Growth Expectations and Decision to Renovate a Golf Course: An Application of a Censored Model with the Simultaneity Test

A. Bilgic, Harran University, Turkey, and W. J. Florkowski, University of Georgia, Department of Agricultural and Applied Economics, 1109 Experiment Street, Griffin, Georgia, 30223-1797, USA; phone: 770-228-7231, ext. 112; E-mail: wflorko@griffin.uga.edu

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A. Bilgic, Harran University, Turkey, and W. J. Florkowski, University of Georgia

Abstract

Golf course renovation and expected business growth were examined. Endogeneity test on the renovation decision and a censored expected growth model rejected the hypothesis of simultaneity and decisions were modeled separately. Key determinants for both decisions were golf facility features, but not respondents' characteristics.

Key words: Golf course, simultaneous model, probit model, endogeneity test,.

JEL Classifications: Q15, Q21, Q26

1. Introduction

Demand for golf shows an upward trend in the United States. The number of golfers and the number of golf courses increased by 78.7 %, and 18.3%, respectively, between 1980 and 1999. In 1999, about 27 million golfers used 15,195 golf courses, including private, semi-private, and public golf courses. Among golf course numbers the most rapid increase was registered in the number of daily fees courses which increased by 57.7% between l980 and 1999 (The U.S. Census Bureau; National Golf Foundation, 2005). In addition, the number of public golf courses available for play increased from 2,736 in 1987 to 3,780 in 1992. Revenues at public golf courses increased by 110 percent from 1987 to 1992, from $1.1 billion to $2.3 billion.

To attract new and retain old clients through its integrity, a golf course requires a periodic renovation. The renovation has an effect on the growth performance of the facility. A planned renovation incurs costs lowering the revenue growth. Private and public golf enterprises have recognize that to build a reputation of a great course, yearly modifications may be necessary to maintain game quality. Otherwise, clients could switch to other nearby facilities and adversely affect future of the enterprise in question. All these circumstances bring design, overhead, and investment costs which may have an undesired effect on the performance of the enterprise.However not undertaking a renovation may create a gap between new and old facilities that may have an important repercussions for revenues. Old facilities may have been recognized over several decades and have an established pool of clients, while new facilities with a innovative design may lure golfers away from nearby facilities. Thus, in a competitive environment, a renovation and the growth performance of the facility may affect each other and change the dynamics of the golf market.

Two distinct features of renovations with implications for generating growth are considered. First, how does the facility operate differently with and without a planned renovation with respect to valuing the facility and operator characteristics. Second and a more important issue, is there an endogeneity of the course renovation and expectations of a facility growth. Both observed and unobserved operator and facility factors which determine the renovation decision and the expected growth rate may impact each other.

This study examines factors responsible for a future renovation and the expected growth rate using a simultaneous censored equation model with a binary model. The endogeneity problem raises, where observed and unobserved factors determining one equation are also relevant for another equation. The censored equation determines factors responsible for the expected growth performance of an enterprise, while the binary equation determines factors affecting the probability of a future renovation decision of the facility.

The following section introduces the simultaneous censored equations followed by the presentation of data. The empirical model estimation results are reported in the subsequent section. The last section concludes with implications relevant for decision making.

2. Empirical Model

Consider two simultaneous equations:

$$y_{i1}^{*} = g_1 y_{i2}^{*} + x_{i1}' b_1 + e_{i1}, \qquad y_{i1} = 1\left(y_{i1}^{*} > 0\right) \tag{1}$$

$$y_{i2}^{*} = g_2 y_{i1}^{*} + x_{i2}' b_{21} + e_{i2}, \qquad y_{i2} = Max\left(L_{i2}, y_{i2}^{*}\right) \tag{2}$$

where y_{i1} and y_{i2} are corresponding latent dependent variables of the realized variables, y_{i1}^{*} and y_{i2}^{*}, respectively. Independent variables y_{i1} and y_{i2} represent the decision about the future renovation and the firm expected relative growth, respectively; x_{i1}, and x_{i2} are vectors of exogenous, potentially overlapping, variables; $(_1$, $(_2$, $\$_1$, and $\$_2$ are conformable parameters to be estimated, while g_1 and g_2 are identically and normally distributed errors with zero means and F_{12} covariance (Vella and Verbeek, 1994; Maddala, 1999; Vella and Karmiel, 1999; Greene, 2002).

