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Convergent Validity of Conjoint Values for Farmland Conservation Easement Programs

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CONVERGENT VALIDITY OF CONJOINT VALUES FOR FARMLAND CONSERVATION EASEMENT PROGRAMS

By

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An Abstract of the Thesis Presented
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Conversion of farmland has recently become an important policy issue in the US. Between 1982 and 1997, over seven million acres of prime farmland was converted to developed land in the US, which is a 3% decrease in total farmland. This is also the case in Maine, where forty thousand acres of prime farmland has been converted to non-farm uses over the same time period. This constitutes about an 8% decrease in total farmland, where farmland is only 6% of the total land in Maine.

A decrease in the amount of farmland, along with the increased public support for farmland protection has led to a number of farmland preservation programs. A popular and effective means of preservation of farmland is conservation easement programs. These programs require farmers to voluntarily sell the right to develop their land for commercial and residential purposes.

A considerable amount of money has been spent on the acquisition of development rights on farmland, and applications of these easements have been increasing. It is important to investigate if the benefits of these programs outweigh the costs of purchasing easements. Although there is an available market price for the cost of agricultural conservation easements, the value of these programs is not known. This research aims to estimate the value Maine residents place on farmland conservation easement programs, and to identify the types of farmland that has the strongest public support.

Conjoint analysis was employed, since it is a useful tool for a study that focuses on investigating values for a heterogeneous good like farmland conservation. Conjoint analysis is a survey-research method that presents a set of alternatives to respondents, which have different levels of component attributes. While conjoint is very useful for the current application, its use in environmental economics is quite new. There are a number of issues and concerns about designing conjoint surveys. The methodological objectives of this study aim to investigate how the effect of the placement of monetary stimulus, the number of alternatives in the choice set and the exclusion of status quo alternative affects the coefficient estimates.

The study objectives were accomplished by administering a mail survey to a random sample of 2,000 Maine residents. In order to meet the methodological objectives, four different versions of the survey were created. Vst presents typical conjoint questions, and coefficient estimates from this version was used to test the convergence of estimates from other versions.

The estimation results suggest that people are more likely to support a conservation easement program that targets prime farmland near urban areas, with vegetables and with a relatively large protected area. According to the convergent validity test results, the placement of the monetary stimulus and the exclusion of the Status Quo alternative do not affect the coefficient estimates. However, the number of alternatives in the choice set affects the coefficient estimates.

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CHAPTER 1

INTRODUCTION

Conversion of farmland has recently become an important policy issue in the US. Between 1982 and 1997, over seven million acres of prime farmland[1] were converted to developed land in the US, which is a 3% decrease in total farmland (USDA, 2002). Farmers own 41% of the land area in the US, however they only own 8% of the land, which is not forested. In Maine, forty thousand acres of prime farmland were converted to non-farm uses over the same time period. This constitutes about an 8% decrease in total farmland, where farmland is only 6% of the total land in Maine.

Farmland has been converted to other uses since its value in agriculture has decreased relative to the market value of alternative uses of the land. However, the market value of the farmland does not reflect the value of the external benefits that are provided, such as open space. Farmers are compensated for their agricultural production, and in some instances, for the recreational use of their land. However, they are not compensated for other benefits such as the undeveloped land enjoyed by the public. (Western Governors' Association, The Trust for Public Land and National Cattlemen's Beef Association, 2001). If farmers were compensated for all services provided by their land, then the value of the land in agriculture might outweigh its

[1] Prime farmland is the land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses (USDA, 2002).

value in alternative uses of the land, such as residential and commercial development (Bergstrom et al., 1985).

1.1. Issues About Farmland Conservation in the US

Public support for farmland preservation has led federal, state and local governments, and non-governmental organizations to take some precautions. One of the most popular and effective means of preserving farmland is a Conservation Easement Program (CEP), where farmers voluntarily sell or retire the right to develop their farmland (Daniels, 1991; Nelson, 1992). The purpose of CEPs are to preserve farmland and protect it from development by limiting the use of land for residential, commercial or any kind of non-agricultural development.

By July 2002, over one million acres of farmland in the US were covered by conservation easements (American Farmland Trust, 2002). Nearly $2 billion has been spent to fund these CEPs. In Maine, over $1.5 million has been spent on conservation easements to protect 2,555 acres of farmland. At the national level this is an average of $1,746 per acre and the comparable figure for Maine is $634 per acre. CEPs are also funded by donations from land trusts, landowners and other groups. Thus, the cost figures do not reflect the full cost of the easements.

Purchasing conservation easements is very costly. Studies have inquired if CEPs are the best policy tool to preserve farmland (Kline and Wichelns, 1993; 1994). In order to investigate this, one should examine if the benefits of these CEPs outweigh the costs of purchasing conservation easements. Since the costs of

easements are known, it is important to get information on how much people are willing to pay for preservation, as well as what types of the farmland they are willing to preserve. The later will provide information on the benefits of CEPs.

Kline and Wichelns (1996) showed that the most important reasons to preserve farmland for Rhode Island residents were environmental objectives (protecting groundwater, protecting wildlife habitat, preserving natural places) Agricultural and aesthetic objectives (providing local food, keeping faming as a way of life, preserving rural character and scenic quality) were also notable motivations of citizen support for farmland preservation.

Another study conducted by Furuseth (1987) in Mecklenburg County, North Carolina found a strong level of public support for protecting local agricultural resources. Almost half of the respondents would be willing to pay more taxes to protect local farmland. These studies show that farmland cannot be regarded as only a food source; it also provides external benefits, such as environmental services and amenity values.

1.2. Measuring the Value of Farmland Preservation

There are a small number of studies that have investigated the value the public place on the preservation of farmland. These studies found that households would pay between $50 and $180 to protect around 25,000 acres of farmland (Bowker and Didyckuk, 1994; Rosenberg and Walsh, 1997). However, these studies did not

specifically investigate the value of agricultural conservation easements. They were also conducted in very small towns and the sample sizes were quite small.

This research investigates the value of conservation easements to farmland in Maine. In addition to providing original value estimates for Maine, this research improves on previous farmland valuation studies in several ways. First, it is the only study that estimates values for protecting farmland at the state level. All previous studies were done at the local level. However, most land conservation funds are provided at the state or national land.[2]

Second, all previous studies have typically estimated a single value for farmland preservation and have not looked at how the type of farmland preserved affects the value estimates. For this purpose, this study employs conjoint analysis, while the previous studies used contingent valuation methods.

Conjoint analysis is a survey-research methodology, which is usually employed for its ability to deal with multidimensional situations, especially when tradeoffs between alternatives are important (Foster and Mourato, 2002). Conjoint analysis allows the identification of the types of farmland that have the strongest public support for preservation and the estimation of values for preserving different types of farmland. Because the cost of CEPs is likely to vary substantially from parcel to parcel, it is important to know parcel characteristics that generate the highest public value. Wichelns and Kline (1993) stated that the social benefits and the costs of

[2] For example, this thesis study is a part of a project funded by USDA, which conducted a national survey for conservation easements to farmland.

conservation easements depend on farmland attributes, such as farm size, soil types, location, visibility from public roads, and many others.

1.3. Thesis Objectives

This thesis has two types of objectives, policy and methodological. The policy objectives of this thesis are:

P1. estimate the value of farmland Conservation Easement Programs in Maine,

P2. identify what farmland attributes are valued the greatest.

In pursuing these objectives, this research improves on previous research by taking state rather than local perspective, having a larger sample size so that there can be more statistical confidence in the results, and identifying how value estimates vary for different types of farmland attributes. These improvements will enhance the usefulness of value estimates for the design and implementation of state level CEPs.

Conjoint analysis is very useful for the current application, however its use in environmental economics is quite new. There are a number of issues and concerns about designing conjoint surveys. Three of these issues are investigated in this thesis. The methodological objectives are:

M1. whether the placement of the monetary stimulus as the first or last attribute affects coefficient estimates;

M2. whether the number of the alternatives (two or three alternatives) in the choice set affects coefficient estimates;

M3. whether the exclusion of status quo alternative (no CEP) affects coefficient estimates.

Some researchers claim that conjoint may provide more information than other non-market valuation techniques. (DeShazo and Fermo, 2002; Louvier and Timmerman, 1990). However, the trade-off is the increased choice complexity and burden on the respondents (DeShazo and Fermo, 2002; Saelensminde, 2002).

The design of conjoint questions is very crucial. The subjective decisions of researchers on the design of conjoint questions may affect the outcomes. One of the important issues is the placement of the monetary stimulus. Monetary stimulus is the item that reflects the policy cost. The placement of the monetary stimulus may affect peoples' preferences. The literature suggests that WTP estimates from conjoint analysis might be higher than WTP estimates from other methods (Stevens et al., 2000). One explanation to this is; if cost attribute is presented as the first attribute, the coefficient estimates might be overestimated, since it may receive more attention than other attributes. This thesis investigates this issue by presenting the cost attribute as the first attribute in one version and as the last attribute in another version.

Another empirical issue is the number of alternatives presented to the respondents in the choice set. The number of alternatives may affect peoples' preferences in different ways. First, respondents may have trouble dealing with complex questions as the number of alternatives increase. DeShazo and Fermo (2002) showed that choice complexity significantly affected choice consistency and welfare

estimates. Second, the assumption of independence of irrelevant alternatives (IIA)[3] may not hold. Third, the coefficient estimates might be affected by the lack of incentive compatibility. Respondents might behave strategically in order to affect the survey results, or ill defined or inconsistent preferences with economic theory might lead inappropriate results (Carson et al., 2000). In his article, Lloyd (2002) questioned the validity of the survey results because of the existence of the biases and shortcuts that can affect peoples' judgments and decision-making.

The final concern is the status quo (SQ) alternative in the applications of conjoint analysis to environmental economics. The SQ alternative implies maintaining the current situation, which corresponds to "do nothing" in policy terms. The Status Quo alternative has been included in some studies, while it has been excluded in others (Boyle et al., 2001). There might be some respondents who do not want a change in the current situation, or who do not support the implied policy. Inclusion of the SQ allows these respondents to state their decisions (Holmes and Adamowicz, *forthcoming*). It is also necessary to include SQ for welfare estimates, which are usually calculated for a change from the current situation to a new situation.

By investigating these different approaches in the conjoint question, this thesis aims to test the convergent validity of conjoint analysis. Convergent validity is established if two or more different measurement techniques provide statistically indistinguishable estimates of the same theoretical concepts. This research

[3] IIA suggests that if a subset of the choice set truly is irrelevant, omitting it from the model altogether will not change the parameter estimates systematically (Greene, 2000).

investigates the convergence of coefficient estimates from different treatments of conjoint question.

1.4. Methods

The study objectives were accomplished by administering a mail survey to a random sample of 2,000 Maine residents. In order to meet the methodological objectives, four different versions of the survey were created. The standard version, Vstandard (hereafter Vst), presents conjoint questions in a traditional way. In Question 1, respondents were asked to choose between alternative conservation 'Program A' and 'Program B'. In Question 2, they were asked to vote for alternative conservation 'Program A' or 'Program B', or not to vote for any (status quo alternative). In Vst, the monetary stimulus was presented as the last attribute. Since Vst is the standard version, coefficient estimates from Vst will be used to test the convergent validity with the estimates from other versions.

Second version, Vmonetary_stimulus (hereafter V$), addresses the methodological objective M1, and differs from Vst by presenting the monetary stimulus as the first attribute. Third version, Vnumber_of_alternatives (hereafter Valt), was designed to test objective M2, which aims to investigate the affect of the number of the alternatives presented to the respondents. This version excludes the second alternative Program B, and presents alternatives of Program A and Status Quo in the choice set. Last version, Vnon_status_quo (hereafter Vnsq), addresses the last methodological objective M3. It excludes the status quo alternative, and presents two

(non-SQ) alternatives to the respondents. Both in Valt and Vnsq, the monetary stimulus was presented as the last attribute as in Vst. By methodological objectives, we are hoping to provide some insights for future studies in designing conjoint surveys in environmental economics.

1.5. Thesis Organization

Chapter 2 presents information on current conservation easement programs to farmland in the US and Maine, and discusses the existing literature on the value of farmland preservation. Chapter 3 provides detailed information on conjoint analysis and its application to environmental economics. In Chapter 4, the survey design and data collection methods of this study are presented. Chapter 5 presents the estimation and test results from the analysis. Finally, Chapter 6 examines policy and methodological implications and gives suggestions for future research.

CHAPTER 2

LITERATURE REVIEW

Before discussing the specifics of the design of this research, it is important to understand the policy role of conservation easement programs and other studies that have investigated public values for farmland. The discussion first turns to the extent of public support for CEPs and referendums to raise funds for acquisition of easements. Next, the discussion explains the previous studies that have estimated the people's willingness to pay for farmland preservation. The chapter concludes with a discussion of how this thesis contributes to the literature.

2.1. The External Benefits of Farmland

Farmland provides many benefits to the public, which includes agricultural production, recreation, as well as cultural and environmental services. The public is familiar with recreational use of agricultural lands, such as using the land for hunting, snow-mobiling, etc. The public also benefits from open space services, such as aesthetic and heritage values, groundwater and soil conservation, wildlife habitat, and biological diversity. These are the external benefits of farmland to the society that farmers are not compensated for.

Open space services of farmland have the properties of public goods, and enjoyment of these services by the public is non-rival and non-excludable. The open space benefits enjoyed by one person do not need to decrease the benefits for other

people. For example, someone driving his car by a farm and enjoying the aesthetic beauty of the farmland does not decrease the amount of enjoyment of others who follow. Farmland also provides non-excludable services, since it is not possible for a farmer to prevent passersby from enjoying the scenic beauty of the land. Everybody driving or walking by a farm can enjoy the aesthetic beauty.

Farmers are only compensated for their agricultural production, and in some instances for the recreational use of their land, for example fees for hunting. However, they do not get any compensation for the other benefits of their land to society. Although society benefits from cultural and environmental amenities of farmland, these values do not produce any revenue to the farmers.

The existence of these external benefits may create an inefficient market for agricultural land (Halstead, 1984). Since its value in agriculture is undervalued, farmland will be converted to other uses. Many farmers who are experiencing financial stress may not be able to resist offers from developers to buy their land (Western Governors' Association, The Trust for Public Land and National Cattlemen's Association, 2001).

A decrease in the farmland nationally, along with the increased public support for farmland protection, has led federal and local governments, and non-governmental organizations to take some precautions. Agricultural zoning, property tax breaks, conservation easement programs and other kinds of growth management techniques are some of the preservation methods that have been employed in the US (Daniels, 1991).

2.2. Conservation Easement Programs

This study focuses on one of these policy tools, namely conservation easement programs. CEPs have recently become one of the most popular and effective means of preserving farmland. A conservation easement involves purchasing the development rights of farmland from landowners.

Property owners have many rights on their property such as usage, leasing, selling, mortgaging and bequeathing the land, and constructing on their land. An easement allows the exchange of one or more of these rights from the landowner to another party (Wiebe et al., 1996). For example, easements are sold for road or utility access across private properties. A conservation easement is an easement that restricts or prohibits a specific type of land use for conservation of natural resource protection objectives. For example, a farmland conservation easement purchases the rights of the owner to develop his/her land for non-agricultural purposes. Under CEPs, farmers keep the rights of farming, selling or bequeathing the land, and constructing residential buildings only for their family. The agreement binds the rights of the future landowners through the easement duration.

The purpose of a conservation easement is to conserve and protect farmland from development pressures in the long run. The legislative objectives of these programs are the preservation of agricultural resources and farming activities, as well as the preservation of benefits from open space retention, including scenic views, watershed protection, and wildlife habitat (Kline and Wichelns, 1994).

The criteria in selecting the land for CEPs are the level of the development pressure and agricultural quality of the land (Daniels, 1991). A medium level of development is usually preferred since the preservation of farmland with a high development pressure will be very costly. Kline and Wichelns (1993) stated that the farmland parcels to be preserved should be selected according to the marginal impacts of parcel characteristics on both the costs and benefits of farmland preservation. They found that the social benefits and the costs of conservation easements depend on farmland attributes, such as farm size, soil types, location, visibility from public roads, and many others.

Most of the easements are permanent, whereas some of them may state a specific period in the agreement, usually for a relatively long time period. Long-term preservation provides a good opportunity for young farmers to start their business, and for old farmers who want to retire and leave their land for the next generation to guarantee their farming activities (Daniels, 1991).

Farmers are compensated for restricting the future use of their lands. The value of the easement is the difference between the value of the land with conservation easement and the value without the easement (Daniels, 1991; Lassner, 1998; American Farmland Trust, 2002). That is, farmers will get the difference between the market value of their land and its value in agricultural use. Farmers can

use the compensation money on any investment, and this may allow them to improve their farming conditions.[4]

Conservation easement programs are purchased by private or public agencies. Private agencies are national non-profit organizations, such as the American Farmland Trust, The Nature Conservancy, or local land trusts, such as the Maine Coast Heritage Trust. Public agencies are federal government agencies, such as the Natural Resources Conservation Service, or state and local government agencies (Wiebe et al., 1996).

The main sources of funding conservation easements for public purchases are bonds, property taxes, real estate transfer taxes, sales taxes, annual appropriations and federal funds (American Farmland Trust, 2002). Also a substantial amount of easements are received via donations. Bonds are the most popular source of funding, which are issued by cities, states and other public entities to finance large public projects. Taxes are a regular stream of revenue. However, they are unpopular among the public. Annual appropriations are one of the means of allocating funding for farmland protection from general or discretionary funds. However, annual appropriations and federal funds are not predictable from year to year. There are other types of funding raised by cellular phone tax, credit cards and lottery revenues. For example, in 1996, the Land for Maine's Future Program issued the first state-sponsored credit card to raise funds for farmland preservation.

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[4] Farmers can also receive several tax benefits. For example, donors can get a deduction of 30% of their income tax, whereas donor corporations are limited to a reduction of 10%. A conservation easement on a farmland reduces the value of the land for estate tax so that the estate may be subjected to a lower tax level than without conservation easement (American Farmland Trust, 2002).

