An Analysis of Inflation in Timber Harvesting Costs[1]

by
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Abstract

A logging cost index developed from production and cost data from 19 logging firms was graphically and statistically compared with related Producer Price Indexes (PPIs) to demonstrate that true logging costs have risen faster than both logging contract rates and logging input prices. Graphical comparisons between the cost index and PPIs indicated that logging costs outpaced logging contract rates and logging input prices for much of the study period (1993-1997). Sign tests indicated that the two types of indexes were not different, but tests were considerably weakened by the small time period used. Results suggested that changes in logging costs were driven by factors in addition to inflation, such as production and the possible compliance with environmental restrictions.

INTRODUCTION

One of the most important challenges for the U.S. forest products industry is to assure that local, regional, and national wood supply systems are maintained at an internationally competitive level of performance (Stuart et al., 1998). Wood supply systems consist of many functions, including those necessary to purchase and convert standing timber into industrial raw materials, to transport the raw materials in an appropriate form and timely manner to manufacturing facilities, and to insure a future supply of wood while attempting to satisfy the broad range of stakeholders in the process. A variety of methods to perform these processes have evolved at local, regional, national, and international levels. Customer groups of the forestry process have a vested interest in understanding the functions and the needed improvements of U.S. wood supply systems.

The forest landowner, logging contractor, and wood using industry are the three major components of production forestry and together form the wood supply system. All three components are interdependent, with the health of each member reflecting the condition of the entire system. The landowner component has been healthy in recent years because of steady increases in stumpage prices, but the wood-using industry, and particularly logging contractors, have suffered (Stuart and Grace, 1998).

Shannon (1998) reported that efficiency, defined as the tons of wood produced per dollar spent, declined in the southeastern U.S. from 1990 to 1995 for a number of logging contractors. Stuart et al. (1998) maintained that variability is the enemy of efficiency and identified five sources of variability affecting timber harvesting—technical, organizational, natural, administrative, and regulatory. Variation caused by these forces may limit an operation's productive capacity and increase input costs. For example, production quotas impact the contractors' ability to pay for fixed costs of capital.

Although it is not listed as a source of variability, Shannon (1998) suggested that inflation also impacts logging efficiency. Inflation is a substantial and continual rise in the general price level resulting from an increase in the volume of money and credit relative to available goods. The impacts of inflation on logging have been largely unexplored. Inflation increases input costs, but is seldom accounted for in harvesting contract rates. Few forest industry firms conduct extensive logging cost analyses to assure that contract rates accurately reflect true logging costs (Shaffer 1986). Understanding inflationary effects on logging costs will provide better insight into the condition of logging businesses. Their survival is critical to wood supply systems and the forest products industry.

The Producer Price Index (PPI) published by the Bureau of Labor Statistics (BLS) measures average changes in selling prices received by domestic producers for their output. The PPI contains more than 14,000 price indexes, and some relate to inputs of logging operations such as equipment, fuel, tires, and repair and maintenance. The BLS also publishes an Employment Cost Index (ECI) that includes labor indexes comparable to logging.

Costs per unit of production calculated from firm-level logging data can be used to develop cost indexes, providing a measure of cost changes over time. Comparisons of these cost indexes with related producer price indexes may illustrate differences between true harvesting costs and input prices. Nonparametric statistical methods provide useful insight into the relationships between cost indexes

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and producer price indexes by testing for differences between the two indexes.

Many outstanding contractors (those with high business and environmental ethics) are reevaluating logging as a feasible business opportunity because the return is no longer worth the investment. Some of these loggers with large operations are downsizing, and others are leaving the industry to pursue other opportunities (Stuart and Grace, 1998). Wood supply systems will not be maintained at internationally competitive performance levels if they do not include exceptional loggers with sound business and environmental principles.

The objective of this study is to determine how logging costs have changed relative to logging contract rates and logging input prices.

METHODS

The Industrial Forestry Operations Research Cooperative at Virginia Polytechnic Institute and State University initiated a study in 1988 to determine the components of logging costs (Loving, 1991). Logging contractors participating in the study provided production and cost data. Loving's study was continued and expanded by LeBel (1993 and 1996), Walter (1998), and Shannon (1998). The project was expanded in 1995 to include more contractors in the Gulf South as well as the Lake States and Northeastern States. The data set currently includes information from more than 90 logging businesses. This study examines a subset of these businesses.