The first model, (1), is a probit model, while the second model, (2), is a censored regression. The censored Tobit equation models responses of the survey respondents, who expressed a non-positive growth expectations , i.e., no growth or a decline in growth. Censoring occurs primarily due to the firm's economic conditions that prevent growth.

To obtain the two step estimator, the reduced form is:

$$\begin{aligned} y_{i1}^{*} &= x_{i1}' p_1 + v_{i1}, \qquad y_{i1} = 1\left(y_{i1}^{*} > 0\right) \\ y_{i2}^{*} &= x_{i2}' p_2 + v_{i2}, \qquad y_{i2} = Max\left(L_{i2}, y_{i2}^{*}\right) \end{aligned} \tag{3}$$

Before proceeding with the estimation of equations (3), we simplify the process. Because the sample data provide no information about the scale of y_{i1}^{*} therefore, we drop the scalar variance parameter, s_{11}, from the analysis. The scalar variance is set to 1 (Greene, 2002). The maximum likelihood is applied to obtain the reduced form parameters using the probit and censored Tobit models for the decision to renovate the facility and the expected growth rate. The estimated reduced form of expected values corresponding to each equation were instrumental variables in the partial reduced forms:

$$\begin{aligned} y_{i1}^{*} &= g_1\left(x_{i1}'\hat{p}_1\right) + x_{i1}'b_1 + e_{i1} + g_1 v_{i2}, \qquad & y_{i1} &= 1\left(y_{i1}^{*} > 0\right) \\ y_{i2}^{*} &= g_2\left(x_{i2}'\hat{p}_2\right) + x_{i2}'b_2 + e_{i2} + g_2 v_{i1}, \qquad & y_{i2} &= Max\left(L_{i2}, y_{i2}^{*}\right) \end{aligned} \tag{4}$$

Because of the loss of scale information in sample data, the parameter estimates, $(_1$ and $\$_1$, are scaled in the probit model by the variance, $\text{Var}[g_{i1}+(_1<_{i2}]=2_1=\dfrac{\left[1+g_1^2+2rg_2\right]}{\left[1-g_1g_2\right]^2}$. The second equation of equation (4) is estimated using the censored Tobit model. The asymptotic variance-covariance of parameter estimates of both models are corrected using Murphy and Topel (1985) procedures. The maximum likelihood for equation (3) is:

$$\begin{aligned} L_{probit} &= \prod_{y_{i1}^{*}=0} \Pr\left(y_{i1} = 0\right) \prod_{y_{i1}^{*}=1} \Pr\left(y_{i1} = 1\right) \\ &= \prod_{y_{i1}^{*}=0} \left(1 - \Phi\left(\frac{g_1\left(x_{i1}'\hat{p}_1\right) + x_{i1}'b_1}{q_1}\right)\right) \prod_{y_{i1}^{*}=1} \Phi\left(\frac{g_1\left(x_{i1}'\hat{p}_1\right) + x_{i1}'b_1}{q_1}\right) \end{aligned} \tag{5}$$

$$\begin{aligned} L_{censored\ Tobit} &= \prod_{y_{i1}^{*}=0} \Pr\left(y_{i2} = 0\right) \prod_{y_{i2}^{*}>0} \Pr\left(y_{i2} > 0\right) \\ &= \prod_{y_{i1}^{*}=0} \Phi\left(-\left(\frac{g_2\left(x_{i2}'\hat{p}_{21}\right) + x_{i2}'b_2}{q_2}\right)\right) \prod_{y_{i2}^{*}>0} \frac{1}{q_2} f\left(\frac{y_{i2} - g_2\left(x_{i2}'\hat{p}_2\right) - x_{i2}'b_2}{q_2}\right) \end{aligned} \tag{6}$$

where 2_1 and 2_2 are scale parameters for probit and censored regression models, respectively. We further assume a multiplicative heteroscedastic form for the variance term, 2_2:

$$q_{i2} = q_2 \exp\left(z_i' g\right) \tag{7}$$

where z_i is a set of exogenous variables producing unequal variances across enterprises. Next, log likelihood functions are applied to above functions to obtain consistent parameter estimates.

3. Data

The survey of golf courses was implemented to obtain information about the renovation intentions, growth expectations, and course maintenance issues in 2001. The survey included 14 southern states of the United States, i.e., the golf courses located in mild climate. However, Florida was excluded from the survey because of specific climatic conditions, some of which were not shared by other southern states (e.g., subtropical climate of the southern Florida). The list of 4,892 golf courses was obtained from the National Golf Course Association (NGCA). Only members of the NGCA were surveyed.

