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The Role of Local Policies on Resource Utilization: Timber Harvesting in St. Tammany Parish, Louisiana

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Abstract
Seemingly unrelated regression was used to investigate if the passage of forestry-related ordinances has had an effect upon timber harvesting activities in St. Tammany Parish, Louisiana. Results indicate that a significant negative relationship exists between a $10,000 road bond ordinance and the level of timber harvest in the Parish.
Key Words: ordinances, regulation, timber harvest, urbanization, exurbanization

The Role of Local Policies on Resource Utilization: Timber Harvesting in St. Tammany Parish, Louisiana

Introduction

A growing trend of concern to many in the forestry community is the proliferation of state and local government regulations of forestry practices on private land (Hickman 1993; Granskog et al, 2002; Jackson, 2003). Granskog et al.(2002) updated previous work by Martus (1992) and found that the total number of local ordinances had more than doubled across 13 southern states from a total of 141 in 1992 to 346 in 2000. Granskog et al. (2002) concluded that this pattern of growth in ordinances has continued since 1970 with the number of ordinances doubling every 5 years. Forestry-related ordinances are typically used to regulate harvesting activity, minimize damage to public roads, and to preserve environmental and aesthetic quality. However, ordinances passed at the local government level are of particular concern since these are often developed independently and without a full understanding of possible economic consequences (Green and Hains, 2001; Jackson et al., 2003). Additionally, such forestry-related ordinances often have unpredictable impacts on local forestry operations and the unintended consequence of reducing long term timber supply when landowners accelerate harvest to avoid new regulation they consider burdensome (Cubbage, 1991; Greene and Siegel, 1994).

A major factor in the increase of ordinances is a shift in population from urban areas to more rural settings. Former urban dwellers generally have fewer economic and personal ties to rural agriculture and forest economies and are therefore less likely to see a rationale for timber harvesting activities (Hickman, 1993). Granskog et al. (2002) linked the growth of local government ordinances to social conflicts resulting not only from the growth of urban areas, urbanization, but also to exurbanization, the migration of urban residents to rural areas. The new rural residents typically are unfamiliar with the historical importance of forestry to a local economy and react adversely to the unpleasant appearance of harvested areas by organizing community movements and lobbying local government to pass ordinances that are restrictive to forestry practices, often without considering the effectiveness of the ordinance itself or the economic impact on the local economy.

A number of studies have surveyed the existence of forestry-related ordinances across the South and have grouped them into one of five categories that included public property ordinances, timber harvesting ordinances, tree protection ordinances, environmental protection ordinances, and special feature or habitat protection ordinances (Hickman and Martus, 1991; Hickman 1993; Greene and Siegel, 1994; Spink et al., 2000; Granskog et al., 2002). Public property ordinances are intended to protect public roads and bridges from damage resulting from timber harvesting activity as well as to ensure public safety. Timber harvesting ordinances are adopted to restrict certain types of forestry or silvicultural operations and generally require adherence to best management practices and require harvest permits. Tree protection ordinances are intended to preserve trees as land is developed. Environmental protection ordinances seek to protect environmental and aesthetic values by retaining forested tracts. Special feature or habitat protection ordinances are designed to protect scenic or environmentally valuable area by requiring the use of aesthetic management zones.

Of the five types of ordinances discussed in the literature Hickman (1993) indicated that the most popular regulatory ordinances in the South are those directed at the protection of public property. Granskog et al. (2002) also indicated that public property protection ordinances account for nearly half of all ordinances in the South. The passage of such property protection ordinances has grown from 59 in 1992 to 158 in 2000 (Granskog et al., 2002). Ordinances of this type have the potential for negative economic impacts given that a common regulatory requirement of such ordinances is the posting of a performance bond that can range from $1,000 to $25,000 (Hickman, 1993).

St. Tammany Parish, located just north of New Orleans, Louisiana is a prime example of an increasingly exurbanized area that has passed ordinances deemed by many in the forestry community as being excessive both in terms of cost and regulatory rigor (Jackson et al., 2003; Martus, 1992). From 1970 to 2003, the population of St. Tammany parish has nearly tripled. This growing exurbanized population coupled with the historic role that forestry plays in the local economy, along with the proliferation of forestry related ordinances, presents an interesting opportunity for empirical analysis.

