College of Business
College of Forestry

Studies in Management and Accounting for the FOREST PRODUCTS INDUSTRY

INVENTORY COSTING ALLOCATIONS: A CASE STUDY

Joel L. Powell
James D. Roles

Monograph Number 42
March 1996

Joel L. Powell is a CPA and an audit partner with the Eugene office of Moss Adams. He has nearly 20 years of experience in public accounting, and specializes in providing services to closely-held companies in the forest products industry. He has also served as chairperson of the Oregon Society of CPA's Forest Products Industry committee, and is a member of the American Institute of Certified Public Accountants.

James D. Roles is the controller of Douglas County Forest Products. Prior to joining Douglas County Forest Products nine years ago, Jim was the Division Controller for the Southern Oregon Division of the Coca Cola Bottling Co. Of Oregon. He got his start with Arthur Andersen and Co. And is a graduate of San Jose State University.

INVENTORY COSTING ALLOCATIONS: A CASE STUDY

by Joel L. Powell and James D. Roles

INTRODUCTION

This monograph presents a methodology of allocating raw material and manufacturing costs to specific products based on those product's relative market value. The concept of allocating costs based on inventoriable asset values has been referred to as cost-to-value allocations. OSU Monograph Number 37, "A Survey and Analysis of Cost-To-Value Allocation Practices of Solid Wood Product Manufactures", surveyed existing practices and generally concluded:

- Companies are more likely to use cost-to-value methods to allocate stumpage costs from timber contracts than depletion of fee properties. Some companies use such methods to allocate both stumpage and depletion; however, a majority of companies surveyed do neither.

- Cost-to-value allocations are used more commonly in determining the wood content cost of lumber, veneer and plywood inventories; however, the majority of those surveyed considered volume only when allocating manufacturing costs and valuing log inventories.

Forest products companies have traditionally relied on average cost concepts in preparing monthly operating statements for management. Cost accounting based solely on average cost assumptions generally lacks economic substance in situations where:

- A company produces a variety of lumber and other products using logs of various species, sizes and grades.

- Raw material prices are a significant component of inventoriable products, and sources include timber contracts, fee timber and open market logs (including those purchased under a "camp run" price, log trade or whole deck purchase arrangement).

- Logs are sorted and merchandised to maximize their value.

- Raw material prices are changing rapidly, and the physical movement of the inventory is not consistent with the period used to aggregate average costs (e.g. company is using a three-month rolling average cost flow assumption, prices are changing in either direction significantly, and certain species, grades or sizes of logs are not turning over every three months).

- Harvest plans are affected by various internal and external factors (e.g. market-related decisions to only cut selected species currently, forest practices regulations which limit the availability of certain fee timber volumes, or logging practice restrictions which require selective methods for specific stands).

- The mix of log and manufactured wood product inventories is inconsistent from month to month, or with production runs (e.g. ending inventories contain a grade and specie mix that is either higher or lower than the mix of production runs used to accumulate pooled costs).

The decision to use some level of cost-to-value allocations for inventory costing purposes can effectively be reduced to these general alternatives:

- Total Cost Allocation - Wood fibre and manufacturing cost components are both allocated using relative value concepts.

- Partial Cost Allocation - A differentiation is made between wood fibre and manufacturing costs. Wood fibre costs may be assigned to specific products using relative value concepts while manufacturing costs are applied on either a constant per unit basis (e.g. average cost) or variable basis which reflects the various production processes and complexities.

We recognize, while both of the above alternatives are probably more theoretically sound than simple averaging methods, neither are without inherent and/or practical difficulties. Supporters of partial cost allocation theory will argue that manufacturing costs are a function of the various handling and sawing processes, and not relative value of the final products. Arguments in favor of total cost allocation would generally be practicality and the theory that the manufacture of certain fall-down products is necessary to recover the cost of the higher-valued products (e.g. it isn't feasible to recover only clear vertical grain wood from a single log).

