

12-1917

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Recommended Citation

Justin, W. H. (1917) "Valuation of Futures in Flour Mill Accounting," *Journal of Accountancy*. Vol. 24: Iss. 6, Article 3.

Available at: <https://egrove.olemiss.edu/jofa/vol24/iss6/3>

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Valuation of Futures in Flour Mill Accounting*

By W. H. JUSTIN

During the last few weeks the United States food administration has fixed the price of wheat and the price of flour, and now steps are being taken which may result in fixing the price of bread.

With all this price-fixing there must of necessity be a great deal of cost-finding and profits-finding. This is what the food administration is now doing in the milling industry, and it should be of special interest to accountants, inasmuch as this industry, though one of the most ancient, is yet capable of great improvements in its accounting methods.

Perhaps to the experienced accountant there is little difference between the accounting essentials of the flour mill and those of any other continuous production factory. There are no secrets, and the books of account offer no mysteries to the inquiring mind; but there is a phase of flour mill accounting that is somewhat removed from the usual routine—this is the valuation of futures. It is with this phase of the work that the present article is concerned.

It is the common practice, of course, to sell flour for future delivery, and to buy wheat to protect the sale. When it is more convenient to do so, options on wheat for future delivery are bought instead of the cash wheat. This gives rise to a group of facts that may be represented as follows:

1. Options on wheat may be outstanding, either bought or sold;
2. Cash wheat may be bought and in store or in transit;
3. Flour may be booked for future manufacture and delivery.

Any one or any group of these conditions may prevail, and our problem is to make a proper valuation of the futures thus represented.

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To this end we must prepare a statement such as the following:

STATEMENT OF FUTURES

- I. Wheat options long.
Must be applied against a sale already made, and for this purpose must be taken at cost.
- II. Wheat options short:
Must be applied against a purchase already made, and for this purpose must be taken at price actually booked.
- III. A. Flour bookings:
 - (1) Gross unfilled orders, at price actually booked,
 - (2) Flour already manufactured and on hand, at booked price,
 - (3) Deduct (2) from (1) = net unfilled orders.B. Wheat necessary to fill net unfilled flour sales:
 - (1) Wheat in elevator, at cost,
 - (2) Wheat in transit, at cost,
 - (3) Wheat bought but not shipped, at cost,
 - (4) Options bought, at cost,
 - (5) Wheat necessary to buy, if any, at market price,
 - (6) Total cost of wheat necessary to fill bookings, Sum of (1), (2), (3), (4) and (5).C. Operating cost.
D. Offal production.
E. Value of B (6) plus C minus D = net cost of filling orders.
F. Difference between A (3) and E = unrealized loss or gain on unfilled orders.
- IV. Results of I, II and III combined = net unrealized loss or gain on all outstanding futures.

Result of IV is to be carried to its proper place in the regular balance-sheet of the company, either as an asset or a liability.

This statement of futures, when properly compiled, represents the loss or gain that is latent in the options, the cash wheat and the booked flour.

Now, it is evident that if a mill has booked with its customers flour orders amounting to, say, 30,000 barrels for future delivery,

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all the stocks of flour and wheat on hand plus any options bought and outstanding will be needed theoretically to fill the unfilled orders. I use the word theoretically because the process involved is purely for the purpose of establishing what loss or gain might be expected should all futures be closed out at once.

In order that a practical application might be made of the statement of futures, the following concrete example is given and the solution proposed:

1. Flour booked for future delivery, 29,946½ bbl.
2. Flour on hand, 1,383½ bbl.
3. Wheat on hand, 18,880 bu.
4. Wheat bought for future delivery, 122,227 bu.

Upon examination of the receiving records, it is found that the wheat mentioned under 3 above tests 58 lb. to the bushel; of that mentioned under 4, 51,684 bushels are in transit and specified as 60 lb. wheat; and the balance, 70,543 bushels, mentioned under 4, is not yet shipped and is specified as at least 47 lb. wheat. Upon referring to the yield chart, we find that of the 58 lb. wheat it requires 4.8 bushels to produce a barrel of flour; of the 60 lb. wheat it requires 4.6 bushels to the barrel; and of the 47 lb. wheat it requires 5.9 bushels to the barrel.