Previous empirical work in estimating the impact of forestry-related ordinances is limited primarily to assessing the growth of ordinances and their perceived impact through surveying logging and forestry professionals (Greene and Haines, 1994; Martus, 1992; Martus et al, 1995; Spink et al., 2000; and Granskog et al., 2002). A limited number of studies have looked at relationships beyond surveys of existing ordinances and perceptions of those affected by them. Stier and Martin (1997) investigated the economic impact of a state level regulation in Wisconsin affecting a six county region along the Wisconsin River. The regulation required private landowners to leave buffer zones along the banks of the river. Kittredge et al. (1999) compared stumpage values over five years for two adjacent states (Massachusetts, which has extensive forestry related regulations, and Connecticut, which has extremely limited regulations) and found that such regulations do not adversely affect stumpage or landowner profits. As far as the authors are aware, no study has attempted to estimate a relationship between the timber harvest rates and forestry ordinances that are directly related to timber harvesting activities. The objective of this study is to evaluate the potential consequences of forestry-related ordinances by determining if the passage of such ordinances has had an effect upon timber harvesting activities. This will be investigated by modeling the relationship between timber harvesting practices and the passage of forestry-related ordinances in St. Tammany Parish. Separate models will be estimated for pine sawtimber and pulpwood harvest because of the significantly different operations and markets that exist in each of these sub-industries. Harvest levels will be modeled as a function of stumpage prices, population growth, time, rainfall, and forestry-related ordinances. The ordinances will be incorporated into the models through the use of dummy variables.

Data

The Code of Ordinances for St. Tammany Parish published December 31, 2002 was examined to determine adoption dates for ordinances that are forestry related. Section 12-003 defines the provisions for the land clearing permit that include the purchase price of the permit at $150, cost for inspection of $100, and requirements for a natural uncut buffer zone of at least fifty feet in width surrounding a harvest area. The provision also allows for only one access opening which can not exceed one hundred linear feet. The proceeding requirements of Section 12 of the Code of Ordinances for St. Tammany Parish are defined collectively by six ordinances which were not defined individually. Three of the ordinances that comprise the requirements of Section 12 were adopted in 1984, 1985, 1986. The remaining three ordinances were adopted in 1987. St.

Tammany Parish Land Use Ordinance No. 523 Section 5.17 requires that a road bond in the amount of $10,000 be posted by anyone who obtains a land clearing permit. This provision became effective on October 1, 1990. The provisions of the land clearing permit and the road bond are examples of what the literature refers to as timber harvesting and public property protection ordinances, respectively. Dummy variables were created for each of the individual ordinances enacted in 1984, 1985, and 1986, and for the road bond policy enacted in 1990. Another dummy variable was created to collectively account for the three ordinances enacted in 1987.

Stumpage prices for the state of Louisiana as well as volumes of pine sawtimber and pulpwood harvested by parish from 1970 to 2003 were compiled (Louisiana Department of Agriculture and Forestry, 2004). The Louisiana Department of Agriculture and Forestry maintains a record of annual stumpage prices and timber harvested by parish as recorded through the collection of severance taxes from harvesting activities. Timber harvest data includes Pine sawtimber harvest per thousand board feet (Mbf) and Pine pulpwood harvest per cord. Stumpage prices for both Pine sawtimber and pulpwood were converted from nominal to real dollars using the 1982 Producer Price Index for lumber and wood products (Bureau of Labor Statistics, 2004). Population estimates for St. Tammany Parish for 1970 to 2003 were obtained from the U.S. Census Bureau (2004). Annual precipitation data for St. Tammany parish was obtained for the years 1970 to 2003 (National Oceanic and Atmospheric Administration, 2004).

Methodology

Seeming unrelated regression (SUR) was used to investigate the relationship between forestry-related ordinances and timber harvest levels in St. Tammany Parish.