The survey was implemented in a single mailing due to cost considerations. A total of 720 completed questionnaires was returned generating the return rate of 15 percent. The return rate of this magnitude is acceptable. Business operators including farmers, tend to ignore mailed questionnaires, especially those originating from outside their professional organizations. Questionnaires were returned from all 14 states, but the number returned per state varied. The final sample used in this study contains 543 observations after the deletion of incomplete responses.

We use the same set of variables in the estimation of both models with one exception. We prefer dummy indicators for the age of firm in the probability decision, while measuring it as a continuous variable in the growth expectation model. We used all continuous variables in a multiplicative form to represent the heteroscedasticity. Table 1 shows variable names and descriptive statistics.

4. Results

Table 2 shows estimation results. Two tests for the presence of heteroscedasticity were carried out in the censored Tobit model. In addition, specification tests of endogeneity were conducted for each equation. The Wald statistics distributed as a chi-squared with the number of z as degrees of freedom under the null hypothesis that all (s are equal zero revealed the presence of heteroscedasticity in the censored regression model[1]. The second implied tests were the tests of endogeneity whether specific explanatory variables can be treated as exogenous to the structural equation (Vella, 1993a; 1993b). A generalized residual obtained from the reduced form equation was used as an additional regressor in the structural equation (Smith and Blundell, 1986; Rivers and Vuong, 1988; Vella, 1993a; Vella, 1994). A simple t-test of this parameter indicates whether the simultaneity is present. The generalized residuals obtained from the reduced form of probit and censored Tobit models are as follows:

$$\begin{aligned} \hat{n}_{i1} &= E(n_{i1}|y_{i1}) = \left(y_{i1} - \hat{\Phi}_{i1}\right)\hat{f}_{i1}\left(1-\hat{\Phi}_{i1}\right)^{-1}\hat{\Phi}_{i1} \qquad \textit{for probit} \\ \hat{n}_{i2} &= E(n_{i2}|y_{i2}) = -\hat{s}_2(1-I_i)\hat{f}_{i2}\left(1-\hat{\Phi}_{i2}\right)^{-1} + I_i\tilde{n}_{i2} \quad \textit{for censored Tobit} \end{aligned} \tag{8}$$

where $\hat{\Phi}_{i1}$ and $\hat{f}_{i1}$ are the cumulative distribution function and probability distribution function of the standard normal distribution evaluated at the probit estimates, $\hat{\Phi}_{i2}$ and $\hat{f}_{i2}$ are cumulative and probability distribution functions of normal distribution of censored Tobit model estimates, $\hat{s}_2$ is the estimated scale parameter estimate from censored Tobit model, $\tilde{n}_{i2} = y_{i2} - x'_{i2}\hat{p}_2$, and I_i is a dummy indicator equal one if y_{i2} is uncensored and zero otherwise (Vella, 1993a). Smith and Blundell (1986) show that under the null hypothesis of no simultaneity the test is equivalent to a score test (Pagan and Vella, 1989; Vella 1994;

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[1] The applied Wald statistic was $w = \hat{g}'\hat{\Sigma}_g\hat{g}$, where $\hat{\Sigma}_g$ is the estimated variance-covariance matrix of $\hat{g}$.

Vella, and Grogery, 1996) or Lagrange multiplier test of weak exogeneity, i.e, Cov[v_1, v_2]=0, (Newey, 1985; Tauchen, 1985; Greene, 2002).

The significance of generalized residuals of parameter estimates not reported here does not confirm a dependency between the two decisions. That is the simultaneity of both models is not confirmed and, thus, each equation is separately estimated. In addition, the negative coefficients on the generalized residual variables in both models show that unobserved factors reducing the probability decision for future renovation would also reduce the expected growth of golf facilities[2].

Results of the structural equations indicate that observed and unobserved factors affecting growth expectations also reduce the probability of renovation decision. Similarly, the observed and unobserved factors responsible for determining the probability of renovation decision would reduce the expected growth of a golf course enterprise (Table 2). This is an important result showing the negative trade off between the decision to renovate and the expected growth of the enterprise. The effect of the growth variable on the probability decision confirms less desire for the renovation. It is plausible that respondents with high expectations of business growth find themselves financially secure and can afford a renovation as compared to those with low growth expectations. On the other hand, the planned renovation variable included in the growth expectations model shows that the higher the probability to renovate, the higher the probability of the expected growth reduction. Good management and maintenance efficiency may lower costs leading to high growth performance.

