Effects of Shifting Populations and Preferences on Nonindustrial Landowner Behavior: An Example from Virginia

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(Abstract)

The study was undertaken in response to a prediction by the Virginia Department of Forestry (VDOF) that current harvest levels cannot be sustained into the future given an increasing growth to removal insufficiency throughout the state of Virginia. The purpose of the study is to determine how market signals, land and owner characteristics, and owner preferences affect landowners' decisions concerning their forestland. Particular emphasis is placed on the effects of absenteeism and land fragmentation on landowner behavior. Such information is important for targeting policies that will successfully maintain commercial timber levels throughout the state.

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I. Introduction

Forest fragmentation is predicted to increase as population densities are both enlarging and extending further out into rural areas (SAF 1997, USDA Forest Service 1997). As commercial and residential development occurs, land holdings are breaking up into smaller pieces. Management of the timber resource in these smaller units may reduce timber available for commercial harvesting. Further, current landowner assistance programs, geared toward owners of larger tracts, are less applicable to the owners of these fragmented properties. This trend also has important implications for environmental quality and wildlife management.

It is also well known that at the same time forestland is becoming increasingly fragmented, more and more people are investing in land that is located far from their residence. It is generally thought that many of these absentee landowners have less information about timber harvesting assistance programs and stumpage prices than resident owners and thus are less likely to harvest timber from their properties. If this is true, the increasing number of absentee owners may have an adverse effect on Virginia's future timber availability.

Projections of future timber availability are based on more than just physical factors. The outlook for timber availability is dependent on the quality of timberland, present and previous rates of harvest and reforestation, and existing timber stock (Liu and Scrivani 1997). Topography, owner characteristics and values, as well as market signals also jointly affect the quantity and quality of the timber resource. Approximately 77% of Virginia's 15.4 million acres of commercial timberland are owned by nonindustrial private forest (NIPF) landowners. Since such a large portion of Virginia's forestland is privately owned, it is important to understand the factors directly related to how nonindustrial landowners choose to manage their forestland.

The purpose of this study is to determine what factors influence harvesting/reforestation rates, bequest probabilities, and debt load among Virginia's NIPF landowners, as well as how these decisions differ across various ownership types. In particular, we are interested in the effects of land fragmentation and absenteeism on

landowners' forest management decisions. The empirical results are used to determine harvesting and reforestation probabilities based on physical characteristics of private land holdings, market signals, demographic attributes, and revealed preferences of the owners. We also establish differences in the harvesting and reforestation rates for various ownership types. Finally, we investigate the factors influencing a landowner's buying price and reservation price per acre of land in an effort to determine whether or not amenity values associated with landownership and/or timber stock are capitalized into land prices.

Previous studies have focused primarily on the relationships between harvesting and reforestation decisions and forest, landowner, and economic characteristics (e.g., Birch (1992), Greene and Blatner (1986), Royer (1987), Romm et al. (1987), Dennis (1989, 1990), Alig et al. (1990), Kuuluvainen et al. (1996)). However, this earlier work does not focus on debt/savings or bequest decisions. In our model, because landowners are assumed to value forest amenities, timber harvesting/reforestation and debt, savings, and bequest decisions are not separable (Koskela 1989). We extend the previous separable models by simultaneously examining all of the interrelated decisions NIPF landowners face. Finally, unlike other work, we analyze the relationship between land parcelization and the harvest decision, and we consider the importance of absenteeism to decisions.

Our results support the assumption of nonseparability of landowner decisions. Stumpage prices, tract size, and risk perception prove to be the most important influences of the harvest decision, while debt level, average slope of the land, and bequests contribute to the reforestation decision. The factors that most significantly affect bequest behavior are stumpage prices, debt load, and value placed on non-market commodities attributed to unharvested forestland. Level of debt is most influenced by age and employment status. Absentee landowners have higher incomes and debt than resident landowners, and we will show that this contributes to important differences in behavior. Absenteeism and land fragmentation are shown to significantly affect harvest rates among Virginia's NIPF landowners. These population trends are not as important in

decisions concerning debt load or bequests, however. Finally, the results show that various land characteristics, existing timber stock, and owner preferences are capitalized into land prices.

The remainder of the paper is organized as follows. In Section I, we introduce our model of nonindustrial landowner behavior and discuss the first order conditions related to harvesting, reforestation, bequests, debt load, and land reservation price. Here, we highlight the implication that forestry decisions and debt/savings/bequest decisions are nonseparable. In Section II, we present the econometric model, and in Section III we present results from estimating the landowner response models, interpret likelihood ratio tests, and discuss marginal effects of important variables in the harvesting, reforestation, and bequest decisions. In Section IV, we address some long-run considerations by removing the assumption that land is fixed and observing how characteristics of the forest and preferences of the landowner affect land prices. Finally, the last section contains concluding remarks.

II. Model of Nonindustrial Landowner Behavior

The theoretical model presented here is based on the following utility function[1]:

$$U(Q, C_1, C_2; \Omega). \tag{1}$$

The landowner faces the following budget constraints:

$$C_1 = P_1 X_1 - S_1, \text{ and} \tag{2}$$

$$C_2 = \frac{1}{(1+r)}\{[(K_0 - X_1) + F(K_0 - X_1) - Q]P_2 + (1+r)S_1\}, \tag{3}$$

where Q represents unharvested timber stock (set aside for amenity values), C_1 and C_2 are consumption in periods 1 and 2 respectively, P_1 and P_2 are stumpage prices in periods 1 and 2, X_1 is timber volume harvested in period 1, S_1 is savings in period 1, r is interest rate, and K_0 is bequest from the previous generation (or standing timber stock). Q can be

[1] We have assumed that nontimber benefits are not separable from consumption in the utility function. Thus, there will be income effects that are important in the decision to bequeath.

thought of as the unharvested timber stock bequeathed to the next generation. Ω represents other characteristics of the landowner important to utility, like absenteeism.

As income increases over time, landowners presumably care more and more about the amenities of their forestland. By including a variable for amenity values in the utility function, we are implying that preferences for nontimber benefits are not separable from consumption decisions (Koskela 1989). The first budget constraint (see equation (2)) implies that consumption in period 1 depends on income from harvesting in period 1, net of savings. The second budget constraint (see equation (3)) suggests that consumption in period 2 depends on income from harvesting in period 1, the stock set aside for amenity values, stumpage prices in period 2, and savings from period 1. In this model, unharvested timber for amenity values, savings, and timber volume harvested (Q, S_1, and X_1) are *endogenous* variables. The landowner takes the market price as given.

The landowner maximizes (1) subject to (2) and (3). The first order conditions, derived by substituting C_1 and C_2 into (1) and differentiating with respect to Q, X, and S, are represented in equations (4) - (6) as follows:

First Order Condition for Q, the unharvested timber stock:

$$\frac{\partial U(\cdot)}{\partial Q} - \frac{\partial U(\cdot)}{\partial C_2}\left(\frac{1}{(1+r)}P_2\right) = 0$$

Rearranging terms, we obtain the following:

$$\frac{\partial U(\cdot) \big/ \partial Q}{\partial U(\cdot) \big/ \partial C_2} = \frac{1}{(1+r)}P_2 . \qquad (4)$$

Equation (4) implies the landowner chooses Q so that the marginal rate of substitution (MRS) between period 2 consumption and nontimber benefits equals the marginal discounted value of harvesting; that is, timber income enters the landowner's choice of nontimber benefits.

First Order Condition for X_1, timber harvested in period 1:

$$\frac{\partial U(\cdot)}{\partial C_1}P_1 + \frac{\partial U(\cdot)}{\partial C_2}\left(\frac{1}{(1+r)}\right)[-1-F'(K_0 - X_1)]P_2 = 0 \qquad (5)$$

Equation (5) implies that the landowner harvests such that the marginal utility of consumption is equal over the two periods.

First Order Condition for S_1, savings in period 1:

$$-\frac{\partial U(\cdot)}{\partial C_1} + \frac{\partial U(\cdot)}{\partial C_2} = 0 \qquad (6)$$

In equation (6), the landowner saves so that the marginal utility of consumption remains constant between time periods. Substitution for $\partial U(\cdot)/\partial C_2$ from equation (6) into equation (5) yields:

$$\frac{\partial U(\cdot)}{\partial C_2}P_1 + \frac{\partial U(\cdot)}{\partial C_2}\left(\frac{1}{(1+r)}\right)[-1-F'(K_0 - X_1)P_2] = 0\,.$$

Simplifying, we have:

$$\frac{P_1(1+r)}{P_2} = F'(K_0 - X_1) + 1\,. \qquad (7)$$

At the optimum, harvesting will take place so that the value of the ratio of stumpage prices for the two time periods is equal to growth of the forest stock.

Solving equation (4) for P_2 and substituting into equation (7), we have:

$$P_1\left(\frac{\partial U(\cdot)/\partial C_2}{\partial U(\cdot)/\partial Q}\right) = F'(K_0 - X_1) + 1\,. \qquad (8)$$

Specifically, the landowner harvests so that the marginal product of growth (RHS) equals the price, multiplied by the MRS between consumption and nontimber benefits (LHS). Thus, harvesting depends on preferences for non-market goods, and the nonseparability condition holds. If amenity values did not exist, harvesting would depend only on land and owner characteristics such as timber stock, stumpage prices, access, and risk preferences. In this case, harvesting and debt/savings/bequest decisions would not be interdependent, the standard assumption in previous empirical work.

Recall the first order condition for unharvested timber stock (see equation (4)). The corner solution for nontimber activities (where Q=0) provides a condition where a landowner will never choose to either reserve land for amenities or bequeath timber to their heirs, as opposed to harvesting:

$$\frac{\partial U(\cdot)}{\partial Q} < P_2\left(\frac{1}{(1+r)}\right)\frac{\partial U(\cdot)}{\partial C_2} \Leftrightarrow Q = 0. \tag{9}$$

The landowner will choose not to reserve land for amenities or bequeath timber when this inequality holds because, when this is the case, the marginal utility from not cutting is less than the discounted marginal utility of potential harvest income. Therefore, we would expect high amenity values (measured by U(·)) to encourage a landowner to hold standing timber and bequeath it, while factors contributing to high stumpage prices would lead to harvesting.

By using the nonseparability condition found in equation (8) and examining the corner solution for harvesting (where $X_1 = 0$), we can also determine under which conditions a landowner will harvest:

$$P_1\left(\frac{\partial U(\cdot)/\partial C_2}{\partial U(\cdot)/\partial Q}\right) < F'(K_0 - X_1) + 1 \Leftrightarrow X_1 = 0. \tag{10}$$

When this inequality holds, harvesting does not occur. Therefore, harvesting is more likely if prices are high or nontimber benefits are low. Although it is not explicit, a perception of increased risk to harvesting represents a marginal disutility from harvesting, causing the equation to be more likely to hold (because the LHS decreases). In this case, the landowner would be less willing to harvest (i.e., invest in timber production). Finally, if debt is high, savings is low, implying a low net income. The marginal utility of consumption is therefore high, and the landowner is more likely to harvest (because the LHS is higher).

Neither absenteeism nor land fragmentation can be analyzed directly with these equations, because they indirectly affect utility and marginal utility (through Ω in equation (1)). Some researchers have argued that absentee landowners hold land mainly

for amenity values (Shaffer and Meade 1997). If this were true, they would be less likely to harvest timber. If absenteeism increases, as is expected, the future availability of timber in Virginia may be adversely affected. Further, land fragmentation affects access to timber. It is more difficult to manage timber in smaller units because, as the costs involved with harvesting increase, loggers become less willing to harvest these small quantities of timber. With increased logging costs, the landowner receives a lower price and becomes less inclined to harvest (see equation (10)). Therefore, the model suggests that if land fragmentation continues, timber availability will decline.

III. Econometric Specification

In this section, econometric specifications of the first order conditions (FOC's) are presented for the model described in Section II. These FOC's must hold simultaneously.

The first order conditions in stochastic reduced form can be written as follows:

(1) $H = f(P,Q, M, D, A, S, T, X, B, \phi, \Omega, \varepsilon_h)$
(2) $R = f(P, Q, M, D, A, S, T, X, B, \Omega, \varepsilon_r)$
(3) $B = f(P, Q, M, D, A, S, \Omega, \varepsilon_b)$
(4) $D = f(Q, M, A, T, X, \Omega, \varepsilon_d)$

where

H is harvesting probability;
R is reforestation probability;
B is probability of having bequest values;
D is debt load;
P is stumpage price;
Q is timber stock[2];
M is exogenous income;
A is probability of having amenity values;
S is tract size;
T is topography;
X is access to timber;
ϕ is risk perception;
Ω is a vector of demographic characteristics such as age, employment status, marital status, and size of household;
$\varepsilon_h, \varepsilon_r, \varepsilon_b,$ and ε_d are error terms;

The simultaneous determination of the FOC's implies that a two staged least squares (2SLS) procedure must be used to estimate the full model. Harvesting, bequests, reforestation, and net savings (or debt as a proxy) are the endogenous variables. In this model, the order condition for identification is satisfied by ensuring there are enough exogenous variables excluded from each equation to identify the endogenous variables. This avoids the possibility that one equation is a linear combination of another (Kennedy

[2] In the empirical models, average size class of pines, hardwoods, and mixed pine/hardwoods are used, in addition to number of forested acres, as proxies for timber stock.

1992). Since cross-sectional data are used in the model, it is also possible that the variances of the errors are not constant over observations. For example, large landowners may have large fluctuations in harvests in response to errors. Therefore, all equations must be tested for, and when necessary corrected for, heteroskedasticity.

Finally, harvesting, reforestation, and the decision to bequeath property to heirs are qualitative responses because we are modeling them as choices following equations (9) – (10). Thus, a logit model appropriate for this data is used.

IV. Empirical Model

IV.1 Data Discussion and Study Area

To estimate the empirical model, data was obtained using a mail survey targeting NIPF landowners within the Thomas Jefferson Planning District of Virginia. The Thomas Jefferson Planning District (TJPD), located in the Northern Piedmont Region of Central Virginia, is comprised of five counties including: Albemarle, Fluvanna, Greene, Louisa, and Nelson Counties. It covers a 2,155 square mile total area, of which 946,533 acres are forested (Liu and Scrivani 1997). The district serves as a model study area of Virginia's future timber availability because it embodies both mountainous and piedmont regions. Further, this area has undergone an 8% overall increase in population between 1990 and 1995. This growth was concentrated in the suburbs and adjacent rural areas of Southern Greene, Western Fluvanna, and Northern Nelson Counties as well as around the affluent suburbs of Albemarle County (TJPDC 1996). Currently, population pressures are more severe in the Northern Piedmont than in any other region of Virginia (VDOF 1997, Thompson and Johnson 1996). Out of the 21 planning districts of Virginia, the TJPD is ranked third with respect to population growth (Knapp 1998).

IV.2 Sampling Procedure

A random mail survey of 1550 landowners was conducted in the Spring of 1998. The most recent tax maps for each county and courthouse records were used to obtain landowner names, addresses, and parcel sizes. The sampling intensity was stratified between counties according to the proportion of total forested land in the Thomas Jefferson Planning District.

None of the corporate-owned properties or properties less than five acres in size were included in the sample. The survey was sent to 535 landowners in Albemarle County, 440 in Louisa County, 172 in Greene County, 265 in Nelson County, and 228 in Fluvanna County.

IV.3 Survey Design

The survey was designed by following the methods outlined in Dillman (1978). The survey emphasized market and nontimber benefits of the forest, risk preferences, values placed on environmental quality, and demographic information.[3] A focus group meeting was held with five county foresters who work closely with private landowners in the Thomas Jefferson Planning District, to ensure that the questions would be clear. The survey was pretested on a random sample of 80 NIPF landowners in Culpeper County, Virginia—also located in the Northern Piedmont region of the state. The final survey included a postcard follow-up, which was sent to all landowners.

We received a total of 508 completed surveys out of 1490 (i.e., 1550 mailed out less 60 that were undeliverable) for a response rate of 34%. A telephone survey of 50 randomly chosen nonrespondents from Albemarle and Louisa Counties was also conducted to determine whether these landowners were statistically different from those sampled. A paired t-test showed that there is no significant difference between the demographic attributes of the respondents and the nonrespondents.

[3] A complete copy of the landowner survey is found in Appendix 1.

IV.4 Definitions of Variables

Table 1 defines all variables used to estimate the landowner response models. Dummy variables include: absentee/resident status (Absentee), the decision to bequeath timber to heirs or not (All), whether or not landowner spent at least 100 days in non/consumptive activities on his/her property for 1997 (Amenity), whether or not land was bought by the landowner (Bought), employment status (Employed), whether or not landowner has harvested (Harv), absence/presence of a conservation easement (Havece), high/low debt (Hidebt), whether or not average size class of hardwoods on property is sawtimber (Hsized), whether or not land was inherited by the landowner (Inherit), small/large tract size (Large), whether or not landowner resides on property (Liveprop), marital status (Married), whether or not average size class of mixed pine/hardwoods on property is sawtimber (Msized), whether or not average size class of pines on property is sawtimber (Psized), whether or not landowner reforested after last harvest (Reforest), risk perception regarding timber production (Risk), and presence/absence of streams (Streams).

Data transformations are performed on several variables to convert them to a more usable form. For example, 1997 gross income and acres of trees cut during the last harvest are measured categorically in the survey (following Dillman 1978) and subsequently transformed into continuous variables. Income is originally measured in $10,000 increments, and acres of trees cut is measured in 5-75 acre increments. Midpoints are taken for each of these variables. Two endogenous variables, one representing stumpage prices (Pricea) and the other representing debt load (Amtowed), are predicted in the first stage of the 2sls estimation procedure. These predicted values are identified as Phat and Debthat, respectively. Finally, the price originally paid by the landowner per acre of land is obtained in 5-year increments (as suggested in our focus group meeting). Because land was purchased at different points in time, the nominal prices are deflated by the average consumer price index over that 5-year time period.