SUR is an extension of linear regression that allows the error terms of a system of equations to be correlated. The model takes the following general form:

$$y_i = X_i b_i + e_i, \qquad i = 1, \ldots, M,$$

where

$$e = \left[e_1', e_2' \ldots, e_M'\right]'$$

and

$$E\left[e \mid X_1, X_2, \ldots, X_m\right] = 0$$

$$E\left[ee' \mid X_1, X_2, \ldots, X_m\right] = \Omega \ .$$

It appears that each equation is unrelated since each equation in the system has its own parameter vector b_i. However, the correlation across the errors in different equations provides links that can be exploited in estimation (Wooldridge, 2002).

Since no prior work has attempted to estimate a relationship between timber harvest rates and forestry-related ordinances that are directly related to timber harvesting activities, no clear guidelines exist for determining what variables are necessary for inclusion in the model. Economic theory requires that stumpage price be included in the model. Since harvest in one period is directly influenced by the previous period's harvest, a lagged harvest variable should also be included. Timber harvest levels may also be influenced by a wide range of factors that include the discount rate, U.S. housing starts, logging cutbacks in other regions due to restrictive legislation such as the Endangered Species Act, the level of Canadian wood imports, and exchange rates (Rucker et al., 1999). For the purposes of simplifying the model these numerous exogenous effects were internalized by expressing sawtimber and pulpwood harvest for St. Tammany Parish as a ratio of the total timber harvest for the state of Louisiana. Since the afore mentioned exogenous factors should affect timber production in Louisiana equally across all parishes, expressing harvest levels in St. Tammany as a ratio of state totals preserves needed degrees of freedom in the estimation when the time series is as limited as it is in this study. Harvest of pine sawtimber and pulpwood relative to the total harvest levels in Louisiana are depicted in Figures 1 and 2, respectively. Notice the surge in harvest levels just prior to the 1990 implementation of the land use ordinance requiring a $10,000 road bond. Greene and Siegel (1994) indicated that ordinances can have the unintended consequence of accelerating harvest levels as landowners attempt to avoid new regulations they consider burdensome. By modeling harvest as function of ordinances and other relevant variables we will investigate whether a significant relationship exists between reductions in harvest levels in St. Tammany Parish and forestry-related ordinances.

We estimate the following two equation system using SUR:

$$STHarvest_t = ß_{10} + ß_{11}Time_t + ß_{12}Bond + ß_{13}Ordinance1984 + ß_{14}Ordinance1985 + ß_{15}Ordinance1986 + ß_{16}\ Ordinance1987 + ß_{17}STStumpage_t + ß_{18}STHarvest_{t-1} + ß_{19}PopGrowth_t + ß_{1,10}Rainfall_t + e_{1t}$$

$$PWHarvest_t = ß_{20} + ß_{21}Time_t + ß_{22}Bond + ß_{23}Ordinance1984 + ß_{24}Ordinance1985 + ß_{25}Ordinance1986 + ß_{26}\ Ordinance1987 + ß_{27}PWStumpage_t + ß_{28}PWHarvest_{t-1} + ß_{29}PopGrowth_t + ß_{2,10}Rainfall_t + e_{2t}$$

where $STHarvest_t$ is St. Tammany pine sawtimber harvest in year *t* expressed as a ratio of total Louisiana pine sawtimber harvest in year *t*, $PWHarvest_t$ is St. Tammany pulpwood harvest in year *t* expressed as a ratio of total Louisiana pulpwood harvest in year *t*, $Time_t$

is the year, *Bond* is a dummy variable indicating years that the $10,000 road bond is in place, *Ordinance1984*, *Ordinance1985*, *Ordinance1986*, and *Ordinance1987* are dummy variables representing the implementation of forestry-related ordinances in those respective years and the subsequent years the ordinances are in place, $STStumpage_t$ is the real Louisiana stumpage price for pine sawtimber in year t, $STHarvest_{t-1}$ is the ratio of St. Tammany pine sawtimber harvest to total Louisiana pine sawtimber harvest in year $t-1$, $PWStumpage_t$ is the real Louisiana stumpage price for pulpwood in year t, $PWHarvest_{t-1}$ is the ratio of St. Tammany pulpwood harvest to total Louisiana pulpwood harvest in year $t-1$, $PopGrowth_t$ is the one year growth rate in St. Tammany parish population from year $t-1$ to t., and e_{1t} *and* e_{2t} *are error terms.* It is reasonable to assume that the error terms from the sawtimber and pulpwood models are correlated, therefore prompting the decision to use SUR as the method of analysis.