[2] Interested readers may request these results upon request.

We now return to impacts of other variables included in the estimation of both models. We first discuss the impacts of variables on the decision to renovate. In a binary model, the marginal estimates of each variable are used to explain the relative rather than the initial effects of exogenous variables on the probability of the decision to renovate the golf course (Greene, 2003). The marginal effect of an explanatory variable, m, on the probability decision to renovate the golf enterprise at the mean of each sample variable is:

$$m_k = \frac{E\left(y_{i1} = 1 | x_{i1}\right)}{¶ x_{k1}} = b_k f\left(x_{i1}' b_1\right) \tag{9}$$

where N is the probability distribution function and subscript k stands for the variable in question, $\$_1$ and x_{i1} are set of all possible parameter estimates and variables in equation 3, respectively. A marginal impact of a dummy variable, say q, is difference between two derivatives (equation 8) evaluated at presence of the variable,1, and without presence of the variable, 0:

$$m_k = \frac{E\left(y_{i1} = 1 | x_{i1}\right)}{¶ x_{k1}} = \left[b_k f\left(x_{i1}' b_1\right)\right]_{q=1} - \left[b_k f\left(x_{i1}' b_1\right)\right]_{q=0} \tag{10}$$

Letting $C = f\left(x_{i1}' b_1\right)$, and $C = \left[f\left(x_{i1}' b_1\right)\right]_{q=1} - \left[f\left(x_{i1}' b_1\right)\right]_{q=0}$ for continuous and dummy variables, then m_k has a normal distribution with mean **C$** and variance CEC', where E is the variance-covariance of the initial parameter estimates, **$** (Greene, 2003). The signs of marginal effect estimates are consistent with the signs obtained for the initial estimates.

Entrepreneurs' age indicates that the decision to renovate the facility declines as entrepreneurs advance in age. This is a plausible result indicating that younger entrepreneurs are more willing to renovate the facility than older entrepreneurs. The sign on the age-squared variable indicates that the non-linear relationship between age and the probability decision is convex rather than concave. Educational attainment has a positive effect on the decision to renovate. The length of experience in working at a golf course facility has an unexpected sign indicating that more experienced entrepreneurs less likely desire a renovation than less experienced respondents. The directional effect of the experience variable is consistent with the age variable indicating that younger respondents with fewer years of experience would more likely renovate a facility than older respondents with a longer experience in the industry. Young respondents may feel that the course is outdated and view a renovation as a way to modernize a facility meeting expectations of the younger generation of players. The experience variables shows a convex relation with respect to the renovation decision in a way similar to the age variable. Being an owners or a superintendents has a negative but insignificant effect on the decision to renovate the facility. Those operators who use the Internet frequently seem more likely to renovate than those operators who do so less frequently. This result is consistent with expectations that frequent users of the Internet may obtain additional information from multiple sources with regard to the importance of renovation (Escalante et al., 2003).

The marginal effect of past renovations indicates that an increasing desire for future renovation is significantly associated with a renovation completed in the past. This result supports the notion that a past renovation generates an influx of players and revenues. Facilities established long ago may require significant and frequent renovations to match the recently established facilities.

Both total acreage and the turfgrass acreage per hole increase the desire for a renovation, perhaps, due to an anticipated increase in future profits. This contradicts the idea that the larger size of the facility means higher maintenance costs and, in turn, lowers the probability of a renovation. Acreage subjected to a future renovation has a significant and positive impact on the probability decision of opting for a renovation. The positive, but statistically insignificant influence of the number of rounds played per hole shows on the probability of the renovation decision is consistent with the increased wear-and-tear of a course resulting from a heavy traffic. The negative effect of the total marginal effect on growth expectations of the same variable, however, seems to indicate that the facility approaches its capacity and any additional growth is limited.

