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ESTIMATES OF THE MAGNITUDE OF BLENDING EFFICIENCIES IN THE PACIFIC NORTHWEST WHITE WHEAT INDUSTRY

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Abstract

The unique nature of the white wheat grading specification and accompanying price discounting schedule creates the opportunity for large Pacific Northwest grain elevator firms to realize returns from white wheat blending. This paper estimates the potential size of these returns for the period 1969 to 1979, assuming optimal blending practices were employed.

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Several studies have attempted to identify and quantitatively assess economies of scale in the grain trading industry. The general conclusion is that location and transaction specific scale economies exist in grain transportation and storage [Araji and Walsh, Caves, Thompson and Dahl]. Broader economies may also arise from information coordination and risk reduction. As Caves concludes [p. 121]:

> "There appears to be scale economies in coordination and risk-bearing that are due to the characteristics of information as an input....also, scale economies in transportation and storage facilities create large scales for efficient individual transactions, and thereby impose large overall scales for substantial risk-pooling within the enterprise."

The fact that the world grain trade is dominated by a few large firms would seem to indicate that economies of scale, be they internal or external, are operative.

More subtle efficiencies may also exist beyond scale economies normally assumed in grain handling. One such efficiency appears to be available to the operators of elevators in the Pacific Northwest (PNW) who are able to blend white wheat for test weight and dockage. Large firms are able to blend white wheat of various quality characteristics to take advantage of the discounted prices paid to producers of low test weight wheat and/or to the practice of rounding-down the measured content of dockage in wheat samples to the nearest one-half percentage point.

This article attempts to estimate the size of potential returns available to PNW grain traders who (a) have the capability to precisely measure quality differentials in white wheat, (b) have sufficient storage capacity to separate white wheat lots by incremental quality differences, and (c) draw wheat from a sufficiently large geographic region to acquire large volumes of wheat of different quality.

This paper is divided into three sections. The first section describes the grading standards for white wheat, the discounts associated with low test weight, and the procedure for measuring and reporting dockage in each sample. The second section outlines the process by which larger grain handlers could have blended white wheat in the years 1969 through 1979. The final section provides an estimate of the potential returns to grain handlers had the blending efficiencies been fully exploited industrywide.

WHITE WHEAT GRADES AND DISCOUNTS

The Pacific Northwest white wheat grading and pricing structure provides the opportunity for blending efficiency returns. A principal criteria in differentiating between number one white wheat and lower grades is test weight. To be graded number one, soft white wheat must weigh at least 60 pounds per bushel. Lots delivered to elevators weighing less than 60 pounds are discounted.[1/] For example, wheat weighing 59 pounds is discounted one cent per bushel by the elevator company. In contrast, wheat weighing more than 60 pounds per bushel receives no premium. Since almost all export contracts specify "number two or better" grade, exporters can dilute high test weight wheat, on which no premium is paid, with discounted number two, three, four, and five grade wheat and still meet contract requirements.

No premium is paid for high test weight wheat because there is generally more than enough number one wheat available. In many years, as much as half the PNW white wheat exported to Japan, the leading customer, was number one wheat, even though number two would have satisfied contract specifications. This was due to a shortage of lower grade wheat to be used for grade-down blending.

Returns to farmers also are influenced by the presence of dockage in white wheat. The farmer's price is reduced by the percent dockage estimated from a random sample, rounded down to the nearest half percent. For exmaple, wheat determined to contain .4 percent dockage is officially graded as zero dockage, and wheat containing .9 percent dockage is graded as .5 percent.

Thus, a farmer marketing wheat containing .6 percent dockage would receive 99.5 percent of the per bushel market price. For a country price of $3.45 (Oregon average farm price in 1979), the producer price would be reduced by 1.725 cents per bushel. The elevator could then blend this wheat with a lot of approximately equal size containing .2 percent dockage, thereby creating a lot with .4 percent dockage. This blended lot would be officially graded as zero dockage and resold with no price reduction.

While these blending practices may occur at any elevator, export elevators and river subterminals have the greatest potential for realizing blending returns. These elevators have both the storage capacity and quality measurement technology to determine incremental differentials in both test weight and dockage. Moreover, because they serve a broad geographic area, they draw wheat which covers the quality spectrum.