Table 1
Definitions of Variables in the Empirical Model

Variable	Definition (units)
Acres	total size of land ownership (acres)
Absentee	1 if landowner resides > 50 miles from property, else 0
Acresmid	total area cut during last harvest (acres)
Age	age of landowner (years)
Aginc	total agricultural income landowner earned in 1997 (dollars)
Agland	total size of portion of land ownership devoted to agriculture (acres)
All	1 if landowner intends to bequeath all timber on the property to heirs, else 0
Amenity	1 if landowner places value on forest amenities, else 0
Amtowed	current amount of debt landowner carries (dollars)
Bequest	1 if landowner plans to bequeath property to heirs in the future, else 0
Bought	1 if land was bought, 0 if inherited
Dayshnt	time spent hunting (days/year)
Educ	level of education completed
Employed	1 if employed, 0 if unemployed/retired
Forland	total size of forested portion of land ownership (acres)
Harv	1 if landowner has harvested trees from property, else 0
Havece	1 if property contains a conservation easement, else 0
Hidebt	1 if landowner currently carries > $150,000 in debt, else 0
Hsehold	total number of people in household
Hsized	1 if average size class of hardwoods on property is sawtimber, 0 if poletimber/pulpwood
Incmid	total income landowner earned in 1997 (dollars)
Inherit	1 if land was inherited, 0 if bought
Large	1 if tract size is > 15 acres, else 0
Liveprop	1 if landowner resides on the property, else 0
Married	1 if married, else 0
Miles	approximate distance between landowner's residence and the property (miles)
Msized	1 if average size class of mixed pine/hardwood on property is sawtimber, 0 if poletimber/pulpwood
Noncons	time spent in nonconsumptive recreation activities (days/year)
Paylanda	price landowner paid per acre of land (dollars/acre)
Pricea	actual income received from timber harvesting (dollars/acre)
Psized	1 if average size class of pine trees on property is sawtimber, 0 if poletimber/pulpwood+B54
Reforest	1 if landowner spent money to reforest following harvest, else 0
Risk	1 if landowner perceives risk involved with timber production, else 0
Roads	approximate total length of roads on the land (miles)
Selland	landowner's per acre land reservation price (dollars/acre)
Slope	1 if 0-10% grade, 2 if 11-20% grade, 3 if greater than 20% grade
Streams	1 if streams are present on the property, else 0

IV.5 Descriptive Statistics

Table 2 presents the descriptive statistics for all variables used in the landowner response models. Discussion of these statistics is divided according to: demographic attributes, ownership characteristics, forest characteristics, and landowner preferences.

IV.5.1 Demographic Attributes

The average age of the landowners sampled is 60 years old. This finding is consistent with Dennis' (1989) finding of 59 years for Northeastern landowners, and is relatively consistent with Hodge's (1991) results for Virginia, where 50% of the landowners were 61 years or older. Absentee owners and owners of smaller tracts tend to be slightly younger. Just over half of the respondents are employed (53%). A larger percentage of absentee landowners (57%) and owners of small tracts (65%) hold jobs, which is consistent with their younger ages. Most of the respondents are married (80%), with an average household size of 2.6 people. These numbers remain similar across ownership types.

Average gross income for 1997 is $91,142.19, which makes sense for owners of at least five acres in the relatively high-income area surrounding Charlottesville.[4] Absentee landowners have a much higher mean income than resident owners, and owners of larger tracts earn more than owners of smaller tracts, as is expected.

Aside from exogenous income, the average landowner earned $8,844.52 in gross agricultural income for 1997. Absentee landowners earned significantly less agricultural income ($5,300.30) than resident landowners ($9,786.66), and owners of small tracts earned on average much less ($3,614.50) than owners of the larger tracts ($9,639.87). Current debt load carried by the average respondent is $103,254.14. The typical absentee

[4] However, this estimate may not exhibit a high degree of accuracy because, again, all reported incomes are in $10,000 increments and midpoints of these increments are used. Furthermore, the highest income category listed on the survey, $100,000 or higher, was selected by 29% of the sample, and we are uncertain as to how much more than $100,000 these people have earned. The midpoint was estimated at $200,000. Therefore, the income measures should not be taken as absolutes; they should only be used for making inter-group comparisons and for estimating marginal effects of income on management decisions.

landowner, who owns at least two properties, carries three times the debt load of the typical resident owner, and owners of large properties carry one and a half times the debt of owners of small properties. Mortgages are ranked as the primary source of debt, so these findings are certainly believable. The figures for agricultural income and total debt load are expected to be more accurate than exogenous income level, because the questions were asked in an open-ended fashion, and no data transformations were needed.

IV.5.2 Ownership Characteristics

Slightly over three-quarters of the landowners bought their land and one quarter inherited it. More absentee owners inherited their land than any other group and owners of small tracts were the least likely to inherit. The average price paid per acre by those landowners who bought their land is $1,297.16. The average price landowners are willing to accept per acre of land to sell it now is much higher ($5,704.93). The largest gap between buying price and selling price occurs for absentee owners, and the smallest is for the owners of smaller tracts. Perhaps many of the absentee landowners bought their properties as investments, and so are maximizing rents. The larger properties are mostly on farms, while the smaller properties are closer to residential areas. There are more buyers and thus more demand for the smaller properties, which would explain a more dramatic increase in selling price.

The results show that 22% of the landowners in our sample are absentee (i.e., their residences are located at least 50 miles from their properties). Shaffer and Meade (1997) and Birch (1995) estimated that 16% and 14% of Virginia's landowners could be considered absentee, respectively. Hodge (1991) approximated a much larger percentage (32%). The definition of "absentee" is consistent with these other studies.[5] While 78% of the landowners are considered resident landowners, only 65% actually reside on the property in question.

IV.5.3 Forest Characteristics

Average tract size of this sample is 185.32 acres, of which 125.04 acres are forested and 49.7 acres are reserved for agricultural use. Absentee owners are 13% more likely to hold large tracts (i.e., > 15 acres) than are resident owners.

We were unable to obtain much detailed information about timber stock, but we did determine the average size class of the pine tree, hardwoods, and mixed pine/hardwoods contained on each of the properties. More hardwoods are in the sawtimber class than mixed pine/hardwoods, and more mixed pine/hardwoods are in the sawtimber class than pines, as would be expected. Approximately 10% of the landowners have conservation easements to protect the trees on their land. Resident landowners are more likely to have conservation easements than absentee landowners, while tract size does not seem to influence the decision.

Most landowners have streams on their properties (87%), and the average slope of the land is 10-20%. The mean length of private roads is 1.86 miles, indicating a high degree of accessibility to timber. Absentee landowners have twice as many total miles of roads as resident landowners.

IV.5.4 Landowner Preferences

The majority of the landowners intend to bequeath timber and/or land to their heirs (53%). We obtain similar numbers for each ownership category. However, owners of small tracts are the most likely to bequeath, despite the fact that they are the least likely to have inherited their land. At least 79% of the landowners sampled place value on forest amenities, a necessary condition for nonseparability between timber harvesting and debt/savings/bequests decisions. Resident landowners appear to place more value on amenities than absentee owners, and owners of small tracts appear to value amenities more than owners of large tracts.[6]

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[5] For discussion concerning why the definition of "absentee" that is used in this study is thought to be superior to other definitions, see Shaffer and Meade (1997).

[6] Number of days spent in recreational activities is used as a proxy for amenity values. However, absentee landowners do not have the access to their land that resident landowners have, and so it makes sense that they spend fewer days recreating on their land. This does not mean that they value their amenities any less.

Approximately 62% of the landowners have harvested their timber in the past 20 years. This number is comparable to Hodge (1991) where 56% of the landowners had harvested. Absentee and resident landowners appear to harvest at similar rates, although we will examine their harvesting decision more formally later. The largest difference is between owners of large and small tracts; harvest probabilities equal 34% for owners of the smaller tracts and 67% for owners of the larger tracts. This may be an indication that fragmentation indeed affects future timber available for commercial harvesting.

Only 20% of those landowners who harvested also reforested. This finding is consistent with VDOF statements that reforestation efforts have been declining since 1992 (Liu and Scrivani 1997). This might be attributed to lack of information about reforestation and landowner assistance programs and/or budget constraints. The absentee landowners who have harvested timber are almost twice as likely to reforest than resident landowners. Likelihood of reforestation also increases with tract size. Finally, 11% of those sampled are concerned about losing timber to wind storms, ice damage, fire, or disease. Absentee landowners perceive the most risk while owners of small tracts perceive the least.

Each day spent is not valued homogeneously across respondents (i.e. marginal utilities could be high when number of days is low). Furthermore, some landowners may hold intrinsic values for standing timber, which are not considered in this study. Therefore, inter-group comparisons should be viewed with caution.

Table 2
Descriptive Statistics for the Total Sample and by Landowner Group

		Mean				
Variable	**Units**	**Total**	**Absentee**	**Resident**	**Large**	**Small**
Acresmid	acres	46.31	59.4783	42.76	49.81	6.08
Absentee	0/1	0.22	1	0	0.24	0.11
Acres	acres	185.32	210.24	178.66	211.89	9.36
Age	years	59.7	57.37	60.34	60.31	55.96
Aginc	dollars	8844.52	5300.3	9786.66	9639.87	3614.5
Agland	acres	49.7	44.87	50.98	51.4	2.74
All	0/1	0.67	0.72	0.65	0.65	0.74
Amenity	0/1	0.79	0.71	0.81	0.78	0.82
Amtowed	dollars	103254.14	219315.11	72326.72	109010.23	64375.28
Bequest	0/1	0.53	0.54	0.53	0.53	0.58
Bought	0/1	0.76	0.7	0.77	0.73	0.9
Dayshnt	days	6.96	4.6	7.6	7.5	3.45
Educ	level	some college	some college	some college	some college	some college
Employed	0/1	0.53	0.57	0.52	0.51	0.65
Forland	acres	125.04	135.94	122.14	127.15	4.8
Harv	0/1	0.62	0.6	0.63	0.67	0.34
Havece	0/1	0.1	0.07	0.11	0.1	0.09
Hidebt	0/1	0.19	0.22	0.18	0.19	0.18
Hsehold	# people	2.61	2.34	2.69	2.63	2.51
Hsized	0/1	0.45	0.41	0.46	0.44	0.48
Incmid	dollars	91142.19	108510.64	86268.66	92904.11	81093.75
Inherit	0/1	0.25	0.3	0.23	0.27	0.15
Large	0/1	0.87	0.94	0.85	1	0
Liveprop	0/1	0.62	0	0.65	0.63	0.58
Married	0/1	0.8	0.79	0.8	0.79	0.85
Miles	miles	82.97	362.51	4.76	84.67	72.7
Msized	0/1	0.27	0.31	0.26	0.27	0.23
Noncons	days	205.16	76.28	239.89	207.43	190.34
Paylanda	dollars/acre	1297.16	1121.36	1337.22	1119.81	2093.61
Pricea	dollars	1025.54	799.47	1083.78	898.19	1771.43
Psized	0/1	0.13	0.1	0.14	0.13	0.11
Reforest	0/1	0.2	0.31	0.17	0.2	0.21
Risk	0/1	0.11	0.15	0.1	0.12	0.07
Roads	miles	1.86	3.13	1.52	1.97	1.1
Selland	dollars	5704.93	6650	5446.86	5903.16	4302.85
Slope	1,2,3	1.81	1.65	1.85	1.81	1.8
Streams	0/1	0.87	0.92	0.86	0.88	0.84

V. Estimation Results

Table 3 presents results for estimating the equations established by the first order conditions of the theoretical model.[7] The harvesting and bequest equations represent 2SLS logit models (e.g., see Smith and Blundell 1986 for details of this procedure).[8] The reforestation equation represents an ordinary logit model. The harvesting equation is specified linearly, while the bequest equation is in log form.[9] Each of these regressions is estimated by maximum likelihood, and the dependent variables are dichotomous, taking on a value of 1 if the landowner has harvested/reforested or intends to leave all of the land/timber to their heirs, and zero otherwise. The level of debt equation is an OLS regression with a continuous dependent variable. Since cross-sectional data are used, all regressions are corrected for heteroskedasticity using White's procedure (Greene 1997).

V.1 Harvesting

The harvesting logit contains 216 observations once the missing data are rejected. The value of the chi-squared statistic is 43.95, indicating that the regression is highly significant. The regression produces good results with four variables, aside from the constant term, significant at the 15% level: stumpage prices, tract size, risk perception, and time spent hunting. Price is positive and significant at the 5% level.[10] This result supports the view that people are most motivated by stumpage prices in their decision to harvest. In similar regressions, Kuuluvainen (1996) and Dennis (1989) found price to be positive but insignificant at the 10% level and 20% level, respectively.[11] The landowner's perception of risk involved with growing trees is also positive and significant at the 5% level. Since 1992, southern pine bark beetle and ice storms have substantially reduced

[7] For estimation output, including performance measures for each of the logit models presented in Table 3, see Appendix B.
[8] In the harvesting logit, actual timber returns are used for those landowners who harvested, and predicted prices are used for the non-harvesters. This is valid because the landowners are price-takers.
[9] Log and linear specifications were tested for each equation. Since these specifications are both consistent with classes of utility functions (see Chung 1994), this is a valid procedure. Logarithmic variables for Phat, Debthat, and the income variable (Incmid) are represented by Lphat, Ldebthat, and Lincmid, respectively.
[10] Actual returns from timber harvesting (per acre) are used for landowners who have harvested, while predicted prices, obtained in the first stage of 2sls estimation, are used for those who have not harvested.

the growing stock of Virginia's forests (VDOF 1997). The perception that there is risk involved with timber production, manifesting itself in trees lost to disease, ice/wind damage, or fire, would most likely cause a landowner to harvest.[12] Tract size is positive and significant at the 10% level. On large tracts, non/consumptive recreational activities and timber production can jointly occur. Also, the larger land parcels may contain more timber available for commercial harvesting, and the owners of these properties are probably more knowledgeable of harvesting. Days spent hunting (a consumptive nontimber activity) is positive and significant at the 15% level. This is consistent with the finding of the theoretical model presented in Section II, such that harvesting depends on preferences for non-market goods. Hunting is a consumptive use of forestland and so is harvesting timber. Further, clearing trees and engaging in early successional forestry is sometimes conducive to better hunting for some species.

Several variables carry the expected signs but are not significantly different from zero at the 15% level. These variables include income, debt level, a dummy variable for whether or not average size class of pine trees is sawtimber, slope, and decision to bequeath timber. Income has a negative sign. One explanation is that the marginal utility of income from timber harvesting is lower for landowners with higher exogenous income (Dennis 1989). These owners might also place a higher value on amenities, which would result in less harvesting. This is because timber income is traded off with nontimber benefits, as equation (8) of the theoretical model suggests. These results are consistent with the findings of Dennis (1989) and Binkley (1981), however income was significant in their studies. Likewise, Alig et al. (1990) cite income as a leading influence of harvesting found by researchers.

Although its sign makes sense, the variable for level of debt is not significant. Recall equation (10), which implies that, as landowners become more credit-constrained, they may be prone to cut trees from their land to pay off debts. The dummy variable for

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[11] Kuuluvainen (1996) and Dennis (1989) used regional price data as a proxy for actual returns from timber harvesting, while our study uses actual returns.

[12] Equation (10) of the theoretical model presented in Section II suggests that risk perception decreases investment in timber production. However, it is shown to increase the likelihood of harvesting existing timber.

sawtimber-size pine trees (psized) is positive, implying that the landowner is more likely to harvest if mature pine trees are present on his/her property. Number of days spent in nonconsumptive recreational activities like camping, hiking, and wildlife observation is shown to have a slightly negative effect on harvesting trees. Clearing trees can destroy wildlife habitat and scenic beauty which are necessary for these activities; when amenity values are entered into the Faustmann formula, the harvest rotation has been shown to lengthen or not occur at all (Hartman 1976).

Finally, two variables, the dummy variable for whether or not the average size class of hardwoods is sawtimber (hsized) and length of private roads, hold unexpected signs but are not significantly different from zero. Hsized is negative, indicating that those landowners with mature hardwoods may have objectives unrelated to timber production. Conceivably, these landowners hold primarily recreational and/or aesthetic interests in their land. Road length is also negative, implying that the TJPD has an adequate road system that allows for accessibility to most forestland. It would seem that private roads are therefore not always necessary for timber harvesting, in this area.

V.2 Reforestation

The reforestation logit is applied to 104 observations after the missing data are removed. This number is smaller than that for the harvesting logit, because not all the respondents who harvested indicated whether or not they had subsequently reforested, and some respondents skipped this section of the survey entirely. As with the harvesting results, the chi-squared statistic is significant and holds a value of 16.84. In addition to the constant term, three variables are significant at the 15% level, including: debt load, slope, and likelihood of bequeathing timber to heirs in the future. Each of these variables exhibits the expected sign. Debt load is shown to have a strong negative effect on reforestation rates, simply implying that those landowners who are credit-constrained are less likely to spend money to reforest.[13] This observation reinforces the theoretical

[13] It should be noted here that reforestation is either undertaken by landowners on their own or with the help of loggers, in which case a lower price is offered for the timber. The latter situation occurs most often.

model's implication of nonseparability (although we will formally test this later). Slope is shown to negatively affect tree planting, reflecting the difficulties associated with moving equipment in steep areas. Lastly, those landowners who intend to bequeath timber to their heirs are shown to be more likely to reforest. This last finding suggests that the reforestation decision is influenced not only by financial considerations, but also the landowner's value attached to the amenities of the unharvested stock (this is again more evidence of nonseparable decisions).

