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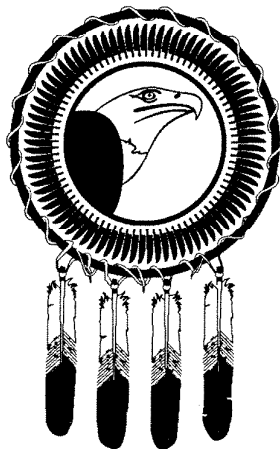
*Can Tribes Manage Their Own Resources?
A Study of American Indian Forestry and the 638 Program*

by

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CAN TRIBES MANAGE THEIR OWN RESOURCES?

A STUDY OF AMERICAN INDIAN FORESTRY AND THE 638 PROGRAM

by

Matthew B. Krepps

"The directors of such [joint-stock] companies, however, being the managers rather of other people's money than of their own, it cannot well be expected, that they should watch over it with the same anxious vigilance with which the partners in a private copartnery frequently watch over their own...Negligence and profusion, therefore, must always prevail, more or less, in the management of the affairs of such a company."

Adam Smith, *The Wealth of Nations*, 1776¹

American Indian tribes have long been treated as wards of the federal government. This relationship was first codified by Chief Justice John Marshall in 1832, and until recently Indian tribes have lived under this legally mandated system of dependence². Under the auspices of the federal trust responsibility, the U.S. Federal Government has historically conducted various enterprises, including the maintenance and marketing of Indian timber resources, on behalf of Indian tribes through the Bureau of Indian Affairs. Perhaps the trust responsibility was intended as a sort of quid pro quo

¹This quote appeared at the beginning of Michael Jensen and William Meckling's seminal work on the principal-agent problem, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure", *Journal of Financial Economics*, 3 (1976). A version of the principal-agent model is developed in this paper and receives more rigorous econometric treatment in a companion paper from which much of the analysis contained herein is drawn. See Matthew B. Krepps and Richard E. Caves, *Bureaucrats and Indians: Principal-Agent Relations and Efficient Management of Tribal Forest Resources* (Department of Economics, Harvard University, draft September 1991).

²United States Supreme Court, *Worcester v. Georgia*, 31 U.S. (6 Pet.) 515 (1832); *Cherokee Nation v. Georgia*, 30 U.S. (5 Pet.) 1 (1831).

for disenfranchising the Indians of untold millions of acres of land during the pursuit of America's "manifest destiny". Whatever the reason for this federal interest in Indian affairs, the Federal Government has effectively been serving as the executor of a will, while the decedent is alive and well.

Although this relationship between tribes and the federal government persisted for almost 150 years, it has not always been willingly endured by the tribes. In response to repeated claims throughout Indian country that tribal economic and political interests were not being properly served by BIA agents, Congress passed the 1975 Indian Self-Determination and Education Assistance Act (hereafter PL 638). PL 638 allows tribes to contract with the Federal Government to conduct various operations formerly conducted on their behalf. BIA funds are typically earmarked for specific programs or individual projects. By participating in the 638 program, a tribe takes over one or more of these aspects itself and receives the concomitant funding to dispense as it sees fit in the task. Restricting our focus to tribal forestry, a tribe could contract with the BIA to undertake a specific project such as inventory or to manage a particular program such as special forest development. The funding for these activities is the same funding that formerly paid the salaries of BIA workers performing the same tasks.

The implementation of PL 638 is feasible because it shifts the onus of accountability for tribal forestry onto the tribes themselves without necessitating any increase in federal appropriations. If federal derogations of the trust responsibility are now detected or even suspected, a tribe can demand and receive control of its portion of BIA forestry appropriations. Although PL 638 threatens to reduce the purview of the Federal Government by facilitating the transfer of control of certain enterprises from the

U.S. Government to the tribes, it is nonetheless very attractive to the politicians who control the BIA's purse strings. The political palatability of PL 638 derives from the fact that past proofs of BIA shortcomings invariably cost the federal government a significant amount of money to redress. In fact, the two most recent investigations of inadequacies in the BIA's fulfillment of the federal trust responsibility vis-a-vis Indian forestry (1977 and 1984) resulted in funding increases of 57 percent and 19 percent respectively. By contrast, funding levels remained roughly constant in real terms for the years 1977-1988 in which no investigations were conducted³.

WHY WRITE ABOUT INDIAN FORESTRY?

Since the passage of PL 638 in 1975, tribal participation in the 638 forestry program has been extensive and well-documented. Of the 75 tribes analyzed in this paper, 49 participated to some degree in the management of their forest resources through the 638 program during the years 1984, 1987, and 1989. Tribal involvement in forestry operations ranged from a completely hands-off approach with full BIA management to total tribal control of day-to-day operations. In spite of the high level of tribal participation of varying degrees, however, there have yet to be any studies performed comparing the success of participating versus non-participating tribes. The lack of serious scholarly attention paid to the 638 forestry program is especially disturbing since some BIA officials have opposed expansion of tribal forestry

³United States Senate, Select Committee on Indian Affairs, Special Committee on Investigations, The Federal Government's Relationship With American Indians: Natural Resources on Indian Lands, Part 11, 101st Cong., 1st sess. (1989), 258.

participation on the grounds of economic efficiency. The often repeated argument that tribes lack the necessary human capital to successfully manage their own resources is again being heard in public debate. This institutional opposition to 638 is not surprising since over 4000 BIA forestry workers have already been replaced by members of tribes who have demanded and received an increased voice in how their timber is managed⁴. Given the political agenda of those who would oppose increased tribal forestry participation (or 638 contracting in other sectors), it is imperative that the success of the 638 forestry program thus far be ascertained.