ESTIMATION OF POTENTIAL BLENDING RETURNS

A lack of sufficient data prevents a complete accounting of actual blending returns earned by Pacific Northwest white wheat merchants. However, the upper

limit of aggregate blending returns can be estimated assuming elevators fully exploit blending possibilities. Two additional assumptions are required. First, white wheat grades are assumed to be solely determined by test weight. While a number of other factors can influence the grade number assigned a wheat lot, test weight is the critical grading factor in the vast majority of cases.[2/]

Second, the wheat quality survey is assumed to accurately reflect the distribution of wheat by grade entering international markets each year. Since nearly 90 percent of PNW white wheat was exported during the period 1969 to 1979 (Table 1), this assumption is justified. The major weakness of this assumption is that wheat is stored from one crop year to the next. Nevertheless, valid estimates of the magnitude of blending efficiencies can be made using this assumption.

Another point to note is the primary subclass of white wheat is exported is western white wheat. This subclass is made by blending at least 10 percent club white wheat with up to 90 percent soft or hard white wheat, and soft white wheat composes at least 85 percent of most export shipments. Despite the use of club wheat in western white wheat, the estimates of blending efficiencies made in this paper are based solely on soft white wheat quality characteristics.

The Pacific Northwest Wheat Quality Surveys provide data on the quality characteristics of the region's wheat crop by subclass [Pacific Northwest Grain Standards and Quality Committee]. Using this date, average per bushel discounts, due to low test weight for wheat marketed in each state, can be estimated as follows:

$$\text{Average per bushel discount} = \sum_{i=1}^{6} w_i d_i \quad [3/]$$

Table 1. Pacific Northwest White Wheat Production and Exports, 1969-70 to 1978-79

Crop year	Production	Exports
	-------million bushels-------	
1969-70	129.3	109.1
1970-71	126.2	105.4
1971-72	139.1	100.3
1972-73	158.8	147.9
1973-74	126.1	114.8
1974-75	179.7	178.8
1975-76	201.4	191.2
1976-77	204.8	172.6
1977-78	147.3	158.3
1978-79	189.1	172.4
TOTAL	1,601.8	1,450.8

SOURCE: U.S. Department of Agriculture, ESCS. "Pacific Northwest Wheat Report." Various issues.

where: w_i is the percentage of each grade produced, and

d_i is the average discount in cents per bushel associated with each grade. No. 1=0, No. 2=1.5, No. 3=3.5, No. 4=5.5, No. 5=8.0, and sample on No. 6=10.0.

The historic annual breakdown of grades produced in each state (Washington, Oregon, and Idaho) is presented in Table 2. The computed estimate of average per bushel discount also is presented. Potential returns are greatest when the percentage of lower quality wheat is high.

Potential returns to blending for dockage also can be estimated. Using the dockage measurements in each state's crop, the potential returns to farmers and elevators from the rounding-down of the percent of dockage can be estimated. For example, if the actual dockage in wheat coming off farms is .7 percent, farmers can gain an average .2 percent. The difference between what elevators earn and what they pay farmers is their net returns for blending for dockage. Thus, the difference between the maximum dockage gain available of .4 percent and the amount received by farmers is the potential average gain available to elevators; in this case, .2 percent.[4/]

Table 3 summarizes potential returns to dockage blending by PNW farmers and elevators for the years 1969 through 1979. When the average dockage percentages are high, elevators have the ability to clean and blend to earn an additional .4 percent on exported white wheat.

RELATIVE IMPORTANCE OF EFFICIENCIES DUE TO BLENDING

The existing white wheat grading and discount schedules represent an opportunity for exporters of white wheat to realize returns from test weight blending from blending to exact dockage levels. Table 4 summarizes the potential returns

Table 2. Estimated Potential Increases in Elevator Margins Due to Efficiencies in Blending for Test Weight by State.