All remaining variables carry the anticipated signs but are also insignificantly different from zero. For example, stumpage prices have a positive influence on reforestation rates. We expect this sign because higher future returns from reforestation should persuade some landowners to invest in reforestation. For example, Royer (1987) found pulpwood stumpage prices to positively affect reforestation rates with significance at the 10% level. Sawtimber prices, on the other hand, actually had a negative effect in his regression, but they were insignificant. Royer attributes his results to the placement of a high discount rate on timber returns by landowners.[14] Time spent hunting positively affects reforestation probabilities. Many of Virginia's game animals such as deer and birds inhabit areas that contain young trees. The planting of such trees could improve the value of the forest for hunting. Time spent in nonconsumptive activities holds an unexpected negative sign, but this variable is not significant at the 15% level.

Landowners who carry a lot of debt may be less inclined to accept the lower price and therefore opt against reforestation.

[14] Royer (1987) argued that reforestation behavior is influenced more by costs than by price. Although costs are not specifically entered into our models, debt load contributed more to reforestation probabilities than price. This indirectly implies the importance of costs to the decision.

V.3 Bequests

The 2SLS bequest logit is specified in logarithmic form and contains 237 observations after the missing data are rejected. The chi-squared statistic is highly significant, with a value of 182.35. Six variables in addition to the constant term are significant at the 15% level. These variables include stumpage prices, income, debt load, time spent in nonconsumptive activities, number of people in the household, and whether or not landowner lives on the property.[15] Stumpage price has a significantly negative effect, suggesting that as prices increase, landowners are more likely to take advantage of the higher prices and harvest their timber rather than bequeath it to their heirs. This makes sense in the U.S., since money and timber bequests are treated equivalently when taxed as inheritance. Income and tract size are both positive. Many of the more affluent landowners with larger tracts have inherited property from their ancestors. Bequeathing property to heirs could represent a family tradition that these landowner wish to continue. Debt load is also positive. This sign is believable because income and debt load are correlated, implying that those landowners with high incomes carry higher mortgages and other loans. These are the same landowners who were just shown to be more likely to bequeath property to heirs. Time spent in nonconsumptive activities is positive. Perhaps the more a landowner values the amenities of the forest, the more likely he/she wants to share them with heirs, as oppose to harvesting. Recall equation (4), which indicates that the landowner makes a trade-off between consumption and nontimber benefits. Household size is also positive, simply indicating that the landowners with children have somebody to pass their property on to, and so are more likely to bequeath property.

The additional variables in the regression: time spent hunting, tract size, harvest decision, age, and marital status, exhibit the predicted signs but do not significantly affect the bequest decision. For instance, the variable representing age is positive. The older portion of the sample probably has more heirs than the rest of the sample. In addition, most of these landowners have presumably written or at least considered their wills. Conversely, the younger landowners may be uncertain as to their future intentions for

[15] Stumpage prices and debt load represent predicted values obtained in the first stage of 2sls estimation.

their land and timber. Marital status is also an indication of the number of heirs, which could explain its positive influence on bequests.

V.4 Debt Level

The OLS regression for debt level contains 374 observations after the removal of missing information. The F-statistic is significant and holds a value of 2.32. The regression works well with 5 significant variables including the constant term. These variables include income, the dummy variable for sawtimber-size mixed pine/hardwoods, slope, age of landowner, and employment status. As expected, debt load is higher as income increases. The more affluent landowners have more money to invest and are able to capture higher credit. This conclusion coincides with the well-known "permanent income hypothesis" from economic theory and equation (6) of our theoretical model, which suggest net savings remains constant across income levels. The dummy variable for sawtimber-size mixed pine/hardwoods is positively correlated with debt level. Perhaps landowners who have mature timber are more apt to carry high levels of debt because they hold expectations of a future wealth effect from timber harvesting. Conversely, slope negatively influences debt load. Perhaps the owners of severely sloping land are not expecting much future timber income, and so they may be less likely to increase their debt or borrow against the value of their property. These people may be holding land more for amenity values. Conceivably, there is a trade-off between amenity values and income from timber production that influences the degree of financial constraints. Lastly, holding a job negatively affects debt load. This is expected; the landowners with jobs are less financially constrained because of their earnings, or they are more able to pay off existing debts. All other variables in this regression display likely signs but are not significantly different from zero.

Table 3
Estimation Results for the Harvesting, Reforestation, Bequest, and Debt Level Equations. The bequest equation is in logarithmic form.

Explanatory Variables	Harvesting (N=216)	Reforestation (N=104)	Bequests (N=237)	Debt Level (N=374)
Constant	0.85*	-0.88653	3.63*	7.26E+05***
	(0.58)	(1.01)	(2.34)	(2.14E+05)
Pricea	6.56E-04***	1.46E-05		
	(2.05E-04)	(2.97E-05)		
Lphat			-0.91***	
			(0.42)	
Incmid	-1.12E-06	2.72E-06		0.76**
	(2.23E-06)	(3.79E-06)		(0.41)
Lincmid			0.15*	
			(0.10)	
Amtowed	3.08E-07	-1.43E-05**		
	(6.02E-07)	(7.78E-06)		
Ldebthat			0.91***	
			(0.42)	
Psized	0.73			-77485.00
	(0.52)			(96369.00)
Hsized	-0.25			-55487.00
	(0.33)			(62398.00)
Msized				1.56E+05***
				(70150.00)
Dayshnt	1.42E-02*	1.36E-02	4.83E-03	-605.65
	(9.01E-03)	(1.32E-02)	(1.29E-02)	(1181.10)
Noncons	-4.48E-04	-8.05E-04	1.64E-03***	-9.82
	(4.49E-04)	(1.09E-03)	(7.85E-04)	(83.57)
Acres	1.84E-03**	-1.70E-04	1.94E-04	
	(9.52E-04)	(1.25E-03)	(3.41E-04)	
Slope	-4.02E-02	-0.72*		-63431.00*
	(0.24)	(0.49)		(44155.00)
Roads	-1.47E-02	0.17		-1608.50
	(1.92E-02)	(0.12)		(2906.10)
All	-0.27	0.91*		
	(0.33)	(0.65)		
Risk	1.36***			
	(0.67)			
Harv			-0.42	
			(0.55)	
Age			2.15E-02	-8342.10***
			(1.86E-02)	(2660.20)
Married			2.74E-02	43098.00
			(0.56)	(78386.00)
Hsehold			0.45**	
			(0.26)	
Liveprop			-0.65**	
			(0.38)	
Employed				-1.97E+05***
				(74880.00)
Log-likelihood:	-122.76	-43.71	-71.32	-5477.43
Chi-squared statistic:	30.82	17.22	182.35	n/a
F-statistic:	n/a	n/a	n/a	2.32

Notes: Standard errors are in parentheses.
* significance at the 15% level, ** significance at the 10% level, *** significance at the 5% level

V.5 Hypothesis Testing

There are several interesting hypotheses to examine which concern differences in landowner behavior across ownership types. For example, we are interested in whether harvesting, reforestation, and/or bequest behavior differs between absentee and resident landowners, as well as between owners of large versus small tracts. Here, the null hypotheses are simply that the models do not change for each ownership group; that is, the parameter estimates of the restricted models remain statistically similar to those of the corresponding unrestricted model.[16] The results of such tests provide us with insight regarding the absenteeism and land parcelization issues discussed earlier.

Debt levels may also influence landowners' management behavior. According to the logit results presented earlier, the more credit-constrained the landowner is, the more likely he/she is to harvest and the least likely he/she is to reforest or bequeath property to heirs. By testing the equivalence of this model between landowners who carry a heavy debt load (i.e. > $150,000) and those who do not, we will attempt to further establish behavioral differences. Other groups to test between are owners that hold amenity values versus those who do not and those with versus without bequest motives.

Previous models have assumed separability between harvesting and reforestation and debt/savings/bequest decisions, in that harvesting and reforestation decisions have been examined without regard to debt and preferences. However, the theoretical model described in Section II implies nonseparability between these decisions. The fact that preference variables are significant in the harvesting and reforestation models of Table 3 also suggests nonseparability. The final hypothesis test permits us to formally examine whether separability is a valid assumption. Here, the null hypothesis is that landowners behave similarly with regards to harvesting and reforestation despite how high their debts are, whether or not they hold bequest values, or whether or not they value amenities from the forest stock.

V.6 Results of the Likelihood Ratio Tests

Results of the likelihood ratio tests are presented in Table 4. Highly significant differences in harvest probabilities are found between absentee and resident landowners, landowners with high and low debts, and owners of large and small tracts. The null hypotheses that the parameter estimates for the restricted and the unrestricted models are jointly equal must be rejected at the 0.01 level for these cases. Absenteeism, debt load, and land parcelization are each found to influence the decision to harvest, as a result. However, neither the presence nor absence of amenity/bequest values significantly contribute to the harvest decision. In these cases, the null hypotheses cannot be rejected.

Highly significant differences in reforestation rates are also found between absentee and resident landowners, and the null hypothesis that they behave similarly is rejected at the 0.01 level. However, neither tract size or debt load appear to affect reforestation rates; the null hypothesis cannot be rejected. Neither amenity values nor bequest values prove to influence harvesting rates, and we suspect that this is true for reforestation rates. Therefore, we do not test for differences between these groups.

Next, important differences in the decision to bequeath property to heirs are found between absentee and resident landowners. The null hypothesis that their bequest motives are similar is rejected at the 10% level. These results coincide with the conclusion of the bequest logit that those landowners who reside off the property are more likely to bequeath their property than are resident owners. Debt load does not seem to influence bequests significantly for this sample; we cannot reject the null hypothesis. These are the only tests that are performed concerning the decision to bequest.

All hypotheses were rejected for the debt level equation at the 0.01 level. Therefore, in this sample, absentee and resident landowners, landowners with and without amenity/bequest values in addition to owners of large and small tracts carry significantly debt loads.

When debt level and other preference variables are dropped from the harvest logit and a likelihood ratio (LR) test is performed to test for parameter stability, we reject the

[16] Greene (1997) discusses the likelihood ratio test in detail. The test is performed by splitting the data

null hypothesis that harvesting rates are not affected by these preference variables. The results affirm the theoretical model's conclusion of nonseparability, implying that all decisions must be estimated simultaneously (see Appendix B for estimation output).

Table 4
Values of Likelihood Ratio Test Statistics for the Harvesting, Reforestation, Bequest, and Debt Level Decisions

	Harvesting (d.f. = 12)	Reforestation (d.f. = 9)	Bequests (d.f. = 11)	Debt Level (d.f. = 11)
Absentee/Resident Landowners	53.32* (0.01)	27.05* (0.01)	18.13** (0.10)	863.51* (0.01)
Amenity/No Amenity Values	10.08 (0.70)	n/a	n/a	181.57* (0.01)
Bequest/No Bequest Values	9.30 (0.70)	n/a	n/a	2601* (0.01)
High/Low Debt	38.49* (0.01)	n/a	9.14 (0.70)	n/a
Large/Small Tracts	31.62* (0.01)	5.25 (0.90)	n/a	707.73* (0.01)

Notes: Significance levels are in parentheses.
* rejection of null hypothesis at the 1% level, ** rejection of null hypothesis at the 10% level

V.7 Marginal Effects

For the logit models, another way to investigate whether nonindustrial landowners differ in behavior is by estimating and comparing marginal effects. Marginal effects are defined as the change in probability of the decision with respect to a unit change in an explanatory variable (Maddala 1986). The marginal effects of important variables for the harvesting, reforestation, and bequest decisions are presented in Tables 5a, 5b, and 5c, respectively.

The marginal effects are expected to be larger for the harvesting logit than for the other regressions because absenteeism and tract size are both significant in this regression, while neither of them is significant for the reforestation or bequest logits. For the harvest decision, the perception that there is risk involved with losing timber to wind/ice damage, fire, or disease seems to affect harvest probabilities very differently over the ownership types. For instance, resident landowners who perceive risk are more responsive to risk than absentee landowners, and are 2% more likely to harvest. Resident landowners tend to earn less income than absentee landowners (see Table 2), so it makes sense that they are more sensitive to risk. The owners of large properties, however, are

according to ownership type and running separate regressions to define restricted and unrestricted models.

more responsive to risk than owners of small tracts, being 17% more likely to harvest. These owners tend to earn higher incomes, which may imply that they are less sensitive to risk. However, debt represents a larger share of their income, which might make them more sensitive to risk (see Table 2). Recall that this is consistent with the likelihood ratio test results from Table 4, which show significant differences in harvest probabilities between landowners with high/low debt. Further, recall the harvest logit's finding of a positive sign for debt level, indicating that as debt increases, harvesting probabilities increase. The landowners who value forest amenities and bequests are also more responsive to risk than those who do not. This may be attributed to the fact that these landowners have more substitution possibilities. If they perceive timber investments to be risky, they may substitute toward nontimber amenities (Koskela 1989).

The dummy variable for sawtimber-size pine trees also influences harvesting rates very differently across the ownership types. For example, resident landowners are 26% more likely to harvest than absentee landowners, when their pine trees are mature. Perhaps resident landowners are more knowledgeable of the conditions of their forestland, so they can make more educated decisions concerning timber harvesting. Landowners who place value on the amenities on their land and have bequest motives are 3% and 4% more likely to harvest when their pine trees are mature, respectively. Since these people recreate on the land, they tend to see it on a regular basis. Therefore, these landowners may also be more in tune with their land and market, and harvest when the conditions are favorable. The owners of the larger tracts are also more responsive to the size class of their pine trees. The probability of harvesting is 9% higher for them. It can be argued that most of the large properties are more knowledgeable of harvesting. Owners with mature pine trees who carry little debt are also more likely to harvest timber than are owners of mature pines with a lot of debt. This result supports our view that landowners who carry heavy debt loads are willing to harvest sooner (i.e. before their trees have reached the sawtimber class), to pay off their debts.

The marginal effects for the harvest decision are fairly similar between ownership groups with respect to the remaining explanatory variables. However, we find some

notable differences for owners of large versus small properties when we look at sawtimber-size hardwoods (Hsized) and timber bequests (All). For example, owners of large tracts are 3% less likely to harvest hardwoods from their land when those hardwoods are in the sawtimber class than are owners of small tracts. Perhaps the most affluent landowners (i.e. those owning the largest tracts) place a higher value on amenities. Most of the hardwoods throughout the sample area are not valued highly for timber production, but may hold significant amenity values. The probability that an owner of a large tract will harvest decreases 5% for owners who value timber bequests. The decrease is only 1% for owners of small tracts. This is believable because the larger tracts contain more trees. A landowner may be less willing to harvest a 75-acre tract of mature hardwoods that is reserved for their heirs than a landowner with a comparable 10-acre tract, because the larger tract holds a higher non-market value. Harvesting of the 10-acre tract would not affect the landowner's marginal utility as much.

Recall that the reforestation logit does not work as well as the other regressions because of a reduced sample size. This explains why the estimated marginal effects are very small. Nevertheless, there are some noteworthy differences for both bequest intentions and the slope. For example, resident landowners with bequest values are 9% more likely to reforest than are absentee landowners. Since landowners who have bequest values care about the welfare of future generations, planting trees is a way to pass a larger stock of timber off to future heirs. Although slope does not lead to significant differences in harvesting rates between absentee and resident landowners or between owners of large/small tracts, it does affect reforestation probabilities between these ownership types. Slope negatively influences reforestation rates more for resident than for absentee landowners, whereas, it has a larger impact for owners of small tracts than for owners of large tracts.

Finally, many of the marginal effects of important variables in the bequest decision are fairly large, but no significant differences are apparent. This is evidence that bequest values are not significantly different across ownership types and debt loads, but

they are very responsive to the explanatory variables. For example, debt and household size have very significant effects on the bequest decision.

Table 5a
Marginal Effects of Important Variables in the Harvesting Decision

	Absentee	Resident	Amenity Values	No Amenity Values	Bequest Values	No Bequest Values	Large	Small	High Debt	Low Debt
Constant	0.1570	0.1664	0.1807	0.1444	0.1866	0.1461	0.1652	0.0542	0.1448	0.1949
Pricea	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0	0.0001	0.0002
Incmid	0	0	0	0	0	0	0	0	0	0
Amtowed	0	0	0	0	0	0	0	0	0	0
Psized	0.1315	0.3930	0.1549	0.1238	0.1609	0.126	0.1416	0.0465	0.1241	0.1671
Hsized	-0.0408	-0.0432	-0.053	-0.0423	-0.0628	-0.0492	-0.0484	-0.0159	-0.0424	-0.0571
Dayshnt	0.0027	0.0028	0.003	0.0024	0.0026	0.002	0.0028	0.0009	0.0024	0.0033
Noncons	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	0	-0.0001	-0.0001
Acres	0.0003	0.0003	0.0004	0.0003	0.0004	0.0003	0.0004	0.0001	0.0003	0.0004
Slope	-0.0139	-0.0147	-0.0086	-0.0068	-0.0008	-0.0006	-0.0078	-0.0026	-0.0069	-0.0092
Roads	-0.0026	-0.0027	-0.0031	-0.0025	-0.0032	-0.0025	-0.0029	-0.0009	-0.0025	-0.0034
All	-0.0530	-0.0566	-0.0573	-0.0458	-0.047	-0.0368	-0.0524	-0.0172	-0.0459	-0.0618
Risk	0.3168	0.3357	0.2887	0.2306	0.2822	0.2209	0.2639	0.0866	0.2313	0.3113

Table 5b
Marginal Effects of Important Variables in the Reforestation Decision

	Absentee	Resident	Large	Small
Constant	-0.0005	-0.1141	-0.033	-0.1207
Pricea	0	0	0	0
Incmid	0	0	0	0
Amtowed	0	0	0	0
Dayshnt	0	0.0016	0.0005	0.0019
Noncons	0	-0.0001	0	-0.0001
Acres	0	0	0	0
Slope	-0.0003	-0.0715	-0.0269	-0.0984
Roads	0.0001	0.0180	0.0062	0.0228
All	0.0004	0.0929	0.0340	0.1246

Table 5c
Marginal Effects of Important Variables in the Bequest Decision

	Absentee	Resident	High Debt	Low Debt
Constant	-0.8896	-0.8438	-0.88	-0.9063
Lphat	-0.2242	-0.2126	-0.2201	-0.2267
Lincmid	-0.0369	-0.035	-0.0358	-0.0369
Ldebthat	0.2245	0.213	0.2204	0.227
Dayshnt	0.0012	0.0011	0.0012	0.0012
Noncons	0.0004	0.0004	0.0004	0.0004
Acres	0	0	0	0
Harv	-0.1049	-0.0995	-0.102	-0.105
Age	0.0053	0.005	0.0052	0.0054
Married	0.007	0.0067	0.0067	0.0069
Hsehold	0.1115	0.1058	0.1092	0.1125
Liveprop	-0.1581	-0.1499	-0.1578	-0.1626

VI. Revisiting Land Fragmentation and Absenteeism

VI.1 Addition of Dummy Variables for Land Fragmentation and Absenteeism

While the marginal effects and hypothesis tests between landowners and land characteristics established differences, introducing dummy variables into the regressions will allow us to determine directions for shifts in the estimated equations due to tract size changes or absenteeism. We will also be able to determine the relative significance of tract size and absenteeism to the landowner's decisions.

