

Notes on Data Processing

Robert C. Marshall*, Jean-Francois Richard[†]
and Chaohai Shen[‡]

September 26, 2019

1 Number of Auctions

Our primary data was purchased from the Timber Data Company (TDC; contact was Doug McDonald). The data purchased from TDC contained information on 3,157 auctions. The TDC data included auctions in eastern Washington, Idaho, and Montana by the USFS as well as the states. Discussions with TDC resulted in a few updates to the data originally provided. In addition, a few corrections were made to the data based on direct information about specific auctions provided by IDL staff in response to a public information request from us. Details of these specific updates are available from the authors upon request.

Even though the focus of our study is IDL auctions, we used the data for the USFS sales as well as the Montana and eastern Washington State sales for the creation of two variables, the most important of which is the number of feasible bidders (the

*Penn State University, Department of Economics, rcm10@psu.edu

[†]University of Pittsburgh, Department of Economics, fantin@pitt.edu

[‡]East China Normal University, Department of Business Administration, cshen@alumni.psu.edu

other variable was firm specific inventories). Recall that one criterion for being a feasible bidder is that the top three species in terms of volume purchased historically by the bidder should be at least 60% of the species, in terms of volume, sold at the tract in question. Since a bidder can potentially be bidding at auctions in eastern Washington, Idaho, and Montana (state and USFS auctions), we used auction data from all of these areas to determine what a bidder had purchased historically. For this reason, sales outside of Idaho have potential implications for our analysis.

There are 3,046 auctions with complete location information and volume information. These 3,046 auctions were used to calculate bidder's specialized species, bidder's inventory, tract inventory and local forest productivity. There are 2,770 auctions with complete location information, volume information and information about the size of the sale (in terms of acres). Within these 2,770 auctions, there are 1,070 IDL auctions. The time period of this data is from January 2001 to June 2016.

We selected IDL auctions with 2 or more bidders (2+ auctions) as follows:

1. We excluded data for 2001 to 2003 from the estimation in order to calculate a temporally consistent inventory variable for the years 2004 through 2015 (the data for 2001 to 2003 was used to calculate the 2004 inventory variable).
2. We excluded data on auctions we had for the first half of 2016 – our supply variable requires us to have data for six months into the future.
3. We also dropped one sale with an obviously miscoded size (e.g. tract was recorded as 8,800+ acres).
4. We eliminated pole sales. To be precise, we dropped every sale whose sale name contained "pole".

5. We only kept the scale sales. (There are 23 two-or-more bidder lump-sum sales, and 40 two-or-more bidder ton sales)

We also did the following adjustment:

1. There is one auction (104SID30990572) where Idaho Forest Group bid against Bennett Forest Ind. Since IFG was a merger of Bennett Forest Ind and Riley Creek Lumber in 2008, we are not sure what happened in this auction.
2. There is one auction (082SID20253010) where the number of active bidders is greater than one but there is no second bidder's name recorded, so we eliminated this auction.
3. There are auctions (072SID60980170, 053SID20290234, 081SID30370273, 042SID40990769) for which we do not have the second bidder's location information. These were eliminated.
4. There are auctions (092SID10150170, 043SID20290235) for which we do not have the first bidder's location information. These were eliminated.

In the end, we are left with 626 two-or-more bidder non-pole scale sales.

For the one bidder auctions,

1. We selected the period 2004-2015, eliminating auctions with incomplete location information, size information or bidder information.
2. We also eliminated one auction where the number of active bidders equals one but there are two bidder names recorded.
3. We eliminated three auctions (152SID20290265, 143SID20290257, 143SID20290261) where we were unable to get the first bidder's location information.

4. We eliminated one auction (052SID50980138) because we have no information about the first bidder, TAMARACK RESORT. This is a bidder different from "TAMARACK MILLS", whose information we have collected.
5. We dropped all the pole sales. To be precise, we dropped every sale whose sale name contains "pole".
6. We only kept the scale sales. (There are 6 one bidder lump-sum sales, and 15 one bidder ton sales)

In the end, we had 82 one bidder non-pole scale sales.

