



Perceptions and reality: How National Forest System employee views correlate with frequency of unsold timber offerings

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ABSTRACT

When National Forest System (NFS) tracts of timber are offered for sale and do not receive any bids from prospective buyers, mandated sales targets may be missed, additional costs can be incurred to the agency, and there is potentially lost opportunity for sustainable forest management. We validated NFS employee perceptions of unsold or “no-bid” offerings against observed no-bid sales. Using ordinary least squares, we regress three different definitions of timber sales against proximate and underlying factors influencing no-bids. We found statistical significance for some proximate factors, including small tree diameter at breast height, seasonal restrictions, and low volume sales. However, the sign of the coefficients for seasonal restrictions and low volume sales were not what we would have expected. Furthermore, we found statistical significance for underlying factors, including perceptions regarding market information and unplanned road costs with coefficient signs in the direction expected. Moreover, we provide some detailed suggestions for future data collection and other avenues for research. Although our data have some limitations, these findings further our understanding of public timber sales.

1. Introduction

The *Multiple-Use Sustained Yield Act of 1960*, 16 U.S. Code § 528 et seq, 1960 mandates establishment and administration of National Forests to provide multiple use and sustained yield of products and services from National Forests, which includes watershed and wildlife management, recreation opportunities, and sustained timber harvests. Timber sales from National Forests support local economies and are often used as a management strategy to achieve healthy and resilient forests. When tracts of timber are offered for sale but receive no bids from prospective buyers, they can cause the National Forest System (NFS) to miss mandated sales targets, incur additional costs, or lose opportunities for forest management. Unsold or “no-bid” offerings can be problematic for NFS administrators since significant time is dedicated to putting sale packages together. Due to these factors, no-bids issues were an active area of research.

“No-bids” have challenged the United States Forest Service (USFS) over the last 40 years (Schuster and Niccolucci, 1991). Some past research has used econometric methods to explore stumpage prices and timber sale impacts on rural communities (e.g., Brown et al., 2012a; Haynes, 1983; Klepacka et al., 2017) and log export prices (Korhonen

et al., 2023). The small number of scientific studies conducted specifically related to “no-bids” often focus on sale-specific appraisal factors (e.g., Buongiorno and Young, 1984; Gebert et al., 1998; Sendak, 1991; Brown et al., 2012b), and very few explore the underlying institutional, policy, and market factors (e.g., Niccolucci, 1989a, 1989b).

NFS employees have over ten thousand cumulative years of experience working on timber sales, about 88% of which sell at the first offer (on average). Yet, about 3% of offerings sell upon re-offer without modification, 6% sell upon re-offer with modification, and 3% never sell (Frey et al., 2022, 2023). In previous work, a series of interviews were conducted with employees from the National Forest System (19 interviewees) and the timber buying industry (9 interviewees) who had extensive experience and knowledge of timber sales, which revealed a framework for understanding the causes of no-bid sales (Frey et al., 2022, 2023). A follow-up survey of NFS employees to understand the perceived magnitude and spatial distribution of these drivers was subsequently conducted (Frey et al., 2023). In this study we aim to use the survey data to explore and validate perceptions of NFS employees.

Validation studies comparing revealed preference (RP) to stated preference (SP) data have been conducted in the field of environmental economics and tourism and recreation economics. Most often, these

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studies aim to confirm willingness to pay for ecosystem services or recreation values. Such literature suggests that comparing RP and SP data increases the amount of information available to model understudied topics and can potentially identify survey respondent biases (Adamowicz et al., 1994, 1997; Whitehead et al., 2008). In this case, SP are perceptions expressed in interviews and surveys and RP are data about no-bid sales recorded in the NFS Timber Information Manager (TIM) (USDA Forest Service, 2021).

The purpose of this exploratory brief communication is to validate employees' perceptions of factors that may impact no-bid sales by comparison with administrative data (USDA Forest Service, 2021). Although the data have limitations, this is a unique opportunity and a novel approach to understanding public land timber sales. To our knowledge, no other study has explored NFS employees' perceptions of no-bid sales using survey methods, and additionally compared those perceptions to recorded no-bids on National Forests. We believe findings may assist NFS managers to focus efforts on improving certain areas of timber sales, where perceptions and observed no-bid sales correlate.