The shares of past and future spending on renovation in total spending on renovation positively influence the probability decision, but only the share of future renovation has a significant impact. Whether the golf facility is a part of real estate development has a positive though insignificant effect on the renovation decision. As the distance from the nearest other golf course increases, the probability to renovate declines. This is an expected result because the proximity of another golf course creates a choice for golfers, who may demand a renovation of the facility or become attracted to a competing facility located nearby. The regional dummies indicating the location of a facility have no statistically significant effects on the renovation decision or the expectations of growth although the direction of the effects confirms the observed trends, i.e., the heavier use of golf courses in the Mid-Atlantic and Southeastern regions than the South and the West.

Among respondent characteristics showing a significant influence on growth expectations, age variables show a concave relationship indicating diminishing growth expectations, while both experience variables, which are statistically significant, show convex relationship with growth expectations (Table 2). Respondent's education has a significant impact on the facility's expected growth and this result supports earlier studies (Liu, Tsou, and Hammitt, 1999). As respondents earn more education, the growth performance of the facility will significantly increase. Highly educated golf facility operators are likely to be efficient managers confidently dealing with golf clients and other people (Mata, 1996; Storey, 1994; Westhead and Storey, 1996; Honjo, 2004). Our findings are consistent with the suggestion by Story (1994) who argues that energy and commitment to pursue fast growth may increase with the entrepreneur's age.

Past and planned renovations diminish growth expectations because money devoted to renovation limits resources for the future firm's growth, but the effect of the future renovation is larger than that of the past renovation. These results are, perhaps, due to the fact that the risk associated with past and future renovations bring higher maintenance and other renovation related costs which may adversely affect the future growth. Being an older facility significantly reduces the growth performance relative to facilities five years old or newer. This is an expected result because newly established facilities may want to foster growth to compete with older facilities which have long been established and well recognized. An increase in the share of total acreage intended for renovation reduces the expected growth. In addition, the statistical insignificance of the effect of acres per hole viewed as a proxy for the firm size supports Gibrat's Law, which suggests that growth and firm size are mutually independent (Liu, Tsou, and Hammitt, 1999; Honjo, 2004). Liu, Tsou, and Hammitt (1999) and Honjo (2004), however, reject Gibrat's Law using a Japanies manufacturing data to examine the growth of new start-up firms. Rounds played per hole have a significant, positive impact on growth expectations. The distance from the nearest golf course has no significant effect on growth expectations. This result suggests that the decision to renovate implies a desire to match the competitor in order to retain its clientele rather than viewing a renovation as a decision driven by the desire to out-compete a neighboring facility.

One of the important implications in a censored model is a unitary impact of estimates on the dependent variable. We first need to define the conditional mean function for censored model as:

$$E\left[y_{i2}|x_{i2}\right] = \Phi\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_{i2}}\right)\left[x'_{i2}\hat{b}_2 + \hat{q}_{i2}\left(\frac{f\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_{i2}}\right)}{\Phi\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_{i2}}\right)}\right)\right]$$

$$E\left[y_{i2}|x_{i2}\right] = \Phi\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i g\right)}\right)\left[x'_{i2}\hat{b}_2 + \hat{q}_2\exp\left(z'_i g\right)\left(\frac{f\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i g\right)}\right)}{\Phi\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i g\right)}\right)}\right)\right] \qquad (11)$$

$$E\left[y_{i2}|x_{i2}\right] = \Phi\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i g\right)}\right)\left[x'_{i2}\hat{b}_2\right] + \hat{q}_2\exp\left(z'_i g\right) f\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i g\right)}\right)$$

where $\hat{q}_{i2} = \hat{q}_2\exp\left(z'_i g\right)$, $\mathbf{x_{i2}}$, $\mathbf{\$_2}$ are all exogenous variables and all corresponding parameter estimates, respectively. The marginal impact of a common variable, $x_{i2} = z_{i2,}$ on the growth is[3]:

$$m_k = \frac{\P}{\P x_k}E\left[y_{i2}|x_{i2}\right] =$$

$$\left[\Phi\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i\hat{g}\right)}\right)\frac{\P}{\P x_k}\left[x'_{i2}\hat{b}_2\right] + \left[x'_{i2}\hat{b}_2\right]\frac{\P}{\P x_k}\Phi\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i\hat{g}\right)}\right)\right] + \qquad (12)$$

$$\left[\hat{q}_2\exp\left(z'_i\hat{g}\right)\frac{\P}{\P x_k} f\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i\hat{g}\right)}\right) + f\left(\frac{x'_{i2}\hat{b}_2}{\hat{q}_2\exp\left(z'_i\hat{g}\right)}\right)\frac{\P}{\P x_k}\hat{q}_2\exp\left(z'_i\hat{g}\right)\right]$$