This problem, then, presents itself: Are the wheat and flour stocks sufficient to fill the unfilled orders, and if so, what will be the result? The following solution is based upon the above data (marginal letters and figures refer to the various sections of the statement of futures).

STATEMENT OF FUTURES

I. - II. All options closed out prior to the close of the period under review.

III. A. Flour bookings at actual price booked, bulk at mill:

- (1) 29,946½ bbl. at \$7.03 = \$210,506.02,
from which deduct
- (2) 1,383½ bbl. at \$7.03 = \$9,722.49,
flour on hand
- (3) 28,563 bbl. at \$7.02949 = \$200,783.53
net unfilled orders.

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Amount to be realized from bookings,	\$200,783.53
B. Wheat necessary to fill unfilled orders:	
(6) See statement,	\$283,995.74
C. Operating cost, see statement,	20,358.85
D. Offal production, see statement,	55,841.35
E. Net cost of filling orders,	\$248,513.24
F. Unrealized loss in unfilled orders,	47,729.71

IV.

Result of I., II. and III. combined. Since there is nothing under I. and II., the result is F,	47,729.71
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Result should be carried to company's balance-sheet as an intangible liability.

STATEMENT OF WHEAT NECESSARY TO FILL UNFILLED ORDERS

Wheat already bought:

1. 18,880 bushels 58 lb. wheat in elevator, of which it takes 4.8 bushels to the barrel.
2. 51,684 bushels 60 lb. wheat in transit, of which it takes 4.6 bushels to the barrel.
3. 70,543 bushels 47 lb. wheat not shipped, of which it takes 5.9 bushels to the barrel.
4. None.

Remainder necessary to buy:

5. 6,615 bushels 60 lb. wheat at market price, \$2.92, of which it takes 4.6 bushels to the barrel.

See yield chart for verification of above yields.

Applying values to above requirements:

B. (1)	18,880 bu. ÷ 4.8 produces	3,933 bbl., cost	\$39,000.00
(2)	51,684 bu. ÷ 4.6 produces	11,236 bbl., cost	107,605.34
(3)	70,543 bu. ÷ 5.9 produces	11,956 bbl., cost	118,074.60
(4)			
(5)	6,615 bu. ÷ 4.6 produces	1,438 bbl., market	19,315.80
(6)	147,722 bu.	produces 28,563 bbl.,	283,995.74

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Cost of wheat to fill unfilled orders—the above wheat producing a yield of 5.17179 (average). This figure will be used in the statement of offal production and also in the proof of unrealized loss.

Result carried to statement of futures, III. B. (6).

STATEMENT OF OPERATING COST

Based on a 24-hour run per day, 750 bbls. flour per day, from 60 lb. wheat, and 67 cents operating expense per bbl.

750 barrels per day at 67 cents, operating expense per day, normal, \$502.50.

147,722 bushels wheat \div 28563 = 5.17179, average yield, bushels per barrel.

Wheat of this yield produces a capacity loss of 6 per cent., see yield chart, under 54 lb. test weight.

100 per cent. minus 6 per cent. equals 94 per cent.: 94 per cent. of 750 barrels equals 705 barrels.

Operating expense remains the same, \$502.50 per day.

\$502.50 \div 705 equals \$.71277 per barrel — cost per barrel when grinding 54 lb. wheat, the yield of which is 5.17179 bushels per barrel.

28,563 barrels at \$.71277 equals operating cost to fill unfilled orders, \$20,358.85.

Above basis includes maintenance of plant, upkeep, manufacturing of flour and offal and marketing of the product.

Result carried to statement of futures, III. C.

STATEMENT OF OFFAL PRODUCTION

147,722 bu. \div 28563 equals 5.17179, average yield.