1.1 Additional Miscellaneous Issue

There are bidders whose recorded names are probably not firms names. For example, there is one auction won by "WILCOX, ZAIN". Initially, we were unable to match this name with a firm but after some online searching we were able to complete the information for this auction 054SID40990383.

2 Variables from Data Directly

The definition of variables in this section were provided by TDC in the code book or based on direct communication with Mr. McDonald.

2.1 Winning bid

The winning bid is the variable named "highbidvalue".

2.2 Lstar

Lstar is the variable "bdt" in the TDC data. This is the total number of bidders submitting bids greater than or equal to the reserve price.

2.3 Volume

Volume is the variable "voltot" in the TDC data. This is the total volume of timber sold at each auction (in Mbf). This is the volume for all products.

There is another variable named "volsaw" in the TDC data. That is the total volume of sawtimber sold at each auction (in Mbf).

2.4 Reserve price

Reserve price is the variable "advalue" in the TDC data.

2.5 Acres

Acres is the variable "acres" in the TDC data, which records the acres to be harvested.

2.6 Logging cost

Logging cost is the IDL estimate of the cost of logging the tract.

2.7 Term

This is the variable "trm" in the TDC data. Term is the maximum amount of months that the winning bidder can take to complete the specified cut of the tract.

2.8 Business Size

Business size appears in the TDC data as follows.

business size 1 = 1-25 employees

business size 2 = 26-75

business size 3 = 76-150

business size 4 = 151-250

business size 5 = 251-500

business size 6 = 501-750

business size 7 = 751-1,000

business size 8 = over 1,000 employees.

There are 8 bidders whose business size information is missing. We tried to get the number of employees online for each of these bidders, and define its business size following the same criteria as above.

- PETTIT LOGGING, J & M, this is a bidder who never bid as a top 2 bidder after year 2001. The number of employees is not available online. So we temporarily set its business size as 1, and do not include this bidder as a potential bidder for any tract after 2001.
- MERRELL LOGGING, MARK, employs a staff of approximately 3, we define the business size=1.¹
- HENDERSON LOGGING, STEVE, employs a staff of approximately 2, we define the business size=1.²

¹<https://www.manta.com/c/mmdsgl8/merrell-logging-inc>

²<https://www.manta.com/c/mm7pt81/steve-henderson-logging-inc>

- HENDERSON LOGGING, PAT, employs a staff of approximately 8, we define the business size=1.³
- WILCOX, ZAIN, this is a person owning a smaller logging company. We don't have the exact information about the company. We define it as a business size 1 "firm".
- SILVICULTURAL ENTERPRISES, employs a staff of approximately 4, we define the business size=1.⁴
- FINKE LOGGING, employs a staff of approximately 20 to 49, to be conservative we define the business size=1.⁵
- FULLER LOGGING, TIM, employs a staff of approximately 2, we define the business size=1.⁶

2.9 Species

The species sold in IDL, Montana, eastern Washington and USFS are not always coded in a uniform way. In the TDC code books (the code book TDC sent us with the data along with the older code book for the 1983-1992 USFS data used in BMR 1997), we can find the species names for most of the major species sold in the tracts. It has been confirmed by TDC that the old USFS codebook works for our data.

There are 10 species codings that are important for IDL sales — grand fir, Doug-fir, western red cedar, ponderosa pine, lodgepole pine, pulpwood, Englemann spruce, cedar products, western white pine, and small sawlog. They are part of our variable

³<https://www.manta.com/c/mmfbq0p/pat-henderson>

⁴<https://www.manta.com/c/mmfl5h9/silvicultural-enterprises-inc>

⁵<https://www.manta.com/c/mmg8tmw/finke-logging-co-inc>

⁶<https://www.manta.com/c/mm5g9sv/tim-fuller-logging-llc>

constructions for estimation. For IDL auctions, there are three species for which we do not have information: HL, RWD, and LPP. However, HL was only sold once in all the auctions of our data set, and the volume is 190MBF. RWD was sold twice in all the auctions of our data set, and the total volume is 60+165=225MBF. LPP was sold once in all the auctions of our data set, and the volume is 220MBF. These species are de minimis in size. There are also some small volume species rarely sold by the USFS, Washington state, and Montana for which we have little information. Details are available from the authors upon request.