[3] We will not present full derivations of the marginal estimates here due to a tedious and complicated algebra involved. A well known delta method is applied to obtain the variance-covariance of the marginal impact estimates. LIMDEP provides marginal impact estimates with variance-covariance estimates internally. Interest readers may request the full derivations of the marginal impact estimates with delta method upon request.

$$\frac{\partial}{\partial x_k}\Phi\left(\frac{x'_{i2}\hat{\beta}_2}{\hat{\theta}_2\exp\left(z'_i\hat{\gamma}\right)}\right)=\left(\frac{\hat{\theta}_2\exp\left(z'_i\hat{\gamma}\right)\hat{\beta}_k-x'_{i2}\hat{\beta}_2\exp\left(z'_i\hat{\gamma}\right)\hat{\theta}_2\hat{\gamma}_k}{\left(\hat{\theta}_2\exp\left(z'_i\hat{\gamma}\right)\right)^2}\right)\phi\left(\frac{x'_{i2}\hat{\beta}_2}{\hat{\theta}_2\exp\left(z'_i\hat{\gamma}\right)}\right)$$

where (13)

$$\frac{\partial}{\partial x_k}\phi\left(\frac{x'_{i2}\hat{\beta}_2}{\hat{\theta}_2\exp\left(z'_i\hat{\gamma}\right)}\right)=\left(\frac{\hat{\theta}_2\exp\left(z'_i\hat{\gamma}\right)\hat{\beta}_k-x'_{i2}\hat{\beta}_2\exp\left(z'_i\hat{\gamma}\right)\hat{\theta}_2\hat{\gamma}_k}{\left(\hat{\theta}_2\exp\left(z'_i\hat{\gamma}\right)\right)^2}\right)\phi\left(\frac{x'_{i2}\hat{\beta}_2}{\hat{\theta}_2\exp\left(z'_i\hat{\gamma}\right)}\right)$$

We report the marginal effects of significant variables on economic growth of the firms. One additional year of education advances the economic growth by 0.0426 unit (i.e., a unit is identical to percent because growth performance is measured in percent). An additional share of dollar spent on past renovation fosters the economic growth by 0.61 unit, while an additional share of dollar allocated to future renovation diminishes the economic growth performance by 1.0506 unit. An additional mile away from the nearest golf course increases economic growth by 0.0039 unit. An additional rounds per hole has invisible significant negative unit effect on the growth performance of the firm.

The number of rounds of golf played per hole has twofold effect: A positive and significant effect on growth expectations generates, in turn, more growth and less desire for future renovation; secondly, a positive effect on the probability decision may also lessen the desire to expand the course. Figure 1 shows the relationship between the number of rounds played per hole and the probability decision, and between the rounds played per hole and the expected growth. The relationship is linear. One unit increase in the number of rounds played per hole results in a 0.0004 percent increase in the growth expectations, while a unit increase in the expected growth fosters increased the probability of the renovation decision by 0.3492 of a unit. As such, the more rounds played per hole, the more desire for renovation and the higher the expected growth. In such a case, the golfing facility should focus on finding a way to attract more golfers.

5. Conclusions and Implications

This study investigated the golf course renovation decision and the expected growth using a simultaneous censored regression model in combination with a binary decision model. In addition, the censored regression was modeled in the presence of heteroscedasticity. The tests conducted on the simultaneity of both equations revealed that both the renovation decision and censored growth model should not be simultaneously determined. An additional test revealed that variables assumed no joint significant contribution under the null hypothesis was rejected.

The majority of respondent-specific characteristics were not key factors determining the decision to renovate the facility. On the other hand, most of the enterprise-specific characteristics played an important role in determining the renovation decision probabilities.

With respect to respondent-specific characteristics, it was found that golfing facilities managed by younger respondents were more likely to grow than those run by their older counterparts. Firms managed by highly educated respondents were more likely to be characterized by higher growth expectations than the golf courses headed by less educated respondents supporting conclusions of recent economic growth studies (Honjo, 2004). Respondents, who were owners were more likely to expect growth, while respondents who were superintendents were more likely to expect limited growth. Growth expectations decreased with an increase in business experience, a finding consistent with earlier studies (Storey, 1994). Also consistent with earlier studies was the effect of the respondent's age indicating that the younger were more likely to expect growth (Honjo, 2004).