Estimation of models like the one described above are often not straightforward due to the presence of the lagged dependent variable. Time series models often have autocorrelation problems, and when the model contains autocorrelation and a lagged dependent variable, SUR estimates are biased and inconsistent. The Durbin-Watson h statistic (Greene, 2003) was used to test for the presence of autocorrelation within the model. Autocorrelation is often indicative of a misspecified model. An additional problem of hetroskedasticity is also often present in time series models. White's test for hetroskedasticity (Greene, 2003) was also performed on the model.

It is expected that time, the lagged harvest variable, and stumpage will be positive in sign. Time was included to account for technological change in harvest practices, and as technology improves, harvest is expected to increase as well. Lag of harvest should also positively impact harvest. Higher stumpage prices serve as motivation for land owners to harvest timber resulting in a positive relationship. The population growth rate is expected to negatively impact harvest. As population increases harvesting activities are theoretically assumed to decrease (Granskog et al., 2002). Rainfall is also expected to negatively impact harvesting activities. The expected signs of the bond and ordinance variables are unknown and the primary focus of this study, although the authors hypothesize that the bond variable will negatively impact harvest due to its comparatively large financial obligation relative to the other ordinances.

Seemingly Unrelated Regression Results

Regression results for the sawtimber and pulpwood equations are shown in Table 1. Before using SUR, the sawtimber and pulpwood models were run individually using least squares and tested for autocorrelation and heteroskedasticity. Neither autocorrelation nor heterskedasticity were detected in either model. Since results indicate the absence of autocorrelation, the regression estimates are unbiased and consistent.

In the sawtimber model all variables have the expected signs except for population growth, which is not significant, and time. The road bond and lagged harvest variables are significant at the 1% level, with the road bond having a negative effect on sawtimber harvest and lagged harvest having a positive effect. The negative effect of time and the positive effect of stumpage are significant at the 5% level and the negative effect of rainfall is significant at the 10% level. In the pulpwood model all variables again have the expected signs, except for population growth and time. The negative effect on sawtimber harvest of rainfall and the positive effect of stumpage and population growth are all significant at the 5% level while the ordinances passed in 1984 and 1987 are positively significant at the 10% level.

Discussion

This study analyzed possible relationships between local forestry-related ordinances and the harvesting of timber and pulpwood. Significant relationships were found between the road bond policy and harvest levels in the sawtimber and pulpwood models, but the effects of the other forestry-related ordinances were inconclusive. The lagged harvest variable was significant in the sawtimber model but not in the pulpwood model. An explanation of the nature of these two forest products allows for an understanding of this result. Pulpwood is essentially a secondary product that is harvested in mid-rotation as dictated by biological factors. Reasons for mid-rotation pulpwood harvests includes reducing timber volume to allow for increased growth of the primary product (i.e., sawtimber) and to reduce the risk of insect infestation and fire resulting from overstressed trees and dense timber stands. Thus we would not expect pulpwood harvest to be as sensitive as sawtimber to past harvested quantities.

The provision for the road bond ordinance indicates that the $10,000 security could be posted by either party involved in the timber sale. In the case of non-industrial private forestland owners this security is typically bonded by the logging firm. The requirement of $10,000 increases fixed costs for logging firms and may have the effect of reducing the number of firms that are willing to operate in St. Tammany parish and therefore reduce the number of timber harvesting bids. For these reasons it is not surprising to find a significant negative relationship between the road bond ordinance and sawtimber and pulpwood harvesting in St. Tammany parish.