The overall study was designed to monitor the performance of a subset of the logging industry. American Pulpwood Association pulpwood producer surveys conducted by Munn et al. (1998) and Watson et al. (1989) indicated that relatively few contractors produce the majority of wood supplied to wood consuming firms. These logging contractors are key to the success of the U.S. forest products industry. Tankersley (1998) reported that forest products companies are interested in the health of outstanding loggers because these companies must be in compliance with SFI or other environmental criteria to be able to compete in foreign markets.

There are several criteria a logging business must meet for inclusion in the study. First the contractor must be a professional, which includes meeting social and regulatory obligations for running a business such as insurance obligations and environmental responsibility. Participating contractors were nominated by peers within the logging industry or by APA member companies. Scientists then met with each contractor to discuss the contractors' willingness and ability to participate in the study. The final determinant of contractor inclusion was their willingness to participate and ability to provide data. Contractors also have the option of leaving the study at any time they wish.

Data Collection

Production and cost data were collected from nineteen contractors in seven states during personal meetings with each contractor. The meetings were conducted at the contractors' logging job or office, and lasted approximately two to six hours. Several researchers including Cutshall (1999), Miller (1999), Shannon (1998), Walter (1998), Omohundro (1999), Altizer (1999), and LeBel (1996) provided portions of the data for this study.

Production and Cost Data

Yearly, and in some cases quarterly and weekly, production data were obtained from the participating loggers, representing the green tons of wood delivered to mills. Most of the production data provided were in tons, but some were converted from cords or MBF to tons using local conversion factors.

The cost information represents the cost associated with getting wood from the stump to the mill. The goal was to obtain quarterly data, however, only yearly data was available for most contractors. Information was obtained in several forms, including tax returns, professional accounting reports, or directly from the contractor's books. These costs were aggregated into the six categories listed in Table 1. Detailed sub-categorical information was gathered from a subset of four contractors. The size of the subset was determined by the number of contractors who were willing and able to provide this level of cost detail.

Major Cost Components

The labor component includes all items related to employee compensation, including the owner's salary. Owner's salaries varied arbitrarily between contractors, and some contractors did not provide salary. Therefore, Shannon (1998) used an annual salary of $30,000 instead, arguing that this amount would be needed to hire a supervisor to assume the same responsibilities. An annual salary of $20,000 plus $0.30 per ton was assumed for all owners in this study to account for differences in operation size. Loving (1991) included workers compensation in the insurance component; however, it was included in the labor component for this study because it is a function of the number of workers employed and is required by state law for contractors participating in this study.

Equipment costs include depreciation, taxes, licenses, and interest. Depreciation was used instead

of note payments because it was more readily available and was easily obtained from tax forms or financial statements. Payment to principal would have been more challenging and time-consuming and was unavailable in some cases. Shannon (1998) recognized that using depreciation strays from the desired cash flow analysis but illustrated that depreciation plus interest are roughly equivalent to equipment costs. He demonstrated that depreciation plus interest underestimate cash flows to note payments.

Table 1. A breakdown of the six cost categories used.

1. Equipment
   - A. Note payments or depreciation
   - B. Taxes and licenses
   - C. Interest
2. Labor
   - A. Payroll (wages and salaries)
   - B. Payroll taxes
   - C. Workers compensation insurance
   - D. Employee benefits
3. Consumables
   - A. Tires
   - B. Fuel, oil, and lubricants
   - C. Repair and maintenance
   - D. Expensed tools (chain saws)
4. Overhead
   - A. Secretary wages
   - B. Bookkeeping or accounting fees
   - C. Office expenses
   - D. Other licenses
   - E. Fines
   - F. Legal and professional dues
   - G. Travel expenses
   - H. Phone and radio expenses
5. Insurance
   - A. General liability
   - B. Equipment (fire, theft, vandalism)
   - C. Umbrella policy
6. Contracted Services
   - A. Contract trucking
   - B. Contract labor

Consumable supplies are non-labor, legally expensed, short-term (hour, month, or year) costs. These primarily include fuel, oil, lubricants, tires, repairs and maintenance, and expensed tools like chain saws.

Transportation of wood materials to mills or other facilities is an important function of logging operations, and several strategies are used to perform this function. Some contractors elect to do all of their own trucking, and others sub-contract all of the hauling. A combination of contractor-owned and contract trucking is also used. Contractors may also organize logging and trucking into separate businesses for legal and tax reasons. Some of these logging firms spend considerably more on contract services than others, so an assumption is necessary to account for these differences.