2.2.1. Farmland Conservation Easement Programs in the US

The action for conservation easements started relatively recently. The nation's first agricultural conservation easement program is located in Suffolk County, N.Y., and was enacted in 1972 (Daniels, 1991). The next states to apply conservation easements to farmland were Maryland and Massachusetts in 1978. The primary motivations for early conservation easements were regional food security and the loss of open space.

In 1981, the National Conference of Commissioners adopted The Uniform Conservation Easement Act (American Farmland Trust, 2002). Since then, 21 states have adopted laws to enable conservation easements based on the Uniform Conservation Easement Act, and 23 states have adopted their own laws enabling conservation easement.

By July 2002, the total number of agricultural conservation easements was 6,996[5] in the US, and the total protected farmland was 1,135,941 acres[6] (American Farmland Trust, 2002). Of this number, 922,287 acres are state-level conservation easements, whereas 213,654 acres are local easements. An amount of $1,984,000,000[7] has been spent to acquire these easements. For the current fiscal year, $389,000,000 is available to purchase additional development rights. However, these figures cannot be regarded as the full cost of the conservation easements,

[5] This number does not necessarily reflect the total number of farms protected, as some programs acquire a property in stages and may hold multiple easements on the same farm.
[6] Number of acres protected by the program to date.
[7] Amounts may include unspent funds that are encumbered for installment payments on completed projects.

because the funds also received donations from land trusts, landowners or from local governments.

2.2.2. Farmland Conservation Easement Programs in Maine

The state of Maine adopted conservation easement enabling law in 1987, and acquired the first agricultural conservation easement in 1988 (American Farmland Trust, 2002). The number of the agricultural conservation easements in the state is seven, and the total protected land is 2,555 acres. To acquire these easements, $1,620,000 had been spent and another $1,000,000 is available for the acquisition of additional easements on farmland.

The sources of the funding are state appropriations and bonds, and royalties from credit cards (American Farmland Trust, 2002). Also, the Federal Farmland Protection Program (FPP) is one of the funding sources. It was established in 1996 to provide funds to state, local and tribal CEPs.

A considerable amount of money has been spent on the acquisition of development rights on farmland, and applications of these easements have been increasing. Less is known about the benefits of CEPs. In particular, little is known about public support for conservation easements. Although referenda data specific to agricultural conservation easements are not available, data on referenda for the protection of parks and open space are available and presented in the following sections.

2.2.3. Referenda for Open Space Protection in the US

The number of referenda for open space protection is indicative of high public interest in this policy tool (Table 2.1). At least half of all the states had open space referenda on their ballots. In 2002, 28 states had at least one measure, with an average of about 5 measures per state. Since 1998, at least 70% of the measures have been accepted, while in 1999, 90% of the measures were passed.

The largest state measures in 2002 in terms of dollars generated, were two different measures in California with $2.3 and $1.5 billion. In 2001, the largest state measure was in Morris County, New Jersey, generating $192 million for twenty years.

The overall results document a consistent and substantial public support for the protection of open space across the country. Since 1998, the number of total measures passed is 529. An amount of $25 billion-fund has risen for open space protection throughout the nation. As it was noted earlier, the acquisition of agricultural conservation easements has cost at least $2.3 billion to society, which constitutes 8% of the overall funding created for open space protection.

Table 2.1: Referenda Results for Open Space Protection in the US

	1998	1999	2000	2001	2002
Num. of states involved	26	22	30	24	28
Number of Referenda	146	102	209	196	189
Number of winning ref.	126	92	174	137	141
Passage Rate	84%	90%	83%	70%	75%
Total Funds	$8.3 billion	$1.8 billion	$7.5 billion	$1.7 billion	$5.7 billion

Source: Land Trust Alliance, 2001, 2002

2.2.4. Referenda for Open Space Protection in Maine

Citizen referenda results in Maine indicate a substantial public support for open space protection in all measures (Table 2.2). Since 1999, all referenda measures were approved, creating a $56,087,000 fund for open-space protection. Almost 5% of this fund has been spent on agricultural CEPs. It is not surprising that the percentage of conservation easements is much less in Maine than it is nationally, since the percentage of farmland is only 6% of the total land. On the other hand, this may necessitate more conservation programs in Maine.

Table 2.2: Referenda Results for Open Space Protection in Maine

	1999	2000	2001	2002
Number of measures	1	6	1	1
Percent passed	100%	100%	100%	100%
Funds raised	$50,000,000	$3,087,800	$1,500,000	$1,500,000

Source: Land Trust Alliance, 2001, 2002.

More information is given about the referenda held in Maine, since this research was applied in this state. Table 2.3 presents detailed information about the each referendum held in Maine. In 1999, environmental, business and social groups in Maine collaborated to create the largest environmental bond in the state's history by a statewide referendum. An amount of $50,000,000 was raised in order to acquire public land and conservation easements to protect wetlands, farmland and other undeveloped land in the state. Since 1999, the public demonstrated their support of open space protection by approving all the measures. Note that in some measures, the public support was 100%.

Table 2.3: Detailed Referenda Results for Maine

Year	Location	Number of Measures	Approve Rate	Funds Raised
1999	State-wide	1	69%	$50,000,000
2000	Freeport	1	54%	$500,000
2000	Harpswell	1	100%	$59,800
2000	Kennebunk	1	100%	$25,000
2000	Scarborough	2	100%, 75%	$1,750,000
2000	Phippsburg	1	79%	$753,000
2001	Falmouth	1	73%	$1,500,000
2002	Saco	1	68%	$1,500,000

Source: Land Trust Alliance, 1999, 2000, 2001, 2002.

Although CEPs have substantial public support, the purchasing of conservation easements is very costly. It is important to investigate if the benefits of these programs outweigh the costs of purchasing easements. Although there is an available market price for the cost of agricultural conservation easements, the value of these programs is not known. To our knowledge, there is not a study in the literature that investigated this issue. However, there are several studies investigated the people's willingness to pay for farmland preservation. In the following section, the existing literature on the value of farmland preservation will be discussed.

2.3. Previous Studies on the Value of Farmland Preservation

A small number of studies have estimated the value of farmland preservation: Halstead (1984), Bergstrom, Dillman and Stoll (1985), Beasley, Workman and Williams (1986), Bowker and Didychuk (1994) and Rosenberg and Walsh (1997).

The common feature of these studies is that they estimated a single value for peoples' willingness to pay for conservation of farmland and have not investigated how the type of farmland preserved affects the value estimates (Table 2.4). The studies were conducted in small counties, and the sample sizes of the studies were quite small.

2.3.1. Mean Annual WTP for Farmland Preservation

The mean WTP estimates range from $28 to $256 annually. Some of these studies estimated WTP for specific locations, while others did not. In some analyses WTP was estimated in per acres, whereas in other studies it was estimated for a specific size of land.

Table 2.4: Comparison of the Contingent Valuation Studies of Farmland Preservation

Authors (Year)	Question Format	Study Area (Sample Size)	Mean Annual WTP	Acres to be protected	Variables used in the Model (sign)
Halstead (1984)	Bidding game	Three MA towns (n = 85)	$28-$60 for low, $70-$176 for high development	Not specified	Income (+) Level of development (+) Distance to farmland (+)
Bergstrom, Dillman, Stoll (1985)	Open ended	Greenville County, SC (n = 250)	$13.00 per acre	72,000	Age (+) Income (+) Education (+) Acres to be protected (+) INFO (-)
Beasley, Workman, Williams (1986)	Bidding game	South Central Alaska (n = 119)	$76 for low, $144 for high development	Not specified	Income (+)* Level of development (+) Age (-) LOC (-) HEAD (+) KOP (+)
Bowker & Didychuk (1994)	Payment card	Moncton area of New Brunswick, Canada (n = 92)	$49 $68 $78 $86	23,750 47,000 71,250 95,000	Distance to farmland (+) Size of household (+) Acres to be protected (+) Income (+)* CSG (+) VIS (+)
Rosenberg & Walsh (1997)	Payment card	Yampa River Valley, CO (n = 171)	$107 $181 $231 $256	12,500 25,000 37,500 50,000	Income (+) Acres to be protected (+)* Size of household (-) Age (-)* IMP (+)

Asterisk (*) denotes variable has an insignificant effect on WTP.

Halstead stated that the mean annual WTP ranges from $28 to $60 to avoid a low level of development, and it changes from $70 to $176 to avoid a high level of development. A similar study of Beasley et al. estimated mean annual WTP estimates of $76 and $144 to avoid a low and a high level of development, respectively. Both studies did not specify the amount of protected area.

Bergstrom et al. estimated the mean annual WTP as $13 per acre, concerning a total protected area of 72,000 acres.

The analyses of Bowker and Didychuk, and Rosenberg and Walsh show that there is a non-linear relationship between WTP and size of the protection area. According to the estimates of Bowker and Didychuk, mean annual WTP per household is $68 for 47,000 acres of protected area, and it is $86 for 95,000 acres. As it can be observed, when the size of the protection area doubles, the WTP only increases by 26%. This can also be observed in the estimates of Rosenberg and Walsh. The WTP bid in their analysis is $181 for 25,000 acres and it is $256 for 50,000 acres. Also, it should be noted that these two studies estimated quite different WTP estimates for almost the same amount of protected area. For example, Bowker and Didychuk found mean annual WTP as $49 for about 25,000 acres, whereas Rosenberg and Walsh found it to be $181 for the same size of land.

2.3.2. Variables That Affect WTP for Farmland Preservation

The variables used in the models are quite consistent across studies. However, the significance of the parameters corresponding to these variables is not consistent

across studies. The most commonly employed significant variables are income, level of development (pressure on farmland), distance to farmland[8], acres to be protected, age and education of the respondent, and size of the household.

The affect of some of these variables on the bid is the same across the studies. For example, income, level of development, distance to farmland and acres to be protected has positive affects on the bid. However, the affect of some variables, such as age of the respondents and size of the household, is not consistent across the analyses.

The models also contain some dummy variables that have significant effects on the bid. Bergstrom et al. employed a dummy variable, INFO, which represents the information given to respondents about the specific benefits of the prime land. It was found that the respondents, who did not receive any information, have higher bids than the respondents who received the information. Authors claim that respondents are not able to separate amenity benefits of the farmland from other benefits. This supports the idea that respondents should be informed about the policy that they are being surveyed.

Beasley et al. employed LOCATION variable to separate residents of two main locations. The estimate results showed that the bids given by residents of different towns are significantly different from each other. This shows how WTP estimates may change from one place to another. They also employed HEAD (head of household) and KOP variable, which indicates having previous knowledge of the

[8] Distance of the respondent's house to the nearest farmland.

proposed government program to purchase development rights on agricultural land. These variables were found to be significant and have positive effects on the WTP bid.

Bowker and Didychuk employed VIS dummy variable that represents visit to farmland, and CSG variable that indicates the affiliation with conservation–type organizations. The results show that respondents who visit farmland at least once a year and/or who has relation with any conservation organizations have higher bids than the respondents who do not.

Another significant dummy variable is IMP, which was used by Rosenberg and Walsh. Respondents who believe the relative importance of valley ranch open space[9] to other environmental issues in the study area have higher WTP bids than others.

There are other dummy variables employed, but they were found to be insignificant. For example, Bergstrom et al. found that farmland background, involvement in commercial development, involvement in commercial agriculture, residence of urban or rural area and payment vehicle have insignificant effects on the bid. Farm background was also found to be insignificant in the models of Bowker and Didychuk.

[9] Valley ranch is the area analyzed in the mentioned study.

2.4. Insights for the Current Research

CEPs are being approved at a very high rate across the country. Public support is demonstrated by actual votes on referenda for CEPs and previous valuation studies. The valuation studies indicate that values may change substantially from region to region of the country. All previous studies were done in small counties and the sample sizes of the surveys were quite small. It is not possible to generalize these results for broader populations, and develop statewide estimates where most CEP policy decisions are made.

There is not a study conducted in Maine for the valuation of farmland conservation. Farmland constitutes a very small part of the total land in Maine, and the loss of farmland is higher than the national loss rate. These motivations led us to conduct a statewide survey in Maine in order to estimate the value people place on agricultural conservation programs.

Considering literature on the valuation, the studies of Halstead, Bergstrom et al., and Beasley et al. are outdated. The bidding game employed by Halstead and Beasley et al. is an old question format, which is not used any more. It is better update these analyses according to new methodological tools and recent information. Conjoint analysis was employed in this study, which allows us to estimate the value of conservation easement programs to farmland, and to investigate how the value of CEPs can change depending on the type of farmland. The findings of this study help us to target conservation programs according to public preferences. Conjoint analysis will be discussed more detailed in the next chapter.

CHAPTER 3

CONJOINT DESIGN

For a study that focuses on investigating values for a heterogeneous good like farmland conservation, conjoint analysis (CJ) is a useful tool. Conjoint analysis allows us to estimate the value Maine residents place on conservation easements to farmland and to identify the types of farmland that the public is more likely to protect as open space.

3.1. Conjoint Analysis

Conjoint analysis has been widely used in marketing research and has been recently used as a non-market valuation method for applications to natural resources and environmental economics (Boxall et al., 1996). While the use of conjoint analysis in environmental applications is new, the number of conjoint studies is increasing and the types of research applications are quite diverse. Applications include; diesel odor reductions (Lareau and Rae, 1989), water quality (Stevens, Barrett and Willis, 1997), recreational site choice (Louviere and Timmermans, 1990; Adamowicz, Louviere and Williams, 1994), as well as land preservation, such as conservation on forestland (Garrod and Willis, 1996; Boyle, Holmes, Teisl and Roe, 2001), wetland (Morrison, Bennett and Blamey, 1999), and nature reserve (Baarsma, 2003). However, CJ has not been employed to estimate the value of conservation on farmland.

Conjoint analysis is a survey-research methodology that asks respondents to evaluate items in terms of their attributes. Attributes are characteristics of the good or service that are hypothesized to affect consumer choices. Respondents are asked to indicate their preferences for two or more items that differ in terms of the level of one or more attributes.

A key attribute for economic applications is the inclusion of a monetary stimulus. Inclusion of cost provides an estimate of the marginal utility of money, which allows researchers to estimate the marginal values (implicit prices) for the non-monetary attributes. These implicit prices allow the calculation of Hicksian surplus estimates.

While conjoint analysis is a very useful tool for applications in environmental economics, the design of the conjoint question is quite complicated. A researcher should be careful about the design and the presentation of attributes and alternatives in conjoint questions.

3.1.1. Attributes and Alternatives in Conjoint Questions

Alternatives are simply the number of different combinations of attribute levels respondents are asked to consider. For example, an individual needs to decide on a mode of transportation between his/her house and work. The alternative transportation modes might be taking a public bus and driving a car. Assume that there are two attributes that affect the transportation choice; the time spent on traveling and the cost of the transportation. This simple example involves two

alternatives and two attributes (Table 3.1). In this example, car is the quicker one, but it costs more than the bus.

Table 3.1: Attributes and Alternatives of Transportation Mode

	Alternatives	
Attributes	**Bus**	**Car**
Travel Time	50 minutes	20 minutes
Travel Cost	$1.00	$2.00

Most people would prefer a shorter travel time and a lower cost of transportation. However, conjoint questions typically do not have dominant alternatives (shortest time and lowest cost), and individuals are faced with choices where they must make tradeoffs between attributes. In this case, an individual has to choose between a cost-efficient mode of transportation and a time-efficient mode of transportation. Consequently, an individual's transportation choice provides information about the relative utility he/she places on travel time and cost.

CJ can be used for different types of policy applications. Assume that a state agency wants to establish a program to protect open space and needs to create funding for this purpose. In order to have public support, the government needs to learn about public preferences for open space protection. They can conduct a survey to find out what types of open space are most desirable for protection. Suppose the attributes that are being considered for prioritizing open space are location and soil quality of the land, and one-time cost of the conservation program to households (Table 3.2).

Table 3.2: Attributes and Alternatives for Open Space Conservation

Attributes	Option 1	Option 2	Option 3
Location	Near Urban Area	No Priority	No Priority
Soil Quality	Prime Farmland	Prime Farmland	No Priority
One-time Cost	$75	$50	$25

In this example, the levels of the location attribute are 'near urban area' and 'no priority', the levels of the soil quality attribute are 'prime farmland' and 'no priority', and lastly, the monetary attribute (one-time cost) varies in different dollar amounts.

The estimation results derived from these types of questions would allow researchers to identify the types of attributes that public support for preservation and, implicit prices can be estimated. Consequently, this helps the government agency to target conservation programs and to develop policies accordingly.

As CJ offers more information, the complexity of the design for researchers and the burden on respondents increases (DeShazo and Fermo, 2002; Louvier and Timmerman, 1990). Therefore, the design of attributes and alternatives is very crucial. This study aims to investigate some issues about the design of the conjoint questions. These involve the placement of the monetary stimulus, the number of alternatives presented to the respondents, and the exclusion of status quo option.

3.1.1.1. The Monetary Stimulus

The monetary stimulus is the key attribute for economists, which allows researchers to conduct welfare estimates. It allows comparison of results across different analyses and allows transfer of the results to other applications (Breffle and Rowe, 2002). Inclusion of cost may increase the realism of the questions to the respondents.

The literature suggests that WTP estimates from CJ are usually higher than estimates from contingent valuation (Stevens et al., 2000; Ready et al., 1988). Magat et al. (1988) found that estimates from open-ended Contingent valuation are much less than estimates from paired comparison choice experiment. They stated that contingent valuation approach might create incentives for respondents to undervalue their true estimates, whereas choice experiment eliminates these incentives and thus provides more accurate WTP estimates. By presenting varying levels of attributes, CJ presents more realistic choices to the respondents and thus seems to provide more accurate estimates. The studies of Stevens et al. (2000) and Takatsuka et al. (2002) confirmed that estimates from CJ were much higher than estimates from contingent valuation, although WTP estimates derived from these contingent valuation and CJ choice experiment should be the same according to neoclassical economic theory. Stevens et al. states that CJ estimates have often been biased upwards since most previous studies have counted 'maybe' responses as 'yes' responses.

These studies presented several reasons that explain the difference in estimates, such as the presentation of information or substitutes, or different processes

of making choices for each method. The higher WTP estimates from CJ might be explained by the presentation of monetary stimulus attribute in the conjoint question. When the monetary stimulus is presented first, people might pay more attention to it than they do to the other attributes. To investigate this suggestion, conjoint questions were applied where the monetary stimulus was the last attribute presented in one version, and it was the first attribute in another version.