If the members of Congress are influenced by the dictates of economic expediency, and in this era of astronomical government deficits they most assuredly are, this study could prove especially timely. In light of the current level of federal indebtedness and the increasing vociferousness with which Indian tribes are asserting their economic and political sovereignty, it is difficult to imagine that the U.S. Government will long perpetuate a paternalistic trust responsibility that is costing over thirty million dollars per year in forestry alone. There is an irreconcilable tension in the system, with the only road to equilibration being increased tribal involvement in the management of Indian forest resources.

This study finds that tribal control of forestry under PL638 results in significantly better management. A detailed statistical analysis of forestry operations reveals that tribal control dramatically improves productivity. With no increase in the number of workers, output rises dramatically under 638 contracting by as much as 40% for the

⁴Telephone interview with Mr. Derek Parks, BIA Office of 638 Administration, Washington D.C., 11 Nov., 1990.

typical tribe able to move to complete tribal control. Similarly, tribal control results in better marketing and sharply higher prices received by tribes for their resources. Shifting to total tribal control under PL638 would allow the typical tribe to receive prices as much as 6% higher than under BIA management.

The analysis that follows also indicates that the tribes with the most business experience are currently the most successful forest managers. Economists refer to this increased efficiency over time as a learning curve: unit costs of production decline as cumulative output rises because people get better with practice. The functional implication of the value of forestry experience is that if tribal foresters can gradually assume increasing levels of responsibility over time, while working alongside (and monitoring) experienced BIA foresters, their descent down the learning curve will certainly entail less economic hardship than would an unexpected withdrawal of the government presence.

METHOD OF ANALYSIS

This study is an attempt to estimate the relative contributions of BIA and tribally-employed workers to the productivity of Indian forests. Rather than simply report anecdotal evidence regarding a handful of reservations, this study subjects data from a nationwide sample of 75 forested tribes to the rigors of statistical analysis. Specifically, this study attempts to ascertain the effects of increased Indian forestry participation on the two components of the revenues received in forestry operations: quantity harvested

and price obtained.

ANALYSIS OF QUANTITY HARVESTED

In order to determine whether tribal participation leads to better forest management it is necessary to have a benchmark against which performance can be measured. Fortunately, the minimum optimal harvest rate for every forest is determined by Mother Nature. The quantity of timber harvested in one year at this rate is referred to as the biological annual allowable cut (AAC). To understand the concept of a forest's AAC, one must first understand the components of the harvest decision calculus⁵. The decision to harvest any given stand of trees is a function of the growth rate of the trees, current and expected timber prices, and the market rate of interest and/or the rate of time preference of the forest's owner (explained below). Standing timber represents an asset for which the expected annual return is equal to the annual increment to the forest's biomass multiplied by the expected change in the price of timber. The annual cost of holding this asset is the foregone interest that could have been earned by harvesting the trees and investing the proceeds. Therefore, timber should be harvested as long as the discount rate exceeds the expected value of the annual percentage increment to the value of the forest's biomass.

At the beginning of every fiscal year, BIA foresters calculate the biological annual

⁵For a lucid explanation of the factors affecting the resource extraction decision, see Forest L. Reinhardt, Forest Products Firms and Their Timber Suppliers: Essays in Economic Organization and Behavior, Ph.D. Diss., Harvard University, 1990, and David H. Jackson, The Microeconomics of the Timber Industry (1980).

allowable cut for each Indian forest. The AAC is the quantity of timber whose expected growth rate is economically negative given any positive rate of interest. This timber has essentially stopped growing and, if left standing, represents foregone investment opportunities and serves only to delay replanting and the realization of subsequent harvest receipts. Therefore the AAC represents the minimum amount of timber a value-maximizing tribe would offer for sale each year, and thus provides a benchmark by which to gauge the success of PL638. If, other things being equal, tribes involved in 638 harvest a greater share of their AAC than tribes who participate on a lesser scale or not at all, then it follows that tribal involvement increases productivity. Unfortunately, other things are not equal. Tribes obviously differ in many regards other than the degree of 638 participation. These differences, if unaccounted for, could lead to spurious conclusions regarding the impact of tribal involvement on forest productivity. Economists therefore employ a technique known as multiple regression to simulate an other-things-being-equal situation.

Ideally, the sample of 75 forested Indian tribes would differ only in their degree of 638 participation, thereby facilitating a straightforward measurement of the impact of changes in tribal involvement on productivity. Although this is not the case, multiple regression obviates the need to have the sort of classical control group commonly employed in psychological and biological experiments, i.e. one that differs from the experimental group only with respect to the parameter being analyzed. In this study, the relationship of interest is the one between tribal involvement and forest productivity. Multiple regression essentially allows us to enter into a computer variables corresponding to any intertribal differences that might influence a tribe's harvest level,

and then to calculate the correlation of each variable to the quantity harvested as if only that variable were changing. In this way, multiple regression creates the classical control group of psychological and biological experimentation.