3 Variables from Public available source: lumber price

Producer Price Index by Commodity for Lumber and Wood Products: Softwood Lumber, made from Purchased Lumber (WPU081107) FRED St Louis.⁷

4 Variables Calculated

4.1 Tract locations

The location information recorded in the original data from TDC is not in a latitude-longitude system, but the Township and Range Survey System.⁸ We transferred the data into a latitude-longitude system with this website (<http://www.earthpoint.us/Default.aspx>).

An example of the outcome of this transfer is given in Figure 1.

In our data, we chose range, township and meridian as input. We did not select "sections". We used the Centroid output from the website (see Figure 1) as the

⁷<https://fred.stlouisfed.org/series/WPU0811>

⁸<http://www.jsu.edu/dept/geography/mhill/phygeogone/trprac.html>

Figure 1: Township and Range transferring to Latitude and Longitude

Township and Range - Search By Description.

A user account is **not** needed for the features on this web page.

Enter Township and Range. Optionally enter Section. Google Earth flies you there using BLM data. Hint: pause for a moment after choosing each of the criteria. This allows the data to be loaded into the drop-down boxes.

State ⌵
 Principal Meridian ⌵
 Township ⌵
 Range ⌵
 Section ⌵ (optional)

Free. User account is not needed.

If you want to see the surrounding townships, then once you have clicked the "Fly To" button, come back and click the BLM or National Atlas "View on Google Earth" button. Free. User account is not needed.

Township - BLM database

Township	T49N R5W
Meridian	Boise
State	Idaho
Source	BLM
GLO	GLO Township Records
Calculated Values	
Acres	19,548
Centroid	47.5859513, -116.9686948
Corners	NW47.6293452, -117.0233266
	NE 47.6293562, -116.9141002
	SE 47.5417656, -116.9154883
	SW47.5425409, -117.0225914

For illustration only. User to verify all information. www.earthpoint.us

latitude and longitude for the tract.

4.2 Bidder Information

The bidder information we sought includes: bidder (mill) location, bidder's business size, bidder's established year and bidder's closing year.

4.2.1 Identity and Business Size

There are 156 unique bidder names in IDL sales from 2001 to 2016 (January-June) that finished as a top 2 bidder. Identity information is only provided for the top 2 bidder.

We cannot find information regarding the following bidders online and thus we do not know their location or years of operation:

1. BURNABY ENTERPRISES
2. M J M LOGGING
3. MATTHEWS LOGGING, LAYNE
4. WEBB & DORRY
5. DORY LOGGING, FRANK
6. RENEWABLE ENERGY OF IDAHO
7. TWO FOOT LOGGING
8. MR LOG
9. W E SULLIVAN LLC
10. DIRKS, BRENTON
11. BALIK, TOM.

ALL of these bidders are recorded as business size 1 in the TDC data.

In addition, we do not have information for CROWN PACIFIC PARTNERS LP.⁹

⁹It filed for Chapter 11 bankruptcy in June 2003, with its remaining assets, 520,000 acres (2,100

There is one bidder named "TAMARACK RESORT". We do not have the related information, except noting there is one hotel with the same name.

Overall, we do not have information for above 13 bidders. Therefore we have useful information for $156-13=143$ unique bidders.

4.2.2 Miscellaneous Bidder Identity Issues

- There is another business size 1 firm named as "M R LOGGING" that bid in year 2001 only once in our full data set. This bidder may be the same bidder as "MR LOG". TDC recorded them as two different bidders.
- Two business size 1 bidders MURRAY, L J and MURRAY, LEROY may be the same bidder, but TDC recorded them as two different bidders. We are unable to find two different location information for these two. Therefore, in the mill locations, we only kept one location.
- Two business size 2 bidders SUN MOUNTAIN LUMBER and SUN MOUNTAIN TIMBER may be the same bidder, but TDC recorded them as two different bidders. We are unable to find two different locations for these firms. Therefore, in the mill locations, we only kept one location.
- Two business size 1 bidders BROWN BROS CONSTRUCTION and BROWNS BROTHERS may be the same bidder, but TDC recorded them as two different bidders. We are unable to find two different location information for them. Therefore, in the mill locations, we only kept one location.
- Two business size 1 bidders LODGE LOG HOMES/ BALBACH and LODGE LOGS may be the same bidder, but TDC recorded them as two different bidders.