Management is generally responsible for designing accounting systems to capture and report reliable product cost and financial reporting information. A variety of methods and assumptions are presently used by some companies to allocate raw material and other costs to recognize the inherent value differences of individual products. The following case study presents how one company allocates costs using relative value concepts. The case discusses how the company refined its simple average cost method to allow detailed relative value allocations. An attempt is also made to analyze the methodology, discuss the advantages and disadvantages, and show where further refinements may be beneficial in specific situations.

CASE STUDY

The Company manufactures lumber and veneer from Douglas fir, Noble fir, Hemlock and other white wood logs ranging from 12 inches to 70 inches in diameter. The facility is a cutting mill, producing vertical grain, clear products for domestic and export markets. The Company also sorts and accumulates certain high grade logs which are milled to individual customer specifications. Large cull logs are peeled into veneer.

The Company acquires logs under public and private cutting contracts, fee timber purchases and open market log transactions. Differences in bid species and available volume estimates under cutting contracts effectively reduce the reliability of bid prices for costing and financial reporting purposes. Open market log purchases are often on a "camp run" or "purchased deck" basis. Accordingly, aggregate raw material costs are generally not distinguishable on the basis of grade or specie.

The Company initially used simple averaging methods to measure stumpage costs and value its log and finished product inventories. However, management began to realize that timber contracts with skewed bids and disproportionate harvest mixes were distorting monthly depletion charges and operating results. Efforts to sell specific products in response to current market conditions compounded this phenomenon, leaving an inventory mix that was either over or under valued at month end.

Delivered Raw Material Costs

Exhibit 1 presents a sample "pay as cut" cutting contract where Douglas fir was the primary bid specie. Remaining prices to be paid under the contract are the original advertised prices. The Company reallocates stumpage costs to individual species based on relative market value at the time the contract was awarded. Per unit values of standing timber are provided by the Company's timber department, and are usually calculated by subtracting estimated falling and bucking, logging and hauling costs from delivered pond prices used in the original bid process. Company cruise volumes for the subject contract are extended using the per thousand (per M) amounts derived above to determine the extended relative value of the contract by specie. The final step is to reallocate the cost of the stumpage using the relative weighted market value percentages.

The Company accounts for differences between the amount of stumpage billed based on contractual rates and the amount expensed based on reallocated rates as either deferred or accrued stumpage costs. The reallocated stumpage rates are reviewed and updated periodically (e.g. quarterly) for any changes in remaining cruise volume estimates, indexed price adjustments, contract modifications, etc. These control procedures ensure that the cash dollars incurred on the contract are expensed on a timely basis.

EXHIBIT 1

REALLOCATION OF STUMPAGE RATES

	MBF NET VOL (Company Cruise)	CONTRACT RATE/MBF	TOTAL	MARKET VALUE PER M	EXTENDED VALUE	WEIGHTED PERCENTAGE	REALLOCATED STUMPAGE	REALLOCATED STUMPAGE RATE
DF	6,000	600	$ 3,600,000	$ 600	$ 3,600,000	70.50%	$ 2,738,115	$ 456.35
HEM	1,500	85	127,500	475	712,500	13.95	541,919	361.28
NF	750	85	63,750	600	450,000	8.81	342,264	456.35
WF	500	85	42,500	450	225,000	4.41	171,132	342.26
WP	250	200	50,000	475	118,750	2.33	90,320	361.28
NET	9,000		$ 3,883,750		$ 5,106,250	100.00%	$ 3,883,750	

The benefit of cost reallocation is most evident in periods where species are harvested disproportionate to the overall contract mix. The following table summarizes the effect of reallocation on operating results if all white wood volume in the contract in Exhibit 1 was harvested prior to the Douglas fir.

Specie	Volume MBF	Contract Rate	Reallocated Rate	Difference
Hemlock	1,500	$ 127,500	$ 541,919	$ 414,419
Noble fir	750	63,750	342,264	278,514
White fir	500	42,500	171,132	128,632
White pine	250	50,000	90,320	40,320
		$ 283,750	$ 1,145,635	$ 861,885

The objective of relative value pricing is to improve inventory costing and financial reporting. Clearly, operating results would be significantly overstated in the above scenario without reallocation. Conversely, operating results would be understated if only Douglas fir volume was removed.