The annual harvest level of a forest (measured in million board feet) is a function of four primary factors: the amount of timber available for sale, the maintenance efforts of low-skilled workers, the marketing efforts of high-skilled workers, and the internal rate of time preference of the forest's owner⁶. The AAC (also measured in million board feet) is included in the productivity statistical analysis in order to control for size differences among tribal forests. The inclusion of AAC permits the measurement of how well a tribe performs given what it has to work with. Having controlled for intertribal scale effects, the foremost purpose of this multiple regression production analysis is to determine whether the productivity of forestry workers differs depending on whether they are employed by the BIA or the tribe, and if so to quantify the differences.

The productivity of low-skilled labor is measured as the average contribution of each low-skilled worker to the value maintenance of the total growing stock of a tribe's forest. The productivity of high-skilled labor is measured as the average contribution of each high-skilled worker to the successful transformation of mature timber into harvest receipts. The computer-generated "coefficients" of these labor variables measure how much the addition of a BIA or tribal worker adds to forest output. They allow us to ascertain whether tribal workers are more or less productive than their BIA counterparts. If the answer is more, then PL638 can be judged a success with respect to productivity

⁶Sources of data are given in the companion to this paper, Krepps and Caves, *Bureaucrats and Indians: Principal-Agent Relations and Efficient Management of Tribal Forest Resources*, op. cit.

and the argument that tribes lack the sophistication to manage their own resources can be safely dismissed.

With inputs of labor and available timber controlled, we expect that intertribal differences in the rate of time preference will affect the quantities harvested by each tribe. The rate of time preference is a measure of the relative value placed by a tribe on present and future income. The market interest rate is commonly used as a first-order approximation of the rate of time preference because a dollar this year and a dollar plus interest next year are of equal value if one's demand for money is the same in both periods. However, there are two primary factors which could cause a forested tribe's rate of time preference to diverge significantly from the market interest rate. These factors are the reservation unemployment rate and the percentage of timber harvested in a given year that was owned by individual tribal allottees rather than the tribal collectivity. Higher unemployment might bias the resource extraction decision toward current harvests because economic hardship tends to promote present-orientedness⁷. Higher allottee timber ownership might serve as an impetus to current harvests if individuals' rates of time preference do not include the full consideration of descendants that may characterize tribal decisionmakers.

The variables defined above - the AAC, the number of BIA and tribal workers of each skill class, and the rates of unemployment and allottee ownership - are the primary determinants of a tribe's annual harvest level. However, in order to fully

⁷For a discussion of the link between economic hardship and one's internal rate of time preference, see Emily C. Lawrance, Poverty and the Rate of Time Preference: Evidence from Panel Data, 99 *Journal of Political Economy* 54 (1991). This link is also a basic tenet of Franco Modigliani's life-cycle consumption theory.

understand the impact of 638 on forest productivity, it is necessary to account for differences in motivation and experience between BIA and tribal workers. First, we employ a variable representing the number of high-skilled tribal workers divided by the total number of BIA agents employed in each forestry operation. As mentioned above, 638 participation has already resulted in the replacement of over 4000 BIA agents with tribal members⁸. An awareness on the part of BIA agents of this apparent cost of underperformance should induce all such agents to exert more effort when working alongside tribal foresters who might be monitoring their activities. This monitoring effect is important to quantify, otherwise the regression results will underestimate the degree to which tribally-employed workers outperform BIA workers or will overestimate the degree to which BIA workers outperform tribal workers. Second, a variable representing the average quantity of timber per tribal member is included as a measure of the importance of timber to the individual and to the tribe. An individual tribal member's stake in a well-managed forest is a function of the quantity of timber per tribal member because the receipts from timber harvests redound to members in the form of tribally-provided public goods (such as school systems) and/or per capita income. A further consideration is the solicitude that individual members have for their tribe⁹. Notwithstanding personal gain, the strong cultural unity that is characteristic of many Indian tribes should enable them to counteract the free-rider problem, i.e. the tendency for individuals to desire something and expect others to perform the work of securing

⁸Mr. Derek Parks (*supra* note 4).

⁹For a discussion of the sociocultural factors that unite tribes, see Stephen Cornell, The Return of the Native: American Indian Political Resurgence, London, Oxford University Press (1988).

it for everyone. An additional factor that might induce tribal members to outperform BIA agents is the Administrative Deduction, a program which stipulates that 10% of a tribe's timber receipts be reinvested in the tribal forest. This 10% is often used to employ more tribal members as forest workers. Thus, when the harvest level falls and timber receipts decrease, tribal members are the first ones to lose their jobs.

Finally, we expect 638 participation to be most successful where the tribe possesses general business experience and/or specific experience in forest management. Therefore, variables are included to control for differences in these parameters. The rate of employment in tribally-owned businesses serves as a proxy for a tribe's ability to mobilize and achieve sustainable economic activity. The inclusion of forestry experience is predicated on the assumption that Indian foresters face a learning curve.