Shannon (1998) evenly distributed contract services costs into labor, equipment, and consumable supplies by adding 30 percent of its costs into each of these components. Miller (1999) computed percentage costs of these components for log trucking companies and found that labor accounted for approximately 40 percent, equipment 20 percent, and consumable supplies 30 percent. In this study, the contract services component was distributed using this 40-20-30 percent split. Overhead accounted for the remaining ten percent but was not included because it is a fixed cost that is present with or without contract services.

Cost Indexes and Producer Price Indexes

Five cost components (labor, equipment, consumable supplies, overhead, and insurance) and tons of wood produced were used to calculate annual total costs per ton from 1993 to 1997. Costs per unit of output were used because comparisons will be made with PPIs, which are computed from price per unit measures. A total cost index was developed, using 1993 as the base year.

PPIs for 1993 (base year) to 1997 were chosen in relation to overall logging operations and logging component costs. The PPI for Contract Logging (SIC 911) or PPI CL was selected for comparisons with the total cost per ton index because of its design to reflect changes in prices (contract rates) received by logging contractors. Although a national index, it is reasonable to assume its legitimacy for making comparisons given the large coverage area in this study.

The combination of labor, equipment, and consumable supplies (LEC) costs represented 93 percent of the total operating costs for contractors in each of the five years. A weighted composite PPI (PPI Composite) of LEC inputs was developed for comparison with the total cost index. The following PPIs were used to develop a PPI for consumable supplies: # 2 Diesel Fuel (WPU 057303), Truck/Bus Tires, Including Off-Highway Tires (WPU 07120105), and Maintenance and Repair Construction (SIC BMRP#). Percentages of fuel, tires, and repair and maintenance from a four-contractor subset were applied to their respective PPIs as weights to construct the PPI for consumable supplies.

The PPI for non-agricultural Wheeled Off-Highway Tractors (WPU 11280108) was used for the equipment component to represent skidders and

feller-bunchers, and the non-seasonally adjusted Employment Cost Index of total compensation for Private Industry Blue-Collar Occupations (ECI 11202I) was used for the labor component. Percentages of labor, equipment, and consumable supplies costs were used as weights to develop the PPI Composite and were based on the total LEC cost.

Comparisons of Indexes

Graphical comparisons between the total cost index and related PPIs mentioned in the previous two sections were performed to illustrate relationships between the two types of indexes. These comparisons will illustrate the possible inflationary effects on logging costs and help to examine potential differences between logging costs and contract rates and input prices.

The BLS was unable to provide specific information about the data used to develop PPIs. There was uncertainty in the types of data used to develop the PPI for Contract Logging (SIC 911), but BLS analysts Catron (1998), Davies (1998), Owens (1998), and Stanton (1998) reported that the index reflected prices, or contract rates, loggers receive for their services. The amount of logging related commodities or services included in other PPIs was also undetermined. Although there are weaknesses associated with the use of these PPIs, they are the only estimates available for making comparisons with logging cost indexes.

While graphical comparisons are helpful in visualizing relationships between two indexes, a statistical comparison was also computed. Nonparametric statistical comparisons were conducted by using the one-tailed sign test. The sign test was chosen because of its usefulness in testing whether one random variable in a pair tends to be larger than the other random variable in the pair (Conover, 1980). Nonparametric statistical inferences can be made without using large random samples, but their limitations should be kept in mind.

Sign Test (one-tailed)

$\boldsymbol{H_0}$: $P(+) \leq P(-)$

$\boldsymbol{H_1}$: $P(+) > P(-)$

$\boldsymbol{H_0}$ indicates that cost indexes tend to be greater than PPIs $\alpha = 0.10$

RESULTS AND DISCUSSION

The PPI CL was compared with the Cost/Ton index because it best represents the logging firms used in this study (Figure 1). The Cost/Ton index followed the same general trend as the PPI CL from 1993 to 1994, then the Cost/Ton index increased considerably more than the PPI CL until 1996. From 1996 to 1997, however, the Cost/Ton index decreased more than the PPI CL did. Results from the sign test indicated no significant differences between the two indexes, but the test was weakened by the small sample size of four years. The graphical comparison of these two indexes tends to substantiate Shaffer's (1986) claim that contract rates are rarely adjusted to reflect true logging costs.