2. Data and methods

The data used for analysis come from two sources: (1) a questionnaire-based survey of NFS employees, and (2) administrative timber sales data from the TIM database. The questionnaire asked for respondents' level of agreement with statements related to potential drivers, or causes, of unsold timber offerings. Potential drivers were previously identified through a set of semi-structured interviews with knowledgeable actors in the NFS and among timber purchasers. They were categorized as "proximate" causes, which were sale-specific reasons why a potential bidder might choose not to bid on a particular offering, and "underlying" factors, which were interrelated issues that influence the proximate causes and can make them more or less likely to occur (Frey et al., 2022, 2023). The survey was conducted in March 2021 and disseminated electronically to all NFS employees involved in timber sales in any capacity. 784 employees responded to the survey, an estimated a 38.3% response rate among positions most directly linked to timber sales. More detailed information about the survey can be found in Frey et al. (2023).

Observational data characterizing national timber sales was retrieved from the NFS TIM (USDA Forest Service, 2021). The TIM includes information on procedural sale steps such as when the bidding process was held, as well as supporting information such as the National Forest and Ranger District, estimated timber volume and land area, species, and product class, advertised minimum bid value, number of bids received, and final winning bid value.

Both survey responses and TIM data were aggregated to the level of NFS "appraisal zones." Appraisal zones represent 86 unique sub-regions nationally, to which each of the NFS' 400+ Ranger Districts is assigned, based on geography including shared timber markets and similar ecological characteristics. Of the 784 survey respondents, we were able to definitively place 628 (80%) into a single, distinct appraisal zone, representing 53 out of 86 appraisal zones. Respondents not placed into an appraisal zone included those who did not state a specific Ranger District, and those who work on multiple Ranger Districts or National Forests. After subsequently filtering out appraisal zones with fewer than 3 survey respondents, there remained 604 respondents representing 37 distinct appraisal zones. The mean number of survey respondents per appraisal zone was 16.4 (max = 53, and min = 3).

Using ordinary least squares (OLS) with robust standard errors, percent of sold timber offerings in an appraisal zone was regressed on NFS employees' views of various factors believed to impact sales and make unsold offerings more likely. The dependent variable¹ was the percent of sales that were sold in an appraisal zone from years 2015–2020.

Table 1 describes the variables based on primary stakeholder perspectives of "no-bids" (Frey et al., 2022, 2023), which are used in each model. Dependent variables included three definitions of "sold," including those that sold upon first offer, sold later without modifications, or sold later with modifications. Explanatory variables were the percent of respondents in an appraisal zone that responded "often" or "almost/always" for proximate factors, and "somewhat agree" or "completely agree" for underlying factors (calculated from a five-point scale of "never/rarely" to "almost/always" for proximate, and "completely disagree" to "completely agree" for underlying). A selection of statements from the larger group of all proximate causes and underlying factors were chosen for this analysis, considering those which had the most variability across NFS regions. This was important because factors with little or no variability in perception across the various

Table 1

Variables from administrative data (dependent variables) and survey (explanatory variables used for comparisons).

Variables	Variable descriptions
Dependent variables:	
Sale Categories 2–4	Percent of offerings in an appraisal zone that sells at any time.
Sale Categories 3–4	Percent of offerings that sell on first offering or at some later point without modifications to the sale parameters
Sale Category 4	Percent of offerings that sell on first offer.
Explanatory variables:	
Proximate causes	
Hauling cost	It's too costly to haul to the mill
Small trees	The average diameter of harvest trees is too small
Marketability risk	There is too much risk surrounding the marketability of the product
Seasonal restrictions	Seasonal restrictions in the sale make it infeasible or undesirable
Construction	The specified construction and/or reconstruction work is too expensive, complex, or undesirable
Low volume	Low volume/acre yields make the sale too costly
Explanatory variables:	
Underlying factors	
Staffing	There is adequate staffing at the district/forest levels for me to concentrate on my job duties
Market info	I have access to mill prices and general market conditions to help me as I prepare my portion of the timber sale package
Planning	The time required to complete the required planning portion (example: NEPA) of our timber sales generally works for our timber sale timelines
Litigation	Litigation of projects often hinder[s] our timber sales timelines
Pressure from targets	The pressure of hitting a target or selling a sale often pushes sales forward
Unplanned road cost	Road packages normally end up being more expensive than anticipated in our timber sales