It is hoped that the variables defined above account for all important determinants of the quantity of timber harvested by a tribe¹⁰. If significant influences on productivity are omitted, it is likely that they are specific to particular time periods and/or regions. Therefore, additional variables are employed to account for the geographic location of each forest and the time of harvest¹¹.

¹⁰The adjusted R-squared for the production function regression is .903 indicating that the variables included in the model account for all but 10% of the variance in tribal harvest levels.

¹¹The region-specific dummy variables represent tribal forests located in the northwest plains, north-central, east coast, and southwest regions of the United States; the Pacific northwest is the omitted region. The time-specific dummy variables indicate tribal timber sold during 1984 and 1987; 1989 is the omitted year. The inclusion of year-specific variables is also necessary because observations for a single tribe in different years would otherwise confer upon the model an undeservedly high degree of explanatory power. Although not reported, the dummy variables did contribute to the explanatory power of the model.

RESULTS OF PRODUCTION ANALYSIS

The aforementioned variables were entered into a computerized regression program which generated an effect coefficient and a significance level for each one. The sign and magnitude of each coefficient reveal the direction and magnitude of the corresponding variable's influence on quantity harvested. The significance level represents the level of surety with which we can reject the hypothesis that the variable in question bears no relationship to the quantity of timber harvested by a tribe. The significance level is essentially a measure of the confidence with which the computer-generated coefficients can be accepted.

The multiple regression analysis was performed on a sample of 75 forested Indian tribes throughout the United States in each of three years: 1984, 1987, and 1989. This time period corresponds to very detailed labor input data available in periodic BIA internal program evaluations. Whether or not a tribe is included in the data set depended on the following criteria: a positive AAC and some level of forestry employment, BIA and/or tribal. Tribes with no AAC were eliminated from the sample because it would be specious to infer anything about the productivity of labor inputs when the optimal harvest level is likely to be zero. Further, there is no point in attempting to assess the motivational implications of a tighter tribal-BIA nexus when there is nobody to motivate.

Table A-1 of the appendix to this study reports the results of the statistical production analysis. The quantity harvested is closely related to the AAC as expected;

however, the coefficient less than one indicates that tribal timber is typically harvested at less than the minimally optimal rate. The coefficients for both skill classes of labor indicate that tribal members working under PL638 are significantly more productive than BIA workers given the amount of timber each has to work with. The addition of a typical high-skilled tribal 638 worker adds 24,000 board feet of harvest; adding one more high-skilled worker under BIA control may actually reduce a tribe's harvest (the effect coefficient is negative). Meanwhile, the typical additional PL638 low-skilled worker that is added to the workforce is 75% more productive than an additional BIA-controlled worker. This differential labor productivity provides a compelling rebuttal of the argument that tribes cannot manage their own resources.

The positive influence of allottee ownership on quantity harvested suggests that tribal cultural unity is sufficiently strong to overcome the free-rider problem which would otherwise undermine a tribe's incentive to harvest the optimal quantity of timber. The unemployment rate appears to be positively correlated with the quantity harvested, but the variable was not reported for reasons outlined below¹². The insignificance of the variable representing the monitoring capacity of Indian foresters reveals that the superior productivity of tribal labor derives from these workers' own efforts and not from any energizing effects on BIA personnel.

Additional factors that influence worker productivity are the importance of timber to tribes and their members and tribal business and forestry experience. Tribes for

¹²The correlation matrix of the data set indicates that the tribal unemployment rate is negatively correlated with tribal business experience and 638 participation. The unemployment rate was dropped from the model because it infected the model with multicollinearity and did not successfully control for time preference.

whom timber comprises only a small fraction of total income have relatively little incentive to harvest the optimal quantity, while tribes with little business or forestry experience may be incapable of harvesting the optimal quantity of timber. The positive influence of per capita tribal timber holdings on the harvest level demonstrates that tribal foresters do exert more effort when they can appropriate more of the benefits of their own productivity. Although a tribe's forestry experience appears unrelated to the quantity harvested, the significantly positive influence of employment in tribally-owned businesses provides strong evidence that the productivity of Indian workers increases with the amount of general business experience possessed by tribes involved in 638 contracting. This finding constitutes a powerful argument in favor of pursuing economic development through tribally-run businesses because it implies that there are positive spillover effects of attaining business acumen. As tribes come to understand what it means to run an enterprise, they will attain a competitive advantage over the BIA that is unmitigated by their present inexperience.

The most important conclusion to be drawn from the preceding analysis is that replacing BIA agents with tribal members can significantly increase forest productivity. Figure 1 illustrates the potential for increasing productivity through 638 participation. Tribal members currently comprise an average of 20% of high-skilled labor and 40% of low-skilled labor inputs applied to a tribe's forest (represented on the graph by "0"), the remainder being BIA employees. The average tribe currently harvests approximately 12.5 million board feet of timber annually. Given the productivity difference which exists between similarly skilled tribal and BIA workers, Figure 1 illustrates the harvest levels that could be achieved with different proportions of BIA and tribal labor. It should be

noted that these values are derived from extrapolation and are based on the assumption that the productivity gap is constant across the entire range of tribal involvement levels¹³.