Crop year	Percent of production in each grade							Increased margins due to blending for test weight
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Sample	Total	
	percent							(cents/bushel)
Washington:								
1969.....	81.2	11.3	4.0	2.5	1.0	--	100.0	.527
1970.....	--	--	--	Not Available			--	--
1971.....	76.8	15.5	5.2	1.8	.4	.3	100.0	.575
1972.....	71.0	23.2	4.0	.8	.4	.6	100.0	.624
1973.....	70.4	19.6	6.4	1.8	.8	.9	99.9	.771
1974.....	72.6	17.6	5.1	1.9	.7	2.1	100.0	.813
1975.....	43.6	31.4	18.3	4.2	1.2	1.3	100.0	1.568
1976.....	39.2	34.5	21.4	3.4	.8	.8	100.1	1.597
1977.....	52.6	28.1	12.3	3.7	1.8	1.5	100.0	1.349
1978.....	68.0	22.0	6.8	1.5	.6	1.0	99.9	.798
1979.....	65.3	24.0	6.9	2.3	.6	.9	100.0	.866
Idaho:								
1969.....	77.4	11.3	7.0	3.8	.5	--	100.0	.663
1970.....	--	--	--	Not Available			--	--
1971.....	75.8	17.8	4.0	1.0	.6	.8	100.0	.590
1972.....	74.4	21.4	3.1	.7	.2	.2	100.0	.504
1973.....	60.3	26.9	9.8	2.0	.3	.7	100.0	.950
1974.....	64.9	26.6	6.3	1.3	.9	.5	100.5	.813
1975.....	31.2	42.4	17.7	5.5	2.3	1.0	100.1	1.842
1976.....	21.7	43.8	28.6	4.7	.9	.3	100.0	2.018
1977.....	17.8	32.0	28.6	4.7	.9	.3	100.0	2.889
1978.....	63.3	30.0	4.5	1.2	.2	.7	99.9	.759
1979.....	48.6	35.7	10.6	2.7	1.0	1.4	100.0	1.275
Oregon:								
1969.....	76.1	13.9	5.8	2.7	1.5	--	100.0	.680
1970.....	--	--	--	Not Available			--	--
1971.....	79.8	12.7	4.9	1.8	.8	.7	100.7	.595
1972.....	70.4	18.7	6.5	2.1	1.4	.9	100.0	.825
1973.....	64.9	22.5	7.1	4.0	.7	.8	100.0	.950
1974.....	56.1	30.9	8.9	2.2	1.2	.6	99.9	1.052
1975.....	44.7	36.8	12.3	3.8	1.3	1.1	100.0	1.405
1976.....	36.2	21.6	26.3	10.6	3.1	2.3	100.1	2.305
1977.....	23.5	40.3	23.6	8.0	2.9	1.7	100.0	2.272
1978.....	51.8	24.0	10.5	7.7	4.9	1.1	100.0	1.653
1979.....	44.0	32.0	15.2	4.7	2.5	1.6	100.0	1.630

Discount Schedule for Test Weight:

Grade	1	2	3	4	5	Sample
Average Discount	0.0	1.5¢	3.5¢	5.5¢	8.0¢	10.0¢

Source of Wheat Quality Data: U.S.D.A. "Quality Wheat", Pacific Northwest Grain Standards and Quality Committee. Various issues.

Table 3. Estimated Potential Increases in Elevator Margins Due to Efficiencies in blending for Dockage by State 1969, to 1979.

