AN ANALYSIS OF PROFIT MARGIN HEDGING STRATEGIES IN THE BROILER INDUSTRY

by

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CHAPTER I

INTRODUCTION

The typical vertically integrated broiler firm is constantly faced with variable input costs, primarily corn and soybean meal, and variable sales revenues from selling their output, iced broilers, in the cash market. The profit margins for the integrators can fluctuate widely from week to week. Integrators are faced with volatile prices for their iced broilers basically for four reasons: (1) the commodity is perishable, (2) the broiler production cycle is relatively short and the integrator can adjust his production relatively quickly to fluctuating profit margins, (3) broiler consumption varies seasonally, and (4) broiler prices are closely related to volatile pork prices.

Iced broilers must be consumed within a relatively short period of time. If consumption in a given week falls below that week's production, the excess production cannot be held for an extended period of time, unless diverted into a non-fresh market. In this situation, the processor normally lowers his price until he sells all his product. Thus, when quantity supplied exceeds quantity demanded at a given price, there is great downward pressure on price. Consumption must equal production within a period of a few days.

Given stable broiler prices, higher (lower) feed prices diminish (increase) the profit outlook, causing the integrator to reduce (increase) production. To illustrate the price fluctuation of inputs and outputs facing the broiler integrator, the following example is given. In February of 1972, the integrator was faced with the following prices; 28.1 cents/lb. for ready-to-cook (RTC) broilers, $1.21/bu. for corn, and $85/ton for soybean meal (Table 1). With these prices, the integrator's profit margin was about 1 cent a pound. Over a period of eleven weeks, corn and soybean meal prices increased and broiler prices fell nearly 2-1/2 cents per pound. Instead of making an expected one cent profit margin, the integrator lost two cents per pound. If the integrator was slaughtering 500,000 birds a week, a loss of approximately six cents a bird would have meant a loss of $30,000 a week.

During the period 1971-1975, corn prices ranged from a low of $1.05/bu. to a high of $3.74/bu. Soybean meal prices for the same period ranged from a low of $73/ton to a high of $412/ton. Likewise, broiler prices ranged from $.24/lb. to $.60/lb. Therefore, price fluctuations for broiler inputs and outputs have been great.

Consumption of broilers varies seasonally. Domestic consumption is highest during the second and third quarters of the year and lowest during the first and fourth quarters. Prices are normally strongest in the second and third quarters when consumption is high.

Lt is well known in the industry that broiler prices are more highly related to pork prices than to beef prices. Havlicek, Myers, and Henderson [5] found that the cross elasticity of broilers at retail level with respect to the price of pork is three times the magnitude of

Table 1. Broiler and feed prices, monthly 1971-75.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
---------- Broilers, 9-city delivered monthly,[a] cents per pound ----------												
1971	26.4	27.5	27.0	26.7	28.4	29.5	30.4	28.0	27.2	25.9	24.8	24.2
1972	27.1	28.1	28.1	25.7	27.1	28.6	29.7	29.2	30.1	28.2	27.6	28.2
1973	32.8	37.3	41.1	43.6	41.6	41.7	49.0	60.3	48.4	40.0	34.4	36.1
1974	39.7	39.4	38.8	36.3	35.6	34.0	36.0	36.8	39.9	39.3	41.9	40.7
1975	41.6	41.4	40.7	40.1								
---------- Corn, No. 2 yellow, Chicago (average monthly prices),[b] dollars per bushel ----------												
1971	1.59	1.57	1.55	1.51	1.52	1.57	1.48	1.29	1.16	1.10	1.07	1.22
1972	1.22	1.21	1.22	1.26	1.28	1.25	1.29	1.29	1.40	1.32	1.33	1.57
1973	1.58	1.59	1.59	1.65	2.01	2.42	2.52	2.91	2.47	2.37	2.50	2.68
1974	2.90	3.13	2.99	2.69	2.70	2.93	3.35	3.36	3.55	3.74	3.48	3.47
1975	3.19	2.96	2.90	2.96	2.82	2.91	2.95					
---------- Soybean meal, 44 percent, Decatur (average monthly prices),[c] dollars per ton ----------												
1971	80	78	77	74	78	82	84	79	73	75	74	81
1972	83	85	91	94	95	95	101	101	108	109	123	174
1973	120	128	133	130	146	168	163	182	169	163	155	165
1974	170	169	165	156	151	151	157	180	176	185	183	180
1975	176	167	161	164	161	162	161					

[a] Broiler Marketing Facts First Quarter 1975.

[b] Feed Situation, Economic Service, USDA.

[c] Agricultural Prices, Statistical Reporting Service, USDA.

the cross elasticity with respect to the price of beef when measured on a monthly basis. The monthly estimated retail cross elasticity for broilers with respect to the price of pork ranges from a low of .285 in June to a high of .361 in January. With respect to the price of beef, the estimated retail cross elasticities range from a low of .090 in June to a high of .120 in January.

It is not unusual for iced broiler cash prices to vary as much as 30 to 40 percent within a few months. However, once the egg is set the bird is usually grown out to the required weight, regardless of whether the price of the final output will cover the costs of production. Therefore, in an effort to provide a means of protection against the risks of price change, the broiler industry was instrumental in the development of a futures market contract in iced broilers on the Chicago Board of Trade. It has been the experience in other industries served by futures markets that income stability may be achieved by hedging in futures contracts.