The above example illustrates the effect of reallocating stumpage costs under a "pay as cut" cutting contract. However, the same inherent costing benefits would be present in any situation where a lump sum price is paid for a bulk source of raw materials (e.g. lump sum contract, fee timber purchase, open market logs purchased under a camp run price, etc.). Some companies further expand their depletion accounting to include cost allocations by grade for a primary species (e.g. Douglas fir). Allocations of this nature require detailed initial cruise information and close monitoring of subsequent volume estimates to avoid significant adjustments at the end of the harvest period.

There are also other resource-related factors which raise important accounting issues. These factors include a higher reliance on fee and other private timber sources, along with the impact of increased restrictions on timber harvest practices. For example, initial cost allocations and amounts of available timber volume for depletion purposes have been impacted by expanded stream set aside and snag and green tree retention requirements, as well as "green-up" rules which restrict the size of clear cuts and the timing of harvests from adjacent tracts.

Log and Finished Product Inventories

The Company generally assumes a three-month FIFO cost flow for valuing its log and lumber inventories. Accordingly, wood fibre and manufacturing costs are accumulated and pooled for the most recent three-month period. Exhibits 2 through 5 illustrate the methodology and related effects from using cost-to-value allocations for pricing log and lumber inventories.

Logs scaled into the yard for the period are identified by grade and specie as illustrated in Exhibit 2. The volume for each item is multiplied by its current market value to compute an extended value and weighted percentage used to allocate the pool of actual costs accumulated for that period. An allocated cost per thousand (per M) is then applied to the volume in ending inventory to arrive at the final inventory cost. This amount is compared to ending market value to ensure inventories are appropriately stated at the lower of cost or market.

EXHIBIT 2

REALLOCATED LOG INVENTORY - AVERAGE MIX

	Volume (MBF) Of Logs To Yard	Relative Market Value	Extended Value	Weighted Percentage	Allocated Actual Costs	Allocated Cost Per M	Ending Inventory Volume (MBF)	Ending Inventory Cost	Ending Market Value
Culls	248.069	$ 150	$ 37,210	0.608%	$ 36,500	$ 147.14	165.380	$ 24,333	$ 24,807
Utility Culls	1,642.063	200	328,413	5.369	322,142	196.18	1,094.709	214,762	218,942
Select Culls	1,707.728	250	426,932	6.980	418,781	245.23	1,138.485	279,187	284,621
#4 Mill	20.461	350	7,161	0.117	7,025	343.32	13.640	4,683	4,774
#3 Mill	1,179.366	450	530,715	8.676	520,582	441.41	786.244	347,055	353,810
#2 Mill	5,096.903	575	2,930,719	47.913	2,874,763	564.02	3,397.935	1,916,509	1,953,813
#1 Mill	2.710	600	1,626	0.027	1,595	588.54	1.806	1,063	1,084
Select Mill	774.986	700	542,490	8.869	532,133	686.64	516.658	354,755	361,660
#3 Peelers	1,179.043	950	1,120,091	18.312	1,098,705	931.86	786.029	732,470	746,727
#2 Peelers	83.551	1,200	100,261	1.639	98,347	1,177.09	55.701	65,565	66,841
#1 Peelers	65.120	1,400	91,168	1.490	89,427	1,373.27	43.413	59,618	60,779
	12,000.000		$6,116,786	100.000%	$ 6,000,000		8,000.000	$ 4,000,000	$ 4,077,858