3.1.1.2. The Number of Alternatives in the Choice Set

Another important issue to consider is the number of the alternatives presented to the respondents. The choice set should include all the available important options in order to avoid omission of a relevant alternative. In the transportation mode example, two options are presented: taking the public bus or driving to work. In big cities, such as Washington DC and New York City, the metro (or subway) is also a main mode of transportation. In this case, if taking the metro is excluded from the choice set, respondents who might take the metro will be forced to choose other alternatives. This will lead inappropriate estimation results.

This might be a case in the valuation of use values. The design of alternatives for non-use values is quite different. The first example is a private choice problem. However, in the example of a public good, such as open space protection, only one program can be targeted, and the decision is taken by a public referendum. Individuals vote to express their preferences, and they give decision based on the number of alternatives in the choice set.

The number of alternatives can affect the decision making process. The evaluation of each alternative with two or more attributes might increase the choice complexity (Saelensminde, 2002). Increased complexity raises the burden of respondents and may lead to inconsistent choices. Saelensminde (2002) suggests that inconsistent choices are common in choice experiments, and these choices have a significant affect on the valuation estimates. DeShazo and Fermo (2002) state that choice complexity significantly distorts welfare estimates. They investigated the relation between the number of alternatives and the variance of the error term. They found a quadratic relation, indicating that the variance of the error decreases due to a more exact match of preferences, and after some point it increases due to a more complex choice set.

The number of alternatives can also affect the lack of incentive compatibility. It is assumed that the respondents should respond to the survey in such a way as to maximize their expected utility (Carson, et. al., 2000), and the decisions people make represent a true reflection of their preferences (Lloyd, 2002). However, it is possible that respondents may respond strategically, or preferences may be ill defied or inconsistent with economic theory. Lloyd (2002) gives detailed examples where the axioms of completeness and stability or the axiom of continuity[10] may not hold.

Lastly, adding and deleting alternatives may also affect IIA. IIA suggests that omitting an irrelevant alternative from the choice set does not change the parameter estimates (Greene, 2000). According to IIA, the elasticity of choosing one alternative

[10] The axioms of completeness and stability assume that people have complete and stable preferences for the commodity being valued, and the axiom of continuity assumes that people are willing and able to trade attributes of the valuation task.

is equal to the elasticity of choosing another alternative (Louviere, 1991). IIA limits the flexibility of elasticity and brings strong assumptions to preferences. The constant elasticity proportion is not a true representation of real choice processes.

Suppose that respondents are presented with two alternative conservation programs A and B, and SQ. If the alternative program B were excluded, the probability of choosing alternative A would rise relative to the probability of choosing SQ option. This situation violates IIA. IIA assumes that the probability of choosing A and SQ would rise at the same proportion when logit model is employed. This might not be the case if SQ option is excluded. SQ can be regarded as an irrelevant alternative, which does not affect IIA.

This study investigates whether the number of alternatives affects the coefficient estimates. In order to investigate this, respondents were presented with two alternatives of agricultural conservation programs and a Status Quo option in one version, and they were presented with only one alternative program and a Status Quo option in another version.

3.1.1.3. The Status Quo (SQ) Alternative

The SQ alternative implies maintaining the current situation, which corresponds to "do nothing" as a policy implication. Some researchers include status quo in their studies, while others do not. Refer to Boyle et al. (2001) for a summary of the debate in the literature regarding whether or not the status quo should be included.

Status Quo allows a place for respondents who do not favor any of the alternatives in their choice set, and who prefer to maintain the current situation to indicate this preference. If the status quo alternative is excluded from the choice set, these respondents will be forced to choose one of the other alternatives, which will yield inappropriate results. This implies that they value the program when in fact they do not (Homes and Adamowicz, *forthcoming*). In real life people are not forced to choose, but they have the option of not to choose. Thus, including the SQ is a more realistic case.

The inclusion of the SQ alternative also helps to estimate the consumer surplus (loss or gain) derived from a change in environmental quality. The SQ provides a basis for the current situation. If it is not included as an alternative, the estimate model cannot be used to make comparisons between a program and the current situation. The estimation results can only be used to make comparisons between two different programs.

Some researchers suggest that including the SQ does not necessarily create a more realistic choice set, or it does not improve the value estimates (Breffle and Rowe, 2002). Breffle and Rowe (2002) claim that the (non-SQ) alternatives allow the researchers a more direct way to measure the marginal rate of substitution between alternative programs. They also suggest that inclusion of SQ may be an easy escape for some respondents. They compared binary choice formats, one excluding and another including the SQ option. They found that the former is superior to the later in terms of coherence.

This study investigates the exclusion of the status quo alternative. For this purpose, conjoint questions were applied where the status quo option was included in one version, and it was excluded in another version.

3.1.2. Experimental Design of Conjoint Choice Set

The identification of attributes and attribute levels is important. The number of attributes and the differences in attribute levels can affect the choice consistency (Dellaert, Brazell and Louviere, 1999). These components are usually identified according to policy requirements and people's preferences derived from focus group studies. In this study, these components were identified according to an extent focus group study, which was conducted in five different states, including Maine.

The proper design of the alternatives with different levels of attributes in the choice set is necessary in order not to get biased parameter estimates and collinear variables (Holmes and Adamowicz, *forthcoming*). There are different ways of conducting the experimental design for conjoint analysis. The most common ones are full factorial design, fractional factorial design and randomized design.

A full factorial design combines every level of each attribute with every level of all other attributes (Holmes and Adamowicz, *forthcoming*). Fractional factorial design excludes some of the combinations in the full factorial design in order to decrease the burden of respondents. Lastly, randomized design includes random sampling of combinations from full factorial design.

It is necessary to present information to the respondents about the attributes and their levels. This study designed an information booklet to inform respondents about the necessity of the research and the policy, as well as the current condition of the attribute components in Maine.

A careful design of conjoint questions is necessary but not sufficient. A researcher has to decide on how to present alternatives to the respondents in the survey. There are different response formats of the conjoint question, which will be examined in the next section.

3.1.3. Response Formats of Conjoint Analysis

The three common types of response formats are rating, ranking and choice. Rating requires respondents to state their preference for each alternative on a numerical scale, which is defined by the researcher (Mackenzie, 1993). The ranking approach requires respondents to rank a set of alternatives from the most preferred to the least preferred. Lastly, the choice approach requires respondents to choose one among a given set of alternatives.

Following the example of open space protection, it is possible to illustrate the three different types of response formats. In a rating question, suppose respondents are asked to rate alternatives on an integer scale from 10 (most preferred) to 1 (least preferred). In a ranking question, respondents are asked to rank these alternatives, when '1' is the most desired one and '3' is the least desired one. In a choice format, respondents are asked to choose only one of the given alternatives, where "1" denotes

the chosen alternative and "0" denotes otherwise. Table 3.3 presents a sample of possible responses to this conjoint question. In the given example, each format suggests that Option 2 is the most preferred alternative in the choice set.

However, there are some issues to consider when choosing one of the response formats. Each format has its own advantages, but also has some points that are criticized by researchers. For example, some researchers claim that the rating approach provides more information than the other two response formats since it shows the magnitude of the preference (Louviere, 1988). Also, it is possible for respondents to be indifferent or ambivalent between alternatives in ratings. On the other hand, the rating approach is criticized because of its cardinality and it is problematic to compare ratings across respondents since each may use different parts of scale to rate the options (Mackenzie, 1993).

Table 3.3: Example of Response Formats

Attributes	**Option 1**	**Option 2**	**Option 3**
Location	Near Urban Area	No Priority	No Priority
Soil Quality	Prime Farmland	Prime Farmland	No Priority
One-time Cost	$75	$50	$25
Example Response Formats			
RATE	5	8	4
RANK	2	1	3
CHOICE	0	1	0

A problem that can be encountered both in rankings and ratings is that as the number of alternatives increases, the burden of the respondent increases. This questions the capability of respondents to answer complex questions that necessitates ordering of alternatives, each of which has a number of attributes. This may lead to inconsistent ratings and rankings. Foster and Mourato (2001) found that the presence of inconsistent ranking is substantial enough not to be ignored. They state that although this does not affect the estimation of the WTP, it does affect the coefficient estimates.

Another concern is that choice behavior is indirectly implied by ratings and rankings, and it is not possible to suggest whether respondents are in the market. However, by the choice format it is possible to find out whether respondents actually buy the goods. For example, in the earlier example, a researcher can ask a referendum question if they vote for one of the given alternative programs and find out if respondents are actually in the market.

The choice approach is more realistic in the sense that consumers normally do not rank or rate their alternatives, but choose one among their alternatives (Louviere, 1988). It is a familiar experience for respondents, since every household needs to make a decision in his/her daily life on choosing one of the alternatives in the market or not choosing any.

Besides the advantage of familiarity, the choice format decreases the burden of the respondent relative to ratings and rankings. Respondents have to deal with ordering many different levels of attributes in other formats, whereas in the choice

format they only need to choose their most desirable and only choice. This also avoids the potential problems that arise from a situation when respondents lose their attention after choosing their first preferences.

Boyle et al. (2001) found that there is no convergent validity between these three response formats. They state that recoding ratings to rankings or choice data; and recoding rankings to choice data does not give the same estimates. Another study by Morrison and Boyle (under review) derived the same result between rankings and the choice experiment. These results raise the question of which response format is more appropriate to use.

A researcher should consider every aspect of these formats when selecting a response format for his/her research. Literature suggests that the choice format might be the most appropriate format for conjoint questions, especially for environmental goods and services that respondents are less familiar with. Boyle et al. (2001) states that the choice approach may be more desirable because of the limitations of ranking and the cardinality of rating. Louviere (1988) points out that the choice format is more desirable, since the burden of the respondent is lower and choosing-one among the alternatives is a better approximation of realistic behavior. As he mentions:

> "Choice experiments have the great advantage of allowing one to observe how choice changes as a function not only of changes in attributes of alternatives, but also of changes in the number and composition of competing alternatives." (page 114)

Boxall et al. (1996) and Adamowicz et al. (1994) point out the same unique advantage of the choice approach. After considering these aspects, the choice format is preferred for this study.

3.2. Theoretical Model for Estimation

It is necessary to define the theoretical basis behind conjoint analysis for empirical analyses of responses. Conjoint analysis choice format depends on the random utility theory, which presents discrete choices in a utility maximizing framework (Hanley et al., 1998; Boxall et al., 1996).

Individuals maximize their utility (U) according to the quantity and quality of the goods and services they consume subject to their income.

$$(3.1) \qquad U(X; Q) \text{ st } P_x X \leq I,$$

where X is the composite Hicksian good, Q is the environmental quality, P_x is the price of the composite good and I is the individual income. From the maximization problem, it is possible to get indirect utility function $V(P_x, I; Q)$. Further assume that, any change in environmental quality does not affect the prices of the other goods. Thus, one can say that the indirect utility of an individual is a function of income and environmental quality, $V(I,Q)$.

In the conjoint analysis, each alternative i in the choice set (C) has a utility level for each individual:

(3.2) $V_i (Q_i, I, S) + \mu_i,$

where V_i is the systematic, observable component and μ_i is the random error component, as the researcher cannot capture all of the respondents' perspectives. Utility of an individual depends on Q_i (a vector of attributes associated with alternative i), I and S (socio-economic characteristics of the individual other than income).

If utility is linear in parameters, then

(3.3) $V_i (Q_i, I, S) = \alpha_0 + \alpha_1 Q_i + \alpha_2 I + \alpha_3 S$

Assume that Q_0 represents the attributes in the current situation, that is the status quo alternative, and Q_1 represents the attributes associated with a conservation program and *WTP* is the amount that residents are willing to pay for this program. If an individual has a utility, such as

(3.4) $V_1 (Q_1, I - WTP, S) = V_0 (Q_0, I, S),$

it appears that this person is indifferent between the current situation and the conservation program. A person chooses the conservation program, if and only if,

(3.5) $$V_1 (Q_1, I - WTP, S) > V_0 (Q_0, I, S)$$

The probability of choosing a conservation easement program will be a conditional probability since it depends on the choice of the program. The probability of choosing the alternative program over status quo is,

(3.6) $$P (V_1 > V_0) = P [(V_1 (Q_1, I - WTP, S) + \mu_1) > (V_0 (Q_0, I, S) + \mu_0)]$$

$$= P [(V_1 (Q_1, I - WTP, S) - V_0 (Q_1, I, S) > \mu_0 - \mu_1)]$$

The socioeconomic characteristics of the consumer are the same in both situations (with and without the program) and the difference in income in these two situations is the cost of the conservation program. Given that the utility is linear in parameters, when the difference between initial and subsequent utilities is taken, socio-economic characteristics and income drops, and environmental qualities and the cost of the program remains.

(3.7) $$V_1 - V_0 = \alpha(Q_1 - Q_0) - \beta WTP$$

The probability of choosing an alternative program over the status quo can be estimated by a binary logit model:

$$(3.8) \qquad P(V_1) = \frac{e^{V_1}}{\sum_{i}^{1} e^{Vi}}$$

where $i = \{0, 1\}$.

Assume that there are more than two alternatives in the conjoint question presented to respondents. Suppose alternative A is chosen over any other alternative i in the choice set (C), then $V_A > V_i$, where all $i \in$ C and A is not equal to i. The probability of choosing alternative A over the other alternatives in the choice set is

$$(3.9) \qquad P(A \mid C) = P[(V_A + \mu_A) > (V_i + \mu_i)]$$

$$= P\,[(V_A - V_i) > (\mu_I - \mu_A)]$$

The decisions of respondents depend upon the differences in their utilities across the available alternatives. Again, S and I drop since they remain the same across the alternatives in the choice set. The assumptions made in order to estimate equation (3.9) are; the errors are independently and identically distributed, all errors have the same scale parameter and independence of irrelevant alternatives assumption holds (Hanley et al., 1998; Holmes and Adamowicz, *forthcoming*).

In this case, the probability of choosing alternative A can be estimated by multinomial logit model:

$$P(A) = \frac{e^{\mu V_A}}{\sum_{i}^{N} e^{\mu V_i}} \tag{3.10}$$

where N is the number of alternatives in the choice set, and μ is a scale parameter, which is assumed to be equal to 1 in this study.

The compensating variation (CV) derived from a change with and without conservation program depends on the utility differences between these two conditions (equation 3.7). It is calculated as:

$$CV = \frac{(V_i - V_o)}{\hat{\beta}} = \hat{\alpha}_i \frac{(Q_i - Q_0)}{\hat{\beta}} \tag{3.11}$$

where V_i and V_o are the utilities derived from alternative i and the SQ, respectively, and $\hat{\beta}$ and $\hat{\alpha}_i$ are the coefficient estimates of the monetary stimulus and of Q_i, respectively. As it is mentioned earlier, $\hat{\beta}$ is the marginal utility of income, which allows researchers to calculate marginal prices for other non-monetary attributes. For example, the marginal price (MP) for an attribute j is

$$MP_j = \frac{\hat{\mu}_j}{\hat{\beta}} \tag{3.12}$$

where $\hat{\mu}_j$ is the coefficient estimate of that attribute.

3.3. Summary

Conjoint analysis is a survey-research methodology that is used in the applications of heterogeneous goods, like farmland. The application of CJ to environmental economics has been increasing, while, to our knowledge, it has not been used for the valuation of farmland conservation, yet.

It is possible to capture use and non-use values and unobservable behaviors by conjoint analysis. CJ asks respondents to evaluate alternatives, which have different levels of attributes. Monetary stimulus is the key attribute for economic applications, which provides an estimate of the marginal utility of money and allows researchers to estimate the implicit prices for the non-monetary attributes.

The conjoint question can be conducted in different formats. The respondents can be asked to rank or rate the alternatives in the choice set, or choose one of them. The choice format is preferred for this study because of its advantages over other formats. Respondents are familiar to choosing one from their alternatives, and it is possible to find out whether the respondent is actually in the market. Also, the burden of respondents is much lower in the choice approach relative other formats.

In the choice format, respondents choose the alternative that gives them the highest utility. The utility of an individual, which is derived from his/her choice, depends on the attributes associated with the alternative and socio-economic characteristics of the individual. On the other hand, the probability of choosing that alternative depends on the differences in utilities across the available alternatives. The probability function is estimated by the logit model in this study.

CHAPTER 4

DATA AND MODEL

A mail survey was conducted to collect the data for this research. The survey was developed and designed according to the information derived from a series of focus groups. This research is a part of a broader project funded by USDA's National Research Initiative, which aims to identify the farmland attributes that are important to the public and should be protected as open space. Focus groups were conducted in five different states. However, the research results repeated in Chapter 5 are only for the segment of the research conducted in Maine.

4.1. Focus Groups

The five focus sites were Ohio, Georgia, Colorado, Oregon and Maine, and the focus groups study was conducted in May, June, July, August and September of 2000, respectively. The focus groups were composed of people from different backgrounds, including urban, rural and suburban residents.

At the first two sites, exercises focused on identifying terminology and language associated with open space amenities and important farmland attributes. Subsequent groups concentrated on learning about how individuals compare and trade-off farmland attributes. In the last set of focus group study, which was

conducted in Maine, participants were given a draft survey, which included an information booklet.[11]

The first set of focus groups was held in Columbus, Ohio. Participants were asked to discuss on "open space" and "rural landscape" terms, and they were asked to record positive and negative attributes of farms. In addition, they were asked questions related whether or not open space should be preserved. The results suggested that 'open space' is a very broad term and interpretations of this term vary significantly across the public. Also, participants had a hard time understanding the idea of purchasing conservation easement programs. The desirable attributes of farmland are supplying food and livestock, work ethic, openness, crops in fields and not contributing to pollution. The undesirable attributes are odor, sensitive to whether (production), and poor access to modern conveniences. When asked if open space should be preserved, participants indicated that preservation is an important but not an urgent issue. Primary motivations for farmland preservation include food security, controlling urban sprawl and saving family farms.