Estimation results for these dummy regressions are found in Table 6. When the harvesting logit includes a dummy variable for absenteeism, the variable proves to be negative and significant at the 5% level, indicating that absentee landowners harvest significantly less than resident landowners. Absentee owners may have less information regarding harvesting than resident landowners, and the hypothesis tests have shown they have dissimilar preferences. This group of landowners may view their land more as a place to visit and enjoy than as an opportunity for timber revenues. This finding supports the view that increases in absenteeism will reduce the total amount of timber available for commercial harvesting (see explanation of equation (10)).

When a dummy variable for large versus small tract size is added to the original harvesting logit, we find the variable to be positive and significant at the 5% level. In this sample, owners of the larger tracts are more likely to harvest than the others. The larger tracts generally have more timber available for commercial harvesting, which leads to higher marginal returns. In addition, the owners may be more knowledgeable of timber harvesting. This supports the view that land parcelization has an adverse effect on timber availability. A dummy variable that differentiates between owners with high debt and owners with low debt is then added to the original harvest regression. Although the likelihood ratio test establishes highly significant differences in harvest rates for owners with high debt and owners with low debt, the dummy variable does not appear to be significant in this regression, even at the 15% level.

The likelihood ratio test results presented earlier indicate significant differences between the reforestation probabilities of absentee and resident landowners, while no

significant differences are found between owners of large tracts and owners of the smaller tracts. Nonetheless, we add dummy variables for each of these ownership types to further analyze their individual effects on reforestation and hence long-run timber availability. Surprisingly, neither absenteeism nor tract size seems to affect reforestation very significantly when they are added individually to the regressions. Both coefficients are positive, implying once again that absentee landowners are more likely to reforest than resident landowners, and owners of large tracts are more apt to reforest than are owners of small tracts. However both variables are not statistically significant.

VI.2 Marginal Effects of Tract Size and Absenteeism for the Harvesting and Reforestation Decisions

The marginal effects confirm the estimation results of the dummy regressions above. Table 7 presents marginal effects for the harvesting equation. Tract size positively influences harvesting rates. In other words, land parcelization is shown to reduce harvesting rates, as has been conjectured. Absentee and resident landowners seem to respond similarly to tract size in their decision to harvest. Absenteeism is shown once again to decrease the likelihood that a landowner will harvest. Owners of large tracts who live more than 50 miles away from their forestland are 15% less likely to harvest than absentee owners of small tracts.

Table 8 shows marginal effects for the reforestation equation. Tract size is shown to positively affect reforestation, but not significantly. Resident landowners tend to respond more to tract size than absentee landowners, possibly because of a better knowledge of timber production. Absenteeism also has a positive but insignificant influence on reforestation rates, even though the sign is negative for harvesting. This is yet another indication that many absentee landowners hold land for amenities. Absentee owners of small tracts are 7% more likely to reforest than are absentee owners of large tracts.

Table 6
Harvesting, Reforestation, and Bequest Decisions
When Dummy Variables are Added for Absenteeism and Land Fragmentation

	Harvesting		Reforestation		Bequest	
Explanatory Variables	**Version 1 (N=211)**	**Version 2 (N=216)**	**Version 1 (N=103)**	**Version 2 (N=104)**	**Version 1 (N = 229)**	**Version 2 (N = 234)**
Constant	0.98**	-6.51E-02	-1.2668	-1.35	-3.29	-2.86
	(0.63)	(0.74)	(1.07)	(1.57)	(2.38)	(2.42)
Pricea	7.15E-04***	7.12E-04***	1.76E-05	1.82E-05		
	(2.11E-04)	(2.15E-04)	(2.98E-05)	(3.18E-05)		
Lphat					-0.76**	-0.76**
					(0.43)	(0.43)
Incmid	-4.39E-07	-1.05E-06	2.58E-06	2.73E-06		
	(2.33E-06)	(2.25E-06)	(3.86E-06)	(3.79E-06)		
Lincmid					-0.14	-0.14
					(0.11)	(0.11)
Amtowed	4.16E-07	2.40E-07	-1.43E-05**	-1.44E-05**		
	(7.09E-07)	(5.02E-07)	(8.06E-06)	(7.83E-06)		
Ldebthat					0.76**	0.76**
					(0.43)	(0.43)
Psized	0.76*	0.70				
	(0.52)	(0.52)				
Hsized	-0.30	-0.19				
	(0.34)	(0.33)				
Msized						
Dayshnt	1.58E-02**	1.42E-02*	1.73E-02	1.36E-02		
	(9.43E-03)	(9.27E-03)	(1.33E-02)	(1.32E-02)		
Noncons	-6.83E-04	-4.35E-04	-4.32E-04	-8.42E-04	1.97E-03***	2.08E-03***
	(4.51E-04)	(4.43E-04)	(9.67E-04)	(1.11E-03)	(8.58E-04)	(8.74E-04)
Acres	1.97E-03***	1.36E-03*	-1.57E-04	-2.42E-04	1.87E-04	2.56E-04
	(9.69E-04)	(9.41E-04)	(1.29E-03)	(1.27E-03)	(3.60E-04)	(3.47E-04)
Slope	-3.39E-02	-3.54E-02	-0.58	-0.71*		
	(0.25)	(0.24)	(0.51)	(0.50)		
Roads	-9.99E-03	-1.63E-02	0.16	0.16		
	(2.07E-02)	(1.95E-02)	(0.13)	(0.12)		
All	-0.22	-0.21	0.65	0.93		
	(0.33)	(0.33)	(0.67)	(0.65)		
Risk	1.89***	1.40***				
	(0.80)	(0.68)				
Harv					-0.52	-0.39
Hsehold					0.52**	0.52**
					(0.27)	(0.28)
Age					2.95E-02*	3.28E-02*
					(1.95E-02)	(1.98E-02)
Liveprop					-0.99*	-1.16***
					(0.63)	(0.52)
Married					-0.10	-2.56E-02
					(0.57)	(0.57)
Employed						
Inherit					1.60E-02	0.11
					(0.53)	(0.54)
Absentee	-1.02***		0.90		0.19	
	(0.41)		(0.67)		(0.84)	
Large		1.04***		0.48		-0.78
		(0.52)		(1.23)		(0.78)
Log-likelihood	-116.05	-120.71	-41.82	-43.62	-69.76	-69.49
Chi-squared Statistic:	38.75	34.92	17.75	17.39	173.72	181.56
F-Statistic:	n/a	n/a	n/a	n/a	n/a	n/a

Notes: Standard errors are in parentheses.
* significance at the 15% level, ** significance at the 10% level, *** significance at the 5% level

Table 7
Marginal Effects of Tract Size and Absenteeism for the Harvesting Decision

	Absentee	Resident	Large	Small	Total
Tract Size	0.1812	0.1822	n/a	n/a	0.182
Absenteeism	n/a	n/a	-0.195	-0.0444	-0.1751

Table 8
Marginal Effects of Tract Size and Absenteeism for the Reforestation Decision

	Absentee	Resident	Large	Small	Total
Tract Size	0.0002	0.0533	n/a	n/a	0.0193
Absenteeism	n/a	n/a	0.0316	0.1029	0.0345

VII. Long Run Considerations and Land Prices

By stratifying the sample and performing hypothesis tests, calculating marginal effects, and testing for the significance of important dummy variables in the regressions, we were able to uncover differences in landowner behavior across various ownership types. However, the model presented earlier represented a short run perspective, because land was assumed fixed. Landowner differences could also affect Virginia's forest sector in the long run, in view of changing ownership patterns and land use decisions. By observing how characteristics of the forest and preferences of the landowner affect land prices, we can investigate how changing landowner characteristics and populations are likely to affect land prices. Although fragmentation is expected to increase timber prices by reducing available timber, the impact on land prices also depends on the extent land and landowner characteristics are "capitalized" into land prices. We investigate this capitalization effect in this section.

Table 9 presents estimation results for the land price equations. These specifications follow the hedonic price literature (Hanley et al. 1997) which assumes prices are functions of the characteristics of goods. Thus, a landowner's marginal willingness to pay for a characteristic can be recovered from the total price. If the marginal willingness to pay for a characteristic is significant, we say that characteristic is capitalized into price.

In Version 1, the dependent variable represents per acre reservation price (i.e. selling price) for the land. [17] The regression works well, with six variables significant at the 15% level. They include the log of the predicted variable for debt level (Ldebthat), the log of income (Lincmid), the dummy variable for presence/absence of streams, length of private roads, average slope, and the variable indicating how the property was acquired (Bought). Debt and income are both positive and significant at the 10% level. Recall that in this sample, those landowners with the most debt also earn the most income, on average. The landowners with higher incomes probably own more valuable land. It also makes sense that landowners with heavy debt loads require a higher price for their land, because they are likely to be concerned with paying off debts. The dummy variable for streams has a highly significant negative effect on land prices. Perhaps portions of those properties with streams are frequently flooded, which could explain the negative effect on price. Length of private roads, on the other hand, is positive, indicating that greater accessibility (i.e., to timber) improves the value the landowner places on land. Slope is also positive. Again, the Thomas Jefferson Planning District (TJPD) is located in the Northern Piedmont region of Virginia, where severe slopes are not prevalent. Although slope is shown to negatively influence harvest rates (see Table 8), rolling hills are aesthetically pleasing to some, and are favorable for many recreational activities. This is yet another indication that landowners hold land for amenity values. Finally, the dummy variable, representing whether or not the landowner bought the land, is positive and significant at the 5% level. This finding is believable because each of these landowners has invested money in the land, and most have invested time.

Several variables are not significant, but hold the anticipated signs. They include time spent in non/consumptive uses of the land, the dummy variable representing presence/absence of a conservation easement, acreage of forest land, agricultural income, and the dummy variable for sawtimber-size mixed pine/hardwoods. For example, time spent in recreational activities on the land (as a proxy for amenity values) is shown to

[17] The reservation price was collected by asking landowners what price they would be willing to accept to sell their land. The question was open-ended. Note also that when a constant term is used in the

positively affect land price, while the presence of a conservation easement on the property and agricultural income both exhibit negative signs. Conservation easements restrict property rights, leading to devaluation of the land. Further, farmland is generally valued less in the market than residential property.[18]

Finally, the quantity of forestland appears to be capitalized in land price more than the quality of the timber stock. Acreage of forestland, and sawtimber-size mixed pine/hardwoods carry the expected positive signs, while the higher quality sawtimber-size pine and hardwoods actually affect price negatively in this sample. However, none of these variables is significantly different from zero at the 15% level.

The dependent variable for Version 2 in Table 9 is the buying price per acre of land (price the landowner paid for the land), deflated by the average consumer price index over the 5-year period in which the land was bought. The regression contains four significant variables, aside from the constant term. They are: income, nonconsumptive use of the land, and the dummy variables for sawtimber-size pines and mixed pine/hardwoods. Income is positive, as it is for the reservation price regression, and is significant at the 5% level. This finding indicates that the more affluent landowners do tend to buy more valuable land. Time spent in nonconsumptive activities and the dummy variable for sawtimber-size mixed pine/hardwoods are also positive, but unlike the reservation price regression, they are significant at the 10% and 5% levels, respectively. The variable representing sawtimber-size pines is negative and very significant. This implies that the market does appear to capitalize amenity values into land prices.

Time spent hunting, road length, slope, sawtimber-size hardwoods, distance between the landowner's residence and forestland (Miles), age, marital status, and employment status each carry the expected sign, but none are statistically significant. The older portion of the sample and those holding jobs paid more for their land, as is expected, because they are probably less financially constrained. The landowners who

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regression, it is highly insignificant. When the constant term is dropped, the regression produces better results. Therefore, the model is specified without the constant.

[18] While agricultural income is negative, acreage of agricultural land actually holds an unexpected positive sign. However, both are statistically insignificant.

live far from their land generally paid more per acre of land (maybe because of information asymmetries), and the single/widowed portion of the sample also paid more.

Table 9
Estimation Results for the Hedonic Land Price Equations
Version 1: Dependent Variable = Reservation Price Per Acre of Land
Version 2: Dependent Variable = Buying Price Per Acre of Land (deflated by the consumer price index)

Explanatory Variables	Version 1 (N=318)	Version 2 (N=370)
Constant		-597.20***
		(186.28)
Ldebthat	1.60**	
	(0.95)	
Incmid		8.67E-04***
		(3.53E-04)
Lincmid	133.50**	
	(78.02)	
Noncons	0.26	0.11*
	(0.98)	(7.28E-02)
Dayshnt	0.23	1.00
	(2.44)	(1.02)
Streams	-1944.0***	
	(947.84)	
Roads	84.23***	0.96
	(37.37)	(2.52)
Slope	737.17**	29.66
	(399.92)	(38.48)
Bought	1291.3***	
	(657.63)	
Havece	-388.71	
	(846.55)	
Forland	0.94	
	(1.24)	
Agland	1.77	
	(3.54)	
Aginc	-1.16E-03	
	(1.40E-03)	
Psized	-1066.00	-178.64***
	(1076.1)	(84.92)
Hsized	-146.73	11.51
	(858.83)	(54.20)
Msized	1659.30	174.58***
	(1457.50)	(61.12)
Miles		6.45E-02
		(7.68E-02)
Age		0.79
		(2.32)
Married		-42.82
		(68.07)
Employed		42.48
		(65.33)
Log-likelihood:	-3293.25	-2809.29
Breusch-Pagan chi-squared	249.64	n/a
F-statistic:	n/a	1.75

Notes: Standard errors are in parentheses.
* significance at the 15% level, ** significance at the 10% level, *** significance at the 5% level

Hypothesis tests can also be performed to determine if there are differences in reservation price and/or buying price between absentee/resident landowners and between owners of large/small tracts. Table 10 shows results of these likelihood ratio tests. For Version 1, reservation prices are significantly different for absentee and resident landowners. The null hypothesis that owner valuation of land is not affected by absenteeism is rejected at the 0.01 level. However, there does not seem to be a significant difference between owners of large and small tracts. For Version 2, it is evident that absenteeism and tract size both influence the price a landowner paid for land.

Table 10
Values of Likelihood Ratio Test Statistics for the Hedonic Land Price Equations
Version 1: Dependent variable = Reservation Price Per Acre of Land
Version 2: Dependent Variable = Buying Price Per Acre of Land (deflated by the consumer price index)

	Version 1 (d.f. = 15)	Version 2 (d.f. = 12)
Absentee/Resident Land Owners	107.49* (0.01)	27.13* (0.01)
Large/Small Tracts	12.47 (0.50)	28.62* (0.01)

Notes: Significance levels are in parentheses.
* rejection of null hypothesis at the 1% level, ** rejection of null hypothesis at the 10% level

Dummy variables for absenteeism and land fragmentation are entered into the hedonic land price regressions to further establish differences. Table 11 presents estimation results for these equations. In Version I, a variable for absenteeism is added, and in Version II, a variable for tract size is added. For the reservation price regression, neither absenteeism nor land fragmentation are significant, even though absenteeism is shown to be significant in the likelihood ratio test results. However, both absenteeism and tract size are both significant at the 5% level for the buying price regression. These results are consistent with the results of the likelihood ratio tests.

To conclude, absenteeism and land fragmentation influence the price a landowner pays per acre of land, but they do not appear to influence reservation price. One possible explanation is that reservation price represents what the landowners capitalize into price,

while the price the landowner actually paid represents market price and thus indicates those characteristics capitalized by the market.