As can be seen from Figure 1, shifting 10% of the forestry workforce from BIA to tribal control results in an increase in productivity of approximately 1.3 million board feet of timber for the average tribe in our sample of 75 forested tribes. This amounts to almost an 11% increase in output. Given that tribes currently receive an average of \$45,570 per million board feet of timber, this means that shifting 10% of the workforce of the typical tribe from BIA to tribal control would bring in an additional \$60,000 in revenue per year (even if increased tribal control does not allow the tribe to improve the prices it receives -- see below). Assuming this relationship holds over the full range from the status quo to 100% tribal control (with quantity capped at the AAC level), 638 contracting could add as much as 40% to productivity and \$200,000 to annual revenues for the typical forested tribe. Over all 75 tribes in this sample, this would mean additional annual revenues of roughly \$15,000,000.

The analysis below indicates that increased tribal involvement leads to increased prices obtained for Indian timber. Therefore, the foregoing estimates of gains from tribal control are understated. Through greater 638 participation, tribes can realize higher prices as well as improved productivity.

¹³This assumption is supported by the random distribution of residuals from the multiple regression estimation.

ANALYSIS OF PRICE OBTAINED

In the preceding production analysis, the annual allowable cut served as a natural yardstick by which to gauge the performance of forestry workers. The AAC represented the minimum optimal harvest level for each forest and the labor productivity coefficients measured the contribution of each type of labor to the attainment of this optimum. A different yardstick is employed to assess labor performance with respect to timber marketing, namely the prices received for similar timber from contiguous national forests.

For each of the 75 Indian forests in our sample there exists a nearby national forest administered by the United States Forest Service. USFS foresters, like their BIA counterparts, do not get to keep any profits generated by the forests they manage. Therefore, with respect to motivation, national forests are organizationally analogous to Indian forests with no tribal involvement. These national forests hold constant the degree of owner involvement (at zero) and provide a base price yardstick against which shifting to tribal marketing under PL638 may be evaluated on a tribe-by-tribe basis. Timber quality differences and divergent contract structuring methods preclude the making of qualitative judgements about the relative marketing performance of the BIA and USFS. Nonetheless, these differences are uniform throughout the United States so the nearby USFS base prices still permit intertribal comparisons of marketing success.

Using USFS timber prices as a base for comparison also effectively controls for the many region-specific and time-specific factors that can influence timber prices and are impossible to explicitly account for in any statistical analysis. If, for example, timber

prices are depressed in a particular year in a particular region due to an economic recession in the region, this recession would be expected to affect both Indian and USFS forestry operations. Measuring Indian timber prices relative to USFS prices allows us to compare forestry performance across tribes even if there is (for example) a regional recession which impacts tribes differently. In fact, since we will be comparing concurrent prices from neighboring forests it is not even necessary to know what the region-specific and time-specific factors might be; they are effectively held constant by applying USFS revenue per species figures to the species bundle sold by the nearest Indian tribe¹⁴. Deviations from USFS prices serve as a proxy for relative management and marketing success.

The three primary determinants of a tribe's position relative to the base price index established by the USFS are: 1) Who markets the tribe's timber?; 2) What are their incentives to obtain a high price?; and 3) How experienced are they?

The marketing of Indian timber is the province of high-skilled workers. The efforts of low-skilled workers are confined to maintenance of the value of the forest's growing stock. Timber sale administration consists of deciding what timber to sell and what market to target when advertising the sale to prospective buyers. Timber revenues are positively correlated with the efforts of high-skilled foresters because the market is fissured such that more effort on the part of the seller raises the prospects of finding buyers willing to pay top dollar. For example, in a well-documented case the BIA refused to support a move by the Quinalt tribe in Washington to export timber. BIA

¹⁴In order to control for unidentified influences that affect only Indian timber sales, the region and time variables from the production analysis are again employed.

agents were selling the tribe's timber for as little as \$16 per thousand board feet while export prices for the same logs exceeded \$1000 per thousand board feet. When the Quinalt Indians brought suit against the Federal Government for failing to fulfill its trust responsibility, the BIA responded by saying that seeking out more lucrative timber markets was not among the mandates of the trust responsibility to Indian tribes¹⁵. It is clear from this example that the efforts exerted by timber sale administrators can have a significant impact on stumpage prices obtained.

Due to the nature of Indian timber sale contract structures, harvest enforcement also plays a vital role in obtaining the highest possible stumpage prices. Harvest enforcement is important because Indian timber sale contracts frequently extend up to two years in duration, with the provision that the buyer will pay a per-species price that is only imperfectly indexed to prevailing timber prices at the time of harvest. Indian timber contracts adjust bid prices to fully reflect after-the-bid market price increases, and to reflect fifty percent of after-the-bid market price declines¹⁶. Because price declines are not fully absorbed by the seller, market downturns can eliminate the incentive to harvest¹⁷. When market prices fall, it becomes the task of high-skilled timber sale administrators to enforce contract provisions requiring that a certain quantity of timber be harvested by a predetermined date. Thus, in most situations, and especially in a

¹⁵United States Senate (*supra* note 3) at 258.