In Georgia, the focus groups were first asked to evaluate the definition of farmland. Then, they were asked to evaluate photographs of farmland scenes from Georgia. They rated each scene on a scale ranging from 1 (very undesirable) to 10 (very desirable) and identified the attributes of the scenes that they liked or disliked. Evaluations of these photographs implied that topography, farm buildings, various crops are desirable, whereas dormant equipment, harvested crops and timberland are

[11] Detailed information about the focus group findings can be found in Paterson et al, 2001.

undesirable. Land with a substantial portion of trees is preferred to land that is largely fields.

In Colorado, the focus groups were asked to evaluate various photographs of farmland scenes from Colorado. Then, participants were asked to vote on a program that would preserve different types of farmland and to choose between two farmland protection programs with different levels of attributes in a conjoint format. The results are generally consistent with those from Georgia. Ratings of photographs of farmland scenes indicate that trees, traditional farm buildings, farm equipment and harvesting activity are positive attributes, whereas grains and plowed fields are negative attributes. Individuals favor conservation programs that target medium-sized, non-corporate-controlled operations and programs that target lands with hay fields and traditional farm structures without livestock.

The evaluation of photographs in the Georgia and Colorado groups suggests that the visual tools such as the photographs of agricultural scenes are problematic because of the manner in which they were interpreted by respondents. Participants were trying to find clues whether the scene represents a family farm, were evaluating the quality of the soil, the quality of the farming operation and the quality of the photographs. It was decided that photographs might be helpful, however they provided unintended clues to the participants. When designing subsequent conjoint questions, the focus was given to verbal descriptions of attributes.

In Oregon, the focus groups were provided information about farmland in Oregon, and farmland preservation programs. Then, participants were asked to

evaluate different farmland attributes that might be targeted in a preservation program. Lastly, they were asked to choose from two preservation programs that have different levels of attributes and the alternative of "do nothing" in a conjoint format. Individuals favored programs that assigned priority to smaller farms without livestock. The location and cost of the conservation program were also other important attributes to individuals.

The last set of focus group study was conducted in Maine. The participants were provided an information booklet and questionnaire, which was similar to the last version of the survey. Then, they were asked to complete the survey and lastly, comment on the clarity of booklet and the questionnaire. The respondents commented that the information booklet and survey materials were clear and effective. Individuals favored programs that target small to medium-sized family farms with surface water and crops. In addition, participants were sensitive to the cost of the program when considering different options. These results were consistent with those from Colorado and Oregon.

Collectively the focus groups suggested that the terms and concepts associated with open space and conservation easement need to be explained very carefully. At least half of the participants were in favor of protecting the farmland. In addition, different means of asking for important attributes of farmland generally provided consistent results. The information derived from focus groups was used to design the final survey. An information booklet was also designed to provide respondents with information about the policy.

4.2. The Design of the Information Booklet

An information booklet was prepared to provide information on current farmland conditions, policy issues about farmland and the terminology used in the survey. The booklet first presents the loss of farmland in the US in recent years and then displays a map of US that shows the acres of prime farmland converted to developed land. The information about the loss of farmland in Maine for the same time period was also included. Following this, information on applying conservation easements to farmland and purchasing development rights were presented. The benefits of these programs to farmers and Maine citizens were also discussed. The potential types of farmland that citizen boards might choose for the purchases of conservation easements were suggested. Lastly, information on the uses, sizes and location of farms, farm ownership and soil quality of farms in Maine was presented.

4.3. The Design of the Survey

The questionnaire contains six sections. The first section has a set of true/false questions to verify the respondents' understanding of the information booklet. The second section asks background questions to determine the experience of the respondents with farms. The third section asks the respondents to rate the importance of different levels of farm attributes in order to set priorities for accepting farmers' bids to sell conservation easements. This part was designed to make respondents think about the farmland attributes and their levels and to prepare respondents for conjoint questions. The fourth section contains four conjoint questions that ask

respondents to choose one among alternative conservation easement programs with different attributes. The fifth section seeks the opinions of respondents concerning various aspects of farms and farmland. The last section contains questions about the socioeconomic characteristics of the respondents.

4.3.1. The Attributes and the Attribute Levels

In the questionnaire, the conjoint question presents five farmland attributes for respondents to consider when voting on conservation easement programs. The attributes are farmland use priority, farmland location priority, land quality priority, total acres of easements purchased and the one-time cost to the household in 2002. The set of levels of the attributes are given in Table 4.1. Farmland use priority has six levels, whereas location and land quality priorities have only two levels. There are five different acres of easements purchased and seven different levels of one-time cost to the household. The attribute levels describing the Status Quo alternative are no priority for farmland use, location and land quality priorities, naturally, 0 acres for total acres purchased and $0 for the cost of the program.

4.3.2. The Experimental Design of the Attributes

A random factorial design is conducted for the experimental design of the attributes. Only main effects were calculated. There are 574 different combinations of attributes, which are calculated by multiplying attribute levels (6*2*2*4*6).

Table 4.1: CEP Attributes and Attribute Levels

Attributes	Attribute Levels
Farmland Use Priority	• growing grain crops • growing hay • growing vegetables' berries, fruit and nuts crops • pasture for livestock • forested land • no priority
Farmland Location priority	• near urban areas • no priority
Land Quality Priority	• prime farmland • no priority
Total Acres of Easements Purchased in Maine	• 0 acres • 12,000 acres • 60,000 acres • 120,000 acres • 240,000 acres
One-time Cost to Household in 2002	• $0 • $3 • $5 • $7 • $10 • $25 • $50

4.3.3 Alternatives

The choice set involves the alternatives of Conservation Easement Program A, Conservation Easement Program B and Status Quo. However, the number and type of the alternatives changes across the versions to investigate if the design of conjoint questions affects the coefficient estimates. More detailed information will be given in the next section.

4.3.4. The Design of the Conjoint Question in the Different Versions

This study aims to examine how the design of the survey may affect the coefficient estimates. In order to investigate this, four versions of the survey are designed (Table 4.2). In Vst, Valt and Vnsq the monetary stimulus is the last attribute presented. In V$, it is presented as the first attribute so that the effect of the placement of monetary stimulus can be tested.

In Vst and V$, respondents were asked to choose between Programs A and B (Table 4.3) in Question 1. In Question 2, respondents were asked if they vote for Program A or Program B, or if they would not vote for either program (SQ option).

Valt was designed to examine the effect of the number of the alternatives on the coefficient estimates. Respondents were asked if they would vote for conservation Program A or not.

In Vnsq, respondents were asked to choose between Programs A and B. This version was designed to examine the effect of the exclusion of status quo on the

coefficient estimates. This is also investigated in Vst and V$, by comparing the estimates from Question 1 with estimates from Question 2.

Table 4.2: The Design of The Conjoint Question in Each Version

Versions	Placement of the Monetary Stimulus	Type of the Question	Alternatives in the Choice Set
Vst	Last Attribute	Q1	A vs B
		Q2	A vs B vs SQ
V$	First Attribute	Q1	A vs B
		Q2	A vs B vs SQ
Valt	Last Attribute	*NA*	*NA*
		NA	A vs SQ
Vnsq	Last Attribute	*NA*	A vs B
		NA	*NA*

Table 4.3: The Treatment of Conjoint Question in Vst

Suppose you had to vote between two conservation easement programs, Program A and Program B. These programs differ in terms of the attributes of the farms that would receive priority in the bidding process, the number of acres in the program and the cost to you. Please tell us which of the two programs you would support if you had to choose between Program A and Program B. You will also be able to tell us if you would vote for one of these programs or to do nothing.

	Conservation Easement Program A	**Conservation Easement Program B**
Farmland use priority	Growing Vegetables, Berries, Fruit And Nut Crops	Growing Hay
Farmland location priority	Near Urban Areas	No Priority
Land quality priority	No Priority	Prime Farmland
Total acres of easements purchased in Maine	120,000	60,000
One-time cost to your household in 2002	$5	$7

9. Which program do you prefer?
(PLEASE CIRCLE ONE NUMBER)

   1 Program A
   2 Program B

10. Now, suppose you could vote between Program A, Program B and doing nothing. How would you vote? (CIRCLE ONE NUMBER)

   1 I would vote for Program A
   2 I would vote for Program B
   3 I would not vote for either program

4.4. Sampling

A total of 2,000 surveys were sent to a random sample of Maine adults over age 18. The sample was stratified into four groups, as there are four different versions of the survey. Each version was sent to a random sample of 500 Maine households.

Following Dillman's method, first, an introductory letter was sent to the respondents to inform about the survey and request them to fill out and send back the surveys. One week later, questionnaires and information booklets were sent. One week after this, postcards were sent in order to remind the respondents about the survey by emphasizing how their involvement was important for the research. Two weeks after the postcards, a second wave of surveys was sent to non-respondents.

4.5. Empirical Model

Using a general conjoint choice format, the utility of an individual derived from his/her choice of a program (UTILITY) can be explained as a function of the attributes of the conservation easement program. Our empirical model includes the following attributes: the one-time cost to the household in 2002, farmland location priority, land quality priority, farmland use priority and total acres of easements purchased. In Table 4.4, the name and the description of the independent variables is given. All variables, other than the COST variable, are dummy variables.

Table 4.4: The Description of the Variables in the Model

NAME OF THE VARIABLE	DESCRIPTION OF THE VARIABLE
Cost variable:	
COST	$3, $5, $7, $10, $25, $50
Farmland Location Priority Variable:	
LOC	1 if near urban area, 0 otherwise
Excluded level	*No Priority*
Farmland Land Quality Variable:	
QUAL	1 if prime farmland, 0 otherwise
Excluded level	*No Priority*
Farmland Use Priority Variables:	
GRAIN	1 if growing grain crops, 0 otherwise
HAY	1 if growing hay, 0 otherwise
VEGET	1 if growing vegetables, berries, fruit and nuts crops, 0 otherwise
PASTURE	1 if pasture for livestock, 0 otherwise
FOREST	1 if forested land, 0 otherwise
Excluded level	*No Priority*
Total Acres of Easement Purchased Variables:	
SMALL	1 if 12,000 acres, 0 otherwise
MEDIUM	1 if 60,000 acres, 0 otherwise
LARGE	1 if 120,000 acres, 0 otherwise
EXLARGE	1 if 240,000 acres, 0 otherwise
Excluded level	*0 acres (SMALL in estimates of Programs A vs. B questions)*

For each attribute category, one of the levels is not included in the model in order to avoid perfect multicollinearity. 'No priority' (for location, quality and use priority attributes) and '0' acres are the excluded levels. The choice of an individual can be defined by a function of attribute levels.

$$(4.1)\quad UTILITY = \beta COST + \alpha_1 LOC + \alpha_2 QUAL + \gamma_1 GRAIN + \gamma_2 HAY + \gamma_3 VEGET + \gamma_4 PASTURE + \gamma_5 FOREST + \phi_1 SMALL + \phi_2 MEDIUM + \phi_3 LARGE + \phi_4 EXLARGE$$

In this model, acres of the protected area were included as dummy variables, since they were presented to the respondents in four sizes. However, there is a concern that acres may be continuous, because of this, both a linear form and a natural logarithm (LN) form of the model are estimated.

For the linear and LN forms, a dummy variable of D_0 was created, which equals 1 when acres of the protected area are not equal to 0 and equals 0 when acres are equal to 0. In the linear model, acres are multiplied with D_0, creating the ACRES variable. In the LN model, natural logarithm of acres is multiplied with D_0, creating the LNACRES variable. The D_0 dummy variable was multiplied with these variables in order to adjust the problem of undefined natural logarithm for 0 acres. We decided to keep the same format for the linear model also. The linear and LN models are:

(4.2) $UTILITY = \beta COST + \alpha_1 LOC + \alpha_2 QUAL + \gamma_1 GRAIN + \gamma_2 HAY + \gamma_3 VEGET + \gamma_4 PASTURE + \gamma_5 FOREST + \phi_1 ACRES + \phi_2 D_0$

(4.3) $UTILITY = \beta COST + \alpha_1 LOC + \alpha_2 QUAL + \gamma_1 GRAIN + \gamma_2 HAY + \gamma_3 VEGET + \gamma_4 PASTURE + \gamma_5 FOREST + \phi_1 LNACRES + \phi_2 D_0$

The estimates from these functions indicate the direction of the relationship between the utilities of the respondents and the attribute levels. For example, one of the expected outcomes is that COST is negatively, and the land quality attribute (QUAL) is positively related with utility.

Because there are different treatments of the conjoint question and the number of alternatives changes across the versions, different probability functions estimated for each version. The probability functions are estimated using a logit model. In binary choice questions, the probability of alternative Program A to be chosen between two alternative programs is:

(4.4) $$P(A) = \frac{e^{V_A}}{\sum e^{V_i}}$$

where V_i is the utility of i. For the responses to Question 1 in Vst and V$, and the responses to Vnsq, $i \in \{A, B\}$. For the responses to Question 2 in Vst and V$, $i \in \{A, B, SQ\}$. Lastly, for the responses to Valt, $i \in \{A, SQ\}$.

From the estimated coefficients, it is possible to calculate Hicksian compensating variation (CV) per household. Compensating Variation is the maximum amount that the individual would be willing to pay for the opportunity to keep his/her utility at the status quo level (Freeman, 1993). In this case, CV is the maximum WTP for preserving the farmland. For example, if Program A targets a *prime farmland* with *vegetables*, which is *near urban area* and *60,000 acres*, the compensating variation per household for this program is:

(4.5)

$$CV = \frac{\left(\begin{array}{l}\hat{\alpha}_1(LOC_A - LOC_{SQ}) + \hat{\alpha}_2(QUAL_A - QUAL_{SQ}) + \hat{\gamma}_4(VEGET_A - VEGET_{SQ}) \\ + \hat{\phi}_2(MEDIUM_A - MEDIUM_{SQ})\end{array}\right)}{\hat{\beta}}$$

where $\hat{\beta}$ is the coefficient estimate of COST variable. The dummy variables are 1 for Program A and 0 for the SQ, then CV may be written as,

$$CV = \frac{\left(\hat{\alpha}_1 + \hat{\alpha}_2 + \hat{\gamma}_4 + \hat{\phi}_2\right)}{\hat{\beta}}$$

Note that CV for this program is the summation of the marginal prices of the targeted attributes. The estimation results and CV calculations help researchers design conservation programs and develop policy strategies.

4.6. Policy Implications

The estimation results reveal the farmland attributes that have a significant effect on peoples' preferences. Conservation easement programs can be designed using information on these significant attributes. The average compensating variation per household can be calculated for targeted conservation programs. This can be used to calculate total compensating variation by generalizing average CV per household to the Maine population. The results help us to estimate people's willingness to pay and to find out the value of different programs. Policy makers employ the benefits of these programs to compare with the cost of easements. Accordingly, they develop policies and regulations.

The following section presents how these estimates can be used for investigating methodological objectives.

4.7. Hypothesis Testing

The methodological objectives can be tested by comparing the coefficient estimates from different versions with estimates from Vst. Let us assume that μ represents the coefficient estimates of all the variables.

4.7.1. Internal Test

The internal test compares the coefficient estimates from Question 1 with the estimates from Question 2 in Vst and V$.

(4.6)

$$H_0 : \mu_{Vst,Q1} = \mu_{Vst,Q2}$$

$$H_0 : \mu_{V\$,Q1} = \mu_{V\$,Q2}$$

In each test, if the null hypothesis is rejected, then the exclusion of status quo alternative matters; if it is not rejected, then the exclusion of the SQ alternative does not matter. That means the estimation results from each part are not significantly different. This allows us to combine responses to two questions and used stacked data for other tests.

4.7.2. Testing the Effect of the Placement of the Monetary Stimulus

First, the coefficient estimates of the stacked data from V$ ($\mu_{V\$}$) will be tested with the coefficient estimates of the stacked data from Vst (μ_{Vst}). Then the coefficient estimates from Question 1 in V$ ($\mu_{V\$,Q1}$) will be tested with the estimates from Question 1 in Vst ($\mu_{Vst,Q1}$). Lastly, a test will be conducted to the estimates from Question 2 in these versions.

(4.7) $$H_0 : \mu_{V\$} = \mu_{Vst}$$

$$H_0 : \mu_{V\$,Q1} = \mu_{Vst,Q1}$$

$$H_0 : \mu_{V\$,Q2} = \mu_{Vst,Q2}$$

If the null hypothesis is not rejected, then the estimates from these two versions are statistically equivalent, and the placement of monetary stimulus does not affect the coefficient estimates. If the null hypothesis is rejected, then the placement of monetary stimulus matters since the estimates are statistically different across the two versions. In this case, individual variables are tested across the versions via Wald test. For example, for the coefficient of cost (β), the tested hypothesis is:

(4.8) $$H_0 : \beta_{V\$} = \beta_{Vst}$$

If the null hypothesis is not rejected, then the estimates of the cost coefficient are statistically equivalent. If the null hypothesis is rejected, then the estimates of cost coefficient are statistically different across the two versions. In this case, the placement of monetary stimulus affects the estimate of the COST variable.

4.7.3. Testing the Effect of the Number of Alternatives

The effect of the number of alternatives is tested by comparing the estimates from Valt, against the coefficient estimates from Question 2 in Vst:

(4.9) $H_0 : \mu_{Valt} = \mu_{Vst,Q2}$

If the null hypothesis is not rejected, then the exclusion of second alternative does not affect the coefficient estimates. If the null hypothesis is rejected, then the number of alternatives affects the estimates.

4.7.4. Testing the Effect of the Exclusion of the Status Quo

A test is conducted between coefficient estimates from Vnsq and Question 2 in Vst , where the former excludes SQ and the later includes it.

(4.10) $H_0 : \mu_{Vnsq} = \mu_{Vst,Q2}$

If the null hypothesis is not rejected, then the exclusion of the SQ alternative does not matter. If it is rejected, then the exclusion of status quo alternative matters.

CHAPTER 5

RESULTS

5.1. Response Rates

From 2,000 mail surveys sent, 710 people responded, and 281 surveys were undelivered due to wrong or insufficient address information. Forty-six people refused to fill out the survey. Accordingly, the effective response rate is 41 percent. The corresponding response rate for each version is 39%, 40%, 43% and 44% for Vst, V$, Valt and Vnsq, respectively. Since the response rate was low and a non-response bias might be present in the response data, a telephone survey was conducted with the people who did not reply.