Crop year	Average actual dockage	Dockage earned by farmers	Gross dockage earned by elevators (assumed)	Net dockage earned by elevators[a/]	Average F.O.B. Western White Wheat export price following harvest [5] Years	Price[b/]	Increased margins due to blending for dockage
	percent						(¢/bushel)
Washington:							
1969.....	.8	.3	.4	.1	8/69-7/70	$1.52	.152
1970.....	--	Not Available			---	--	--
1971.....	.9	.4	.4	.0	8/71-7/72	1.63	0
1972.....	.8	.3	.4	.1	8/72-7/73	2.69	.269
1973.....	1.3	.3	.4	.1	8/73-7/74	5.14	.514
1974.....	1.1	.1	.4	.3	8/74-7/75	4.39	1.317
1975.....	1.0	.0	.4	.4	8/75-7/76	3.94	1.576
1976.....	1.0	.0	.4	.4	8/76-7/77	3.02	1.208
1977.....	1.0	.0	.4	.4	8/77-7/78	3.30	1.320
1978.....	.9	.4	.4	.0	8/78-7/79	3.96	0
1979.....	1.3	.3	.4	.1	8/79-2/80	4.37	.437
Idaho:							
1969.....	1.3	.3	.4	.1			.152
1970.....	--	Not Available			---	--	--
1971.....	1.2	.2	.4	.2			.326
1972.....	1.1	.1	.4	.3			.807
1973.....	1.3	.3	.4	.1			.514
1974.....	1.3	.3	.4	.1			.439
1975.....	1.4	.4	.4	.0			0
1976.....	1.3	.3	.4	.1			.320
1977.....	1.2	.2	.4	.2			.660
1978.....	1.1	.1	.4	.3			1.188
1979.....	1.7	.2	.4	.2			.874
Oregon:							
1969.....	.9	.4	.4	.0			0
1970.....	--	Not Available			---	--	--
1971.....	1.2	.2	.4	.2			.326
1972.....	1.2	.2	.4	.2			.538
1973.....	1.2	.2	.4	.2			1.028
1974.....	1.4	.4	.4	.0			0
1975.....	2.0	0	.4	.0			0
1976.....	1.1	.1	.4	.0			0
1977.....	1.9	.4	.4	.0			0
1978.....	3.2	.2	.4	.2			.792
1979.....	.8	.3	.4	.1			.437

[a/] Gross dockage earned minus dockage earnings by farmers.

[b/] F.O.B. export prices are common to all Pacific Northwest ports and therefore applicable to wheat from each state.

Table 4. Weighted Average Increase in Elevator Margins Due to Efficiencies in Blending for Washington, Idaho, Oregon and the Aggregate Pacific Northwest Region, 1969 through 1979.

Crop year	State totals of efficiencies due to dockage and testweight[A/] (cents/bu.)	Proportion of regional Soft White Wheat production by state [3] (percent)	Weighted average total for the PNW region by crop year[B/] Crop year	Price (cents/bu.)
Washington:				
1969.....	.68	58	1969.....	.71
1970.....	--	--	1970.....	--
1971.....	.58	61	1971.....	.71
1972.....	.89	63	1972.....	1.05
1973.....	1.28	53	1973.....	1.49
1974.....	2.13	55	1974.....	1.67
1975.....	3.14	60	1975.....	2.89
1976.....	2.81	58	1976.....	2.83
1977.....	2.67	55	1977.....	2.73
1978.....	.80	57	1978.....	1.40
1979.....	1.30	54	1979.....	1.67
Idaho:				
1969.....	.81	24		
1970.....	--	--		
1971.....	.92	21		
1972.....	1.31	18		
1973.....	1.46	23		
1974.....	1.25	20		
1975.....	1.84	16		
1976.....	2.32	17		
1977.....	3.55	19		
1978.....	1.95	21		
1979.....	2.15	20		
Oregon:				
1969.....	.69	18		
1970.....	--	--		
1971.....	.92	18		
1972.....	1.36	19		
1973.....	1.97	24		
1974.....	1.05	24		
1975.....	2.98	24		
1976.....	3.21	25		
1977.....	2.27	26		
1978.....	2.44	22		
1979.....	2.07	26		

A/ Sum of last columns of tables 1 and 2.

B/ For example for 1969: .68 (.58) + .81 (.24) + .69 (.18) = .71

potential returns to both types of blending and the weighted potential returns on a regional basis. If blending economies had been employed perfectly, the total potential returns to elevating firms would have been $2.4 million in 1978/1979. Table 5 summarizes the potential total returns over the decade 1969 through 1979. Obviously, estimates presented here reflect gross returns since costs of blending have not been addressed.

The potential gains to exporters do not represent a significant portion of total white wheat sales value. In 1978, the value of PNW white wheat exports was approximately $680 million. Even if all blending efficiencies are exploited, potential returns would amount to only .35 percent of sales. Nonetheless, in an industry characterized by relative low returns as a percent of sales, this incremental gain is important. The size of potential returns, relative to sales, may vary with the overall quality distribution of wheat production, the average export price, and export levels. For example, in 1975, potential returns could have amounted to $5.5 million, or .73 percent of sales volume.

