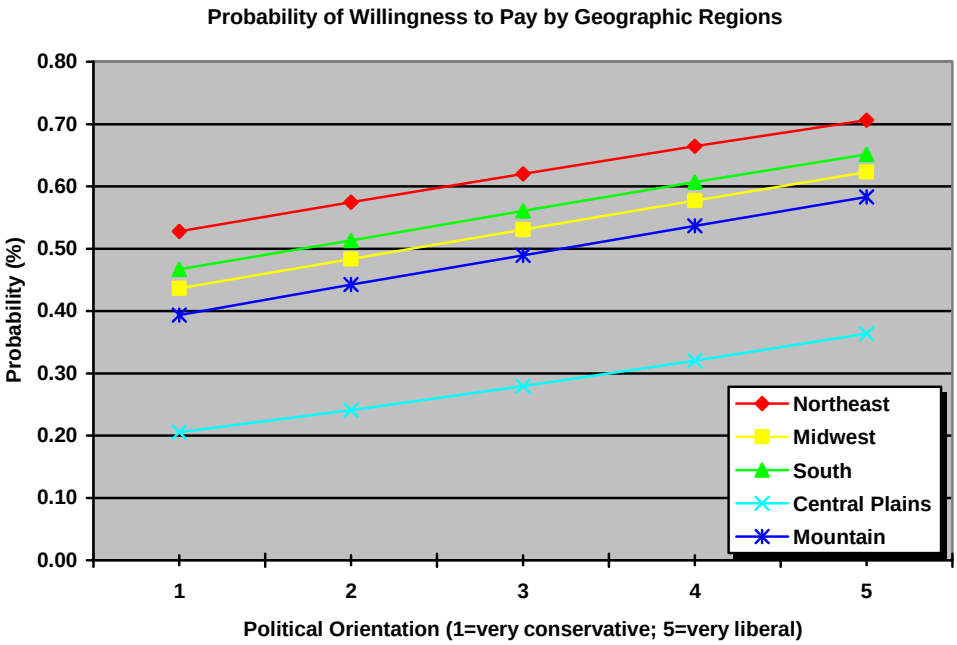

Figure 2. Probability of Expressing Willingness-to-Pay for Preservation of Farmlands by Geographic Regions