5.2. Results from Telephone Survey

The phone survey helped to identify the reasons why some people did not complete surveys. The phone survey was conducted in May 2002. Of the 963 non-respondents, we attempted to contact 492 people by telephone. Of this number, 322 numbers were either disconnected or the respondents were not available[12].

From the 170 respondents we managed to contact, thirty-six people refused to participate in the phone survey or hung up, and forty-two people said that they did not receive the survey. Sixty-six people partially completed the phone survey, and twenty-two people completed it entirely.

[12] We talked to other households, but couldn't contact with the respondent.

These eighty-eight respondents who participated the survey were asked why they did not complete the survey. Seventy-five people answered this question, and some of them presented several reasons. Almost half of them stated that they did not have time to fill out the survey. One fifth of the respondents claimed that they were not interested in conservation easements to farmland. Five people stated that they did not have enough knowledge about the topic, and six people stated that they do not answer surveys. A few people said that they did not feel like completing the survey, and some thought it was not important.

It was revealed that there is a substantial amount of wrong or insufficient addresses. The phone survey results indicate that most people interviewed on the phone were not interested in farmland conservation easement programs.

5.3. Are Respondents Different by Version

It is necessary to have similar respondent profiles across versions before we process convergent validity test. In this section, the socio-economic characteristics of respondents and their experience with farmland issues are summarized. These characteristics were also compared with those of general Maine population. The information about the profile of Maine population was given according to 2000 Census Data, United States Bureau of Census.

The distribution of some of the characteristics is given in percentages. In order to investigate if the percentages are significantly equivalent across versions, a chi-square test was conducted in SAS. Some of the information is given as mean

values for each version. In order to investigate if the mean values are significantly equivalent across versions, an ANOVA test was conducted in SAS. The test results are given according to a 5% confidence level.

5.3.1. Socio-economic Characteristics Across Versions

The distribution of characteristics of respondents can be observed in the following tables (Table 5.1-4). According to the chi-square test results, the percentage of males is significantly equivalent in V$ and Valt (p-value = 0.7342). It is significantly different in other versions (p-value = 0.0001). The comparable figure for Maine residents is 49%, which is the percentage of male residents over 18 years. This reveals that the percentage of male respondents in this survey is much higher than the male percentage in general population.

Table 5.1: The Percentages of Male Respondents for Each Version

Percentage of Male	Vst	V$	Valt	Vnsq
	71	77	71	64

According to ANOVA test, the mean age is significantly equivalent in all versions, other than in V$ (Appendix A, Table A.1). Only the median age of Maine residents is available in Census data. This figure is representative of all ages. Since our sample consists of people over 18, these figures are not comparable.

Table 5.2: Mean Age for Each Version

	Vst	V$	Valt	Vnsq
Mean Age	46	51	47	47

The mean years of education is the same in all versions (Table 5.3). The mean of years of education for Maine residents who are over 25 is 13. This data is not available for residents over 18.

Table 5.3: Mean Years of Schooling for Each Version

Mean Years of Education	**Vst**	**V$**	**Valt**	**Vnsq**
	14	14	14	14

According to the ANOVA test, the mean household income is significantly different in each version (Appendix A, Table A.2). The mean household income is 47,000 for the general Maine population, which is less than the mean income of our respondents.

Table 5.4: Mean Household Income for Each Version

Mean Household Income	**Vst**	**V$**	**Valt**	**Vnsq**
	52,000	49,000	48,000	56,000

5.3.2. Background Information of Respondents

In order to observe respondents' familiarity and experience with farmland, some questions were asked to respondents about their background and familiarity with farm products. According to the answers (Table 5.5), the majority of the respondents do not have jobs related with farming. At least one third of respondents have lived on a farm. However, at least half of the respondents have relatives and friends who lived on a farm.

Around one fifth of respondents reported that they regularly buy products directly from farmers. A substantial percentage of respondents reported that they regularly look for local farm products to buy at the grocery store. However, the percentage of respondents who purchase organic products is quite low. Concerning the aesthetic value of farms, around one-fourth of respondents look for farms when they are traveling.

According to the chi-square test results, the percentage of each characteristic is significantly different across versions. A small number of the percentages are significantly equivalent in pair-wise comparisons across versions. For the detailed summary of test results and p-values refer to Appendix A, Table A.3 – A.10.

Table 5.5: The Percentages for Background Information

Percentage of respondents who...	Vst	V$	Valt	Vnsq
have jobs related with farming	9	12	8	11
have ever lived on a farm	29	29	33	33
have relatives lived on a farm	65	60	68	66
have friends who lived on a farm	58	53	48	54
buy products directly from farmers	19	22	24	28
look for local farm products	39	38	43	40
purchase organic farm products	6	8	12	9
look for farms to see when traveling	20	25	22	23

5.4. Are Respondents Representative of Maine Population

It was also investigated if the respondents are representative of the general Maine population in terms of location. Table 5.6 presents the percentage of respondents and Maine population according to each county. One can say that the respondents are true representative of the Maine population since the percentages are similar.

Table 5.6: The Percentage of Respondents and Maine Population from Each County

COUNTY	Percentage of Respondents in Survey	Percentage of Population
Androscoggin	9	8
Aroostook	5	5
Cumberland	29	20
Franklin	1	2
Hancock	2	4
Kennebec	8	9
Knox	2	3
Lincoln	3	3
Oxford	4	4
Penobscot	10	11
Piscataquis	1	1
Sagadahoc	3	3
Somerset	3	4
Waldo	1	3
Washington	2	3
York	15	15

5.5. The Distribution of Attributes in Returned Surveys

The attributes were distributed equally across versions. However, it is necessary to investigate whether the distribution of attributes in the completed surveys is equal across versions (Table 5.7). It is found that the percentage of each attribute is not significantly different across versions. Refer to Appendix A, Table A.11 for the detailed summary of test results and p-values.

5.6. The Distribution of Choices in the Survey

The distribution of respondents' choices over the alternatives was investigated (Table 5.8). In Question 1 in Vst and V$, respondents were asked to choose between Program A and Program B. In Question 2, respondents were asked to choose between Program A and Program B, or not to vote for either (Status Quo option).

In Question 2 in Vst and V$, the percentage of choosing both Program A and B decreased, since some respondents switched to the SQ option. The percentage of choosing A decreased by 11% and choosing B decreased by 13% in Vst. In V$, the percentage of choosing for Program A and Program B decreased by 15% and 12%, respectively.

Table 5.7: The Percentages of Attributes in Returned Surveys

Percentage of...	Vst	V$	Valt	Vnsq
Farmland Use Priority				
Growing grain crops	17	16	17	17
Growing hay	17	15	14	16
Growing vegetables	17	17	18	16
Pasture for livestock	16	17	18	16
Forested land	16	15	17	17
Farmland Location Priority				
Near urban areas	50	48	52	50
Land Quality Priority				
Prime farmland	51	48	46	50
Total Acres of Easements				
Small: 12,000 acres	25	25	27	27
Medium: 60,000 acres	26	25	25	25
Large: 120,000 acres	25	23	23	24
Exlarge: 240,000 acres	25	26	24	24
One-time Cost to Household				
$3	18	16	17	17
$5	17	16	19	17
$7	16	17	19	17
$10	17	18	16	17
$25	15	17	16	16
$50	17	16	13	15

In Valt, the percentage of choosing A and SQ increased relative to the percentages in Vst and V$, since some of the respondents who could choose another alternative (Program B) switched to Program A and SQ option. Lastly, in Vnsq, the choices were distributed between Program A and B. Note that in binary choices of Programs A and B, people tended to choose Program A more than Program B. It might be because Program A is the first alternative in the choice set.

It is possible to get inconsistent choices, especially as the number of attributes and alternatives increase. The respondents' choices were investigated to see whether they were consistent in their preferences.[13] It is found that the number of inconsistent choices is very low so that it won't affect the coefficient estimates.

[13]It is possible to get some inconsistent choices, where a respondent chooses Program A between Program A and Program B. However, when the options of Program A, B and SQ was given, the respondent might choose Program B, instead. This type of inconsistent responses was given by 4 observations and 4 different respondents in Vst, and by 7 observations and 5 different respondents in V$. Another possible inconsistency is when a respondent chooses Program B between Program A and Program B, but then chooses Program A among the alternatives of Program A, B and SQ. This inconsistency is observed in 8 observations and 5 different respondents in Vst, and in 4 observations and 2 different respondents in V$.

Table 5.8: The Percentages of Choosing Program A, Program B and Status Quo

Percentage of	Vst		V$		Valt	Vnsq
	Q1	*Q2*	*Q1*	*Q2*	*NA*	*NA*
% Choice of A	52	41	53	38	64	53
% Choice of B	48	35	47	35	*NA*	47
% Choice of SQ	*NA*[14]	24	*NA*	27	36	*NA*

5.7. Results of Model Estimation

The probability functions were estimated using a multinomial logit model in Limdep. It is possible to observe the number of observations in each version in Tables 5.9 - 5.11.

5.7.1. Estimation Results from the Dummy Model

In the survey, acres of protected area were presented to the respondents in four sizes; therefore the first model estimated has acres as dummy variables. While creating dummy variables, we had to exclude one level for each attribute category in order to avoid multicollinearity. In the 'acres of the protected area' attribute, we excluded '0 acres'. However, this created a problem in Vnsq, which does not have a SQ option. Therefore, one of the dummy variables, SMALL, is excluded from Vnsq in order to avoid perfect multicollinearity.

[14] NA indicates not applicable.

The coefficient estimates are not the same across the versions (Table 5.9). The significance of variables was given according to the 5% confidence level, otherwise indicated.

As expected, the cost of the program (COST) is significant and has a negative effect on the dependent variable in all versions. The 'near urban area' priority (LOC) is significant in all versions, other than Valt. According to the estimates, it has a positive effect on peoples' preferences. The prime farmland priority (QUAL) is significant in all versions and has a positive effect on the dependent variable.

Among farmland use priorities, GRAIN is statistically significant only in Vnsq, and it has a positive effect on the dependent variable. HAY is statistically significant at a 10% confidence level in Vst and V$, and it has a negative effect on utility. VEGET is significant in all versions, except in Valt, and has a positive coefficient. PASTURE and FOREST are insignificant in all versions. It seems that vegetables is the only crop variety that has a significant and positive effect on people's preferences.

Considering acres protected, SMALL is significant in all versions. However, it has a negative effect in Vst and V$, and a positive effect in Valt. MEDIUM is significant and has a positive effect in Valt and Vnsq, whereas it is insignificant in Vst and V$. LARGE is significant in V$ and Vnsq, and is positively related with the dependent variable. Lastly, EXLARGE is statistically significant and has a positive coefficient in all versions. People are willing to protect relatively larger acres of farmland.

Table 5.9: Results of the Dummy Model for Each Version

VARIABLE	Vst	V$	Valt	Vnsq
COST	-0.01919*[15] (0.00279)[16]	-0.01902* (0.00291)	-0.01886* (0.00518)	-0.01116* (0.00379)
LOC	0.52199* (0.08935)	0.28669* (0.08590)	0.04354 (0.16247)	0.40755* (0.11697)
QUAL	0.70054* (0.08731)	0.44861* (0.08532)	0.28141** (0.16460)	0.53018* (0.11207)
GRAIN	0.01740 (0.15391)	-0.11848 (0.14741)	0.22636 (0.27756)	0.55146* (0.19674)
HAY	-0.28163**[17] (0.15312)	-0.26282** (0.15446)	0.25193 (0.29515)	0.31834 (0.19784)
PASTURE	0.02741 (0.15181)	-0.06189 (0.14693)	-0.03098 (0.27526)	0.30649 (0.19559)
VEGET	0.46373* (0.15264)	0.32970* (0.14568)	0.35861 (0.28111)	0.60831* (0.19749)
FOREST	-0.00501 (0.15200)	0.04660 (0.15075)	0.06233 (0.27758)	0.17207 (0.19178)
SMALL	-0.38051* (0.17377)	-0.30695** (0.16958)	0.61329* (0.27704)	NA
MEDIUM	-0.06408 (0.17107)	-0.11992 (0.16631)	0.56399* (0.28272)	0.27187* (0.16266)
LARGE	0.14194 (0.17402)	0.63648* (0.17022)	0.39073 (0.28990)	0.59109* (0.16205)
EXLARGE	0.66807* (0.17362)	0.69175* (0.16433)	0.77092* (0.28497)	1.00840* (0.16850)
Adjusted R^2	0.27663	0.25265	0.06773	0.07425
Number of observation	1296	1258	689	698
Number of respondents	173	169	182	186
Log Likelihood	-1024	-1026	-437	-435

[15] (*) indicates significance at the 5% confidence level.
[16] Standard errors are in parenthesis.
[17] (**) indicates significance at the 10% confidence level.

5.7.2. Estimation Results from the Linear and Natural Logarithm Models

The probability functions were also estimated when acres are in the linear and natural logarithm (LN) forms (Tables 5.10 - 5.11). In these models, D_0 was excluded in Vnsq, because of the same reason SMALL excluded in Vnsq.

The results from the linear and LN models are similar to the results from the Dummy model. In this section, only the differences in the results of the models will be given. The QUAL and HAY variables are significant at the 10% level in the Dummy model, whereas they are insignificant in the other models. In the LN model, PASTURE is significant at a 10% confidence level in Vnsq.

In the linear model, ACRES is significant in all versions except Valt. However, it has a very small positive effect on the dependent variable. The dummy variable D_0 is significant in all versions, however, its coefficient is positive in Vst and V$, and negative in Valt. In the LN model, LNACRES is significant in all versions other than Valt, and D_0 is insignificant in all versions.

Table 5.10: Results of the Linear Model for Each Version

VARIABLE	Vst	V$	Valt	Vnsq
COST	-0.01912* (0.00279)	-0.01923* (0.00289)	-0.01893* (0.00516)	-0.01136* (0.00378)
LOC	0.51656* (0.08905)	0.28787* (0.08516)	0.04479 (0.16192)	0.40920* (0.11681)
QUAL	0.70112* (0.08723)	0.45986* (0.08474)	0.26955 (0.16411)	0.53560* (0.11189)
GRAIN	0.01858 (0.15384)	-0.05523 (0.14607)	0.23037 (0.27681)	0.56230* (0.19601)
HAY	-0.28790** (0.15265)	-0.22198 (0.15314)	0.24909 (0.29420)	0.32174 (0.19755)
PASTURE	0.02512 (0.15143)	-0.02721 (0.14532)	-0.04073 (0.27430)	0.30909 (0.19324)
VEGET	0.45927* (0.15244)	0.33130* (0.14467)	0.32818 (0.27953)	0.60770* (0.19646)
FOREST	-0.00206 (0.15212)	0.07428 (0.14962)	0.05398 (0.27655)	0.17766 (0.19008)
ACRES	0.0000045* (0.00000)	0.0000045* (0.00000)	0.0000006 (0.00000)	0.0000044* (0.00000)
D_0	-0.38645* (0.16488)	-0.28909** (0.15888)	0.53258* (0.26396)	NA
Adjusted R^2	0.27712	0.24552	0.06819	0.08828
Log Likelihood	-1024	-1037	-438	-435

Table 5.11: Results of the Natural Logarithm Model for Each Version

VARIABLE	Vst	V$	Valt	Vnsq
COST	-0.01929* (0.00278)	-0.01977* (0.00290)	-0.01879* (0.00516)	-0.01073* (0.00378)
LOC	0.53117* (0.08899)	0.28574* (0.08538)	0.04685 (0.16185)	0.40279* (0.11646)
QUAL	0.69986* (0.08696)	0.45063* (0.08472)	0.26224 (0.16383)	0.51419* (0.11122)
GRAIN	0.03320 (0.15369)	-0.08071 (0.14632)	0.22974 (0.27674)	0.53763* (0.19578)
HAY	-0.28421** (0.15247)	-0.22335 (0.15338)	0.24900 (0.29412)	0.30103 (0.19729)
PASTURE	0.01909 (0.15154)	0.00219 (0.14558)	-0.03923 (0.27420)	0.32822** (0.19335)
VEGET	0.47883* (0.15234)	0.35225* (0.14531)	0.32353 (0.27931)	0.63453* (0.19677)
FOREST	-0.02232 (0.15188)	0.07844 (0.14973)	0.05512 (0.27656)	0.18603 (0.19031)
LNACRES	0.32180* (0.03972)	0.36252* (0.04103)	0.01304 (0.07148)	0.31753* (0.05294)
D_0	-3.49260 (0.46876)	-3.83120 (0.48281)	0.45641 (0.82423)	NA
Adjusted R^2	0.27424	0.24675	0.06773	0.08460
Log Likelihood	-1028	-1036	-439	-437

5.8. Marginal Prices

Conjoint analysis allows us to identify the marginal prices of non-monetary attributes. Marginal prices were calculated according to the estimates from Vst in the three models. Results were quite similar across the models (Table 5.12).

Table 5.12: The Marginal Prices of Attributes (based on Vst)

	Marginal Prices		
VARIABLES	**Dummy Model**	**Linear Model**	**LN Model**
LOC*	$27.20	$27.02	$27.54
QUAL*	$36.50	$36.67	$36.28
GRAIN	$0.91	$0.97	$1.72
HAY**	-$14.68	-$15.06	-$14.73
PASTURE	$1.43	$1.31	$0.99
VEGET*	$24.16	$24.02	$24.82
FOREST	-$0.26	-$0.11	-$1.16
EXLARGE*	$34.81	NA	NA
ACRES*	NA	$0.00023 Δacres	NA
LNACRES*	NA	NA	$16.68 Δlnacres

The attributes that have the highest value are LOC, QUAL and VEGET, respectively. This shows that the public is more likely to protect prime farmland with

vegetables, which is near an urban area. Other attributes are statistically insignificant, and do not affect people's preferences. HAY is significant at the 10% confidence level, but it has a negative marginal price. That is, people do not give priority to farmland with hay.

In the Dummy Model, SMALL and EXLARGE are statistically significant, however, SMALL has a negative affect on people's preferences. These results show that people support the protection of relatively larger acres of farmland. In the linear and LN models, the marginal price of ACRES and LNACRES depends on the amount of the protected area.