EXHIBIT 3

REALLOCATED LOG INVENTORY - DISPROPORTIONATE MIX

		AVERAGE MIX			HIGH VALUE MIX			LOW VALUE MIX		
	Allocated Cost Per M	Ending Inventory Volume (MBF)	Ending Inventory Cost	Ending Market Value	Ending Inventory Volume (MBF)	Ending Inventory Cost	Ending Market Value	Ending Inventory Volume (MBF)	Ending Inventory Cost	Ending Market Value
Culls	$ 147.14	165.380	$ 24,333	$ 24,807	165.380	$ 24,333	$ 24,807	1,165.380	$ 171,469	$ 174,807
Utility Culls	196.18	1,094.709	214,762	218,942	1,094.709	214,762	218,942	2,094.709	410,943	418,942
Select Culls	245.23	1,138.485	279,187	284,621	1,138.485	279,187	284,621	2,138.485	524,414	534,621
#4 Mill	343.32	13.640	4,683	4,774	13.640	4,683	4,774	13.640	4,683	4,774
#3 Mill	441.41	786.244	347,055	353,810	786.244	347,055	353,810	786.244	347,055	353,810
#2 Mill	564.02	3,397.935	1,916,509	1,953,813	397.935	224,444	228,813	397.935	224,444	228,813
#1 Mill	588.54	1.806	1,063	1,084	1.806	1,063	1,084	1.806	1,063	1,084
Select Mill	686.64	516.658	354,755	361,660	516.658	354,755	361,660	516.658	354,756	361,660
#3 Peelers	931.86	786.029	732,470	746,727	1,786.029	1,664,332	1,696,727	786.029	732,470	746,727
#2 Peelers	1,177.09	55.701	65,565	66,841	1,055.701	1,242,654	1,266,841	55.701	65,565	66,841
#1 Peelers	1,373.27	43.413	59,618	60,779	1,043.413	1,432,888	1,460,779	43.413	59,618	60,779
		8,000.000	$ 4,000,000	$ 4,077,858	8,000.000	$ 5,790,156	$ 5,902,858	8,000.000	$ 2,896,480	$ 2,952,858

EXHIBIT 4

REALLOCATED LUMBER INVENTORY - AVERAGE MIX

	Board Feet Produced	Relative Market Value Per M	Extended Value	Weighted Percentage	Allocated Actual Production Costs	Allocated Cost Per M	Ending Inventory Volume (MBF)	Ending Inventory Cost	Ending Market Value
Lumber A	887.658	$ 600	$ 532,595	3.725%	$ 335,264	$ 377.69	295.886	$ 111,754	$ 177,530
Lumber B	8,548.575	750	6,411,431	44.844	4,035,937	472.12	2,849.525	1,345,312	2,137,144
Lumber C	3,922.695	1,400	5,491,773	38.411	3,457,020	881.29	1,307.565	1,152,340	1,830,591
Lumber D	409.614	1,700	696,344	4.871	438,342	1,070.13	136.538	146,114	232,115
Lumber E	26.025	2,100	54,653	0.382	34,403	1,321.93	8.675	11,468	18,218
Lumber F	2,740.923	325	890,800	6.231	560,750	204.58	913.641	186,917	296,933
Lumber G	1,464.510	150	219,676	1.536	138,284	94.42	488.170	46,095	73,226
	18,000.000		$ 14,297,272	100.000%	$ 9,000,000		6,000.000	$ 3,000,000	$ 4,765,757

EXHIBIT 5

REALLOCATED LUMBER INVENTORY - DISPROPORTIONATE MIX

		AVERAGE MIX			HIGH VALUE MIX			LOW VALUE MIX		
	Allocated Cost Per M	Ending Inventory Volume (MBF)	Ending Inventory Cost	Ending Market Value	Ending Inventory Volume (MBF)	Ending Inventory Cost	Ending Market Value	Ending Inventory Volume (MBF)	Ending Inventory Cost	Ending Market Value
Lumber A	$ 377.69	295.886	$ 111,754	$ 177,530	295.886	$ 111,754	$ 177,530	295.886	$ 111,754	$ 177,530
Lumber B	472.12	2,849.525	1,345,312	2,137,144	849.525	401,077	637,144	849.525	401,076	637,144
Lumber C	881.29	1,307.565	1,152,340	1,830,591	3,907.565	3,443,686	5,470,591	707.565	623,568	990,591
Lumber D	1,070.13	136.538	146,114	232,115	136.538	146,114	232,115	136.538	146,114	232,115
Lumber E	1,321.93	8.675	11,468	18,218	8.675	11,468	18,218	8.675	11,468	18,218
Lumber F	204.58	913.641	186,917	296,933	513.641	105,083	166,933	3,113.641	637,003	1,011,933
Lumber G	94.42	488.170	46,095	73,226	288.170	27,210	43,226	888.170	83,864	133,226
		6,000.000	$ 3,000,000	$ 4,765,757	6,000.000	$ 4,246,392	$ 6,745,757	6,000.000	$ 2,014,847	$ 3,200,757