¹⁶Interview with Mr. Kenneth Lathrop, BIA Forester, Portland, OR, 3 Jan., 1991.

¹⁷For a discussion of contract enforcement and the incentive to harvest, see Randal R. Rucker and Keith B. Leffler, "To Harvest or Not to Harvest? An Analysis of Cutting Behavior on Federal Timber Sale Contracts", 70 *Review of Economics & Statistics* 207 (1988).

declining market, the sale monitoring efforts of high-skilled workers can have a significant impact on stumpage prices received.

As in the quantity analysis, workers are separated in a statistical analysis into tribal and BIA so that the computer-generated coefficients on such labor measure the relative contributions of the two groups to the sale prices attained for Indian timber relative to nearby USFS timber. Three additional variables are included to capture possible motivational differences that distinguish tribal and BIA timber sale administrators. First, the quantity of timber per tribal employee is again employed to account for the importance of timber receipts to individual tribal members through tribally-provided public goods and to the tribal collectivity as reflected in the individual's solicitude for fellow tribal members. Second, the reservation unemployment rate is again employed as an indicator of the importance to a tribe of current income (relative to delayed income from later harvests). The previous section suggested that high tribal unemployment might bias the resource extraction decision toward current harvests. If tribes experiencing high unemployment exhibit internal rates of time preference that exceed the market interest rate, tribes may harvest timber prematurely in a biological sense. Stumpage prices are an increasing function of log diameter, therefore this propensity for tribes with high reservation unemployment to cut immature timber would depress stumpage prices.

The third factor which influences the motivation of Indian foresters to obtain high stumpage prices is the percentage of timber sold to the tribe and its members. This factor is included because tribes can set whatever price they like for timber that they sell to themselves, irrespective of market prices. In fact, Indian tribes often conduct

referenda in order to secure tribal approval of artificially low timber prices on sales to tribally-owned entities such as downstream milling operations¹⁸. This maneuver bolsters the apparent profits of tribal sawmills and safeguards employment therein. The proportion of timber sold to tribal entities should therefore have a negative influence on stumpage prices. Finally, the percentage of tribal employment accounted for by tribally-owned businesses is again employed to control for the learning curve effects of prior tribal business experience.

RESULTS OF PRICE ANALYSIS

These variables were collected for the same sample of tribes analyzed in the section dealing with quantity harvested. Fifteen of the tribal observations were discarded from the price analysis because the only national forest within a reasonable distance did not sell the same types of timber as its Indian neighbor. In a few instances, national forest data existed only for classes of timber rather than individual species, e.g. Cedar instead of Western Red Cedar and Port-Orford Cedar. In such cases, the aggregate national forest price was applied to all Indian timber species within that category. The region-specific and time-specific variables employed in the previous section are utilized in order to ensure that the USFS base price index does not miss any unidentified influences that are unique to Indian timber sales.

Table A-2 of the appendix to this study reports the results of the multiple

¹⁸Telephone interview with Mr. Larry Schmidt, BIA Timber Marketing Expert, Phoenix, AZ, 9 Oct., 1990.

regression price analysis. The USFS base price is a good predictor of Indian timber prices and therefore serves as an effective control for unidentified aspects of the timber market that might affect tribal stumpage prices. The "effect coefficients" of the workforce measures indicate that tribal control does a much better job of marketing timber. This result holds in spite of the fact that tribes often negotiate to sell timber to tribal entities at below market prices, as evidenced by the negative influence of sales to tribal entities on stumpage prices. The analysis indicates that adding an additional tribal 638 high-skilled worker adds 5.9% to the typical tribe's timber price, whereas the additional BIA-controlled high-skilled worker adds only 1.4% to price.

Both per capita tribal timber holdings and employment in tribally-owned businesses are positively correlated with stumpage prices, thus attesting to the fact that both financial incentives and prior marketing experience are prerequisites to successful timber sale administration.

The one variable which behaves contrary to our predictions is tribal unemployment, which exhibits a significant positive effect on timber prices. As explained above, the tribal unemployment rate should be negatively correlated with stumpage prices if economic hardship promotes the harvest of premature timber. However, the positive coefficient is likely a result of the fact that the AAC was exceeded in only 24% of the tribal observations. What this statistic tells us is that even though high rates of internal time preference may have led tribes with high unemployment to cut more timber, this incentive probably brought them closer to the optimal harvest, rather than inducing them to exceed it. Another possibility is that tribal foresters who work on high-unemployment reservations place a higher value on their jobs than foresters who can

easily find another job, and this fear of unemployment induces greater effort. The importance of 638 job creation to the sample tribes (whose average unemployment rate was 54%) is evidenced by the fact that most 638 contracting involves special forest development, the area which generates the most jobs per dollar of funding¹⁹.

The finding that high-skilled tribally-controlled foresters do a better job of marketing tribal timber than BIA agents provides hard evidence to support anecdotal instances of BIA malfeasance like the Quinalt case outlined earlier. In order to illustrate just how much tribally-controlled foresters under PL638 outperform BIA foresters vis-a-vis timber sale administration, Figure 2 transforms the effect coefficients from both the quantity and price analyses into dollars.