5.9. Welfare Estimation

The average compensating variation (CV) per household can be calculated for a conservation easement according to the farmland attributes that are targeted. CV differs substantially because of the different forms of the model. In the Dummy model, when the LOC, QUAL, VEGET and EXLARGE attributes are targeted, CV per household equals $123. In the Linear model, when LOC, QUAL and VEGET attributes and 240,000 acres of protected area[18] are targeted, CV per household equals $143. In the LN model, it is $207 for a program that targets the same attributes.

It is possible to calculate total compensating variation for an agricultural conservation easement, by generalizing these figures to the Maine population. The average CVs are multiplied with the population of Maine (1,274,923) according to the

[18] 240,000 acres equal to EXLARGE in the dummy model.

2000 Census, and with the response rate of 39%. For example, according to the Dummy model, the total CV for the targeted program mentioned above is $61,158,000. According to the linear and LN models, people are willing to pay $71,102,000 and $102,924,000 for the same type of conservation easement program. As it is noticed, total CV changes substantially according to the model selected.

5.10. The Results of the Convergent Validity Test

A likelihood ratio test was conducted for testing convergent validity of conjoint analysis. Two types of tests were conducted: internal and external tests. Internal tests were conducted within a version between estimation results from Question 1 and Question 2 in Vst and V$. External tests were conducted across the versions. Note that Vst is the standard version; therefore the estimates from other versions were compared with this version. The results and p-values were presented in Table 5.13.

5.10.1. The Results of the Convergent Validity Test from the Dummy Model

According to the internal test results, Q1 and Q2 in Vst are not significantly different in the Dummy model. V$ has the same result for the internal test. These results indicate that the exclusion of the Status Quo alternative does not matter. This allows us to stacked the data for other tests.

Table 5.13: Convergent Validity Test Results

Tested Hypothesis	Dummy Model (*p-value*)	Linear Model (*p-value*)	LN Model (*p-value*)
Internal Tests:			
$H_0 : \mu_{Vst,Q1} = \mu_{Vst,Q2}$	DNR[19] *(0.760)*	DNR *(0.892)*	DNR *(0.883)*
$H_0 : \mu_{V\$,Q1} = \mu_{V\$,Q2}$	DNR *(0.745)*	DNR *(0.875)*	DNR *(0.870)*
External Tests:			
$H_0 : \mu_{V\$} = \mu_{Vst}$	R[20] *(0.026)*	DNR *(0.403)*	DNR *(0.252)*
$H_0 : \mu_{V\$,Q1} = \mu_{Vst,Q1}$	DNR *(0.308)*	DNR *(0.738)*	DNR *(0.600)*
$H_0 : \mu_{V\$,Q2} = \mu_{Vst,Q2}$	DNR *(0.465)*	DNR *(0.846)*	DNR *(0.795)*
$H_0 : \mu_{Valt} = \mu_{Vst}$	R *(0.001)*	R *(0.001)*	R *(0.000)*
$H_0 : \mu_{Valt} = \mu_{Vst,Q2}$	R *(0.009)*	R *(0.004)*	R *(0.003)*
$H_0 : \mu_{Vnsq} = \mu_{Vst}$	DNR *(0.809)*	DNR *(0.164)*	DNR *(0.168)*
$H_0 : \mu_{Vnsq} = \mu_{Vst,Q1}$	DNR *(0.192)*	DNR *(0.109)*	DNR *(0.104)*
$H_0 : \mu_{Vnsq} = \mu_{Vst,Q2}$	DNR *(0.366)*	DNR *(0.543)*	DNR *(0.563)*

[19] DNR = Do Not Reject at 10% confidence level.
[20] R = Reject at 10% confidence level.

According to the external test results, coefficient estimates from Question 1 in Vst and V$ are not significantly different. The same result was derived for the coefficient estimates from Question 2 in these versions. However, when the stacked data from Vst and V$ were compared, the results suggest that these two versions are statistically different.

In order to investigate the difference between these two versions, a Wald test was conducted on each variable in the models. The Wald test results indicate that the coefficient of COST is not significantly different across Vst and V$. The only variables that are significantly different across these two versions are QUAL and LARGE. These results suggest that the placement of monetary stimulus did not affect the coefficient estimates of COST. This might be because cost is a strong attribute that takes the attention of the respondents. However, the change in placement affected some other variables that are not as strong as COST.

The test results suggest that Valt is significantly different from Vst. This indicates that the number of alternatives affects the coefficient estimates. However, note that in Vst respondents were presented with two questions. Respondents who answered Question 2 in Vst might be affected by the existence of a former question. So one might not conclude that the difference is due to the number of the alternatives.

Lastly, Vnsq is not significantly different from Vst. This supports the internal test results that the exclusion of the Status Quo does not matter.

5.10.2. The Results of the Convergent Validity Test for the Linear and LN Models

The test results from the linear and LN models are the same. These are also the same as the results from the Dummy model, other than in one test. The only different result from the Dummy model is the external test between Vst and V$. According to the linear and LN models, Vst and V$ are not statistically different. Since 8 out of 9 test results do not reject the null hypothesis, one can say that the placement of the monetary stimulus does not affect the coefficient estimates.

5.11. Hausman Test for IIA

A Hausman Test was conducted in Limdep for testing Independence of Irrelevant Alternatives assumption (Hausman and McFadden, 1984). The test was conducted to Valt and Vst,Q2 where number of alternatives changes. The test results indicate (Table 5.14) that IIA property holds so that the ratio of the probabilities of choosing any two alternatives is independent of the attributes of any other alternative in the choice set.

Table 5.14: Hausman Test Results

Model Tested	Chi-squared ratio (Degrees of freedom)	Result	p-value
Dummy	13.06 (12)	DNR	0.364
Linear	12.54 (10)	DNR	0.250
LN	12.31 (10)	DNR	0.265

5.12. Swait-Louviere Test for Scale Parameter

The convergent validity test results showed that the number of alternatives in the choice set affects the coefficient estimates. We decided to investigate if this is because of having different scale parameters for each version or because of differences in preferences. The Swait- Louviere test was conducted to Valt and Vst (Swait and Louviere, 1993). According to their article, first a test was conducted to investigate if the coefficient estimates from these versions are significantly different or not. Having significantly different coefficient estimates (p-value=0.067)[21], the second test was conducted investigating if scale parameter equals 1 (as it was assumed in multinomial logit model) or not. The results indicate that scale parameter is not significantly different among these versions (p-value=0.123). This indicates that the convergent validity did not hold since the number of alternatives affected the coefficient estimates.

[21] Scale parameter test results were given according to 10% confidence level.

CHAPTER 6

CONCLUSIONS AND DISCUSSION

The estimation results give insights about the attributes that have the highest value. Similar results were derived from different forms of the models and across the different versions. According to these results, near urban area (LOC), prime farmland (QUAL) and vegetables (VEGET) are significant in most models. Results are mixed over the acres of protected area. EXLARGE is significant in all versions in the Dummy model. The ACRES variable is significant in the linear model, except for Valt. The same result was derived for the LNACRES variable in the LN model.

These results indicate that a conservation easement program should target prime farmland near urban areas, with vegetables and with a relatively large protected area. Compensating variation per household is calculated for selected CEP. These figures are generalized to the general population and the value of conservation program is derived. These are the benefits of farmland preservation. It is important to investigate if the benefits of these programs outweigh the costs of purchasing conservation easements. These results will help policy makers design policies for agricultural conservation easements.

6.1. Policy Implications

Over $1.5 million has been spent on conservation easements to protect 2,555 acres of farmland in Maine (American Farmland Trust, 2002). At the state level this is

an average of $634 per acre. This figure is confirmed with a study conducted by Dalton and Bragg (2003). They found that the average value of dairy farms in Maine is $667 per acre.

According to our estimates from the linear model, the total benefits of a farmland conservation easement are $3,449, $1,990, $512 and $370 per acre for 12,000, 24,000, 120,000 and 240,000 acres of protection, respectively. As it is noticed, as acres increases the marginal value of land decreases. The marginal benefits should be at least as much as the marginal value of the farmland ($634) so that farmers will be willing to sell their land. Farmers who own large acres, such as 240,000 are unlikely to sell their development rights.

When we look at the 90% confidence interval of the average value of dairy farms, we found that the highest mean value is around $1,756 per acres, which might correspond to farms near urban area. These farmlands are more likely to be sold if their size is small, since in this case the marginal benefits are much closer to the marginal value of the land. If the percentage of benefits decreases, then farmers will be more likely to sell the development rights of their land. This information will give some insights to policy makers to design CEPs in the state.

6.2. Methodological Implications

Methodological objectives were tested with a likelihood ratio test by comparing the estimation results from different versions. According to the test results, the placement of the monetary stimulus does not affect the coefficient estimates.

However, in the Dummy model, the test results from stacked data suggest that the placement of monetary stimulus might matter. When a Wald test was applied to individual variables, it was found that the placement of monetary stimulus did not affect the coefficient estimates of the COST variable. However, it affected the coefficient estimates of two other variables (QUAL and LARGE). This shows that the placement of attributes might have an effect on the decision making process and might affect respondents' choices.

The test results indicate that the number of the alternatives affects the value estimates. The exclusion of one of the alternative programs affected the coefficient estimates. It was revealed that this was due to the number of alternatives, not due to the scale parameter. Fewer alternatives seem like a better choice since the choice complexity is negatively related with the number of alternatives. However, the exclusion of one alternative led to the loss of a lot of information. According to the estimation results, four variables that were significant in other versions, turned out to be insignificant when one of the alternatives was excluded. Researchers might have a trade-off when deciding on the number of alternatives.

The results also suggest that the exclusion of the Status Quo alternative does not affect the coefficient estimates. However, for welfare analysis, it is necessary to include the SQ option, which is a basis for the current situation.

6.3. Limitations of the Research

There are some issues about the design of conjoint questions that were not investigated in this research. There are other factors in the design of conjoint questions that might affect the coefficient estimates. The number of attributes, the number of the attribute levels and the differences between the levels of each attribute are all factors that could be changed (Bryan and Parry, 2002; Saelensminde, 2002).

The probability functions were estimated by the multinomial logit model, and many assumptions were made in order to estimate this model. These assumptions are; the errors are independently and identically distributed, all errors have the same scale parameter and independence of irrelevant alternatives assumption holds. Relaxing one or more of these assumptions may yield different results. Although we found that we do not have IIA and scale parameter problems, these assumptions should be test for each individual study.

Finally, the response rate of 41 percent may not give a true representation of the general population. This should be considered when the estimation results are used for policy applications.

6.4. Issues for Future Research

These findings imply that researchers should be very careful in the design of conjoint analysis, since the subjective decisions of the researchers can easily affect the outcomes.

The test results suggest that researchers might be confronted with a trade-off when deciding on the number of alternatives. One way to deal with this might be to present double bounded questions. The first question asks respondents to choose between alternative programs, for example Programs A and B. Suppose a respondent chooses Program A (/B), then the second question asks if the respondent chooses Program A (/B) or the Status Quo option. In this way, researchers will not loose information and they will not have to deal with problems, such as IIA and choice complexity.

The exclusion of the SQ option may not be a problem for researchers who are interested in estimating the marginal rate of substitution between the alternative programs. Otherwise, when SQ is excluded, welfare estimations can be calculated by assuming that acres of protected area is linear. A model with a linear acres variable allows 'zero' values to be assigned for the acres in the current situation, after which compensating variation can be calculated. However, this is quite a strong assumption, which puts restriction on the form of the model.

The design problems identified will make future researchers aware of how their framing of conjoint questions will affect responses. Knowing these problems exist, research can be undertaken to develop new question designs that avoid or minimize these biases.

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APPENDICES

APPENDIX A

ANOVA AND CHI-SQUARE TEST RESULTS

Table A.1: ANOVA Test Results for Mean Age[22]

Test	Result	p-value
Across all versions	R	0.0001
Vst vs V$	R	0.0001
Vst vs Valt	DNR	0.2457
Vst vs Vnsq	DNR	0.2686
V$ vs Valt	R	0.0001
V$ vs Vnsq	R	0.0001
Valt vs Vsq	DNR	0.9557

Table A.2: ANOVA Test Results for Mean Household Income

Test	Result	p-value
Across all versions	R	0.0001
Vst vs V$	R	0.0002
Vst vs Valt	R	0.0001
Vst vs Vnsq	R	0.0001
V$ vs Valt	R	0.0803
V$ vs Vnsq	R	0.0001
Valt vs Vsq	R	0.0001

[22] The ANOVA and chi-square test results were given according to the 5% confidence level.

Table A.3: The Chi-square Test Results for the Percentage of Respondents Who Have Jobs Related With Farming

Test	Result	p-value
Across all versions	R	0.0010
Vst vs V$	R	0.0100
Vst vs Valt	DNR	0.0563
Vst vs Vnsq	DNR	0.4645
V$ vs Valt	R	0.0001
V$ vs Vnsq	DNR	0.2126
Valt vs Vsq	R	0.0246

Table A.4: The Chi-square Test Results for the Percentage of Respondents Who Have Ever Lived on a Farm

Test	Result	p-value
Across all versions	R	0.0007
Vst vs V$	DNR	0.5356
Vst vs Valt	R	0.0039
Vst vs Vnsq	R	0.0186
V$ vs Valt	R	0.0008
V$ vs Vnsq	R	0.0047
Valt vs Vsq	DNR	0.6649

Table A.5: The Chi-square Test Results for the Percentage of Respondents Who Have Relatives Lived on a Farm

Test	Result	p-value
Across all versions	R	0.0001
Vst vs V$	R	0.0003
Vst vs Valt	R	0.0188
Vst vs Vnsq	DNR	0.3455
V$ vs Valt	R	0.0001
V$ vs Vnsq	R	0.0002
Valt vs Vsq	DNR	0.2351

Table A.6: The Chi-square Test Results for the Percentage of Respondents Who Have Friends Lived on a Farm

Test	Result	p-value
Across all versions	R	0.0001
Vst vs V$	R	0.0001
Vst vs Valt	R	0.0001
Vst vs Vnsq	R	0.0091
V$ vs Valt	R	0.0083
V$ vs Vnsq	DNR	0.3231
Valt vs Vsq	R	0.0022

Table A.7: The Chi-square Test Results for the Percentage of Respondents Who Buy Products Directly From Farmers

Test	Result	p-value
Across all versions	R	0.0001
Vst vs V$	R	0.0001
Vst vs Valt	R	0.0003
Vst vs Vnsq	R	0.0001
V$ vs Valt	DNR	0.0905
V$ vs Vnsq	R	0.0001
Valt vs Vsq	DNR	0.1265

Table A.8: The Chi-square Test Results for the Percentage of Respondents Who Look for Local Farm Products

Test	Result	p-value
Across all versions	R	0.0004
Vst vs V$	R	0.0273
Vst vs Valt	R	0.0047
Vst vs Vnsq	R	0.0464
V$ vs Valt	R	0.0052
V$ vs Vnsq	R	0.0084
Valt vs Vsq	DNR	0.2200

Table A.9: The Chi-square Test Results for the Percentage of Respondents Who Purchase Organic Farm Products

Test	Result	p-value
Across all versions	R	0.0001
Vst vs V$	R	0.0001
Vst vs Valt	R	0.0001
Vst vs Vnsq	R	0.0001
V$ vs Valt	R	0.0001
V$ vs Vnsq	R	0.0001
Valt vs Vsq	R	0.0001

Table A.10: The Chi-square Test Results for the Percentage of Respondents Who Look for Farms to See When Traveling

Test	Result	p-value
Across all versions	R	0.0001
Vst vs V$	R	0.0001
Vst vs Valt	DNR	0.3909
Vst vs Vnsq	R	0.0001
V$ vs Valt	R	0.0001
V$ vs Vnsq	R	0.0001
Valt vs Vsq	R	0.0001

Table A.11: The Chi-square Test Results for the Percentage of Attributes

Attribute	Test	Result	p-value
GRAIN	All versions	DNR	0.9345
HAY	All versions	DNR	0.2934
VEGET	All versions	DNR	0.8483
PASTURE	All versions	DNR	0.5449
FOREST	All versions	DNR	0.5561
LOC	All versions	DNR	0.3722
QUAL	All versions	DNR	0.1341
SMALL	All versions	DNR	0.3840
MEDIUM	All versions	DNR	0.9864
LARGE	All versions	DNR	0.8403
EXLARGE	All versions	DNR	0.4886
COST	All versions	DNR	0.5723

APPENDIX B

BACKGROUND INFORMATION BOOKLET

Background Information Booklet

A Program to Purchase Conservation Easements to Farmland in Maine

Please Read Before You Begin the Survey

LOSS OF FARMLAND IN THE UNITED STATES

! **Many communities and individuals across the nation are concerned about farmland being converted to residential, commercial and other non-farm uses.** (For more information you can look at the following site on the internet: http://www.farmland.org)

< Some people are concerned about the amount of farmland being converted.

< Others are concerned about the loss of large, open fields.