The cost of logs sawn (including the effect of log inventory change computed on a reallocated basis) is aggregated with sawmill costs to determine the cost of rough lumber produced for the most recent three-month period. A reduction of accumulated costs is made for allocated chip revenue to recognize the wood fibre and manufacturing cost component of chips produced. Production volume is segregated by grade and specie by analyzing product sales and changes in individual inventory items as summarized in Exhibit 4. The volume of each item produced is multiplied by its current market value to compute an extended value and weighted percentage used to allocate the pool of actual costs accumulated for that period. An allocated cost per thousand is then applied to the volume in ending inventory to arrive at the final rough inventory cost. The Company adds drying and planing costs computed on an average basis for the period to appropriate items in the ending inventory to arrive at its final rough and processed inventory costs (not shown in the attached exhibits). This final amount is then compared to the market value to ensure inventories are appropriately stated at the lower of cost or market.

The effect of reallocating inventory costs are illustrated in exhibits 3 (logs) and 5 (lumber). Those exhibits demonstrate the impact of an ending inventory mix that is disproportionate to the actual production mix. Note that the allocated unit costs per thousand are the same in each case. However, the final log or lumber inventory cost varies significantly depending on whether the overall grade of the ending volumes is higher or lower than that produced during the period of cost accumulation.

ANALYSIS OF THE CASE STUDY

The case study presented above illustrates one approach for effecting cost-to-value allocations. We believe, while no method is without some inherent limitations, the relative value approach used is more theoretically sound than simple averaging methods for manufacturing facilities producing products with high variability. The following summarizes some advantages and disadvantages of using some methodology that recognizes the relative value of products produced.

Advantages and Opportunities

- Cost-to-value allocations will generally result in improved matching of costs and financial reporting of operating results. Depletion costs and ending inventory mix can vary significantly from one period to the next. Operating results which do not reflect the true economic substance of transactions occurring in a period can be materially misleading.

- Integrated operations often supply various manufacturing facilities from a single raw material base. Cost-to-value allocations provide improved reporting of operating results for those separate facilities.

- The method described in the case study is a reasonably practical approach once the initial spreadsheets and formats are developed.

- Information generated by the Company provides management with a more extensive analysis of its inventories which may help identify potential sales and production opportunities and/or problem areas requiring closer attention.

- The process may be useful in defining production alternatives if manufacturing costs can be isolated by product and legitimate production choices exist.

Disadvantages and Limitations

- Certain costs of manufacturing are only volume driven. Allocation based solely on relative value could be misleading.

- Relative value allocations ARE more time consuming than simple averaging concepts. Extensive record keeping and calculations are required to generate and maintain the level of information required.

- The usefulness of relative value allocations may be offset to some extent by a detailed lower of cost or market analysis. Note that while this will help ensure inventories are not overvalued (e.g. low grade mix), it does nothing for improving reporting when there is a high grade mix in ending inventories.

- The usefulness of any costing system is limited if the actual turnover of the inventory is inconsistent with the period of cost accumulation. For example, if a company is holding certain high grade log decks for six to eight months, costs are accumulated over a period of three months, and current costs are either increasing or decreasing significantly, distortions may occur in the valuation of inventories.

SUMMARY AND CONCLUSION

The results of the survey reported in OSU Monograph Number 37, "A Survey and Analysis of Cost-To-Value Allocation Practices of Solid Wood Product Manufacturers", indicates opportunities exist for expanded use of cost-to-value allocations in accounting for stumpage and depletion, and log, lumber, veneer and plywood inventories. This case study provides an illustration of how one company has chosen to address that issue. Our general conclusion is that the benefit of some method of cost allocation that recognizes the inherent value of different products outweighs the costs required to develop and maintain the system to support it.