No conclusions can be made regarding the effect of the other six ordinances pertaining to the land clearing permit on sawtimber harvest levels. However, two of the ordinances pertaining to the land clearing permit have a significant positive relationship on pulpwood harvest. It is assumed that any kind of additional regulation is typically not preferred by those who are regulated, but the degree of financial burden resulting from the provisions of the land clearing permit may not be burdensome enough to have a significant negative impact on harvest levels. More research is needed to test this hypothesis. The result of the population growth variable having a positive impact on sawtimber and pulpwood harvest is unexpected and not easily explained. One possibility for the positive effect of population on harvesting may be the clearing of land for housing. The negative effect of time on sawtimber harvest was also unexpected. It was hypothesized that time would have a positive effect on sawtimber harvest reflecting improvements in harvesting technology. It is possible that time is accounting for effects other than technology resulting in a negative relationship. This study was limited by the data accessible for estimation and could be improved upon by collecting more data. The variables available were limited as was the time period spanned by the variables.

Conclusions

The obvious impact that the St. Tammany road bond ordinance has on harvest levels provides possible indication of diminished property values for forest land. Our model indicates that the passage of the $10,000 road bond has a significant negative relationship with harvesting in St. Tammany parish, and it is reasonable to assume that this may have a negative impact on land value used for timber production purposes. This result should be of interest to other local governments in Louisiana since the State Legislature passed amendments in 1995 to the Louisiana Agricultural Protection Act that prohibits local governments from enacting any ordinances that significantly diminish the value of timberland.

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Figure 1. Pulpwood Harvest in St. Tammany as Percentage of State Harvest over time (1970 – 2003).

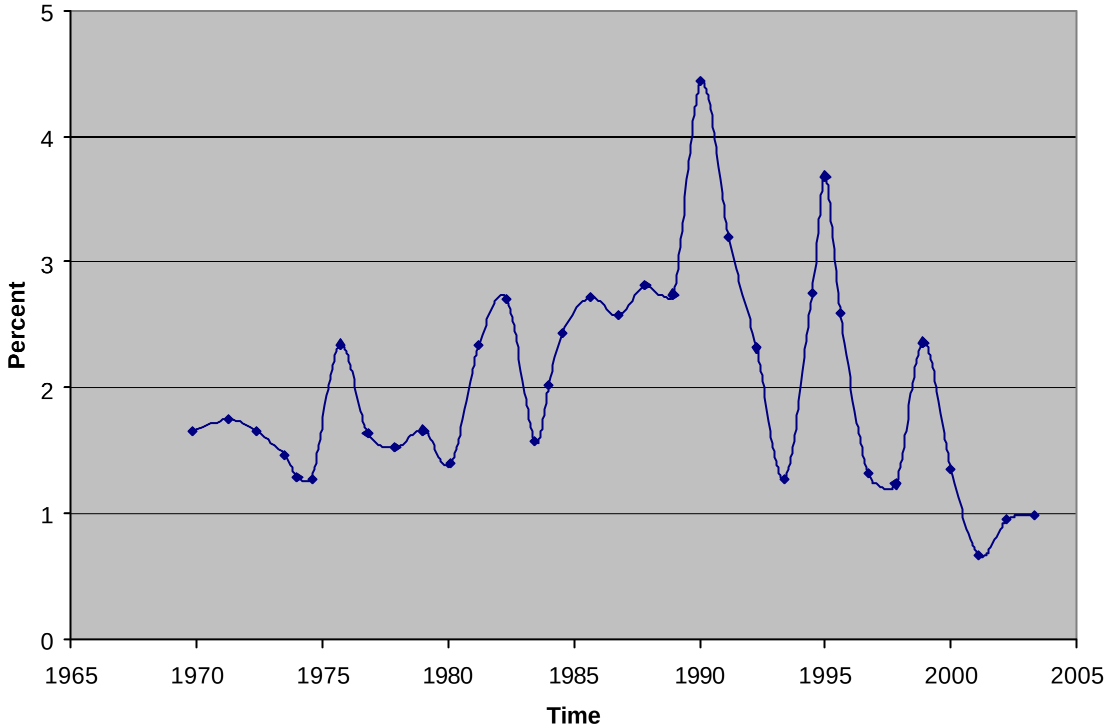

Figure 2. Sawtimber Harvest in St. Tammany as Percentage of State Harvest over time (1970 – 2003).