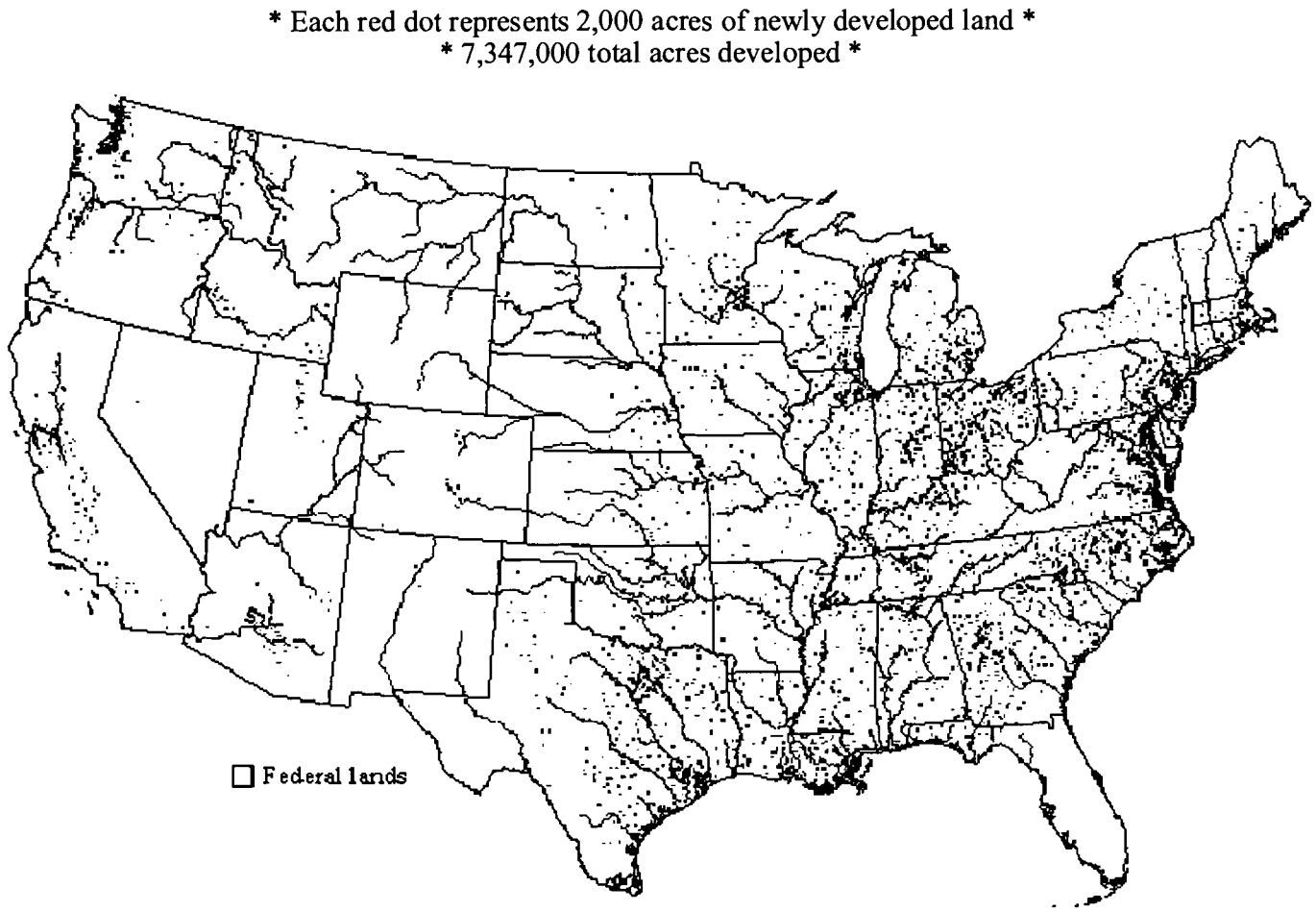
< Others worry that the rural scenery will be diminished.

< Others worry about the sprawl of residential construction into rural areas.

! **The map on the next page shows where <u>prime</u> farmland was converted to nonagricultural uses in Maine and other states between 1982 and 1997.** Prime farmland is land that scientists have determined is the best for growing agricultural crops.

! The purpose of this survey is to learn about **your own** opinions on farmland conversion in Maine.

Figure B.1: Acres of Prime Farmland Converted to Developed Land, 1982-1997



FACTS ABOUT FARMLAND IN MAINE

(Source: U.S. Department of Agriculture's Census of Maine Farmers)

- **Farmers own a small share of the land in Maine.** Farmers own about 1,212,000 acres and this represents about 6% of the land area in Maine.

- **Farmers own cropland, pastures and woodlands.**

- **About 47% percent of the land owned by farmers in Maine is forested.**

- **The amount of farmland in Maine has decreased by about 8% over the last 10 years.**

- **Over the same 10 year period, about 40,000 acres of prime farmland has been converted to other uses in Maine.**

- **Pressure for new development is concentrated in a few areas.** Farmland is being converted to other uses in Cumberland County three times as fast as it is being converted in Aroostook County.

A PROGRAM TO REDUCE THE CONVERSION OF FARMLAND

Suppose a Conservation Easement program was proposed where people who own family farms could voluntarily sell Conservation Easements to their farmland. A family farm is any farm that is owned by a family and is not owned by stockholders who are not related by family or marriage.

- Farmers could submit bids to sell Conservation Easements to all of their land or to just a portion of their land.

- The Conservation Easements would retire the rights to convert farmland to residential subdivisions, commercial developments, or other non-farm uses by placing permanent restrictions on the legal deeds to the properties.

- A Conservation Easement does not make a farmer's land public property like a state park. The land is still owned by the farmer.

- Money to purchase Conservation Easements would come from a one-time payment that everyone in the state would pay through an increase in their 2002 state income taxes.

- The State Legislature would appoint a Citizens Board to administer the program.

- The Citizens Board would have members from different regions of the state.

- Funding for the program would allow for the Citizens Board to hire a staff person to review farmers' proposals, purchase easements, and to monitor compliance on lands where Conservation Easements have been purchased.

- The Conservation Easement Program would only be established if it was approved by a majority of Maine voters in a referendum vote.

OTHER STATES HAVE RECENTLY IMPLEMENTED PROGRAMSTO PURCHASE CONSERVATION EASEMENTS TO FARMLAND

- At least nineteen states have programs to purchase Conservation Easements to farmland.

- In these other states, Conservation Easements have currently been purchased to over 500,000 acres of farmland.

- The prices paid to farmers for Conservation Easements reflect the difference between the higher value they would receive if they sold the land for residential, commercial, or other non-farm uses, and the lower value if they sold to another farmer.

WHAT THE PURCHASES OF CONSERVATION EASEMENTS TO FARMLAND MEAN TO THE CITIZENS OF MAINE

- The land could never be converted to a residential subdivision, commercial development or other non-farm uses.

- The program would help to maintain farmland for farming and large areas of undeveloped farmland.

- Farmland provides important habitat for wildlife that is not provided by other types of land ownership and uses in the state.

WHAT THE SALE OF CONSERVATION EASEMENTS MEAN TO FARMERS

- Farmers will decide if it is in their best interests to offer to sell a Conservation Easement to their land.

- The purchase of a Conservation Easement does not mean that the Citizens Board owns the land; Conservation Easements permanently retire **only** the right to develop the land.

- Farmers who voluntarily sell a Conservation Easement to their land still own their land.

- Farmers can use the money from the sales of Conservation Easements for operating capital for their farms, income or other uses they choose.

- Farmers can continue all of their agricultural activities.

- Farmers who sell Conservation Easements to their land can change crops grown or livestock raised in response to market prices, or choose not to farm.

- Farmers can still build new buildings on the land for their agricultural operations and housing for family members who stay on the farm.

- Farmers can pass their farms on to their children.

- Farmers can sell their land.

- However, the Conservation Easements apply to all future owners.

WHAT TYPES OF FARMLAND SHOULD THE CITIZENS BOARD CHOOSE FOR THE PURCHASES OF CONSERVATION EASEMENTS?

! The program will only be available to family-owned farms.

! While the bids submitted by farmers will be an important factor, the Citizens Board will also consider factors such as the crops grown and location of the farm in making their decisions to purchase Conservation Easements.

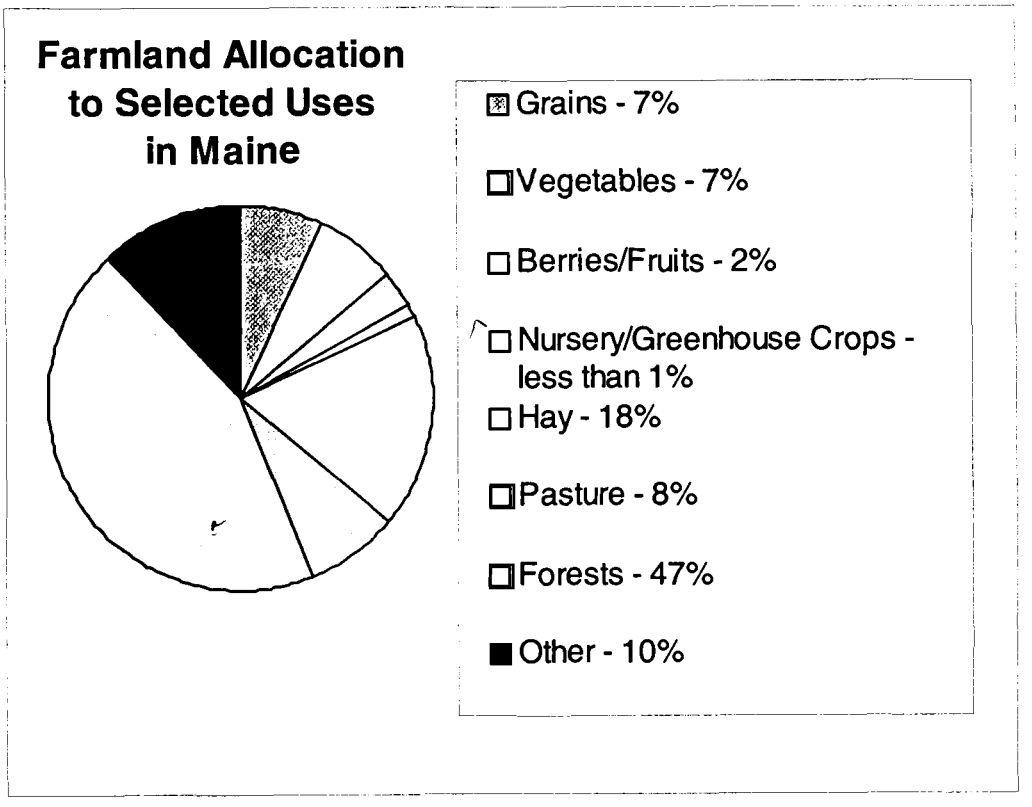
! Other states have used these types of factors to make decisions regarding the purchases of Conservation Easements.

! Below is some information about farms in Maine that you might want to consider when answering questions in the survey. (Source: U.S. Department of Agriculture's 1997 Census of Maine Farmers. You can find this information at the following internet site: http://www.nass.usda.gov/census/).

USES OF FARMLAND IN MAINE

- Maine farms raise about 83,000 acres of **grains** (primarily barley, corn for silage and oats).
- Maine farms raise about 85,000 acres of **vegetables** (primarily potatoes, sweet corn, peas and broccoli).
- Maine farms raise about 30,000 acres of **berries and fruits** (primarily wild blueberries and apple orchards).
- Maine farms raise about 7,000 acres of **nursery crops** and **greenhouse crops** (Christmas trees, small trees and shrubs for landscaping, flowers, etc.).
- Maine farms raise about 214,000 acres of **hay.**
- Maine farms have about 93,000 acres of **pasture land.**

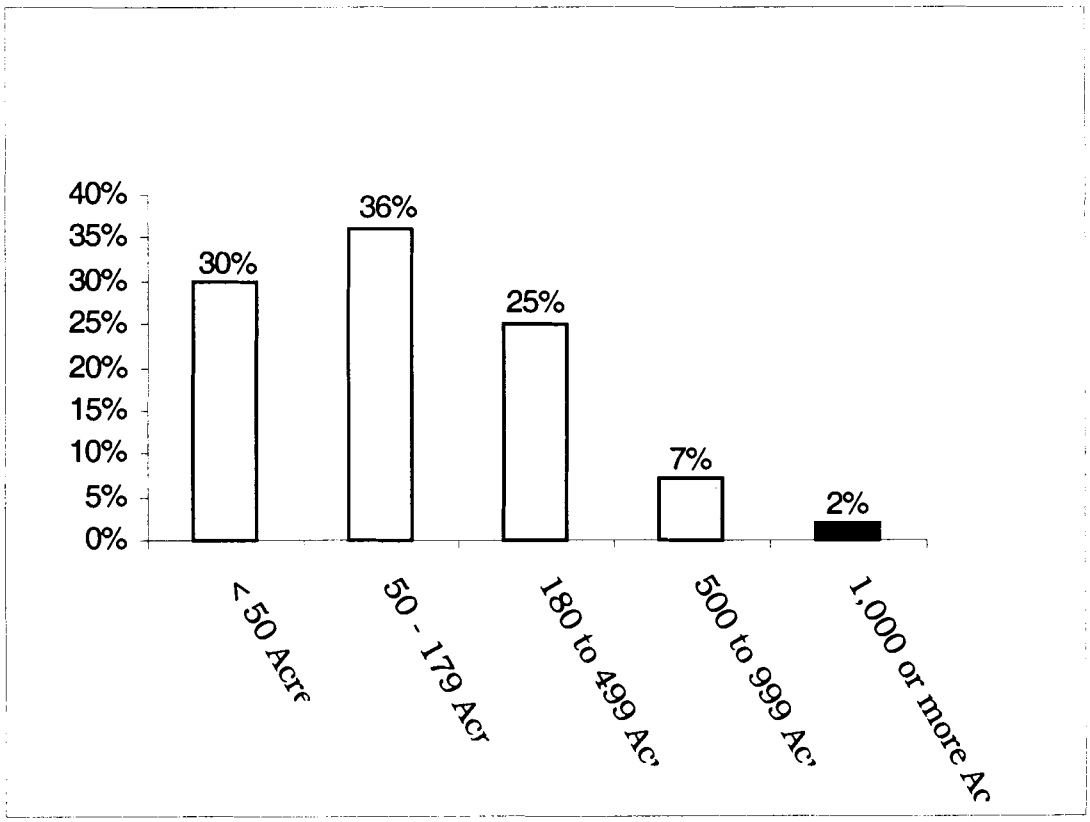
Figure B.2: Farmland Allocation to Selected Uses in Maine



SIZES OF MAINE FARMS

- 30% of Maine farms own fewer than 50 acres.
- 36% of Maine farms own between 50 and 179 acres.
- 25% of Maine farms own between 180 and 499 acres.
- 7% of Maine farms own between 500 and 999 acres.
- 2% of Maine farms own 1,000 acres or more.

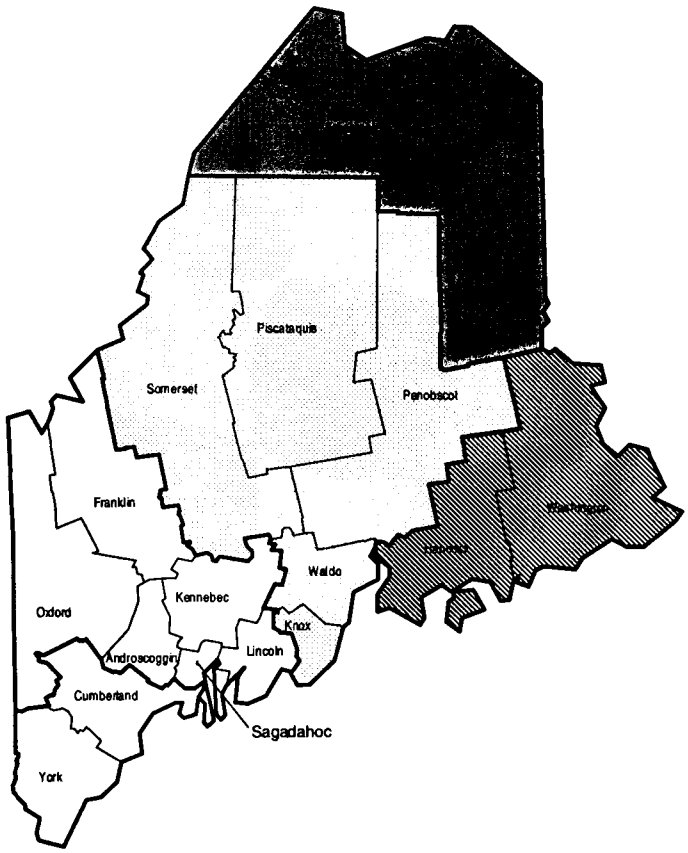
Figure B.3: Sizes of Maine Farms



LOCATION OF MAINE FARMS

- 15% percent of the farms are located in Aroostook County in **northern** Maine and mostly grow potatoes
- 12% percent of the farms are located in Hancock and Washington Counties in **eastern** Maine and mostly grow blueberries
- 35% percent of the farms are located in Kennebec, Knox, Penobscot, Piscataquis, Somerset and Waldo Counties in **central** Maine and are mostly dairy farms
- 16% percent of the farms are located in Cumberland and York Counties in **southern** Maine and are involved in a variety of types of agriculture
- 22% percent of farms are located in other counties.

Figure B.4: Location of Maine Farms



FARM OWNERSHIP IN MAINE

- 81% of farmers live on the farm
- 49% of farmers say farming is their principal occupation
- 87% of farms are owned by an individual or family
- 7% of farms are owned by corporations (farms owned by stockholders who are not related)

SOIL QUALITY

- Prime farmland with high quality soil for farming is very limited in Maine

Please complete the survey now

Feel free to refer back to this information booklet when answering the survey questions

APPENDIX C

PUBLIC OPINION SURVEY

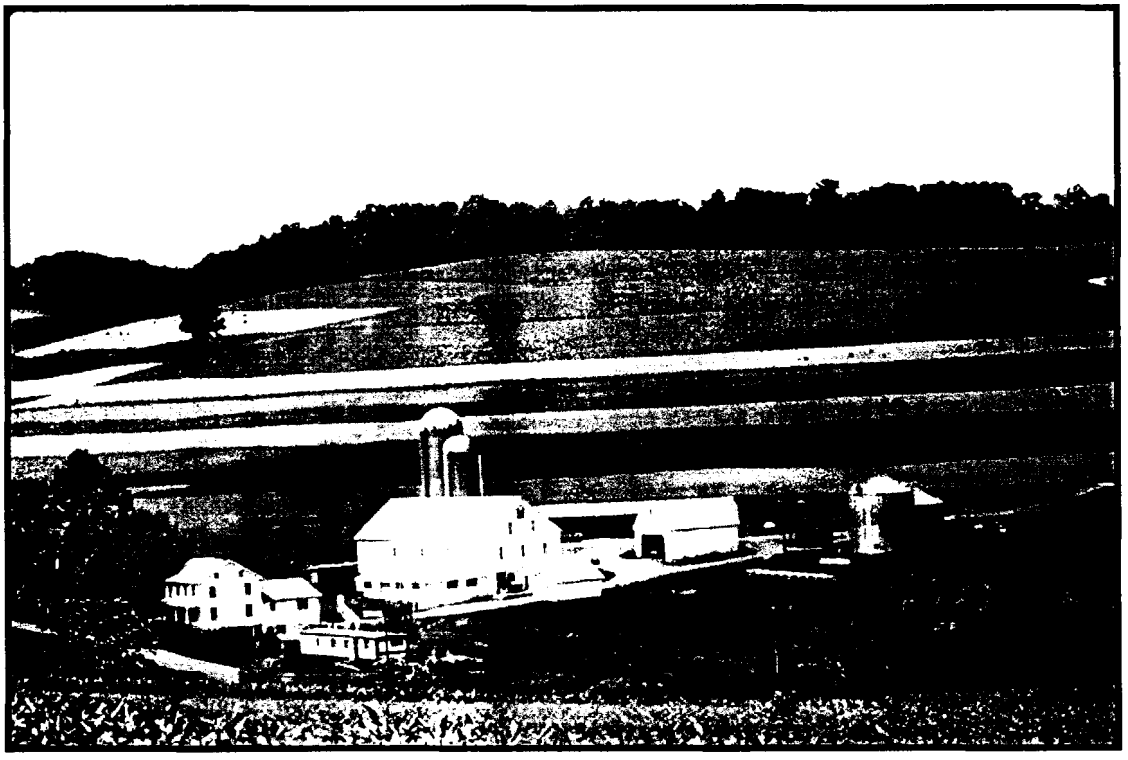
Purchasing Conservation Easements to

Agricultural Land in Maine

Public Opinion Survey

Purchasing Conservation Easements to Agricultural Land in Maine

WHAT DO YOU THINK?