Firms in a competitive industry will operate where price equals marginal cost at a level of output such that long-run average cost is minimized when each firm is in equilibrium. In such a situation, the profits, as measured by accountants, will equal the profits which could be earned if the same level of investment were applied to a different industry.

If the PNW grain marketing industries are effectively competitive, a reduction in the costs of marketing white wheat will be passed back to white wheat farmers in the form of higher farm prices. Therefore, if firms cannot earn monopoly profits in the long run, farmers, and ultimately consumers, can benefit from the blending efficiencies.

However, while farmers as a whole would benefit from efficiencies in marketing, individual farmers who consistently deliver discounted wheat with

Table 5. Pacific Northwest White Wheat Exports and Total Potential Blending Returns to Exporters

Crop year	Millions of bushels exported	Total potential returns[a/]
1968.....	90.3	$ --
1969.....	109.1	774,610
1970.....	105.4	--
1971.....	100.3	712,130
1972.....	147.9	1,552,950
1973.....	114.8	1,710,520
1974.....	178.8	2,985,960
1975.....	191.2	5,525,680
1976.....	172.6	4,884,580
1977.....	158.3	4,321,590
1978.....	172.4	2,413,600

[a/] (Exports) x (per bushel estimated potential blending efficiency returns).

dockage close to the lower one-half percentage point, will be subsidising the track prices paid to farmers delivering number one wheat with dockage close to the upper one-half percentage point. Therefore, the estimated potential elevator gains per bushel, due to blending in each state (Table 4, column 1), also represents an estimate of the increase in the track price above what it would be if nobody delivered discountable wheat, again assuming elevating firms operate in an effectively competitive environment.

It is important to note that farmers also realize direct returns from the rounding-down of dockage percentages. Farmers may have received an estimated $1.6 million additional income in 1978 from rounded-down dockage measurements in their wheat.

FOOTNOTES

1. No. 2 soft white wheat must have a test weight of 58 to 60 pounds per bushel; No. 3, 56 to 58 pounds per bushel; No. 4, 54 to 56 pounds per bushel; No. 5, 51 to 54 pounds per bushel; all soft white wheat below 51 pounds per bushel is designated sample grade.

2. Other grading factors included demanaged kernels, nonremovalbe foreign material, wheat of other classes, and wheat of contrasting classes. Industry estimates suggest that less than one percent of the grading-down of white wheat results from factors other than test weight.

3. The estimated average discount (EAD) in cents per bushel for Washington, in 1979, can be computed as: EAD=.653(0.0) + .24(1.5) + .069(3.5) + .023(5.5) + .006(8.0) + .009(10.0) = .855.

4. If the statewide average dockage is .9 percent, the maximum gain total is .4 percent (.9 - .5). If the average is, say, 1.3 percent, the dockage earned by farmers is .3 percent (1.3 - 1.0), and elevators can clean the wheat so as to precisely set the dockage at .9 percent, thereby earning .4 percent. Only when the average dockages are .9, are elevators unable to realize dockage blending returns.

REFERENCES

Araji, A. D., and R. G. Walsh. "Effects of Assembly Costs on Optimum Grain Elevator Size and Location." Canadian Journal of Agricultural Economics, Volume 17, July 1969.

Caves, Richard E. "Organization, Scale, and Performance of the Grain Trade." Food Rsearch Institute Studies, Volume XVI, No. 3, 1977-1978.

Pacific Northwest Crop Improvement Association. "1977 Wheat Production Estimates by Varieties in Certain Pacific Northwest Counties." Spokane, Washington, May 1978.

Pacific Northwest Grain Standards and Quality Committee. "Quality Wheat from Pacific Northwest-U.S.A.," Pendleton, Oregon. Various issues.

Thompson, Sarahelen R., and Reynold P. Dahl. The Economic Performance of the U.S. Grain Export Industry, Agricultural Experiment Station, University of Minnesota, Technical Bulletin No. 325-1979, St. Paul.

U.S. Department of Agriculture. "Grain Market News." Weekly summary and statistics. Agricultural Marketing Service-Livestock, Poultry, Grain, and Seed Division. Various issues.