With respect to firm-specific characteristics, growth expectations increased with increases in the firm size, number of rounds played per hole, shares spending on past and future renovations, miles from the nearest other golf course and if a facility was a part of a real estate development, while the growth expectations decreased with increases in the course's age, turf grass acreage per hole, and the share of acres to be renovated.

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Table 1. Variable Names and Descriptive Statistics.

Variable name	Description	Mean	St. dev.
PLAN	1 if a respondent wants to renovate the facility in future	.501	.500
GROWTH	Potential growth increase, in percent	4.717	8.038
AGE	Age of respondent, in years	40.796	10.030
AGESQ	Age-squared	1,764.704	903.652
SCHOOL	Education, in years	15.409	1.925
EXPERIEN	Experience of working in the golf industry, in years	17.301	8.799
EXPERSQ	Experience-squared	376.617	395.217
OWNER	1 if owns the facility, 0 otherwise	.063	.242
SUPERINT	1 if superintendent, 0 otherwise	.755	.430
OTHMANGR	1 if other than owner or superintendent, 0 otherwise	.192	.395
WEB	1 if respondent uses the internet frequently, 0 otherwise	3.365	1.424
RENOVATN	1 if the facility had undergone a renovation during 1999-2001, 0 otherwise	.422	.494
AGEESTAB	Age of facility, in years	30.854	27.742
AGEESTAB1	1 if the age of the facility was between 0-5 years, 0 otherwise	.199	.400
AGEESTAB2	1 if the age of the facility was between 6-15 years, 0 otherwise	.206	.405
AGEESTAB3	1 if the age of the facility was greater than 15 years, 0 otherwise	.595	.491
ACRSIZE	Total acreage of the facility per hole	97.032	97.000
TURFSIZE	Total turfgrass acreage of the facility per hole	42.344	22.767
RACRREN	Share of acres to be renovated in total acreage	.099	.286
RNDSIZE	The number of rounds of golf played per hole	16,075.116	8,641.946
RAPPEXP	Past spending divided by total spending on renovation	.305	.426
RSPEND	Future spending divided by total spending on renovation	.284	416
DEVELOP	1 if the golf course was a part of a development, 0 otherwise	.411	.492
MILES	The distance to the nearest golf course, in miles	6.692	7.797
SOUTH	1 if the facility was located in Louisiana or in Mississippi, or in Arkansas, or Alabama, 0 otherwise	.142	.500
SOUTHEST	1 if the facility was located in Georgia or Carolinas, 0 otherwise	.355	.453
MID_ATLT	1 if the facility was located in Tennessee, Virginia, or Maryland, 0 otherwise	.223	.392
WEST	1 if the facility was located in Arizona, California, New Mexico, or Texas, 0 otherwise	.280	.449

Note: TSPEND was scaled by 10,000.

Table 2. Parameter Estimates for Probit and Censored Tobit Models

Variable name	Probit Model		Censored Tobit Model			
	Coefficient	t-value	Coefficient	t-value	Heteroscedasticity	
					Coefficient	t-value
GROWTH	-.0125	-1.026	-------	-------	-------	-------
PLAN	-------	-------	-.6564	-.531	-------	-------
Constant	-1.9403	-.380	-1.2598	-.162	-------	-------
AGE	-.0177	-.309	.0249	.067	.0492	1.101
AGESQ	.0003	.472	-.0001	-.032	-.0004	-.894
SCHOOL	.0507	1.253	.6649[b]	3.244	-.1051[b]	-4.348
EXPERIEN	-.0506	-1.471	-.4351[a]	-1.726	-.0708[b]	-3.640
EXPERSQ	.0008	1.086	.0071	1.282	.0012[b]	2.555
OWNER	-.3583	-.937	.7671	.431	-------	-------
SUPERINT	-.1727	-.895	-.6814	-.588	-------	-------
WEB	.1161[b]	2.055	-------	-------	-------	-------
RENOVATN	.7066[b]	2.309	-.8553	-.576	-------	-------
AGEESTAB2	-.0046	-.019	-5.5571[b]	-3.232	-------	-------
AGEESTAB3	.5015[b]	2.308	-6.2616[b]	-4.064	-------	-------
AGEESTAB	-------	-------	-------	-------	-.0035	-1.518
ACRSIZE	.0009	1.058	.0025	.479	-.0004	-.079
TURFSIZE	.0001	.037	-.0114	-.607	-.0006	-.357
RACRREN	2.4366[b]	3.526	-.0693	-.038	.3356[a]	1.835
RNDSIZE	.0001	.967	.0006[a]	1.787	-.0003[b]	-5.939
RAPPEXP	.1125	.339	2.7770	1.405	-.2738[b]	-2.212
RSPEND	3.0595[b]	10.078	.8389	.541	-.4102[b]	-3.343
DEVELOP	.1424	.841	.4716	.490	-------	-------
MILES	-.0306[b]	-2.689	.0409	.933	-.0078	-1.219
SOUTH	-.0472	-.185	-.8794	-.571	-------	-------
SOUTHEST	.1215	.606	.6685	.601	-------	-------
MID-ATLT	.1322	.599	1.3539	1.236	-------	-------
Sigma	-------	-------	65.6709[b]	.956	-------	-------
Log-likelihood function	-189.9115		-1,344.180			