«SURVME1» - V1

Section A. We presented a lot of material in the Information Booklet. In this section, we will ask a few questions to make sure we presented the information clearly. Please **feel free** to refer to the ***Background Information Booklet*** when answering the questions on this page and other questions in the survey.

1. For each statement below, please circle "T" if you think the statement is true and "F" if you think the statement is false.
(CIRCLE ONE LETTER FOR EACH STATEMENT)

	True	False
Half of the land owned by Maine farmers is **forested.**	**T**	**F**
Farmers **will be required** to sell Conservation Easements to their land.	**T**	**F**
The Conservation Easements will permanently retire the right to develop the land for residential or commercial purposes.	**T**	**F**
Farmers will be **paid for giving up rights** to sell or use their land for residential subdivisions, commercial developments or other non-farm uses.	**T**	**F**
Farmers who sell Conservation Easements **will be able to change** the **types of livestock** they raise **or crops** they grow.	**T**	**F**
Most of the farms in Maine **are owned by families.**	**T**	**F**
Uses of farmland in Maine include growing crops (grains, vegetables, berries and fruits), growing hay, as pasture for livestock and as forestland.	**T**	**F**

Section B. In this section we are interested in learning about your experience with farms.

2. Does your job involve working with farms, farm supplies or farm products?
(CIRCLE ONE NUMBER)

1 YES
2 NO

3. Have you ever lived on a farm?
(CIRCLE ONE NUMBER)

1 YES
2 NO

4. Have any of your relatives or friends ever lived on a farm?
(CIRCLE ALL NUMBERS THAT APPLY)

1 YES, relatives
2 YES, friends
3 NO

5. Please tell us how frequently you do each of the following activities:
(CIRCLE ONE NUMBER FOR EACH ITEM)

	Regularly	**Sometimes**	**Rarely**	**Never**
Buy produce and other products directly from Maine farmers	1	2	3	4
Look for Maine farm products to buy at the grocery store	1	2	3	4
Purchase organic farm products from Maine	1	2	3	4
Look for farms to see when you travel in Maine	1	2	3	4

Section C. In this section we will ask you to rate how much priority you think should be given to certain farm characteristics when setting priorities for accepting farmers' bids to sell Conservation Easements. Please feel free to use the Information Booklet if you need it.

6. How much priority do you think should be given to purchasing Conservation Easements to farmland where the following types of crops are grown? (CIRCLE ONE NUMBER FOR EACH ITEM)

	High Priority					**No Priority**	**Don't Know/ Don't Care**
Farms that raise:							
Grains	6	5	4	3	2	1	0
Vegetables	6	5	4	3	2	1	0
Grass for Pasture	6	5	4	3	2	1	0
Fruits and Berries	6	5	4	3	2	1	0
Greenhouse and Nursery Crops	6	5	4	3	2	1	0
Hay	6	5	4	3	2	1	0
Trees for Timber	6	5	4	3	2	1	0

7. Please tell us how much priority you think should be given to purchasing Conservation Easements to: (CIRCLE ONE NUMBER FOR EACH ITEM)

	High Priority					**No Priority**	**Don't Know/ Don't Care**
Farmland near urban areas	6	5	4	3	2	1	0
Prime farmland with high quality soils	6	5	4	3	2	1	0
A large amount of Farmland	6	5	4	3	2	1	0
Land that will continue to be farmed after the easement is purchased	6	5	4	3	2	1	0

8. How much priority do you think should be given making sure the cost of purchasing Conservation Easements is inexpensive to taxpayers? (CIRCLE ONE NUMBER)

High Priority					**No Priority**	**Don't Know/ Don't Care**
6	5	4	3	2	1	0

Section D. In this section we ask what you think about a number of programs to purchase Conservation Easements to farmland.

- The Conservation Easement Programs we wish you to consider will be the same as described in the Information Booklet.

- Please feel free to refer back to the Information Booklet.

- Only family-owned farmland will be eligible for the program.

- In this section we will ask you to choose between two Conservation Easement programs that give priority to purchasing conservation easements to different types of farmland.

- The programs differ in terms of the characteristics of farms that will be given priority when accepting farmers' bids to sell Conservation Easements.

- The Conservation Easement programs also differ in terms of the total acreage in Maine to be purchased and the cost to your household.

- After you tell us which of the two programs you prefer, we will ask you if you would vote to have one of these programs or to have no Conservation Easement program at all.

- There are four sets of these questions.

Suppose you had to vote between two conservation easement programs, Program A and Program B. These programs differ in terms of the attributes of the farms that would receive priority in the bidding process, the number of acres in the program and the cost to you. Please tell us which of the two programs you would support if you had to choose between Program A and Program B. You will also be able to tell us if you would vote for one of these programs or to do nothing.

	Conservation Easement Program A	**Conservation Easement Program B**
Farmland use priority	«USE1A»	«USE1B»
Farmland location priority	«LOC1A»	«LOC1B»
Land quality priority	«QUAL1A»	«QUAL1B»
Total acres of easements purchased in Maine	«EASEME1A»	«EASEME1B»
One-time cost to your household in 2002	«COST1A»	«COST1B»

«SURVME1»

9. Which program do you prefer?
(PLEASE CIRCLE ONE NUMBER)

1 Program A
2 Program B

10. Now, suppose you could vote between Program A, Program B and doing nothing. How would you vote? (CIRCLE ONE NUMBER)

1 I would vote for Program A
2 I would vote for Program B
3 I would not vote for either program

Suppose you had to vote between two conservation easement programs, Program A and Program B. These programs differ in terms of the attributes of the farms that would receive priority in the bidding process, the number of acres in the program and the cost to you. Please tell us which of the two programs you would support if you had to choose between Program A and Program B. You will also be able to tell us if you would vote for one of these programs or to do nothing.

	Conservation Easement Program A	**Conservation Easement Program B**
Farmland use priority	«USE2A»	«USE2B»
Farmland location priority	«LOC2A»	«LOC2B»
Land quality priority	«QUAL2A»	«QUAL2B»
Total acres of easements purchased in Maine	«EASEME2A»	«EASEME2B»
One-time cost to your household in 2002	«COST2A»	«COST2B»

11. Which program do you prefer?
(PLEASE CIRCLE ONE NUMBER)

1 Program A
2 Program B

12. Now, suppose you could vote between Program A, Program B and doing nothing. How would you vote? (CIRCLE ONE NUMBER)

1 I would vote for Program A
2 I would vote for Program B
3 I would not vote for either program

Suppose you had to vote between two conservation easement programs, Program A and Program B. These programs differ in terms of the attributes of the farms that would receive priority in the bidding process, the number of acres in the program and the cost to you. Please tell us which of the two programs you would support if you had to choose between Program A and Program B. You will also be able to tell us if you would vote for one of these programs or to do nothing.

	Conservation Easement Program A	**Conservation Easement Program B**
Farmland use priority	«USE3A»	«USE3B»
Farmland location priority	«LOC3A»	«LOC3B»
Land quality priority	«QUAL3A»	«QUAL3B»
Total acres of easements purchased in Maine	«EASEME3A»	«EASEME3B»
One-time cost to your household in 2002	«COST3A»	«COST3B»

13. Which program do you prefer?
(PLEASE CIRCLE ONE NUMBER)

1 Program A
2 Program B

14. Now, suppose you could vote between Program A, Program B and doing nothing. How would you vote? (CIRCLE ONE NUMBER)

1 I would vote for Program A
2 I would vote for Program B
3 I would not vote for either program

Suppose you had to vote between two conservation easement programs, Program A and Program B. These programs differ in terms of the attributes of the farms that would receive priority in the bidding process, the number of acres in the program and the cost to you. Please tell us which of the two programs you would support if you had to choose between Program A and Program B. You will also be able to tell us if you would vote for one of these programs or to do nothing.

	Conservation Easement Program A	**Conservation Easement Program B**
Farmland use priority	«USE4A»	«USE4B»
Farmland location priority	«LOC4A»	«LOC4B»
Land quality priority	«QUAL4A»	«QUAL4B»
Total acres of easements purchased in Maine	«EASEME4A»	«EASEME4B»
One-time cost to your household in 2002	«COST4A»	«COST4B»

15. Which program do you prefer?
(PLEASE CIRCLE ONE NUMBER)

1 Program A
2 Program B

16. Now, suppose you could vote between Program A, Program B and doing nothing. How would you vote? (CIRCLE ONE NUMBER)

1 I would vote for Program A
2 I would vote for Program B
3 I would not vote for either program

Section E. In this section we will ask you a few questions about your opinions on some aspects of farms.

17. If you had to choose between purchasing Conservation Easements to different types of land, how would you rate each of these alternatives? (CIRCLE ONE NUMBER FOR EACH ALTERNATIVE)

	Very Important					**Not Important**	**Don't Know/ Don't Care**
Farmland	6	5	4	3	2	1	0
Forestland	6	5	4	3	2	1	0
Lake frontage	6	5	4	3	2	1	0
River frontage	6	5	4	3	2	1	0
Ocean frontage	6	5	4	3	2	1	0
Wetlands	6	5	4	3	2	1	0
Prairie	6	5	4	3	2	1	0
Mountains	6	5	4	3	2	1	0
Undeveloped land in cities	6	5	4	3	2	1	0

18. Please tell us how strongly you agree or disagree with each of the following statements. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	Strongly Agree		**Neither**		**Strongly Disagree**	**Don't Know/ Don't Care**
Farms help to protect water quality in **lakes, rivers and streams**.	5	4	3	2	1	0
Farms help to protect the quality of **well water** people use for drinking.	5	4	3	2	1	0
Pesticides and herbicides used by farmers are major environmental problems.	5	4	3	2	1	0
Disposal of livestock manure is not a major environmental problem.	5	4	3	2	1	0
Soil erosion from farms is a major problem.	5	4	3	2	1	0
Farmland protects rural communities from flooding.	5	4	3	2	1	0
Farms do not contribute to beautiful scenery.	5	4	3	2	1	0
I like to see livestock in fields.	5	4	3	2	1	0
Farms should not raise animals in feedlots and confinement buildings.	5	4	3	2	1	0
Farms provide good wildlife habitat.	5	4	3	2	1	0

Active farms reduce residential and commercial sprawl.	5	4	3	2	1	0
Farms are an important part of rural communities.	5	4	3	2	1	0

19. Please share your views about farming by indicating your level of agreement with the following statements. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	Strongly Agree		**Neither**		**Strongly Disagree**	**Don't Know/ Don't Care**
Most farmers are not wealthy.	5	4	3	2	1	0
The government bails farmers out too much.	5	4	3	2	1	0
Farming is a more satisfying occupation than most others.	5	4	3	2	1	0
The family farm must be preserved.	5	4	3	2	1	0
Corporate farms are more efficient than family farms.	5	4	3	2	1	0
Large farms get too many government benefits.	5	4	3	2	1	0
Small farms are better stewards of the land than larger farms.	5	4	3	2	1	0

Government should treat farms just like other businesses.	5	4	3	2	1	0
Government should not protect farmland for future generations.	5	4	3	2	1	0
Today's food is safer than it ever has been.	5	4	3	2	1	0
Today's food is not as fresh as it has been.	5	4	3	2	1	0
Our country is likely to suffer food shortages in the near future.	5	4	3	2	1	0
Conservation easements help to insure our nation's food supply.	5	4	3	2	1	0

Section F. In this last section, we would like to ask you some questions about your background which will help us compare your answers with those of other people. Please be assured that all of your responses are strictly confidential.

20. Are you: (CIRCLE ONE NUMBER)

1 Male
2 Female

21. What year were you born? (FILL IN THE BLANK)

19____

22. How many years of schooling have you completed? (CIRCLE ONE NUMBER)

1 Eight years or less
2 Some high school
3 High school graduate
4 Some college or technical school
5 Technical school graduate
6 College graduate
7 Post graduate work

23. How many people live in your household? (FILL IN ALL BLANKS)

_____ People age 18 and older

_____ People under the age of 18

_____ Total number of people in your household

24. Which of the following categories comes closest to your 2001 household income? (CIRCLE ONE NUMBER)

1	Less than $10,000	9	$45,000 to $49,999
2	$10,000 to $14,999	10	$50,000 to $59,999
3	$15,000 to $19,999	11	$60,000 to $69,999
4	$20,000 to $24,999	12	$70,000 to $79,999
5	$25,000 to $29,999	13	$80,000 to $89,999
6	$30,000 to $34,999	14	$90,000 to $99,999
7	$35,000 to $39,999	15	Over $100,000
8	$40,000 to $44,999		

THANK YOU FOR YOUR HELP!

APPENDIX D

TELEPHONE SURVEY

ID#_____ (PLEASE CODE RESPONDENT SEX)

1 FEMALE

2 MALE

(CALL 1 2 3 4 5 6)

Hello, my name is _____. May I speak to _____

1 YES → **(CONTINUE)**

2 NO → When would be a good time to call back?

DAY:_____ TIME:_____ AM PM

(IF THE SAME PERSON, CONTINUE WITH NEXT QUESTION. IF DIFFERENT PERSON, INTRODUCE YOURSELF AGAIN.)

I am calling from the University of Maine. We recently sent you a survey about Purchasing Conservation Easements to Farmland in Maine. Do you recall receiving the survey?

1 YES → **(CONTINUE)**

2 NO → **(IF THEY NEED HELP REMEMBERING** -- It came in a large white envelope from the University of Maine and had an information booklet, the survey and a return envelop.)

(IF "NO") → Thank you for your time. **(HANG UP)**

Did you fill out the survey and return it to the University?

1 YES → Thank you for your help with this important study. **(HANG UP)**

2 NO → **(CONTINUE)**

Could you tell me why you haven't completed the survey and sent it back to the University?

1 NOT INTERESTED IN CONSERVATION EASMENT TO FARMLAND
2 I DO NOT HAVE ENOUGH KNOWLEDGE
3 I LOST THE SURVEY
4 THE SURVEY WAS TO DIFFICULT TO UNDERSTAND
5 THERE WAS TOO MUCH TO READ
6 I DO NOT HAVE TIME
7 I DO NOT LIKE THE UNIVERISTY OF MAINE
8 I DO NOT ANSWER SURVEYS
9 OTHER_____

(IF LOST THE SURVEY...)

Would you like us t send you another copy of the survey?

1 YES → We will send another copy. Thank you for your time. **(HANG UP)**
2 NO → Thank you for your time. **(HANG UP)**

(OTHERWISE, CONTINUE...)

Do you plan to fill out the survey?

1 YES → Thank you for your help and we look forward to receiving your survey. **(HANGUP)**
2 NO → **(CONTINUE)**

It is very important to hear from everybody to whom we sent a survey, even if you do not live on or near a farm. Everybody in Maine will pay for the Conservation Easement Program if it is approved. You do not have to know a lot about farms; we are looking for everybody's opinions. Could you please take the time to complete the survey?

1 YES → Thank your for your help and we look forward to receiving your survey. **(HANG UP)**

2 NO → **(CONTINUE)**

To help us understand who does not care to answer the survey, could you please answer few questions?

1 YES → **(CONTINUE)**

2 NO → Thank you for your time. **(HANG UP)**

Have your ever lived on a farm?

1 YES

2 NO

Have any of your relatives or friends ever lived on a farm? The answers are:

1 YES, relatives

2 YES, friends

3 NO

Does your job involve working with farms, farm supplies or farm products?

1 YES

2 NO

How frequently do you buy produce and other products directly from Maine farmers? The answers are:

1 REGULARLY
2 SOMETIMES
3 RARELY
4 NEVER

How frequently do you look for farms to see when you travel in Maine? The answers are:

1 REGULARLY
2 SOMETIMES
3 RARELY
4 NEVER

What year were you born?

19____

How many years of schooling have you completed?

1 EIGHT YEARS OR LESS
2 SOME HIGH SCHOOL
3 HIGH SCHOOL GRADUATE
4 SOME COLLEGE OR TECHNICAL SCHOOL
5 TECHNICAL SCHOOL GRADUTE
6 COLLEGE GRADUTE
7 POST GRADUTE WORK

Thank you for taking the time to help us with this important study. **(HANG UP)**

BIBLIOGRAHPY OF THE AUTHOR

Semra Ozdemir was born in Bolu, Turkey on 14 December, 1978. She graduated from Izzet Baysal Anadolu Lisesi in 1996. She attended the Middle East Technical University (METU) and graduated in June, 2001 with a Bachelor's degree in Economics. She entered the graduate program at Department of Resource Economics and Policy at the University of Maine in September, 2001.

After receiving her degree, Semra will be working as Research Associate in Department of Resource Economics and Policy, University of Maine. Semra is a candidate for the Master of Science degree in Resource Economics and Policy from The University of Maine in December, 2003.