Table 11
Hedonic Land Price Equations When Dummy Variables are Added for Absenteeism and Fragmentation
Version 1: Dummy variable for absenteeism added
Version 2: Dummy variable for land fragmentation added

	Reservation Price		Buying Price	
Explanatory Variables	**Version 1 (N=310)**	**Version 2 (N=317)**	**Version 1 (N=370)**	**Version 2 (N=369)**
Constant			-539.85***	-406.43***
			(186.26)	(192.46)
Ldebthat	2.02**	1.67**		
	(1.12)	(0.95)		
Incmid			9.77E-04***	9.27E-04
			(3.53E-04)	(3.49E-04)
Lincmid	139.56**	125.14*		
	(76.49)	(86.77)		
Noncons	0.46	0.27	7.65E-02	0.11*
	(1.0)	(0.98)	(7.34E-02)	(7.22E-02)
Dayshnt	-0.20	0.14	0.96	1.29
	(2.61)	(2.41)	(1.02)	(1.01)
Streams	-2348***	-2067.40***		
	(1050.50)	(970.68)		
Roads	82.31***	81.92***	1.63	1.12
	(36.80)	(37.91)	(2.51)	(2.48)
Slope	667.36*	698.44**	29.29	23.95
	(424.68)	(414.31)	(38.19)	(38.00)
Bought	1325.7***	1285.70***		
	(680.99)	(663.57)		
Havece	-283.11	-384.08		
	(821.68)	(849.24)		
Forland	0.96	0.94		
	(1.17)	(1.24)		
Agland	2.20	1.63		
	(3.59)	(3.48)		
Aginc	-6.25E-04	-1.18E-03		
	(1.46E-03)	(1.39E-03)		
Psized	-1210.2	-1078.20	-174.97***	-181.38***
	(1122.20)	(1079)	(84.29)	(83.77)
Hsized	-54.89	-165.47	-2.61	8.27
	(832.09)	(852.85)	(54.08)	(53.57)
Msized	1702.10	1631.90	175.71***	181.60***
	(1421)	(1451.50)	(60.66)	(60.35)
Miles			0.15**	6.47E-02
			(8.36E-02)	(7.57E-02)
Age			0.45	1.66
			(2.30)	(2.30)
Married			-43.47	-59.84
			(67.56)	(67.34)
Employed			37.75	38.39
			(64.87)	(64.47)
Absentee	1406.40		-179.86***	
	(1512.50)		(71.01)	
Large		351.13		-257.67***
		(695.23)		(76.72)
Log-likelihood:	-3212.75	-3283.32	-2805.99	-2796.11
Breusch-Pagan chi-squared statistic:	362.05	249.66	n/a	n/a
F-Statistic:	n/a	n/a	2.13	2.52

Notes: Standard errors are in parentheses.
* significance at the 15% level, ** significance at the 10% level, *** significance at the 5% level

VIII. Conclusions

A theoretical model was developed which related harvesting, reforestation, bequest, and debt level decisions. The model was constructed assuming nonseparability between these decisions. Nonseparability implies that all decisions are simultaneously determined, and forest and landowner characteristics are important to consumption, amenities, and forest management decisions. This is a departure from previous NIPF literature, and we show in our empirical analysis that it is important in predicting landowner behavior with respect to forest management decisions. The empirical analysis relies on data from an NIPF landowner survey which was conducted in five counties located in the Northern Piedmont region of Virginia in Spring, 1998. These counties comprise an area where fragmentation and absenteeism are particularly acute problems.

Empirical models for nonindustrial landowners must consider both preferences and forest management decisions simultaneously. Previous work has not focused on debt/savings and bequest decisions, yet when nontimber benefits are important, which they appear to be (79% of the landowners sampled hold amenity values), these decisions impact timber harvesting and reforestation. For example, we have shown that landowners with high debt levels are less likely to reforest. We have also shown that those owners with bequest intentions are more likely to reforest. Further, it is evident that debt and preferences vary over the types of forest landowners. For example, absentee landowners (landowners who reside > 50 miles from their forestland) are likely to be wealthier and carry higher debt loads than resident owners. This is also true for owners of large tracts (> 15 acres), compared to owners of smaller tracts. Finally, owners of large tracts are more likely to perceive greater risk with investment in timber production, which increases harvesting of these tracts considerably.

Many of the current discussions of landowner characteristics are conjectures that have not been empirically tested. We have established differences between absentee and resident landowners. We find that absentee landowners are generally wealthier with higher indebtedness than resident owners. Absentee landowners are also less likely to harvest but are more likely to reforest. This is an indication that absentee landowners

hold land mainly for amenity values. We also find interesting differences with respect to attitude and response to the risk involved with timber production across ownership types. For instance, resident landowners are likely to perceive increased risk to forestry investments, and as a result, they are generally more willing to accept lower prices for timber. Perhaps this is a consequence of having less income compared to resident landowners. This distinction is important because we have shown that risk is an important predictor of harvest rates among landowners.

The results from this study also suggest that we cannot examine the importance of absenteeism and land fragmentation separately; they are related. Recall from above that absentee landowners are less likely to harvest but are more likely to reforest than absentee landowners. Also, the marginal effects have shown that owners of large tracts who are absentee are less likely to harvest and reforest than absentee owners of smaller tracts. These interactions could be important for long term timber availability, since the results indicate that fragmentation and absenteeism may not necessarily decrease the total stock of timber in the forest sector.

Bequests are also important to ensuring long term timber supplies. We show that price, debt, and nontimber preferences are the most important components of bequest behavior. However, absenteeism does not appear to be important, nor does tract size seem to play much of a role. Landowners in fragmented areas do not appear to be any more or less likely to bequeath timber and land to future generations than those in less fragmented areas. The same is true for absentee and resident landowners. Debt load is shown to positively influence bequests. This is probably because those landowners with heavy debt loads own the larger tracts. However, the high debt loads observed for absentee landowners may imply that bequests could be lower for those landowners seeking to reduce debt.

We also find that fragmentation and landowner characteristics can have unexpected effects on land prices. Although fragmented land is expected to increase timber prices through supply shifts, the changing ownership of this land and the preferences of these landowners are perhaps more important in the land market. The

results of this study establish that land characteristics and debt/income affect their reservation prices and to some extent the market price for land. However, forest quality is not generally capitalized into land prices. For instance, sawtimber-size pine trees are actually shown to reduce market price, while the presence of mature mixed pine/hardwoods which are not as suitable for timber production increase price. Thus, it is not the characteristics of timber stock that seem to drive land prices as ownership type changes, but rather land characteristics like streams, slope, and road length, and preferences of landowners. This is one more piece of evidence that fragmentation cannot be examined separately from shifting preferences of landowners.

Future research should include a more complete study of choices between nontimber activities. The bequest decision should also be analyzed in more detail, so that future timber availability and effects of land fragmentation can be better understood. Each of these objectives can be met by using multinomial models.

Researchers should also investigate the future harvesting and reforestation intentions of landowners, as well as their expectations of future land changes. In addition, a more complete understanding of reservation prices for timber and land is needed. Previous work has assumed that the landowner is a price taker. However, if timber harvesting is a process where landowners search over time for offers, then the price a landowner accepts will depend on preferences and debt characteristics.

The Virginia Department of Forestry (VDOF) anticipates that the state's timber supply will not be sustainable in the long-term future. The harvest probabilities identified in this study could be linked to the VDOF's geographic information systems (GIS) model and incorporated into inventory and spatial analyses to predict the direction timber supply will take as population densities increase and ownership trends change.

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Appendix A

Virginia Landowner Forestry Survey 1998
(Culpeper Example)

Virginia Landowner Forestry Survey 1998

Jointly conducted by:

The Department of Forestry
Virginia Tech
304 Cheatham Hall (0324)
Blacksburg, VA 24061

and

The Virginia Department of Forestry
Charlottesville, Virginia

Please circle the number of your answer, where applicable.

LAND OWNERSHIP

Please answer the following questions for your property specified in the cover letter **only**.

Q-1 When did you acquire your land in Culpeper County?
1. LESS THAN 5 YEARS AGO
2. BETWEEN 5 AND 10 YEARS AGO
3. BETWEEN 11 AND 20 YEARS AGO
4. BETWEEN 20 AND 35 YEARS AGO
5. MORE THAN 35 YEARS AGO

Q-2 How did you acquire the land?
1. I INHERITED IT
2. I BOUGHT IT
3. OTHER (PLEASE SPECIFY):

If you chose 1 for Q-2:
How long has the land been owned by your family?

If you chose 2 for Q-2:
How much did you pay for the land?

$ ---------- PER ACRE

OR $ ---------- TOTAL (# OF ACRES: ----------)

Q-3 If you were to consider selling your land, at what price would you consider selling it?

$ ---------- PER ACRE

Q-4 What are your intentions for your land in the future?
1. PASS ALL TO HEIRS
2. PASS PART TO HEIRS (IF SO, HOW MANY ACRES? ----------)
3. SELL THE LAND
4. DEVELOP INTO ANOTHER LAND USE
(PLEASE SPECIFY):

If you intend to pass land to heirs in the future:

How many heirs do you expect to have in each age category?
Note: The categories below refer to **current** ages.
(If none, write "0")

------ LESS THAN 5 YEARS OF AGE
------ BETWEEN 5 AND 15 YEARS OF AGE
------ BETWEEN 16 AND 25 YEARS OF AGE
------ BETWEEN 26 AND 35 YEARS OF AGE
------ MORE THAN 35 YEARS OF AGE

Q-5 Is the property currently held in a trust?
1. YES
2. NO

If yes to Q-5:
Who is completing this survey?
1. OWNER OF PROPERTY
2. TRUSTEE
3. LAWYER

Q-6 Which of the following are you familiar with? (Circle all applicable)
1. LAND USE TAXATION
2. AGRICULTURAL/FORESTAL DISTRICTS
3. CONSERVATION EASEMENTS

Q-7 Is this tract of land currently enrolled in the forestland use tax assessment?
1. YES
2. NO

Q-8 Is this tract of land currently in an agricultural/forestal district?
1. YES
2. NO

Q-9 Does this tract of land currently have a conservation easement?
1. YES
2. NO

Q-10 Do you own other forested tracts in Virginia?
1. YES
2. NO

If yes to Q-10:
What is the total acreage of all your forested tracts in Virginia?

---------- ACRES

Q-11 What is the total acreage of all forested tracts you own in the United States (include your land in Virginia)?

---------- ACRES

LAND CHARACTERISTICS

Please answer the following questions for your property specified in the cover letter **only.**

Q-12 What is your estimate of the average slope of your property?
1. 0-10%
2. 11-20%
3. 21-30%

Q-13 How many miles of dirt or paved roads would you estimate to be on your property?

---------- MILES

Q-14 Do you have any permanent structures (Example: house or other building(s)) on
your property?
1. YES
2. NO

Q-15 Approximately how many **acres** of land do you have in the following uses?

------ FORESTLAND
------ AGRICULTURE (PASTURE/GRAZING AND CROPLAND)
------ OPEN LAND FOR WILDLIFE HABITAT
------ BRUSH LAND
------ RESIDENCE
------ OTHER (PLEASE SPECIFY):

Q-16 Approximately how many **acres** of each forest class do you have on your property? (If none, write "0")

------ PINE
------ HARDWOOD
------ MIXED PINE/HARDWOOD

Q-17 What is the **average** size class of each tree species on your property? (Circle the number of all applicable):

Pine	Hardwood	Mixed Pine/Hardwood
1. Seedling/Sapling	1. Seedling/Sapling	1. Seedling/Sapling
2. Pulpwood/Pole	2. Pulpwood/Pole	2. Pulpwood/Pole
3. Sawtimber	3. Sawtimber	3. Sawtimber

Definitions:
Seedling/Sapling-- trees less than 5.0 inches in diameter at chest height

Pulpwood/Poletimber-- trees at least 5.0 inches in diameter at chest height but smaller than 9.0 inches in diameter at chest height

Sawtimber-- trees 9.0 inches in diameter at chest height and larger for pine and trees 11.0 inches in diameter at chest height and larger for hardwoods

Q-18 In the past 10 years, have you converted any portion(s) of your land to other uses?
1. YES
2. NO

If yes to Q-18:
Approximately how many **acres** did you convert in each of the following categories? (If none, write "0")

------ AGRICULTURE TO FORESTLAND
------ AGRICULTURE TO OPEN LAND FOR WILDLIFE
------ AGRICULTURE TO RESIDENTIAL/COMMERCIAL DEVELOPMENT
------ FORESTLAND TO AGRICULTURE
------ FORESTLAND TO OPEN LAND FOR WILDLIFE
------ FORESTLAND TO RESIDENTIAL/COMMERCIAL DEVELOPMENT
------ OPEN LAND FOR WILDLIFE TO FORESTLAND
------ OPEN LAND FOR WILDLIFE TO AGRICULTURE
------ OPEN LAND FOR WILDLIFE TO RESIDENTIAL/ COMMERCIAL DEVELOPMENT DEVELOPMENT
------ OTHER (PLEASE SPECIFY):

Q-19 Do you intend to convert any portion(s) of your land to other uses within the next 10 years?
1. YES
2. NO

If yes to Q-19:
What type of change do you expect to make?
1. AGRICULTURE TO FORESTLAND
2. AGRICULTURE TO OPEN LAND FOR WILDLIFE
3. AGRICULTURE TO RESIDENTIAL/COMMERCIAL DEVELOPMENT
4. FORESTLAND TO AGRICULTURE
5. FORESTLAND TO OPEN LAND FOR WILDLIFE
6. FORESTLAND TO RESIDENTIAL/COMMERCIAL DEVELOPMENT
7. OPEN LAND FOR WILDLIFE TO FORESTLAND
8. OPEN LAND FOR WILDLIFE TO AGRICULTURE
9. OPEN LAND FOR WILDLIFE TO RESIDENTIAL/COMMERCIAL DEVELOPMENT
10. OTHER (PLEASE SPECIFY): ----------

INCOME FROM YOUR LAND

Q-20 Approximately how much income did you earn from selling timber and/or firewood in 1997? (If none, write “0”)

TIMBER $ ----------
FIREWOOD $ ----------

Q-21 Approximately how much **total** agricultural income did you earn in 1997 and what was the primary source of that income? (If none, write “0”)

$ ---------- Primary source of agricultural income: ----------
(Examples: crop sales, leasing income, livestock sales, dairy product sales, agricultural subsidies)

Q-22 Did you earn any other income from your land in 1997?
1. YES
2. NO

If yes to Q-22:
Approximately how much **income** did you earn from each of the following in 1997? (If none, write "0")

$ -------- HUNTING LEASES (# OF LEASES SOLD: ----------)
$ -------- FISHING LEASES (# OF LEASES SOLD: ----------)
$ -------- CAMPING CHARGES
$ -------- OTHER (PLEASE SPECIFY): ----------

Q-23 Did you allow anybody to recreate on your land within the last year free of charge? (Examples: fishing, hunting, camping)

1. YES (# OF DAYS: ----------)
2. NO

PREFERENCES

Q-24 How would you rank the following reasons for your ownership of forestland? (1 is most important, 7 is least important)

------ ENVIRONMENTAL REASONS (EXAMPLES: PROTECTION OF HABITAT, WATER QUALITY, PROTECTION AGAINST SOIL EROSION)
------ ESTATE FOR FUTURE GENERATIONS
------ INCOME FROM TIMBER PRODUCTION
------ LAND INVESTMENT
------ REAL ESTATE DEVELOPMENT
------ RECREATION (EXAMPLES: HUNTING, FISHING, HIKING, WILDLIFE OBSERVATION)
------ RESIDENCE
------ SCENIC BEAUTY
------ OTHER (PLEASE SPECIFY): ----------

Please answer question 25 for your property specified in the cover letter **only**.

Q-25 Approximately how many **days** were you involved in each of the following activities within the past year? (If none, write "0")

-------- BIKING
-------- BIRD WATCHING
-------- CAMPING
-------- FISHING
-------- FLOWER/BERRY PICKING
-------- HORSES/PASTURING
-------- HUNTING
-------- PHOTOGRAPHY
-------- PICNICKING
-------- RUNNING
-------- WALKING/HIKING
-------- WILDLIFE OBSERVATION
-------- OTHER (PLEASE SPECIFY): ----------

Q-26 Are you currently able to meet every goal you have for your land?

1. YES
2. NO

If no to Q-26:

Why not?

1. NEED MORE INFORMATION
2. NEED MORE MONEY
3. NEED MORE TIME
4. OTHER (PLEASE SPECIFY):

TIMBER HARVESTING

Please answer the following questions for your property specified in the cover letter **only**.

Q-27 For which reasons have trees been cut on this tract of land? (Check all applicable)

------ FIREWOOD
------ FOLLOWING A MANAGEMENT PLAN
------ HOUSE SITE CLEARING
------ INCOME FROM SALE OF TIMBER
------ ROAD OR RIGHT-OF-WAY CLEARING
------ TO CONVERT LAND TO ANOTHER USE
------ TO IMPROVE FOREST HEALTH
------ TO PAY OFF FINANCIAL DEBTS (EXAMPLES ARE HOME MORTGAGES, LOAN PAYMENTS, CREDIT CARDS)

PLEASE CIRCLE ALL APPLICABLE

------ OTHER (PLEASE SPECIFY):

------ NO TREES HAVE BEEN CUT

If **no** trees have been cut:

A. Why haven't you had trees cut on this tract of land?

1. TREES HAVE NOT REACHED MATURITY
2. TREES ARE NOT ACCESSIBLE
3. ENVIRONMENTAL REASONS
4. SCENIC BEAUTY REASONS
5. LACK OF INFORMATION ABOUT TIMBER PRICES OR MARKETS
6. OTHER (PLEASE SPECIFY):

B. The current average price (July-Sept 1997) of **pine** sold in your county is:

$ 53/CORD **OR** $1,325/ACRE

How high would pine prices have to be for you to consider cutting them on your property now instead of later?

1. NO HIGHER
2. HIGHER THAN $53/CORD OR $1,325/ACRE (PLEASE SPECIFY AMOUNT):

   ----
3. I WOULD NOT HARVEST PINE TREES REGARDLESS OF PRICE7
4. I HAVE NO MATURE PINE TREES ON MY LAND

C. The current average price (July-Sept 1997) of **hardwoods** sold in your county is:
(MBF is an abbreviation for Thousand Board Feet)

$ 290/MBF **OR** $2,175/ACRE

How high would hardwood prices have to be for you to consider cutting them on your property now instead of later?