¹ We tried estimating the model with a natural log transform on the dependent variables and did not find different statistical significance from the level dependent variables. Furthermore, we tried $\log(y/(1-y))$ for data bounded between 0 and 1 but opted to continue with level dependent variables to continue to present results from sale category 2–4 (almost all sales eventually sold within regions).

appraisal zones were not likely to correlate with variability in actual occurrences of sales. Since proximate and underlying factors operate on different levels of control (meaning who, if anyone, has the power to change or impact sale factors) and because of limited sample size, models with proximate and underlying factors were run separately.

Each explanatory variable was worded to represent a potential challenge or benefit, which included statements with both positive and negative wording to increase survey-instrument reliability. For example, adequate staffing was worded positively, while unplanned road cost was worded negatively. We have interpreted result coefficients accordingly in the results section. Additionally, Table 2 presents the summary statistics for dependent and independent variables used in regressions.

3. Results

Results corresponding with frequency of occurrence to proximate causes of unsold offerings are in Table 3, and results corresponding with frequency of occurrence to underlying factors are in Table 4. With regards to proximate causes, NFS employees' views of the frequency of occurrence of factors such as high hauling cost, marketability risk, and construction, were not statistically significant regardless of the definition of "sold." R-squared values were between 0.03 and 0.17 and F-statistics were statistically significant ($p < .001$) for sold category 3–4 and 4. This rejects the null hypothesis that none of the explanatory variables were correlated with the dependent variable, i.e., at least one of the explanatory variables does relate to frequency of sale. Interestingly, small tree diameter at breast height (dbh) was negatively correlated with percent of sold offerings, and statistically significant for sold

Table 2
Summary statistics for dependent and independent variables.

Variables	Mean	Standard Deviation	Min	Max
Sale Categories 2–4	0.91	0.07	0.64	1
Hauling cost	0.21	0.22	0	0.83
Small trees	0.1	0.16	0	0.67
Marketability risk	0.11	0.12	0	0.33
Seasonal restrictions	0.11	0.13	0	0.5
Construction	0.21	0.23	0	0.86
Low volume	0.16	0.18	0	0.67
Staffing	0.36	0.27	0	1
Market info	0.4	0.22	0	1
Planning	0.29	0.23	0	1
Litigation	0.39	0.34	0	1
Pressure from targets	0.74	0.27	0	1
Unplanned road cost	0.56	0.25	0	1
Sale Categories 3–4	0.94	0.06	0.71	1
Hauling cost	0.21	0.23	0	0.83
Small trees	0.1	0.17	0	0.67
Marketability risk	0.11	0.12	0	0.33
Seasonal restrictions	0.11	0.13	0	0.5
Construction	0.22	0.23	0	0.86
Low volume	0.16	0.18	0	0.67
Staffing	0.36	0.26	0	1
Market info	0.4	0.22	0	1
Planning	0.29	0.23	0	1
Litigation	0.39	0.34	0	1
Pressure from targets	0.73	0.27	0	1
Unplanned road cost	0.56	0.25	0	1
Sale Category 4	0.99	0.01	0.97	1
Hauling cost	0.21	0.23	0	0.83
Small trees	0.1	0.17	0	0.67
Marketability risk	0.11	0.12	0	0.33
Seasonal restrictions	0.11	0.13	0	0.5
Construction	0.22	0.23	0	0.86
Low volume	0.16	0.18	0	0.67
Staffing	0.36	0.26	0	1
Market info	0.4	0.22	0	1
Planning	0.29	0.23	0	1
Litigation	0.39	0.34	0	1
Pressure from targets	0.74	0.27	0	1
Unplanned road cost	0.56	0.25	0	1

Table 3

Percent of timber offerings sold in an appraisal zone on percent of survey respondents agreeing with statements related to proximate causes of unsold offerings.