STUDIES IN MANAGEMENT AND ACCOUNTING IN THE FOREST PRODUCTS INDUSTRY

Oregon State University

No.	Monograph Title
*1	"The Rush to LIFO: Is It Always Good for Wood Products Firms?" (1976).
*2	"Accounting and Financial Management in the Forest Products Industries: A Guide to the Published Literature," (1977 and 1981).
3	"A Decision Framework for Trading Lumber Futures," (October 1975).
4	"Capital Gains Tax Treatment in the Forest Products Industries," (June 1976).
5	"Measurement Difficulties in the Log Conversion Process," (June 1976).
6	"Capital Budgeting Practices in the Forest Products Industry," (March 1978).
7	"A Reporting and Control System for Wood Products Futures Trading Activities," (July 1978).
8	"Selected Issues of Financial Accounting and Reporting for Timber," (November 1978).
9	"Pool Log Transfer System," (August 1979)
10	"Fundamentals of Financial Major Timber Acquisitions," (February 1980)
11	"LIFO Inventories in the Forest Products Industry," (July 1980).
12	"Accounting Controls for a Forest Products Firm," (January 1981).
13	"Log Inventory Controls," (April 1981).
14	"Accounting Treatment for Wood Products Futures Trading Activities," (October 1981).
15	"A Reporting and Planning System for a Wood Products Operation," (November 1981).
16	"Boise Cascade's Productivity Improvement Program," (January 1982).
17	"Information Systems Planning in Weyerhaeuser Company," (August 1982).
18	"Developing a Strategic Plan for a Forest Products Company: A Case Study," (March 1983).
19	"Company/Employee Gainsharing Programs," (July 1983).
20	"Productivity Improvement Programs of Knowledge Workers in the Forest Products Industry," (November 1983).
21	"Microcomputer Modeling in the Forest Products Industry," (May 1984).
22	"Control and Measurement of Chips," (September 1984).
23	"Accounting for Buying Back Timber Cutting Contracts," (December 1984).
24	"Developing Cross-Hedging Strategies Based on Lumber Price-Change Variation and Seasonality," (May 1985).
25	"Unique Financial Reporting Considerations for Readers of Forest Products Companies Financial Statements," (November 1985).
26	"Improving Productivity Through Internal Contracting," (March 1986).
27	"Perspectives on the Timber Industry From a Lender's Standpoint," (October 1986).
28	"Long-Term Timber Supply and Its Importance in Strategic Planning," (March 1987)
29	"Microcomputer Applications in Timber Management and Accounting," (August 1988).
30	"Producing OSB Using Red Alder: A Feasibility Case Study," (January 1989).
31	"Export Marketing Activities of Small-Firm Lumber Manufacturers," (June 1989)
32	"Gainsharing Plans For Mill Operations In The Forest Products Industry," (October 1989).
33	"Tax Free Exchanges and Timberland Acquisitions," (December 1990).
34	"Education in Business: A Tool and a Responsibility," (May 1991).
35	"Family Firms in the Forest Products Industry," (February 1992).
36	"JIT At Oregon Cutting Systems," (March 1992).
37	"A Survey and Analysis of Cost to Value Allocation Practices of Solid Wood Product Manufacturers," (December 1992).
38	"Unique Financial Reporting Considerations for Readers of Financial Statements of Forest Products Companies," (October 1993).
39	"Control Process for Smaller Forest Products Companies," (December 1993)
40	"Drug Testing in the Workplace," (November 1994).
41	"Conventional Financing of Timber and Timberlands in the 1990's" (July 1995).
42	"Inventory Costing Allocations: A Case Study," (March 1996).

* Out of Print

Studies in Management and Accounting for the Forest Products Industry

This series of monographs is published by the College of Business and the College of Forestry at Oregon State University to disseminate information, research findings, and informed opinion about business issues unique to enterprises in the forest products industry.

Participating as authors and advisors are consultants, professionals, and others experienced in industry matters. This program was begun in 1974.

The views expressed herein are those of the author(s), and do not necessarily represent those of Oregon State University.

Additional information about these Studies may be obtained from the Program Director, College of Business, Oregon State University, Bexell Hall 200, Corvallis, OR 97331-2603.