1. NO HIGHER
2. HIGHER THAN $290/MBF OR $2,175/ACRE (PLEASE SPECIFY AMOUNT):

   ----
3. I WOULD NOT HARVEST HARDWOODS REGARDLESS OF PRICE
4. I HAVE NO MATURE HARDWOODS ON MY LAND

If trees have been cut for firewood and/or sale of timber:

A. When were trees **last** cut on your property? (Include thinning)

1. LESS THAN 1 YEAR AGO
2. BETWEEN 1 AND 5 YEARS AGO
3. BETWEEN 6 AND 10 YEARS AGO
4. BETWEEN 11 AND 20 YEARS AGO
5. MORE THAN 20 YEARS AGO

B. What percent of the harvest did each of the following comprise?

------ % THINNING
------ % PARTIAL HARVEST
------ % CLEARCUTTING

C. Approximately how many acres of trees were cut?

1. LESS THAN 5 ACRES
2. BETWEEN 5 AND 10 ACRES
3. BETWEEN 11 AND 25 ACRES
4. BETWEEN 26 AND 40 ACRES
5. BETWEEN 40 AND 80 ACRES
6. BETWEEN 80 AND 150 ACRES
7. MORE THAN 150 ACRES

D. Approximately how many **acres** of each tree species were cut?
(If none, write "0")

------ PINE
------ MIXED PINE/HARDWOOD
------ HARDWOOD

E. Please answer the following question only if you are fairly certain of the answer.

What was the total volume cut by each type of species?

1. PINE: --------- CORDS

2. HARDWOOD: -------- MBF (Thousand Board Feet)

F. What was the average size of the harvested trees?

1. **Pulpwood/Poletimber**-- trees at least 5.0 inches in diameter at chest height but smaller than 9.0 inches in diameter at chest height

2. **Sawtimber**-- trees 9.0 inches in diameter at chest height and larger for pine and trees 11.0 inches in diameter at chest height and larger for hardwoods

G. How much income did you receive from cutting trees?
(If none, write "0")

$ --------- FROM FIREWOOD FOR SALE (# CORDS: ----------)

$ --------- FROM CHRISTMAS TREES (# TREES SOLD: ----------)

$ --------- FROM SALE TO LOGGER/TIMBER COMPANY

$ --------- OTHER (PLEASE SPECIFY):

H. What was the primary use of your income from cutting trees?
1. PURCHASING ITEM(S)
2. SAVINGS/OTHER INVESTMENT
3. OVERCOMING FINANCIAL BURDENS
4. USE BY CHILDREN (EXAMPLE: EDUCATION)
5. OTHER (PLEASE SPECIFY):

---
6. I RECEIVED NO HARVEST INCOME

I. How did you handle the harvest?
1. I WAS CONTACTED BY A LOGGER/TIMBER COMPANY
2. I HIRED A PROFESSIONAL CONSULTANT
3. I SOUGHT OUT BIDDERS MYSELF
4. I HANDLED THE HARVEST MYSELF AND RECEIVED NO BIDS

J. If you made a timber sale:
(Skip the following three questions if no timber sale was made)

(1) How many bids did you receive for your timber?

-------- BIDS

(2) What was the price range of the timber bids?

HIGHEST BID: $ ---------- /ACRE

LOWEST BID: $ ---------- /ACRE

(3) What was the accepted timber bid price per acre?

$ ---------- /ACRE

K. How often did you harvest timber and/or firewood from your land within the past ten years? (Please fill out the following schedule by putting a **check mark** in each of the boxes that apply).

HARVEST SCHEDULE

	FIREWOOD	TIMBER
1997		
1996		
1995		
1994		
1993		
1992		
1991		
1990		
1989		
1988		
1987		

REFORESTATION
Reforestation means the renewal of forest cover by seeding or planting.

Q-28 Did you spend money to reforest any portion of your tract following the last harvest?
1. YES
2. NO

If no to Q-28:

Why didn't you reforest following the last harvest? (Circle all applicable)
1. HARVEST METHOD DID NOT LEND ITSELF TO REFORESTATION
2. I PREFER NATURAL REGENERATION
3. LAND WAS CLEARED FOR WILDLIFE HABITAT
4. LAND WAS CLEARED FOR PASTURE
5. LAND WAS CLEARED FOR CROP LAND
6. LAND WAS CLEARED FOR RESIDENTIAL/COMMERCIAL DEVELOPMENT
7. NEEDED MORE INFORMATION
8. NEEDED MORE TIME
9. NEEDED MORE MONEY
10. OTHER (PLEASE SPECIFY):

If Yes to Q-28:

A. On average, how much money did you spend per acre to reforest?

$ ---------- /ACRE

B. How many years after harvesting was the land reforested?
1. LESS THAN 1 YEAR LATER
2. BETWEEN 1 AND 5 YEARS LATER
3. MORE THAN 5 YEARS LATER

C. How many acres were reforested?

--------- ACRES

D. What would you consider your primary reason for reforesting?

1. FUTURE INCOME OPPORTUNITY
2. ENVIRONMENTAL REASONS
3. SCENIC BEAUTY
4. LAND STEWARDSHIP REASONS (EXAMPLE: FOR FUTURE GENERATIONS)
5. OTHER (PLEASE SPECIFY): ----------

E. Was an on-site burn conducted on your property to prepare it for reforestation?
1. YES
2. NO

F. Were herbicides used when preparing the land for reforestation or after planting?
1. YES
2. NO

G. Did you reforest with genetically improved seeds?
1. YES
2. NO

H. Were genetically improved seeds used the last time trees were planted in that area?
1. YES
2. NO
3. DON'T KNOW

BEST MANAGEMENT PRACTICES (BMPs)

Best Management Practices (BMPs) are aimed at protecting water quality. Examples include: leaving tree-covered buffer strips by streams, building stable stream crossings, seeding in logging roads/logging decks, building drainage structures on roads, and using gravel on roads.

Q-29 Have you implemented any BMPs?
1. YES
2. NO

If yes to Q-29:

A. What specific forms of BMPs have you implemented?
1. BROAD BASE DIPS
2. CHEMICAL USE AWAY FROM STREAMS
3. MINIMAL SKID TRAILS
4. GRAVEL ON ROADS
5. LOG DECKS AWAY FROM STREAMS
6. LOGGING ROADS/SKID TRAILS LOCATED AWAY FROM STREAMS
7. MINIMAL, STABLE STREAM CROSSINGS (Examples: Fords, Culverts Bridges)
8. SLOPE OF LOGGING ROADS LIMITED TO 10% GRADE
9. SEEDING IN OF LOGGING ROADS
10. STREAMSIDE MANAGEMENT ZONES (SMZs)--*A strip of land adjacent to a stream where trees are present to protect water quality; Also called a "buffer"*
11. WATER BARS
12. OTHER (PLEASE SPECIFY):

B. What was your primary reason for implementing BMPs?
1. TO PROTECT THE ENVIRONMENT
2. LIABILITY REASONS
3. CONCERN ABOUT FUTURE REGULATION
4. OTHER (PLEASE SPECIFY):

C. What other form(s) of conservation practices have you used? (Circle all applicable)
1. CONSERVATION TILLAGE
2. CROP ROTATION
3. INTEGRATED PEST MANAGEMENT
4. WILDLIFE OPENINGS
5. WILDLIFE PLANTINGS
6. OTHER (PLEASE SPECIFY):

Q-30 Do you have any streams on your property?
1. YES
2. NO

If yes to Q-30:

Do you have any streamside management zones (SMZs) on your property?
1. YES
2. NO

If yes:
(1) Have you had trees harvested from any of those streamside management zones (SMZs)?
1. YES
2. NO

If yes:

Did you replant trees in your streamside management zones (SMZs) that were harvested?
1. YES
2. NO

(2) Do you have some streams without streamside management zones (SMZs)?
1. YES
2. NO

FUTURE HARVESTING/REFORESTATION INTENTIONS
(Reminder: Reforestation means the renewal of forest cover by seeding or planting.)

Please answer the following questions for your land specified in the cover letter **only**.

Q-31 Do you expect to cut trees from this property in the future?
1. YES
2. NO

If no to Q-31:
A. Would you say the primary reason for not cutting trees is that you are dissatisfied with a previous harvest?
1. YES
2. NO

B. What are your intentions for your timber in the future?
1. PASS ALL TO HEIRS
2. PASS PART TO HEIRS (# ACRES ----------)
3. SELL TIMBER WITH THE LAND
4. OTHER (PLEASE SPECIFY):

If Yes to Q-31:

A. When do you expect to cut trees?
1. LESS THAN 1 YEAR FROM NOW
2. BETWEEN 1 AND 5 YEARS FROM NOW
3. BETWEEN 6 AND 10 YEARS FROM NOW
4. BETWEEN 11 AND 15 YEARS FROM NOW
5. MORE THAN 15 YEARS FROM NOW
6. DON'T KNOW

B. What type(s) of trees do you expect to cut? (Circle all applicable)
1. PINE
2. MIXED PINE/HARDWOOD
3. HARDWOOD

C. Do you intend to reforest following the tree cutting?
1. YES
2. NO

If no to C:
What would be your primary reason for not reforesting?
1. LACK OF INFORMATION
2. LACK OF MONEY
3. LACK OF TIME
4. PREFER NATURAL REGENERATION
5. HARVEST METHOD DOES NOT LEND ITSELF TO REFORESTATION
6. DON'T CONSIDER REFORESTATION TO BE PROFITABLE
7. LAND USE CHANGE
8. OTHER (PLEASE SPECIFY):

RISK

Q-32 How would you rate the degree of risk associated with growing timber as oppose to other investments? (1 is least risk, 5 is most risk)

1 2 3 4 5

Q-33 How would you rate the degree of risk associated with losing your timber resource to fire, insects, ice damage, or other natural occurrences? (1 is least risk, 5 is most risk)

1 2 3 4 5

Q-34 How concerned are you about future timber prices in your decision about when to harvest? (1 is not concerned, 5 is very concerned)

1 2 3 4 5

Q-35 What do you expect will happen to timber prices over the next 10 years?
1. RISE
2. FALL
3. STAY THE SAME

Q-36 How concerned are you about future land prices in your decisions about what to do with your land? (1 is not concerned, 5 is very concerned)

1 2 3 4 5

ENVIRONMENTAL QUALITY

Q-37 How important to you is environmental quality in your county? (1 is not important, 5 is very important)

1 2 3 4 5

Q-38 How important is environmental quality to you in deciding what to do with your land? (1 is not important, 5 is very important)

1 2 3 4 5

Q-39 How important is income to you in deciding what to do with your land? (1 is not important, 5 is very important)

1 2 3 4 5

Q-40 How willing are you to give up some income to manage your land in an environmentally responsible manner? (1 is not willing, 5 is very willing)

1 2 3 4 5

POLICIES, PROGRAMS, TAXES

Q-41 How much did you pay in each of the following taxes in 1997? (If none, write "0")

$ ---------- INCOME TAX

$ ---------- INHERITANCE TAX

Q-42 Have you had timber income treated as capital gain?
1. YES
2. NO

Q-43 Are you an American Forestry Association certified "Tree Farmer"?
1. YES
2. NO

Q-44 How familiar are you with any forest industry landowner assistance program(s)? (1 is not familiar, 5 is very familiar)

1 2 3 4 5

Q-45 Have you participated in any forest industry landowner assistance program(s)?
1. YES
2. NO

If yes to Q-45:

A. How many times did you receive each of the following benefits? (If none, write "0")

------- FREE SEEDLINGS

------- PLANTING ASSISTANCE

------- MANAGEMENT PLAN

------- OTHER (PLEASE SPECIFY):

B. If you harvested, did you accept a bid from the company that provided the benefit(s) to you? (Skip this question if it does not apply to you).
1. YES
2. NO

Q-46 How familiar are you with the Forest Stewardship Program?
(1 is not familiar, 5 is very familiar)

1 2 3 4 5

Q-47 Have you received a Forest Stewardship plan?
1. YES
2. NO

Q-48 Have you had any other form of forest management plan developed for your land?
1. YES
2. NO

Q-49 How familiar are you with federal/state cost sharing for site preparation and/or tree planting? (1 is not familiar, 5 is very familiar)

1 2 3 4 5

Q-50 Have you received federal/state cost sharing for site preparation and/or tree planting?
1. YES
2. NO

Q-51 How many times have you received federal/state cost sharing payments?

-------- TIMES

Q-52 Approximately how much money did you receive from the cost share program for planting trees? (If none, write "0")

$ ----------

Q-53 Are you familiar with tax breaks for reforestation?
1. YES
2. NO

Q-54 Have you received a tax break for reforestation within the last 5 years?
1. YES
2. NO

Q-55 How familiar are you with Virginia's Best Management Practices (BMPs)?
(1 is not familiar, 5 is very familiar)

1 2 3 4 5

Q-56 Are you a member of any private organization(s)? (Circle all applicable)
1. AMERICAN FORESTRY ASSOCIATION
2. DUCKS UNLIMITED
3. NATIONAL AUDOBON SOCIETY
4. NATIONAL RIFLE ASSOCIATION
5. NATIONAL WILDLIFE FEDERATION
6. NATIONAL WILD TURKEY FEDERATION
7. NATURE CONSERVANCY
8. SIERRA CLUB
9. TROUT UNLIMITED
10. VIRGINIA FORESTRY ASSOCIATION
11. VIRGINIA WILDLIFE FEDERATION
12. OTHER (PLEASE SPECIFY): ----------

DEMOGRAPHICS

The following questions will help us obtain background variables for statistical purposes. Again, as is true for the rest of the survey, all information is strictly confidential. The data will be identified only with the 4-digit number at the top of your survey and all surveys will be destroyed once the data is checked for accuracy.

Q-57 Is your residence located on the property in Culpeper County?
1. YES
2. NO

If no to Q-57:

A. Where is your residence located?

CITY/COUNTY ---------- STATE --------- COUNTRY ----------

B. Approximately how many miles away is your residence from your land in Culpeper County?

-------- MILES

Q-58 What is your age? --------

Q-59 What is your sex?
1. MALE
2. FEMALE

Q-60 What is your present marital status?
1. SINGLE
2. MARRIED
3. DIVORCED
4. WIDOWED

Q-61 How many children do you have? (If none, write "0") ---------

Q-62 What are the ages of each of your children? (If none, write "0")

Q-63 How many people are living in your household?
(Please include yourself)

Q-64 Are you presently
1. Unemployed
2. Employed
3. Retired

If employed, please answer Q-65:

Q-65 What is your primary source of income?
1. TIMBER HARVESTING
2. FARMING OF OWN LAND
3. EMPLOYMENT NOT ASSOCIATED WITH LAND
(OCCUPATIONAL TITLE: ----------)
4. OTHER (PLEASE SPECIFY): ----------

Q-66 What was your approximate gross family income (before taxes) in 1997?
1. LESS THAN $10,000
2. BETWEEN 10,000 AND 19,999
3. BETWEEN 20,000 AND 29,999
4. BETWEEN 30,000 AND 39,999
5. BETWEEN 40,000 AND 49,999
6. BETWEEN 50,000 AND 59,999
7. BETWEEN 60,000 AND 69,999
8. BETWEEN 70,000 AND 79,999
9. BETWEEN 80,000 AND 89,999
10. BETWEEN 90,000 AND 100,000
11. GREATER THAN 100,000

Q-67 What is an estimate of the total amount of money you owe (total of home mortgages, car/other loans, credit card balances)?

$ ----------

Q-68 How would you rank the following debt categories in terms of what you owe in each? (1 is your largest debt, 6 is your smallest debt)

------ HOME MORTGAGE

------ CAR LOANS

------ EDUCATION LOANS

------ CREDIT CARD BALANCES

------ OTHER LOANS (PLEASE SPECIFY):

Q-69 What is the highest level of education that you have **completed**?
1. NO FORMAL EDUCATION
2. ELEMENTARY SCHOOL
3. JUNIOR HIGH SCHOOL
4. HIGH SCHOOL
5. SOME COLLEGE
6. COLLEGE (SPECIFY HIGHEST DEGREE AND MAJOR):

Q-70 Approximately how long did it take you to complete this survey?

Thank you for taking the time to respond to our survey. If you have additional comments, please write them in the space below.