	Sold Category 2–4		Sold Category 3–4		Sold Category 4	
	Coeff. (p-value)	Std. Er.	Coeff. (p-value)	Std. Er.	Coeff. (p-value)	Std. Er.
Intercept	0.999 (0.00) ***	0.002	0.944 (0.00) ****	0.027	0.915 (0.00) ****	0.032
Hauling cost	−0.003 (0.60)	0.005	−0.048 (0.42)	0.059	−0.079 (0.25)	0.067
Small trees	0.007 (0.412)	0.008	−0.098 (0.17)*	0.070	−0.159 (0.07)**	0.083
Marketability risk	0.002 (0.69)	0.005	−0.060 (0.53)	0.097	−0.093 (0.27)	0.082
Seasonal restrictions	−0.001 (0.83)	0.007	0.128 (0.03) ****	0.057	0.103 (0.12)*	0.064
Construction	0.001 (0.61)	0.002	−0.013 (0.71)	0.033	−0.031 (0.40)	0.036
Low volume	−0.007 (0.42)	0.008	0.097 (0.26)	0.084	0.217 (0.05) ***	0.106
R-squared	0.0316		0.1326		0.1668	
F-statistic	0.26		2.70***		2.97***	

*, **, ***, **** - statistically significant at the 0.2, 0.1, 0.05, and 0.01 alpha-levels, respectively.

Table 4

Percent of timber offerings sold in an appraisal zone on percent of survey respondents agreeing with statements related to underlying factors affecting unsold offerings.

	Sold Category 2–4		Sold Category 3–4		Sold Category 4	
	Coeff. (p-value)	Std. Er.	Coeff. (p-value)	Std. Er.	Coeff. (p-value)	Std. Er.
Intercept	0.999 (0.00) ****	0.003	0.966 (0.00) ****	0.047	0.932 (0.00) ****	0.055
Staffing	0.004 (0.27)	0.004	0.018 (0.62)	0.035	0.019 (0.63)	0.038
Market info	0.002 (0.58)	0.003	0.081 (0.14)*	0.053	0.078 (0.22)	0.062
Planning	−0.002 (0.51)	0.003	−0.030 (0.57)	0.052	−0.008 (0.89)	0.061
Litigation	−0.002 (0.49)	0.003	0.025 (0.33)	0.025	0.033 (0.23)	0.027
Pressure from targets	−0.005 (0.27)	0.004	0.012 (0.69)	0.030	0.022 (0.51)	0.033
Unplanned road cost	0.002 (0.38)	0.003	−0.129 (0.02) ****	0.051	−0.155 (0.02) ****	0.063
R-squared	0.0804		0.3883		0.4291	
F-statistic	0.32		4.10****		3.42***	

*, **, ***, **** - statistically significant at the 0.2, 0.1, 0.05 and 0.01 alpha-levels, respectively.

category 4 and significant for sold category 3–4. For example, a one percentage point increase in agreement about low average tree dbh was associated with a 0.16 percentage point decrease in percent sold for category 4. Furthermore, perhaps counterintuitive to what we would expect, a one percentage point increase in agreement that seasonal restrictions make sales undesirable was associated with a 0.13 percentage point increase in sales for sale category 3–4. We found a similar counterintuitive result for low volume sales, where an increase in agreement was associated with a percentage point increase in sold category 4.

With regards to the underlying factors, two of the three models provided a reasonable overall fit indicating some correlation between responses related to perceptions and administrative data. The models for

sold categories 3–4 and 4 had R-squared values of 0.08–0.43 and F-statistics were statistically significant at the 0.01 alpha level for sold category 3–4 and 4. Of note, the perception that road costs end up being more than expected were statistically significant and negatively correlated with percent of sold offerings in these two models. A one percentage point increase in agreement about road costs being more than expected was associated with a 0.13 percentage point decrease in percent sold for category 3–4, and a 0.16 percentage point decrease for sold category 4. Furthermore, in the model for sold category 3–4, access to prices and market conditions was positively correlated and statistically significant with percent of sold offerings (alpha level = 0.14).

The model for sold category 2–4 did not reject the larger null hypothesis that none of the perceptions of underlying factors were correlated with frequency of sale. This may simply be because there is only a small degree of variation in percent of offerings that never sell, which only averages about 3% nationwide (i.e., 97% sell eventually). Thus, the model did not contain enough information to detect a clear correlation at this level. Using different definitions of “sold” (category 3–4 or 4) provided larger overall variability in the dependent variable and greater statistical power in the models.