The yield chart shows that a yield of 5.1 bu. per bbl. produces 105 lbs. of offal, while a yield of 5.2 bu. produces 110 lbs. of offal; then a yield of 5.17179 would produce 109 lbs. of offal, and is shown as follows:

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There are six terms in the series 105 to 110 inclusive; therefore we must find six terms in the series 5.1 to 5.2, considering it as an arithmetical series. By applying the formula, $d = \frac{l - a}{n - 1}$, we find the common difference "d" to be .02. Then the series when completed, is:

The series	The offal values
5.1	105
5.12	106
5.14	107
5.16	108
5.18	109
5.2	110

The average yield being 5.17179, it is nearer to 5.18 than it is to any other term of the series, so we conclude that 109 lbs. of offal would be produced to each bbl. of flour. As there are 28,563 bbls. of flour, there would be 3,113,367 lbs. of offal produced.

A glance at the yield chart shows that offal is produced in the ratio of 3 lbs. of bran to 2 lbs. of shorts. Applying this ratio, we have:

Value of bran at mill door, per cwt. (sacked).....	\$1.75
Value of shorts at mill door, per cwt. (sacked).....	2.15
Average value of offal at mill door per cwt. (sacked)	1.91
Deducting value of sacks:	
Bran sacks, \$118.00 per M. \$.118 each	
Shorts sacks, 114.00 per M. .114 each	
Average offal1164 each .1164
Value of offal per cwt., bulk, at mill door.....	
	\$1.7936
3,113,367 lbs. offal at \$1.7936 per cwt. produces total value	\$55,841.35

Result carried to statement of futures, III. D.

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YIELD CHART

Test weight lbs.	Bushels required per bbl.	Total lbs. product	Milling loss per bbl.	Pounds offal produced	Bran and shorts ratio 3 to 2		Actual experience Per cent. of loss in mlg. capacity
					Pro-portion of bran	Pro-portion of shorts	
60	4.6	276	0	80	48	32	0
59	4.7	281	1	85	51	34	1
58	4.8	286	2	90	54	36	2
57	4.9	291	3	95	57	38	3
56	5.0	296	4	100	60	40	4
55	5.1	301	5	105	63	42	5
54	5.2	306	6	110	66	44	6
53	5.3	311	7	115	69	46	7
52	5.4	316	8	120	72	48	8
51	5.5	321	9	125	75	50	9
50	5.6	326	10	130	78	52	10
49	5.7	331	11	135	81	54	11
48	5.8	336	12	140	84	56	12
47	5.9	341	13	145	87	58	13
46	6.0	346	14	150	90	60	14
45	6.1	351	15	155	93	62	15
44	6.2	356	16	160	96	64	16

The yield chart contains the most vital information to be used in the valuation of futures. In fact, it is the basis for the computations. No definite result can be established without it. It should represent the experience of a great number of mills in various parts of the country. Should this be so, the resultant calculations would be as nearly correct as it is possible for such calculations to be. It is well known that the yield of wheat can at best only be approximated before it is ground.

Taking the yield chart as a basis, no further element of approximation should enter into the calculations.

To show that the foregoing figures are trustworthy and that the result, \$47,729.71, is in reality the loss represented in the futures outstanding in the above milling problem, we give the following proof, carrying decimals to the fifth and sixth places in order that the final showing will check with the final result of the statement of futures.

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PROOF OF UNREALIZED LOSS

Average price of flour per bbl., bulk, at mill.....		\$7.02949
Minus operating cost per bbl.....		.71277
		6.31672
Plus value of offal produced to each bbl., bulk at mill		1.95502
		\$8.27174
Yield	Flour value	
5.17179)	\$8.271740000 (1.599395, wheat value per bu.
	5 17179	
	3 099950	
	2 585895	
	5140550	
	4654611	
	4859390	
	4654611	
	2047790	
	1551537	
	4962530	
	4654611	
	3079190	
	2585895	
Actual cost of all wheat necessary to fill unfilled orders		\$283,995.74
Number of bu. required, 147,722; average cost per bu.		\$1.922500
Average price per bu. mill can afford to pay (see quotient above)		1.599395
		.323105
Loss per bu. on all wheat involved.....		.323105

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Number of bu., 147722

Loss per bu., .323105

738610

147722

443166

295444

443166

\$47729.71, total unrealized loss as shown in
statement of futures, IV.