Appendix B

Estimation Output

Harvesting Logit

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                      Run log line  202
Page  10 º
º  Current sample contains     216 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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              ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
              º Multinomial Logit Model                         º
              º Maximum Likelihood Estimates                    º
              º Dependent variable                 HARV     º
              º Number of observations              216     º
              º Iterations completed                  7     º
              º Log likelihood function       -122.7586     º
              º Restricted log likelihood     -138.1698     º
              º Chi-squared                    30.82246     º
              º Degrees of freedom                   12     º
              º Significance level          0.2096568E-02 º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼

  Variable  Coefficient   Standard Error  z=b/s.e. P[³Z³òz]   Mean of X
  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
          Characteristics in numerator of Prob[Y = 1]
  Constant   0.84879         0.57938        1.465   0.14292
  PRICEA     0.65563E-03     0.20530E-03    3.194   0.00141   417.4
  INCMID    -0.11234E-05     0.22269E-05   -0.504   0.61392  0.8106E+05
  AMTOWED    0.30774E-06     0.60237E-06    0.511   0.60944  0.1120E+06
  PSIZED     0.72765         0.51737        1.406   0.15959  0.1157
  HSIZED    -0.24882         0.32985       -0.754   0.45064  0.4769
  DAYSHNT    0.14165E-01     0.90087E-02    1.572   0.11588   8.903
  NONCONS   -0.44796E-03     0.44930E-03   -0.997   0.31876   193.1
  ACRES      0.18371E-02     0.95151E-03    1.931   0.05351   145.2
  SLOPE     -0.40209E-01     0.24239       -0.166   0.86825   1.728
  ROADS     -0.14660E-01     0.19228E-01   -0.762   0.44581   2.186
  ALL       -0.26929         0.32912       -0.818   0.41324  0.6620
  RISK        1.3558         0.66969        2.025   0.04292  0.9259E-01

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

            Predicted

Actual       0     1 TOTAL

  0         26    47    73
  1         17   126   143
TOTAL       43   173   216
```

Addition of Dummy Variables for Absenteeism and Tract Size to Harvesting Logit

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                      Run log line  597
Page  42 º
º  Current sample contains     211 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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              ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
              º Multinomial Logit Model                        º
              º Maximum Likelihood Estimates                   º
              º Dependent variable                 HARV        º
              º Number of observations              211        º
              º Iterations completed                  7        º
              º Log likelihood function       -116.0529        º
              º Restricted log likelihood     -135.4302        º
              º Chi-squared                    38.75473        º
              º Degrees of freedom                   13        º
              º Significance level          0.2187832E-03 º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼
```

Variable	Coefficient	Standard Error	z=b/s.e.	P[³Z³òz]	Mean of X
Characteristics in numerator of Prob[Y = 1]					
Constant	0.98011	0.59408	1.650	0.09898	
PRICEA	0.71544E-03	0.21066E-03	3.396	0.00068	444.8
INCMID	-0.43877E-06	0.23381E-05	-0.188	0.85114	0.8002E+05
AMTOWED	0.41636E-06	0.70906E-06	0.587	0.55707	0.1104E+06
PSIZED	0.75558	0.52335	1.444	0.14881	0.1185
HSIZED	-0.30285	0.34220	-0.885	0.37615	0.4882
DAYSHNT	0.15754E-01	0.94287E-02	1.671	0.09476	9.114
NONCONS	-0.68277E-03	0.45097E-03	-1.514	0.13003	195.7
ACRES	0.19659E-02	0.96855E-03	2.030	0.04238	142.4
SLOPE	-0.33903E-01	0.25369	-0.134	0.89369	1.722
ROADS	-0.99901E-02	0.20723E-01	-0.482	0.62976	2.225
ALL	-0.22094	0.33916	-0.651	0.51476	0.6540
RISK	1.8897	0.80083	2.360	0.01829	0.9005E-01
ABSENTEE	-1.0165	0.40963	-2.482	0.01308	0.2227

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	26	46	72
1	17	122	139
TOTAL	43	168	211

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                       Run log line  726
Page  51 º
º  Current sample contains     216 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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              ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
              º Multinomial Logit Model                     º
              º Maximum Likelihood Estimates                º
              º Dependent variable                HARV      º
              º Number of observations             216      º
              º Iterations completed                 7      º
              º Log likelihood function      -120.7113      º
              º Restricted log likelihood    -138.1698      º
              º Chi-squared                   34.91705      º
              º Degrees of freedom                  13      º
              º Significance level         0.8718694E-03 º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼

  Variable  Coefficient   Standard Error  z=b/s.e. P[³Z³òz]   Mean of X
  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
          Characteristics in numerator of Prob[Y = 1]
  Constant  -0.65143E-01     0.74104       -0.088   0.92995
  PRICEA     0.71191E-03     0.21522E-03    3.308   0.00094   417.4
  INCMID    -0.10457E-05     0.22484E-05   -0.465   0.64186  0.8106E+05
  AMTOWED    0.24016E-06     0.50195E-06    0.478   0.63232  0.1120E+06
  PSIZED     0.70242         0.52083        1.349   0.17745  0.1157
  HSIZED    -0.19133         0.33470       -0.572   0.56757  0.4769
  DAYSHNT    0.14302E-01     0.92659E-02    1.544   0.12270   8.903
  NONCONS   -0.43496E-03     0.44316E-03   -0.982   0.32634   193.1
  ACRES      0.13646E-02     0.94072E-03    1.451   0.14689   145.2
  SLOPE     -0.35443E-01     0.24360       -0.145   0.88432   1.728
  ROADS     -0.16296E-01     0.19494E-01   -0.836   0.40320   2.186
  ALL       -0.21196         0.33333       -0.636   0.52485  0.6620
  RISK        1.4025         0.68254        2.055   0.03990  0.9259E-01
  LARGE       1.0427         0.52073        2.002   0.04525  0.8981

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

            Predicted

Actual       0     1 TOTAL

  0         27    46    73
  1         14   129   143
TOTAL       41   175   216
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Reforestation Logit

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                      Run log line  198
Page  16 º
º  Current sample contains     104 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍ¼

              ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
              º Multinomial Logit Model                      º
              º Maximum Likelihood Estimates                 º
              º Dependent variable            REFOREST     º
              º Number of observations             104     º
              º Iterations completed                 9     º
              º Log likelihood function      -43.70637     º
              º Restricted log likelihood    -52.31791     º
              º Chi-squared                   17.22309     º
              º Degrees of freedom                   9     º
              º Significance level          0.4533493E-01 º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼
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Variable	Coefficient	Standard Error	z=b/s.e.	P[³Z³òz]	Mean of X
	Characteristics in numerator of Prob[Y = 1]				
Constant	-0.88653	1.0145	-0.874	0.38220	
PRICEA	0.14573E-04	0.29698E-04	0.491	0.62363	2141.
INCMID	0.27181E-05	0.37856E-05	0.718	0.47275	0.8428E+05
AMTOWED	-0.14278E-04	0.77767E-05	-1.836	0.06635	0.1470E+06
DAYSHNT	0.13593E-01	0.13192E-01	1.030	0.30283	8.250
NONCONS	-0.80483E-03	0.10907E-02	-0.738	0.46059	195.4
ACRES	-0.16984E-03	0.12495E-02	-0.136	0.89188	166.9
SLOPE	-0.72213	0.49177	-1.468	0.14199	1.695
ROADS	0.16743	0.12207	1.372	0.17018	1.694
ALL	0.91448	0.65014	1.407	0.15955	0.6923

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	83	0	83
1	18	3	21
TOTAL	101	3	104

Addition of Dummy Variables for Absenteeism and Tract Size to Reforestation Logit

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                      Run log line  395
Page  43 º
º  Current sample contains     103 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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              ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
              º Multinomial Logit Model                        º
              º Maximum Likelihood Estimates                   º
              º Dependent variable              REFOREST       º
              º Number of observations               103       º
              º Iterations completed                   9       º
              º Log likelihood function        -41.82346       º
              º Restricted log likelihood      -50.69867       º
              º Chi-squared                     17.75041       º
              º Degrees of freedom                    10       º
              º Significance level          0.5932268E-01 º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼
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Variable	Coefficient	Standard Error	z=b/s.e.	P[³Z³òz]	Mean of X
Characteristics in numerator of Prob[Y = 1]					
Constant	-1.2668	1.0733	-1.180	0.23788	
PRICEA	0.17578E-04	0.29812E-04	0.590	0.55543	2158.
INCMID	0.25788E-05	0.38618E-05	0.668	0.50428	0.8437E+05
AMTOWED	-0.14279E-04	0.80610E-05	-1.771	0.07649	0.1484E+06
DAYSHNT	0.17319E-01	0.13343E-01	1.298	0.19430	8.330
NONCONS	-0.43223E-03	0.96730E-03	-0.447	0.65499	197.3
ACRES	-0.15678E-03	0.12870E-02	-0.122	0.90304	165.2
SLOPE	-0.57906	0.50509	-1.146	0.25161	1.701
ROADS	0.15625	0.12582	1.242	0.21430	1.704
ALL	0.65051	0.66917	0.972	0.33099	0.6893
ABSENTEE	0.90356	0.66718	1.354	0.17564	0.2039

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	82	1	83
1	17	3	20
TOTAL	99	4	103

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                       Run log line  409
Page  45 º
º  Current sample contains     104 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ¼

              ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
              º Multinomial Logit Model                     º
              º Maximum Likelihood Estimates                º
              º Dependent variable             REFOREST     º
              º Number of observations              104     º
              º Iterations completed                  9     º
              º Log likelihood function       -43.62396     º
              º Restricted log likelihood     -52.31791     º
              º Chi-squared                    17.38791     º
              º Degrees of freedom                   10     º
              º Significance level         0.6620933E-01 º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼
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Variable	Coefficient	Standard Error	z=b/s.e.	P[³Z³òz]	Mean of X
Characteristics in numerator of Prob[Y = 1]					
Constant	-1.3532	1.5673	-0.863	0.38792	
PRICEA	0.18186E-04	0.31830E-04	0.571	0.56777	2141.
INCMID	0.27289E-05	0.37925E-05	0.720	0.47180	0.8428E+05
AMTOWED	-0.14401E-04	0.78334E-05	-1.838	0.06599	0.1470E+06
DAYSHNT	0.13584E-01	0.13180E-01	1.031	0.30273	8.250
NONCONS	-0.84175E-03	0.11093E-02	-0.759	0.44798	195.4
ACRES	-0.24183E-03	0.12689E-02	-0.191	0.84886	166.9
SLOPE	-0.70977	0.49647	-1.430	0.15282	1.695
ROADS	0.16442	0.12223	1.345	0.17857	1.694
ALL	0.92903	0.64879	1.432	0.15216	0.6923
LARGE	0.47958	1.2257	0.391	0.69560	0.9327

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	83	0	83
1	18	3	21
TOTAL	101	3	104

Bequest Logit

```
ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                      Run log line  118
Page   6 º
º  Current sample contains     234 observations.
º
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              º Multinomial Logit Model                      º
              º Maximum Likelihood Estimates                 º
              º Dependent variable              BEQUEST      º
              º Number of observations              234      º
              º Iterations completed                  7      º
              º Log likelihood function       -70.03118      º
              º Restricted log likelihood     -160.2681      º
              º Chi-squared                    180.4738      º
              º Degrees of freedom                   12      º
              º Significance level            0.0000000      º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼

  Variable  Coefficient   Standard Error  z=b/s.e. P[³Z³òz]   Mean of X
  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
          Characteristics in numerator of Prob[Y = 1]
  Constant   -3.2890         2.3804       -1.382   0.16707
  ACRES       0.19757E-03    0.35908E-03   0.550   0.58217   190.4
  NONCONS     0.19894E-02    0.86432E-03   2.302   0.02136   230.5
  DAYSHNT     0.75353E-02    0.13733E-01   0.549   0.58321   7.705
  LDEBTHAT    0.78165        0.42228       1.851   0.06416  -345.8
  LINCMID    -0.13825        0.10469      -1.321   0.18664   9.950
  LPHAT      -0.77959        0.42419      -1.838   0.06609  -349.4
  HARV       -0.52717        0.56752      -0.929   0.35295  0.7179
  HSEHOLD     0.51613        0.27275       1.892   0.05845   2.543
  AGE         0.29941E-01    0.19548E-01   1.532   0.12561   58.34
  LIVEPROP   -1.0768         0.51573      -2.088   0.03680  0.5641
  MARRIED    -0.12974        0.56434      -0.230   0.81817  0.7949
  INHERIT     0.61068E-02    0.52612       0.012   0.99074  0.2479

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

            Predicted

Actual        0     1 TOTAL

  0          79    23   102
  1           3   129   132
TOTAL        82   152   234
```

Addition of Dummy Variables for Absenteeism and Tract Size to Bequest Logit

ÉÍÍÍ
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º LIMDEP Estimation Results   Run log line 203
Page 16 º
º Current sample contains   229 observations.
º
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ÉÍÍÍ»
º Multinomial Logit Model º
º Maximum Likelihood Estimates º
º Dependent variable BEQUEST º
º Number of observations 229 º
º Iterations completed 7 º
º Log likelihood function -69.76360 º
º Restricted log likelihood -156.6260 º
º Chi-squared 173.7248 º
º Degrees of freedom 13 º
º Significance level 0.0000000 º
ÈÍÍÍ¼

Variable	Coefficient	Standard Error	z=b/s.e.	P[³Z³òz]	Mean of X
	Characteristics in numerator of Prob[Y = 1]				
Constant	-3.2860	2.3781	-1.382	0.16705	
ACRES	0.18684E-03	0.36006E-03	0.519	0.60382	189.0
NONCONS	0.19697E-02	0.85780E-03	2.296	0.02166	231.5
DAYSHNT	0.72659E-02	0.13674E-01	0.531	0.59518	7.830
LDEBTHAT	0.76348	0.42472	1.798	0.07224	-340.4
LINCMID	-0.13748	0.10533	-1.305	0.19183	9.975
LPHAT	-0.76142	0.42666	-1.785	0.07433	-344.0
HARV	-0.52436	0.56582	-0.927	0.35407	0.7118
HSEHOLD	0.51590	0.27238	1.894	0.05822	2.520
AGE	0.29487E-01	0.19461E-01	1.515	0.12974	58.19
LIVEPROP	-0.98601	0.63196	-1.560	0.11871	0.5764
MARRIED	-0.10360	0.56728	-0.183	0.85509	0.7948
INHERIT	0.16036E-01	0.53324	0.030	0.97601	0.2445
ABSENTEE	0.19086	0.83928	0.227	0.82011	0.2140

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	76	23	99
1	3	127	130
TOTAL	79	150	229

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                       Run log line  218
Page  18 º
º  Current sample contains     234 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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              ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
              º Multinomial Logit Model                      º
              º Maximum Likelihood Estimates                 º
              º Dependent variable              BEQUEST     º
              º Number of observations              234     º
              º Iterations completed                  7     º
              º Log likelihood function       -69.48802     º
              º Restricted log likelihood     -160.2681     º
              º Chi-squared                    181.5601     º
              º Degrees of freedom                   13     º
              º Significance level            0.0000000     º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼
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Variable	Coefficient	Standard Error	z=b/s.e.	P[³Z³òz]	Mean of X
Characteristics in numerator of Prob[Y = 1]					
Constant	-2.8607	2.4220	-1.181	0.23753	
ACRES	0.25599E-03	0.34686E-03	0.738	0.46049	190.4
NONCONS	0.20753E-02	0.87397E-03	2.375	0.01757	230.5
DAYSHNT	0.89789E-02	0.14072E-01	0.638	0.52343	7.705
LDEBTHAT	0.75734	0.42612	1.777	0.07552	-345.8
LINCMID	-0.13795	0.10571	-1.305	0.19188	9.950
LPHAT	-0.75510	0.42807	-1.764	0.07774	-349.4
HARV	-0.38770	0.58458	-0.663	0.50720	0.7179
HSEHOLD	0.52719	0.27582	1.911	0.05596	2.543
AGE	0.32758E-01	0.19807E-01	1.654	0.09816	58.34
LIVEPROP	-1.1570	0.52353	-2.210	0.02711	0.5641
MARRIED	-0.25604E-01	0.57317	-0.045	0.96437	0.7949
INHERIT	0.11450	0.53939	0.212	0.83189	0.2479
LARGE	-0.77957	0.77941	-1.000	0.31721	0.8590

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	79	23	102
1	3	129	132
TOTAL	82	152	234

Debt Level Regression

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
Í»
º Ordinary    least squares regression    Weighting variable = ONE
º
º Dependent variable is AMTOWED   Mean = **********, S.D. = 574929.1945
º
º Model size: Observations =     374, Parameters =  12, Deg.Fr. =   362
º
º Residuals:  Sum of squares=   0.115174E+15 Std.Dev. =    564058.07069
º
º Fit:        R-squared = 0.06585, Adjusted R-squared =         0.03746
º
º Model test: F[ 11,    362] =    2.32,    Prob value =         0.00924
º
º Diagnostic: Log-L =  -5477.4339, Restricted(á=0) Log-L =   -5490.1712
º
º             Amemiya Pr. Crt.=*********, Akaike Info. Crt.=     29.355
º
º Autocorrel: Durbin-Watson Statistic =   1.25224,   Rho =      0.37388
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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Variable	Coefficient	Standard Error	t-ratio	P[³T³òt]	Mean of X
Constant	0.72610E+06	0.21428E+06	3.389	0.00078	
INCMID	0.75713	0.40654	1.862	0.06336	0.8067E+05
PSIZED	-77485.	96369.	-0.804	0.42190	0.1364
HSIZED	-55487.	62398.	-0.889	0.37447	0.4652
MSIZED	0.15511E+06	70150.	2.211	0.02765	0.2674
DAYSHNT	-605.65	1181.1	-0.513	0.60840	8.067
NONCONS	-9.8150	83.567	-0.117	0.90657	217.0
ROADS	-1608.5	2906.1	-0.553	0.58027	2.068
SLOPE	-63431.	44155.	-1.437	0.15171	1.731
AGE	-8432.1	2660.2	-3.170	0.00166	58.77
MARRIED	43098.	78386.	0.550	0.58279	0.8235
EMPLOYED	-0.19727E+06	74880.	-2.634	0.00879	0.5508

Addition of Dummy Variables for Absenteeism and Tract Size to Debt Level Regression

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
Í»
º Ordinary    least squares regression    Weighting variable = ONE
º
º Dependent variable is AMTOWED   Mean = **********, S.D. = 578543.0235
º
º Model size: Observations =     369, Parameters =  13, Deg.Fr. =   356
º
º Residuals:  Sum of squares=   0.113461E+15 Std.Dev. =    564545.28054
º
º Fit:        R-squared = 0.07885, Adjusted R-squared =         0.04780
º
º Model test: F[ 12,    356] =    2.54,    Prob value =         0.00315
º
º Diagnostic: Log-L =  -5403.9244, Restricted(á=0) Log-L =   -5419.0786
º
º             Amemiya Pr. Crt.=*********, Akaike Info. Crt.=     29.360
º
º Autocorrel: Durbin-Watson Statistic =   1.24546,   Rho =      0.37727
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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Variable	Coefficient	Standard Error	t-ratio	P[³T³òt]	Mean of X
Constant	0.65783E+06	0.21685E+06	3.034	0.00259	
INCMID	0.64827	0.41077	1.578	0.11541	0.8108E+05
PSIZED	-77114.	97966.	-0.787	0.43172	0.1328
HSIZED	-38210.	62966.	-0.607	0.54435	0.4661
MSIZED	0.15619E+06	70624.	2.212	0.02763	0.2683
DAYSHNT	-517.94	1182.9	-0.438	0.66175	8.149
NONCONS	26.620	85.540	0.311	0.75583	217.4
ROADS	-2265.4	2924.2	-0.775	0.43904	2.092
SLOPE	-65593.	44674.	-1.468	0.14291	1.722
AGE	-8065.3	2681.6	-3.008	0.00282	58.68
MARRIED	50331.	79012.	0.637	0.52453	0.8238
EMPLOYED	-0.19434E+06	75381.	-2.578	0.01034	0.5556
ABSENTEE	0.16451E+06	75357.	2.183	0.02969	0.2087