4. Discussion and conclusions

This brief communication reports exploratory results of a comparison between responses from a survey of NFS employees and administrative data to validate respondent perceptions. Historical research on this topic has used sale-specific cost and revenue factors to determine the likelihood of receiving a bid at a given advertised rate, and if so what the approximate value of the winning bid could be (Buongiorno and Young, 1984; Gebert et al., 1998; Schuster and Niccolucci, 1989; Sendak, 1991), including some which included broader macroeconomic conditions as predictors (Niccolucci, 1989a, 1989b; Schuster and Niccolucci, 1991). By contrast, our research was the first to elicit perceptions on this topic from various parties involved in the timber sale and purchase process, both through interviews and a survey of NFS employees. Furthermore, the use of NFS appraisal zones to explore no-bids (as opposed to forests, districts, or regions), to our knowledge, has not been conducted before. Additionally, surveys can provide information and insights that are not available in administrative records. The results of our previous qualitative work have revealed numerous underlying factors including institutional and organizational challenges at the level of the Forest Service, not previously identified in the scientific literature.

That said, it may be valuable, when possible, to compare the results of survey respondent perceptions with observational data. We used OLS regressions to compare perceived frequency of various proximate causes of unsold offerings and level of agreement with statements related to underlying conditions, with the frequency at which offerings sell according to standardized definitions of “sold.” To validate overall correlation, the model fit was measured by R-squared and F-statistics. The F-statistics, in particular, rejected the null hypothesis that none of the explanatory variables were correlated with the dependent variable for four of the six models.

In terms of proximate causes of unsold timber offerings, we were able to validate employees who perceived small tree dbh as an inhibiting factor to sales. Yet, we found counterintuitive results for seasonal restrictions and low volume sales. In particular, the more employees' agreed sales were undesirable or too costly the more likely sales in that appraisal zone were sold. In terms of underlying factors, employees' perceptions about market information and unplanned road costs correlated with percent sold in two of three models, and statistically significant coefficients were in the direction we would expect.

Overall, this validates NFS employees' views for underlying factors, but not all proximate causes. We provide a couple potential explanations. First, most of the identified proximate causes can be controlled for in the timber appraisal process. In this case, the appraiser will simply set a lower minimum bid to attract bidders, so it is possible that there would

be no impact on the likelihood of sale/no sale. Underlying factors may simply be those causes that cannot be directly accounted for in the appraisal process. Second, it is possible that NFS employees do not have a full view of proximate causes, which are more likely to be understood by the bidders themselves, since they are the ones that suffer the potential high costs or low revenues. In this case, the proximate causes could be viewed as external, or not controlled by the NFS, whereas the underlying factors may be internal in terms of institutional or procedural challenges that NFS employees deal with from day to day.

Timber contracts that are put up for sale take significant time and effort to put together. NFS employees who work closely with public timber sales may have insights that have been previously unexplored, or have perhaps not been emphasized, when considering how to reduce the number of no-bid sales. Ultimately, the survey data was fairly limited for this particular purpose of comparing stated perceptions against the reality of NFS timber offerings that go no-bid. We acknowledge the many limitations to our analysis. Primarily, we likely have an omitted variable bias issue. We have not included all factors that influence bidding behavior; thus, we did not fully explain a causal effect of “bid” or “no-bid.” However, the purpose of this exercise was to determine what perceptions correlate with observed sales, based on the theoretical framework outlined in Frey et al. (2022, 2023). To that end, we were not able to run a larger regression with both proximate and underlying factors on the right-hand side due to a low number of observations. These are the reasons we chose to provide a brief communication that outlines results that, while limited, can provide valuable insights to compare with future research. In future survey instruments, we could enhance the questionnaire to improve this type of analysis, by requiring participants to indicate a primary appraisal zone or Ranger District, as well as by asking respondents to focus strictly on the issues that face their area. Furthermore, we would aim to stratify responses across appraisal zones to have a larger and more representative sample. Finally, it may be worthwhile to pursue a stochastic frontier analysis to compare our findings with measurable underlying factors to better estimate producer inefficiencies.

Disclaimer

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CRediT authorship contribution statement

Sonia R. Bruck: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Gregory E. Frey:** Funding acquisition, Project administration, Methodology, Data curation, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

None.

Data availability

Data will be made available on request, and subject to aggregation or summarization to protect confidentiality of respondents.

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