The statistical analysis contained in this paper provides strong evidence that tribal involvement leads to larger harvests and higher prices obtained. Therefore, Figure 2 represents the potential revenue increases realizable through 638 participation. The graph illustrates that shifting 10% of the typical tribe's workforce from BIA to tribal control results in an increase in total forestry revenue of over \$65,000 per year. Over all 75 tribes in the sample, this amounts to almost \$5,000,000 per year. Moving from the current situation to 100% tribal control on all 75 sample reservations could mean an additional \$18,750,000 per year in tribal timber revenues. The potential revenue difference between having 75 forests run entirely by the BIA and 75 tribally-managed forestry operations could be as high as \$33,000,000 or \$440,000 per tribe. This much additional revenue could obviously help ameliorate some of the economic and social

¹⁹Personal interview with Mr. Clifford Reed, BIA Manager of Branch of Natural Resources and Planning, Portland, OR, 5 Jan., 1991.

problems confronting Indian tribes today. However, demonstrating that tribes can manage their own resources must almost certainly be the most valuable benefit which accrues through 638 participation.

WHAT IS THE NEXT STEP?

The tribes who are best prepared to manage their own forests and who have the most to gain have not yet taken control from the BIA²⁰. At the end of 1989, only 8 tribes had complete control over the management of their forest resources. It behooves leaders throughout Indian country to take a long, hard look at how the BIA manages their tribes' timber. There are certainly instances where the BIA does a very good job; however, the quality of BIA management cannot be inferred from the size of the check sent to the tribe at the end of the year. In the absence of tribal involvement, the effects of poor BIA performance cannot be distinguished from the effects of uncontrollable market shocks. Therefore, every tribe must get involved to ensure that its timber is harvested in a timely fashion and sold at fair market value. This is not to say that 638 participation is a riskless opportunity to further tribal economic interests. On the contrary, the results of this paper indicate that some tribes are more suited to forest management than others, e.g. those with prior business experience, and those for whom timber comprises an important part of tribal income. What is suggested is that all tribes, regardless of wealth or experience, enjoy a decided motivational advantage over BIA

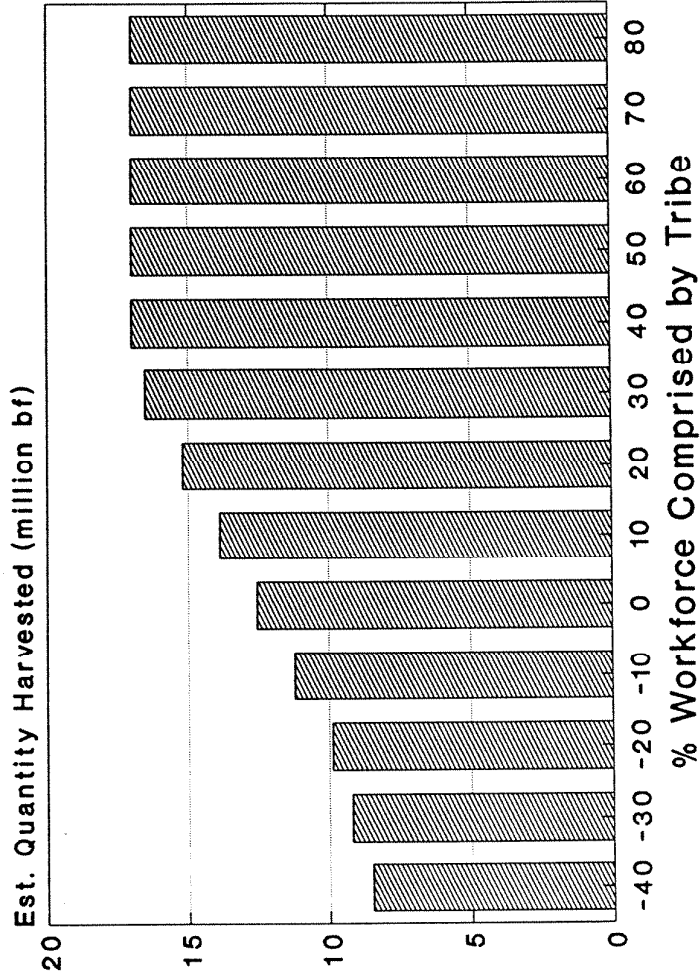
²⁰See Krepps and Caves, *Bureaucrats and Indians: Principal-Agent Relations and Efficient Management of Tribal Forest Resources*.

foresters who are paid flat salaries regardless of how well they manage Indian forests.

With the Eisenhower termination effort still fresh in the minds of today's tribal leaders, the suggestion to push for tribal control of Indian forests will naturally be met with skepticism. Many tribes rely heavily on the fulfillment of the trust responsibility to provide needed services. But if the federal trust responsibility has come to signify undercutting Indian forests and selling tribal timber for a fraction of its value, then greater tribal involvement is the only recourse.