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Í»
º Ordinary    least squares regression    Weighting variable = ONE
º
º Dependent variable is AMTOWED   Mean = **********, S.D. = 578543.0235
º
º Model size: Observations =     369, Parameters =  13, Deg.Fr. =   356
º
º Residuals:  Sum of squares=   0.114872E+15 Std.Dev. =    568044.20059
º
º Fit:        R-squared = 0.06740, Adjusted R-squared =         0.03596
º
º Model test: F[ 12,    356] =    2.14,    Prob value =         0.01396
º
º Diagnostic: Log-L =  -5406.2043, Restricted(á=0) Log-L =   -5419.0786
º
º             Amemiya Pr. Crt.=*********, Akaike Info. Crt.=     29.372
º
º Autocorrel: Durbin-Watson Statistic =   1.24878,   Rho =      0.37561
º
```

Variable	Coefficient	Standard Error	t-ratio	P[³T³òt]	Mean of X
Constant	0.68693E+06	0.22597E+06	3.040	0.00254	
INCMID	0.74300	0.41087	1.808	0.07140	0.8108E+05
PSIZED	-78352.	98575.	-0.795	0.42723	0.1328
HSIZED	-51118.	63055.	-0.811	0.41809	0.4661
MSIZED	0.15788E+06	71083.	2.221	0.02698	0.2683
DAYSHNT	-651.84	1194.2	-0.546	0.58551	8.149
NONCONS	-11.165	84.412	-0.132	0.89485	217.4
ROADS	-1644.4	2927.5	-0.562	0.57467	2.092
SLOPE	-65760.	44992.	-1.462	0.14473	1.722
AGE	-8620.3	2708.7	-3.182	0.00159	58.68
MARRIED	48806.	79663.	0.613	0.54050	0.8238
EMPLOYED	-0.19387E+06	75858.	-2.556	0.01101	0.5556
LARGE	51880.	89646.	0.579	0.56314	0.8699

Hedonic Land Price Regressions

Reservation Price

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
Í»
º Ordinary    least squares regression    Weighting variable = ONE
º
º Dependent variable is SELLAND   Mean = 2491.06289, S.D. =   7729.2495
º
º Model size: Observations =     318, Parameters =  12, Deg.Fr. =   306
º
º Residuals:  Sum of squares=   0.185756E+11 Std.Dev. =      7791.30480
º
º Fit:        R-squared = 0.01914, Adjusted R-squared =        -0.01612
º
º Model test: F[ 11,    306] =    0.54,    Prob value =         0.87340
º
º Diagnostic: Log-L =  -3294.6292, Restricted(á=0) Log-L =   -3297.7016
º
º             Amemiya Pr. Crt.=*********, Akaike Info. Crt.=     20.796
º
º Autocorrel: Durbin-Watson Statistic =   1.70486,   Rho =      0.14757
º
º Results Corrected for heteroskedasticity
º
º Breusch - Pagan chi-squared =   111.3373, with  11 degrees of freedom
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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Variable	Coefficient	Standard Error	t-ratio	P[³T³òt]	Mean of X
NONCONS	0.68519E-01	0.99587	0.069	0.94519	215.3
DAYSHNT	0.16267	2.4302	0.067	0.94668	5.698
LDEBTHAT	1.8668	0.96762	1.929	0.05462	-38.07
LINCMID	120.62	66.903	1.803	0.07240	9.912
BOUGHT	1512.7	689.56	2.194	0.02900	0.7547
HAVECE	-508.39	913.84	-0.556	0.57840	0.7547E-01
FORLAND	0.94791	1.2982	0.730	0.46585	126.8
AGLAND	2.1005	3.4037	0.617	0.53761	49.27
STREAMS	-1787.3	931.97	-1.918	0.05608	0.8585
ROADS	79.724	36.717	2.171	0.03068	1.580
SLOPE	790.28	408.99	1.932	0.05425	1.737
AGINC	-0.14745E-02	0.13907E-02	-1.060	0.28985	0.1051E+05

Addition of Dummy Variables For Absenteeim and Tract Size to Reservation Price Regression

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Í»
º Ordinary    least squares regression    Weighting variable = ONE
º
º Dependent variable is SELLAND   Mean = 2512.11290, S.D. =   7816.5521
º
º Model size: Observations =     310, Parameters =  13, Deg.Fr. =   297
º
º Residuals:  Sum of squares=   0.183880E+11 Std.Dev. =      7868.45004
º
º Fit:        R-squared = 0.02603, Adjusted R-squared =        -0.01332
º
º Model test: F[ 12,    297] =    0.66,    Prob value =         0.78792
º
º Diagnostic: Log-L =  -3214.1218, Restricted(á=0) Log-L =   -3218.2098
º
º             Amemiya Pr. Crt.=*********, Akaike Info. Crt.=     20.820
º
º Autocorrel: Durbin-Watson Statistic =   1.71722,   Rho =      0.14139
º
º Results Corrected for heteroskedasticity
º
º Breusch - Pagan chi-squared =   247.6865, with  12 degrees of freedom
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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Variable	Coefficient	Standard Error	t-ratio	P[³T³òt]	Mean of X
NONCONS	0.29292	0.98231	0.298	0.76576	217.7
DAYSHNT	-0.33715	2.7286	-0.124	0.90175	5.813
LDEBTHAT	2.3664	1.1878	1.992	0.04727	-13.27
LINCMID	124.90	67.414	1.853	0.06490	9.911
BOUGHT	1563.5	723.45	2.161	0.03148	0.7516
HAVECE	-407.11	881.37	-0.462	0.64449	0.7742E-01
FORLAND	0.91261	1.1814	0.772	0.44045	127.5
AGLAND	2.5611	3.4441	0.744	0.45770	48.66
STREAMS	-2196.6	1024.0	-2.145	0.03276	0.8613
ROADS	77.523	36.391	2.130	0.03397	1.609
SLOPE	733.20	432.60	1.695	0.09115	1.727
AGINC	-0.94871E-03	0.14240E-02	-0.666	0.50577	0.1074E+05
ABSENTEE	1538.6	1634.0	0.942	0.34716	0.2000

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º LIMDEP Estimation Results   Run log line 224
Page 12 º
º Sample was reset: REJECT   AGINC=-999$
º
º Sample was reset: REJECT   ACRES=-999$
º
º Current sample contains   317 observations.
º
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º Ordinary   least squares regression   Weighting variable = ONE
º
º Dependent variable is SELLAND   Mean = 2489.45741, S.D. =   7741.4166
º
º Model size: Observations =   317, Parameters = 13, Deg.Fr. =   304
º
º Residuals: Sum of squares=   0.185642E+11 Std.Dev. =   7814.49410
º
º Fit: R-squared = 0.01973, Adjusted R-squared =   -0.01897
º
º Model test: F[12,   304] =   0.51,   Prob value =   0.90803
º
º Diagnostic: Log-L = -3284.6706, Restricted(á=0) Log-L =   -3287.8285
º
º   Amemiya Pr. Crt.=*********, Akaike Info. Crt.=   20.805
º
º Autocorrel: Durbin-Watson Statistic =   1.71180,   Rho =   0.14410
º
º Results Corrected for heteroskedasticity
º
º Breusch - Pagan chi-squared =   112.5550, with 12 degrees of freedom
º
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Variable	Coefficient	Standard Error	t-ratio	P[³T³òt]	Mean of X
NONCONS	0.64306E-01	0.98914	0.065	0.94821	213.2
DAYSHNT	0.56315E-01	2.4094	0.023	0.98137	5.669
LDEBTHAT	1.9420	0.98073	1.980	0.04859	-38.21
LINCMID	108.84	76.034	1.432	0.15331	9.912
BOUGHT	1499.6	693.68	2.162	0.03142	0.7539
HAVECE	-499.40	917.44	-0.544	0.58660	0.7571E-01
FORLAND	0.95688	1.2952	0.739	0.46060	127.0
AGLAND	1.9281	3.3394	0.577	0.56411	49.42
STREAMS	-1939.4	958.91	-2.023	0.04400	0.8612
ROADS	76.681	37.150	2.064	0.03986	1.583
SLOPE	737.82	413.22	1.786	0.07517	1.736
AGINC	-0.14785E-02	0.13661E-02	-1.082	0.27999	0.1055E+05
LARGE	442.08	724.42	0.610	0.54215	0.8738

Buying Price Regression

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                      Run log line  247
Page  14 º
º  Current sample contains     370 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ1/4

ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
Í»
º Ordinary    least squares regression    Weighting variable = ONE
º
º Dependent variable is PAYACRE   Mean = -373.78855, S.D. =    494.5260
º
º Model size: Observations =     370, Parameters =  13, Deg.Fr. =   357
º
º Residuals:  Sum of squares=   0.852404E+08 Std.Dev. =       488.63968
º
º Fit:        R-squared = 0.05541, Adjusted R-squared =         0.02366
º
º Model test: F[ 12,    357] =    1.75,    Prob value =         0.05598
º
º Diagnostic: Log-L =  -2809.2917, Restricted(á=0) Log-L =   -2819.8385
º
º             Amemiya Pr. Crt.=*********, Akaike Info. Crt.=     15.256
º
º Autocorrel: Durbin-Watson Statistic =   2.07389,   Rho =     -0.03695
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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Variable	Coefficient	Standard Error	t-ratio	P[³T³òt]	Mean of X
Constant	-597.20	186.28	-3.206	0.00147	
INCMID	0.86708E-03	0.35301E-03	2.456	0.01451	0.8088E+05
NONCONS	0.10971	0.72795E-01	1.507	0.13267	216.9
DAYSHNT	0.99585	1.0239	0.973	0.33142	8.127
ROADS	0.96320	2.5180	0.383	0.70229	2.086
SLOPE	29.660	38.483	0.771	0.44137	1.726
PSIZED	-178.64	84.918	-2.104	0.03611	0.1324
HSIZED	11.509	54.200	0.212	0.83196	0.4649
MSIZED	174.58	61.121	2.856	0.00454	0.2676
MILES	0.64548E-01	0.76769E-01	0.841	0.40102	77.31
AGE	0.79135	2.3172	0.342	0.73292	58.72
MARRIED	-42.823	68.074	-0.629	0.52971	0.8216
EMPLOYED	42.476	65.329	0.650	0.51599	0.5541

Addition of Dummy Variables for Absenteeism and Tract Size to Buying Price Regression

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
Í»
º Ordinary    least squares regression    Weighting variable = ONE
º
º Dependent variable is PAYACRE   Mean = -373.78855, S.D. =    494.5260
º
º Model size: Observations =     370, Parameters =  14, Deg.Fr. =   356
º
º Residuals:  Sum of squares=   0.837314E+08 Std.Dev. =       484.97487
º
º Fit:        R-squared = 0.07214, Adjusted R-squared =         0.03825
º
º Model test: F[ 13,    356] =    2.13,    Prob value =         0.01220
º
º Diagnostic: Log-L =  -2805.9873, Restricted(á=0) Log-L =   -2819.8385
º
º             Amemiya Pr. Crt.=*********, Akaike Info. Crt.=     15.243
º
º Autocorrel: Durbin-Watson Statistic =   2.06237,   Rho =     -0.03119
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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Variable	Coefficient	Standard Error	t-ratio	P[³T³òt]	Mean of X
Constant	-539.85	186.26	-2.898	0.00398	
INCMID	0.97694E-03	0.35304E-03	2.767	0.00595	0.8088E+05
NONCONS	0.76495E-01	0.73430E-01	1.042	0.29823	216.9
DAYSHNT	0.95666	1.0164	0.941	0.34722	8.127
ROADS	1.6298	2.5129	0.649	0.51703	2.086
SLOPE	29.289	38.194	0.767	0.44368	1.726
PSIZED	-174.97	84.294	-2.076	0.03864	0.1324
HSIZED	-2.6118	54.082	-0.048	0.96151	0.4649
MSIZED	175.71	60.664	2.896	0.00401	0.2676
MILES	0.15176	0.83611E-01	1.815	0.07036	77.31
AGE	0.45316	2.3037	0.197	0.84416	58.72
MARRIED	-43.468	67.564	-0.643	0.52041	0.8216
EMPLOYED	37.753	64.866	0.582	0.56093	0.5541
ABSENTEE	-179.86	71.008	-2.533	0.01174	0.2081

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                       Run log line  355
Page  26 º
º  Current sample contains     369 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
Í»
º Ordinary    least squares regression    Weighting variable = ONE
º
º Dependent variable is PAYACRE   Mean = -374.83201, S.D. =    494.7894
º
º Model size: Observations =     369, Parameters =  14, Deg.Fr. =   355
º
º Residuals:  Sum of squares=   0.824731E+08 Std.Dev. =       481.99443
º
º Fit:        R-squared = 0.08457, Adjusted R-squared =         0.05105
º
º Model test: F[ 13,    355] =    2.52,    Prob value =         0.00253
º
º Diagnostic: Log-L =  -2796.1092, Restricted(á=0) Log-L =   -2812.4124
º
º             Amemiya Pr. Crt.=*********, Akaike Info. Crt.=     15.231
º
º Autocorrel: Durbin-Watson Statistic =   2.11992,   Rho =     -0.05996
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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 Variable  Coefficient   Standard Error  t-ratio  P[³T³òt]   Mean of X
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Constant   -406.43         192.46       -2.112   0.03541
 INCMID     0.92686E-03     0.34881E-03    2.657   0.00823  0.8103E+05
 NONCONS    0.11252         0.72182E-01    1.559   0.11992   215.1
 DAYSHNT     1.2906          1.0139        1.273   0.20389   8.108
 ROADS       1.1237          2.4842        0.452   0.65130   2.090
 SLOPE       23.949          37.996        0.630   0.52890   1.725
 PSIZED     -181.38          83.770       -2.165   0.03104  0.1328
 HSIZED      8.2710          53.569        0.154   0.87738  0.4661
 MSIZED      181.60          60.346        3.009   0.00281  0.2683
 MILES      0.64745E-01     0.75727E-01    0.855   0.39313   77.52
 AGE         1.6583          2.2995        0.721   0.47130   58.75
 MARRIED    -59.839          67.343       -0.889   0.37483  0.8211
 EMPLOYED    38.387          64.471        0.595   0.55194  0.5528
 LARGE      -257.67          76.717       -3.359   0.00087  0.8726
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Separability Test

Harvesting Logit with the Removal of Debt Level, Days Spent in Non/consumptive Activities, and Timber Bequests

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ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
ÍÍÍÍÍÍÍÍ»
º  LIMDEP Estimation Results                      Run log line  220
Page  12 º
º  Current sample contains     367 observations.
º
ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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              ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
              º Multinomial Logit Model                      º
              º Maximum Likelihood Estimates                 º
              º Dependent variable                  HARV     º
              º Number of observations               367     º
              º Iterations completed                   8     º
              º Log likelihood function        -199.9163     º
              º Restricted log likelihood      -239.7353     º
              º Chi-squared                     79.63804     º
              º Degrees of freedom                     8     º
              º Significance level             0.0000000     º
              ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼

  Variable  Coefficient   Standard Error  z=b/s.e. P[³Z³òz]   Mean of X
  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
          Characteristics in numerator of Prob[Y = 1]
  Constant    1.8607         0.52929        3.515   0.00044
  PRICEA     0.16880E-02     0.35212E-03    4.794   0.00000  -28.50
  INCMID    -0.10019E-05     0.16442E-05   -0.609   0.54229  0.8071E+05
  PSIZED     0.58439         0.38766        1.507   0.13169  0.1253
  HSIZED    -0.29689         0.25165       -1.180   0.23809  0.4632
  ACRES      0.17368E-02     0.71080E-03    2.443   0.01455   152.3
  SLOPE     -0.73378E-01     0.18275       -0.402   0.68804   1.736
  ROADS     -0.25125E-01     0.22415E-01   -1.121   0.26231   2.082
  RISK       0.63160         0.39318        1.606   0.10819  0.1090

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

            Predicted

Actual       0     1 TOTAL

  0         60    72   132
  1         38   197   235
TOTAL       98   269   367
```

Vita

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EDUCATION

Virginia Polytechnic Institute and State University, Blacksburg
College of Forestry and Wildlife Resources
M.S. Forest Management and Economics, December 1998
Overall GPA: 4.0/4.0

Virginia Polytechnic Institute and State University, Blacksburg
College of Agriculture and Life Sciences
B.S. Agricultural and Applied Economics, December 1996
Overall GPA: 3.6/4.0

Mary Washington College, Fredericksburg, Virginia
Major: Economics

COURSES

Mathematics for Economists
Applied Microeconomics I
Applied Microeconomics II
Resource Economics
Elementary Econometrics
Mathematical Programming
Forest Management and Economics
Timber Supply and Regional Economics
Environmental Economics
Macroeconomic Theory
Environmental Law
Dendrology Lab
Principles of Silviculture
Survey of Forest Ecology

INDEPENDENT STUDY

Involved researching, collecting, and abstracting college-level economics games, experiments, and simulations to serve as a reference for departmental use. Also involved developing a classroom experiment and lesson plan on tradable pollution allowances.

TEACHING/ RESEARCH

Research Assistant (1997 - 1998)
Designed and conducted a forestry survey of nonindustrial private landowners in Virginia; Performed econometric analyses of the data.

Teaching Assistant (Fall 1998)—Forestry Economics
Assisted professor with grading of homework. Held office hours.

Teaching Assistant (Fall 1997)--Environmental Economics
Assisted professor with reviewing and grading of exams and quizzes

HONORS	Recipient of Cunningham Doctoral Fellowship (1998 - 2000) Dean's List (Spring 1995 - Spring 1998) Gamma Beta Phi Honor Society (Spring 1996, Fall 1996) Garnet and Gold Honor Society (Spring 1996, Fall 1996)
PERSONAL	President of Christian organization on campus (Fall 1997, Spring 1998) Public Relations Volunteer--Montgomery County Humane Society (Fall 1996) Children International Adopt-a-Child Sponsor (1991-1998)