km²) in Washington and Oregon, taken over by creditors in December 2004, who formed Cascade Timberlands, LLC" https://en.wikipedia.org/wiki/Crown_Pacific_Partners

We are unable to find two different locations for them. Therefore, in the mill locations, we only kept one location.

- Bennett Lumber bid under four different names. For 90 out of 99 IDL bids (or 112 out of 131 All bids), the business size of Bennett Lumber is recorded as 3. For the other 9 (or 19 including all bids not just IDL bids), it is recorded as 5. In our data, we set its business size equal to 3.
- KINZUA CORP finished as a top 2 bidder in 3 auctions. It's recorded as a business size 6 bidder twice and a business size 5 bidder once. It bid under two different names. We set its business size=6 in our data set.
- Riley Creek Lumber finished as a top 2 bidder in 202 auctions. It's recorded as a business size 4 bidder 121 times, business size 6 bidder 81 times. We set its business size=4 in our data set.
- TRI-PRO FOREST PRODUCTS finished as a top 2 bidder in 26 auctions. It's recorded as a business size 1 10 times, until 2012 second quarter. After that, it's recorded as a business size 3 bidder. In our data set, we set it to be business size 1 or 3 accordingly.¹⁰
- TRICON TIMBER LLC finished as a top 2 bidder in 210 auctions. It's recorded as a business size 5 180 times, and business size 8 30 times. In our data set, we set its business size equal to 5.

¹⁰Whether business size=1 or not is an important criteria for selecting feasible bidders. As long as we can observe a seemingly sensible direction to determine the bidder's business size, we will follow that. For example, if the business size of a bidder changed to be some number larger than 1 after year 2009 and never changed to be 1 again, then we just assume the business size changed. If its business size changed to be 1 again, then we take the observed business size larger than 1 as a "mistake" in the data.

4.2.3 Locations

We find 194 locations for the 143 bidders. We have collected all the possible locations we can find online (up to May 22, 2019) and attempted to figure out whether the location is for a non-mill headquarters or not. For large firms, such as Boise Cascade, we can clearly mark some location as its non-mill headquarter. For small firms only having one or two locations, we do not know whether this location is just used for its headquarter (if any) or mills. Then, we don't do any elimination.

Overall, we mark FIVE "pure" headquarters for Boise Cascade, Clearwater Paper, Idaho Forest Group, Louisiana-Pacific and Potlatch respectively.¹¹

Therefore, we have $194-5=189$ locations as "mill locations".

Note: There are seven locations listed on Idaho Forest Group's website¹². We did not include the location "ST. REGIS, MT" since this was purchased in 2017. There are two ATHOL, ID locations, and we only kept one.

4.2.4 Firm Longevity

We find the established years and closing years in the following ways:

1. For large firms' mills, we relied on online information.
2. There are mergers or purchases during the period in our data set. If we found the news reporting that merger or purchase happened in some exact year, for example year 2008, then we assumed the bidder being purchased/merged was still bidding in 2008, and the bidder who proposed the merger or purchase or the merged entity started bidding from 2009. Of course, if we are able to find some

¹¹Marking a location as a non-mill headquarters affect the feasible bidders in many auctions since these are close to many tracts.

¹²<https://idfg.com/mill-directions/>

announcement from the firms or news sources clearly stating the month-year when the mill would be closed or acquired, then we will strictly follow it.

3. If we were unable to get the established year or closing year online, we then inferred them based on our data. We assumed the first time one bidder attended any auction in our data (All USFS, Idaho, Montana, Washington auctions) as the time this bidder was established. That would be the established year.

If a bidder bid before year 2004 (finished as the top 2 bidder), but never bid in 2004 or after (that is to say, not finished as the top 2 bidder since we can only observe the top 2 bidder), then we assumed this bidder was "closed" before 2004 (set the closing year equal to any number smaller than 2004).