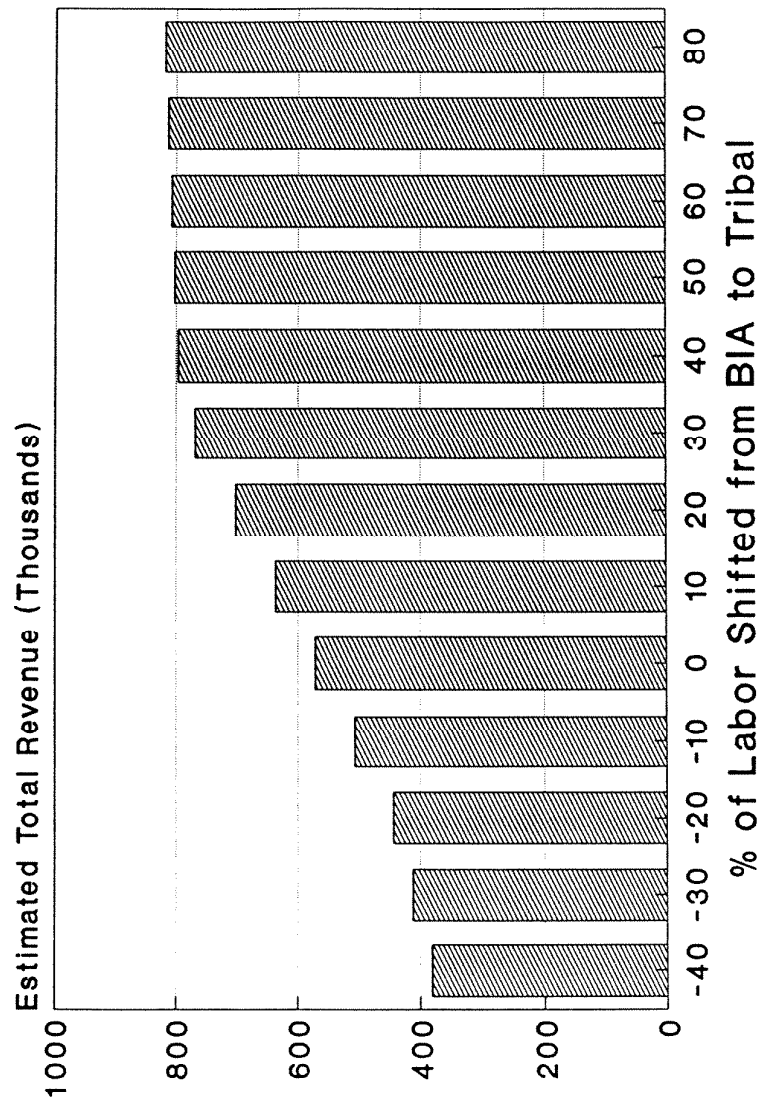
FIGURE 1

SHIFTING TO TRIBAL LABOR CAN DOUBLE OUTPUT



Status quo for the avg. sample tribe is represented by "0".

FIGURE 2
SHIFTING LABOR FROM ALL BIA TO ALL TRIBAL
CAN INCREASE TOTAL REVENUE 115%



Status quo for the avg. sample tribe is represented by "0".

TABLE A-1

<u>EXPLANATORY FACTOR</u>	<u>EFFECT ON HARVEST ("EFFECT COEFFICIENT")</u>	<u>PROBABILITY THAT EFFECT IS SIGNIFICANTLY DIF. THAN 0</u>
AAC	445,000 bf/yr per million allowable cut set by BIA	99.9%
BIA High-Skilled Labor	-14,000 bf/worker/yr given the quantity of timber available to sell	99.9%
Tribal High-Skilled Labor	24,000 bf/worker/yr given the quantity of timber available to sell	99.9%
BIA Low-Skilled Labor	40 bf/worker/yr given the total growing stock available to tend	99.9%
Tribal Low-Skilled Labor	70 bf/worker/yr given the total growing stock available to tend	99.9%
Percent Allottee Ownership	1.34 million bf/yr given the AAC and degree of tribal involvement	99.9%
Per Capita Tribal Timber Holdings	6.59 million bf/yr for each million bf increase in per capita timber holdings	99.9%
Past Tribal Business Experience	306,000 bf/yr for each 10% increase in employment in tribally-owned businesses	99.9%

Note: The model was estimated by generalized least squares jointly with the price equation presented in Table A-2. Predicted effects of explanatory factors are for marginal increments to the means.

TABLE A-2

<u>EXPLANATORY FACTOR</u>	<u>TIMBER PRICE INCREASE DUE TO A 10% INCREASE IN THE EXPLANATORY FACTOR* ("EFFECT COEFFICIENT")</u>	<u>PROBABILITY THAT EFFECT IS SIGNIFICANTLY DIF. THAN 0</u>
USFS Timber Price	5.2%	99.9%
BIA High-Skilled Labor	1.4%	85.4%
Tribal High-Skilled Labor	5.9%	96.2%
% of Timber Sold to Tribal Entities	-3.8%	99.1%
Tribal Unemployment	9.8%	99.9%
Per Capita Tribal Timber Holdings	1.7%	83.9%
Past Tribal Business Experience	17.2%	98.0%

* The predicted price increases associated with the labor inputs are per additional worker. The model was estimated by generalized least squares jointly with the quantity equation presented in Table A-1. Predicted effects of explanatory factors are for marginal increments to the means.