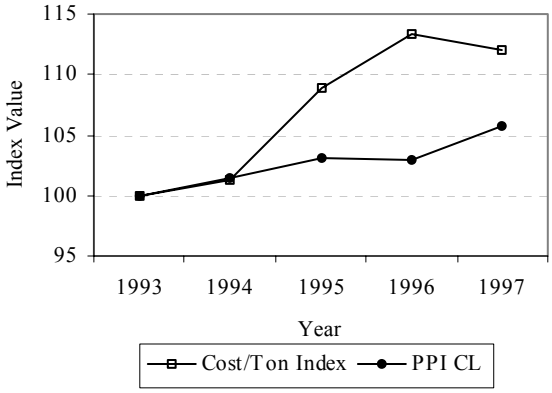

Figure 1. Cost/Ton index versus PPI CL for 1993 to 1997.

The PPI Composite was compared with the Cost/Ton index because it best represents the changes in logging input prices (Figure 2). The two index curves had the same patterns from 1993 to 1994, then the Cost/Ton index increased substantially higher than the PPI Composite did from 1994 to 1995. The index curve patterns were similar for the remaining two years. Sign test results showed no significant differences between the two indexes. The almost parallel curves, except for the period between 1994 and 1995, suggests that inflation has a direct affect on logging costs. However, logging costs increased more than inflation in 1994 and 1995.

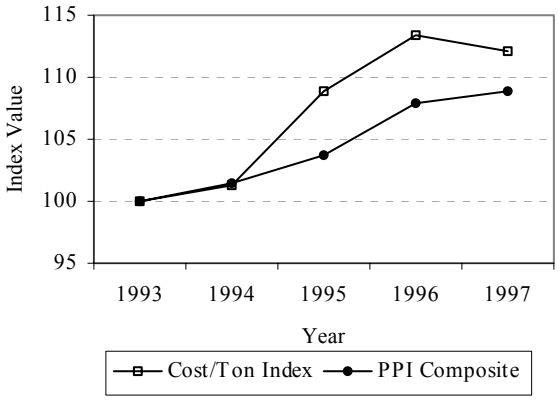

Figure 2. Cost/Ton index versus PPI Composite for 1993to 1997.

The previous two graphical comparisons suggest that logging costs rose greater than both contract rates and input prices from 1993 to 1997.

Additional factors such as weather, business philosophies, procurement systems, and regulations also affect logging costs. Inability to reach a firm's productive capacity has a tremendous effect on costs for contractors because of high fixed costs associated with most logging operations. Contractors are unable to pay fixed costs without sufficient, steady income from production. A production index (Tons) was developed to illustrate how production affects logging costs. The comparison between tons delivered and cost per ton (Figure 3) indicates the role production plays in logging costs. In general, cost per ton is inversely related to production.

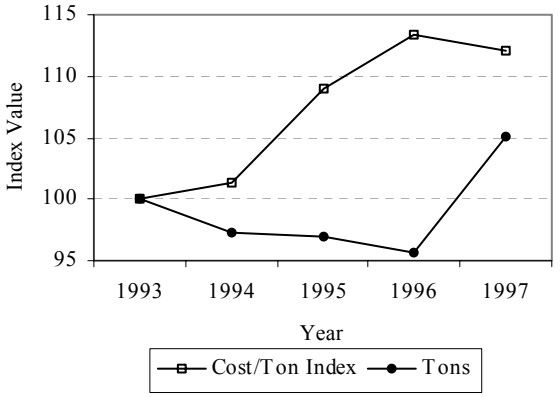

Figure 3. Cost/Ton index versus Tons for 1993 to 1997.

SUMMARY AND CONCLUSIONS

The objective of this study was to determine how logging costs have changed relative to logging contract rates and logging input prices. A total cost per ton index was developed from productivity and cost data for 19 logging firms in seven states, and was compared with the PPI for Contract Logging and with a composite PPI that reflected input price changes.

Graphical comparisons of the total operating cost with the PPIs for contract rates and input prices indicated that changes in logging costs were driven by inflation, but were also driven by other factors. Sign tests indicated that there were no significant differences between logging costs and inflation, as one would expect if the factors driving the change were different from those tested. The small number of observations used (four years) also weakened these tests considerably. It is reasonable to assume that more observations would enable a time series analysis to be performed, which would strengthen the likelihood of significant differences between operating cost changes and inflation.

Contract rates that do not reflect true logging costs (Shaffer 1986), and logging costs that out-pace inflation, as reported here, foretell problems for the wood supply system. Sedjo (1997) has warned that low cost wood-producing regions in other parts of the world threaten to replace harvesting operations in traditional wood-producing regions like the Southeastern U.S. If these conditions worsen, the wood supply system, and ultimately the forest products industry, could face major consequences.

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