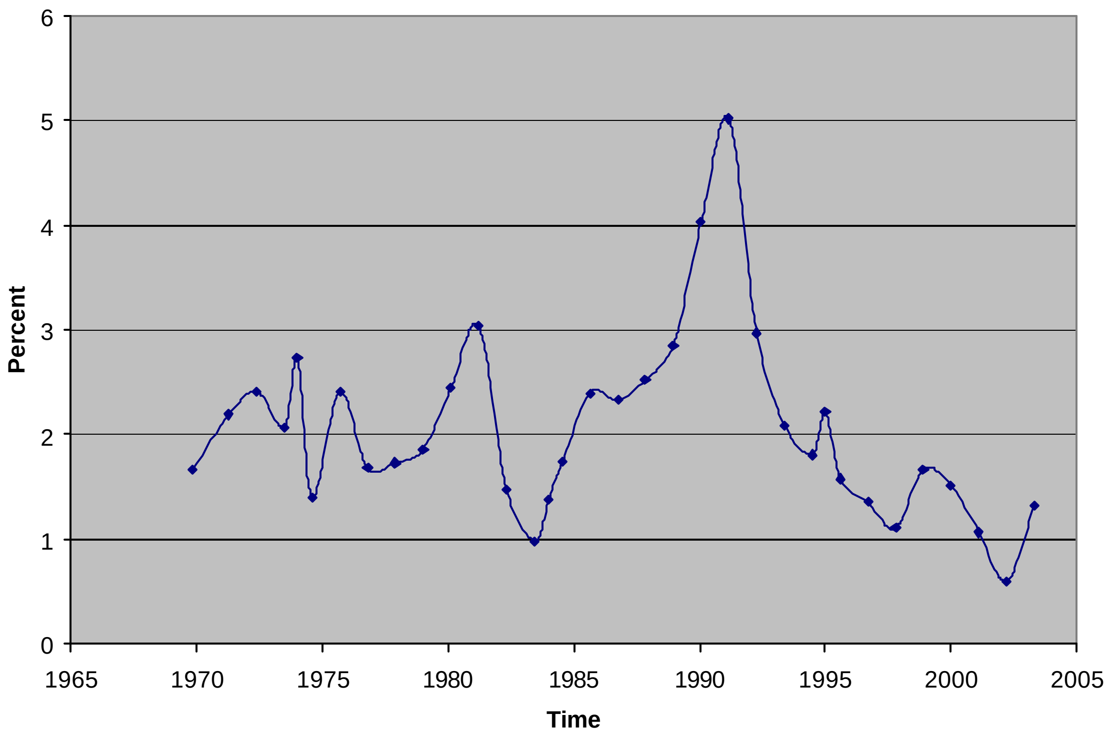

Table 1: Seemingly unrelated regression results for the sawtimber and pulpwood models.

	Coefficient	Std. Err.	p-value
STHarvest			
Time	-.0006814	.0003145	0.036
Bond	-.0150945	.0033962	0.000
Ordinance1984	.0034589	.0052636	0.515
Ordinance1985	.0091854	.0067079	0.178
Ordinance1986	.0036599	.0064834	0.575
Ordinance1987	.0055744	.006231	0.376
STStumpage	.0001407	.0000538	0.012
$STHarvest_{t-1}$	.5544915	.1237316	0.000
PopGrowth	.0763908	.0730085	0.301
Rainfall	-.0001576	.0000794	0.053
Intercept	1.3415	.6180812	0.035
PWHarvest			
Time	-.0006207	.0003032	0.047
Bond	-.0091932	.003819	0.020
Ordinance1984	-.0065368	.0068191	0.343
Ordinance1985	.0143746	.007733	0.070
Ordinance1986	.0032655	.0074482	0.663
Ordinance1987	.0110706	.0063742	0.089
PWStumpage	.0018775	.0006787	0.008
$PWHarvest_{t-1}$	.1717069	.1550019	0.274
PopGrowth	.2203953	.0921881	0.021
Rainfall	-.0002984	.0000883	0.002
Intercept	1.230057	.5967573	0.045

Equation	R-sq	F-Stat	p-value
STHarvest	0.7358	9.20	0.0000
PWHarvest	0.6438	5.93	0.0000