[a] Significant at " = .10, [b] Significant at " = .05. Wald statistics for testing the joint significance of variables used for heteroscedasticity was 49.669 with 13 degrees of freedom. The null hypothesis was rejected in favor of the alternative hypothesis that the chosen variables explained the heteroscedasticity.

Table 3. Marginal Parameter Estimates for Both Probit and Censored Tobit Models

Variable name	Marginal estimates for Probit Model		Marginal estimates for Censored Tobit Model					
	Coefficient	t-value	Direct effect		Indirect effect due to heteroscedasticity		Total effect for a common variable	
			Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
GROWTH	-.0047	-1.026	-------	-------	-------	-------	-------	-------
PLAN	-------	-------	-.3776	-.531	-------	-------	-------	-------
Constant	-.6789	-1.382	-.7248	-.162	-------	-------	-------	-------
AGE	-.0067	-.309	.0143	.067	.1686	1.102	.1830	.703
AGESQ	.0001	.473	-.0007	-.032	-.0015	-.896	-.0016	-.578
SCHOOL	.0192	1.259	.3825[b]	3.355	-.3601[b]	-4.234	.0224	.170
EXPERIEN	-.0192	-1.472	-.2503[a]	-1.682	-.2427[b]	-3.700	-.4930[b]	-3.099
EXPERSQ	.0003	1.086	.0041	1.262	.0040[b]	2.604	.0081[b]	2.295
OWNER	-.1404	-.923	.4413	.431	-------	-------	-------	-------
SUPERINT	-.0645	-.910	-.3920	-.587	-------	-------	-------	-------
WEB	.0441[b]	2.057	-------	-------	-------	-------	-------	-------
RENOVATN	.2586[b]	2.437	-.4920	-.576	-------	-------	-------	-------
AGEESTAB2	-.0017	-.019	-3.1970[b]	-3.187	-------	-------	-------	-------
AGEESTAB3	.1912[b]	2.321	-3.6024[b]	-3.936	-------	-------	-------	-------
AGEESTAB	-------	-------	-------	-------	-.0120	-1.543	-------	-------
ACRSIZE	.0003	1.058	.0014	.479	-.0001	-.079	.0013	.446
TURFSIZE	.4829	.037	-.0066	-.606	-.0022	-.356	-.0088	-.746
RACRREN	.9251[b]	3.634	-.0399	-.038	1.1500[a]	1.844	1.1102	1.038
RNDSIZE	.3492	.968	.0004[a]	1.836	-.0001[b]	-5.647	-.0006[b]	-2.715
RAPPEXP	.0427	.338	1.5976	1.416	-.9382[b]	-2.185	.6594	.555
RSPEND	1.1617[b]	10.959	.4826	.543	-1.4057[b]	-3.348	-.9230	-.989
MILES	-.0116[b]	-2.715	.0235	.939	-.0268	-1.244	-.0032	-.093
DEVELOP	.0538	.847	.2713	.490	-------	-------	-------	-------
SOUTH	-.0180	-.184	-.5059	-.570	-------	-------	-------	-------
SOUTHEST	.0458	.610	.3846	.602	-------	-------	-------	-------
MID-ATLT	.0495	.608	.7789	1.237	-------	-------	-------	-------

[a] Significant at " = .10, [b] Significant at " = .05.

Figure 1: Probability Decision and Expected Economic Growth Performance with Respect to Rounds Played per Hole