A bidder may stop bidding in some year between 2004 and 2016. If we do not have exact information that the bidder was out of business, we assumed this bidder was still open.

When we checked bidder's open or closing information online, we mainly relied on Google Search and Google Map. If the searched result did not show that the mill was permanently closed and Google Map indicated what looks like a mill, we then assumed the mill was still open.

If we knew the exact open/closing month of a mill, then we used the exact month information. Otherwise, we set the open month to be January, and the closing month to be December. For example, if we only knew that a mill was opened in year 2004 and closed in year 2006, then we set its open month to be January and closing month to be December.

4.2.5 Bidder Species

We set the bidder's specialized species as follows:

1. Find out all the auctions won by a bidder from ALL the auctions in our data set, not just IDL auctions. The species and its code can be found in "species code" file (available from the authors upon request).

2. Calculate the total volume of each species won by the bidder.

3. Rank the species based on the total volume won by the bidder – the top 3 species won the most (in terms of volume) are the bidder's specialized species.

4. If a bidder NEVER won any auction previously, then we assume this bidder is NOT specialized in any species.

We have no problem with identifying all the IDL species and matching the IDL species with the species in MT, WA and USFS.

4.3 Comment on bidder identities and mill locations

In the above sections, we described how all the bidder identities and their related mill locations were found.

Given the definition of feasible bidders, the relevant bidders are bidders with business size larger than 1.

We have 42 unique bidders with business size larger than 1 (excluding the possible duplicated one, for example, SUN MOUNTAIN TIMBER). For these 42 bidders, we have 82 mill locations.

4.4 Species Matching

If the top 3 species of a bidder are at least 60% of the species, in terms of volume, sold at the tract in question, then we say the bidder and the tract are "matched" in terms of the species.

4.5 Driving distance

We calculate the mill-to-tract driving distance using an R program with a public package requesting driving distances from Google Map.

The program returns the driving distance between two locations given the fastest route. After manually check some distances, we find that this is not always the "shortest" distance. Sometimes, the shortest distance can be a a little smaller than the distance based on the fast route (several miles less).

We finally determined a 210×189 (tract \times mill) driving distance matrix. Notice that, we included all the 189 mill locations, not just the 82 mill locations for bidders with business size larger than 1.

4.6 L

L is the number of feasible bidders for an auction.

A bidder is feasible if

- (i) the tract is within 150 miles driving distance of their mill or closest mill (for those who operate multiple mills),
- (ii) business size is not the smallest (e.g not 1 on the 1 to 8 scale),¹³
- (iii) the top three species in terms of volume purchased historically by the bidder

are at least 60% of the species, in terms of volume, sold at the tract in question.

There are other requirements for a bidder (mill) to be feasible:

¹³In response to a public information request by us, IDL staff told us that independent contractors are rarely bidders, and only on smaller sales. We've tried to figure out whether a small bidder is a logging contractor or not, and we clearly marked them if they are possibly logging contractors. The number of this kind of bidders is around 70. 2 of them are business size 2 bidders, all the others are with business size 1 bidders. One of the business size 2 bidder, is DEYO BROTHERS, which is one of the two firms may be interested in tracts with volume smaller than 1,000, as suggested by IDL. So we do not eliminate this bidder. The other bidder is SPRINGDALE LUMBER. Even though we did not put any restriction on it, it is not a feasible bidder for any auctions other than those it finished as top2 bidders.

- (1) the bidder (mill) must be still open,
- (2) if a bidder was one of the top two bidders, then this bidder was a feasible bidder regardless of all the above criteria.

There is one more restriction on L when we do the estimation: L must be no less than $lstar$. If the calculated L based on the above criteria is small than $lstar$, then we set $L=lstar$.

Note: according to IDL staff, in response to a public information request by us, Crane Construction and Deyo Bros are operators and could purchase sales, but usually do not unless they are small, as in less than 1,000 Mbf. Therefore, we do not include these two bidders as candidates for any sales with volume $\geq 1,000$ Mbf.