Problem Situation

Historically, the poultry processor had to accept volatile prices for his output, primarily because of the characteristics of the commodity. Within the last few years, the integrator has faced widely fluctuating input prices, primarily those of corn and soybean meal. When eggs are set, the integrator seldom knows the price his birds will bring when they reach a marketable weight. Through hedging, the futures market offers him an opportunity to lock in a major portion of his feed costs by using the corn and soybean meal contracts and to establish a price for his broilers. This opportunity creates a decision problem for the integrator. First, he must decide whether or not hedging is desirable; and second, he must select a hedging strategy.

Objectives

The primary objective of this study is to determine the impact on profit margins and profit margin variance of various hedging strategies for an integrated broiler firm.

More specifically, the objectives are: a) to develop a cost of production budget generator, b) to estimate and investigate basis patterns for iced broilers, corn, and soybean meal for model broiler firm located on the eastern shore of Maryland, c) investigate the concept of locking in weekly profit margins by simultaneously hedging corn, soybean meal, and iced broilers, d) to use simulation analyses to compare the mean and variability of profit margins from alternative hedging strategies, and e) estimate the cost of hedging for each strategy with respect to the initial margin requirements, interest charges on margin calls if needed and commission charges.

Structure of the Study

The thesis is structured as follows. The second chapter explains the hedging concept of locking in future margins for broiler integrators by simultaneously hedging corn, soybean meal, and iced broilers. It will indicate the information needed to utilize this concept. A brief review of other studies concerning hedging strategies is also presented. The third chapter discusses in detail the development of the broiler production cost budget used as a base point for comparing hedging strategies. Additionally, a short discussion concerning the study area and the hypothetical firm is presented. The fourth chapter discusses basis theory, calculations of actual basis for each commodity, and methods of calculating future basis estimates. The fifth chapter explains the computer simulation model used to compute the future net profit margins. The sixth chapter provides analyses of the hedging strategies results in terms of the average and variance of profit margins and contains the conclusions and implications of the study.

CHAPTER II

LITERATURE REVIEW AND HEDGING STRATEGY

Literature Review

The Chicago Board of Trade began trading the iced broiler futures contract in August of 1968. Since then there has been only one published study by Smith and Jones [8] that examined the profitability of hedging iced broilers. Smith and Jones employed two kinds of decision rules: "naive" and "selective." A naive decision rule is one in which the integrator always takes the same action. One example would be: always hedge. A selective decision rule is one requiring the integrator to take a different action depending on such factors as seasonal price patterns and price expectations. An example would be: hedge only during the months of September-December.

A simulated broiler program was established covering the period from August 1, 1968 to October 22, 1973. The length of the production period, from the time the eggs were set until the broilers were sold, was 12 weeks. It was assumed that the firm marketed 28,000 pounds of iced broilers each week. Feed costs were not hedged using the futures market. Four hedging strategies were tested.

Never Hedge. This strategy, which is simply a cash market operation, served as a benchmark for evaluating the other strategies.

Always Hedge. This strategy assumes that a futures contract is purchased and sold for each lot of birds produced. When eggs were set each week, the integrator sold a broiler contract. After 12 weeks, the iced broilers were sold on the cash market and the futures contract was bought back.

Seasonal Hedge. A broiler price index was calculated that indicated broiler prices were below average in the last three months of the year. With this strategy, the integrator hedged all broilers sold during the last quarter of the year only.

Futures-Cash Hedge. With this strategy a futures contract was sold when the futures price for the month the broilers were to be sold was greater than the current cash price.

Table 2 indicates the average returns and variation in returns for the alternative hedging strategies analyzed by Smith and Jones. The results clearly indicate that the completely hedged operation obtained lower gross returns. However, the variation in gross returns under the completely hedged operation is lower than with the totally unhedged operation.

None of the hedging strategies individually provided both higher gross returns and lower gross income variation when compared with the totally unhedged operation. There was a definite trade-off associated with the alternative hedging strategies when attempting to reduce risk, i.e., strategies which generated higher prices had a tendency to exhibit a higher variation in returns.

There have been several studies that have investigated the profitability of hedging live cattle and hogs (Holland, Purcell and Hague

Table 2. Average returns and variations in returns for the various hedging strategies, 1968-1973.[a]

Selling Method	Average Returns	Standard Deviation
	--- Dollars per Hundredweight -----	
Unhedged	$30.70	$7.07
Seasonally Hedged	30.77	7.55
Futures-Cash	29.99	8.43
Completely Hedged	29.41	5.41

[a]Smith, R. C. and H. H. Jones, Hedging Iced Broilers in Delaware, Research Bulletin 411, June 1974, Agr. Experiment Station, University of Delaware, Newark, Delaware.

[6]; Johnson [3]; Schaefer [7]; and McCoy and Price [4]). Most of these studies have concluded that a completely hedged operation normally results in a decrease in the variability of net returns but at the expense of a decrease in average net income.

In the McCoy and Price study, choice feeder steers weighing 650 pounds were considered to be placed on feed at current, weekly average Kansas City prices. Finishing costs were based on a 20,000 head capacity Kansas feedlot. Feed requirements and rations were adjusted as cattle gained weight and progressed through the feeding program. Although the cost of inputs were considered in this study, they were unhedged.

McCoy and Price tested seven hedging strategies over a ten year period (1965-1974) for a typical cattle feedlot operation in Kansas City, Missouri. Table 3 summarizes the results of the study. Similar to the Smith and Jones study on hedging broilers, it was evident that a tradeoff exists between the mean income and the variance of income. The strategy of hedging only when the futures price is higher than the breakeven price and the current cash price illustrates that futures contracts can be utilized to increase profits while holding the variance relatively stable compared to the unhedged strategy.

A number of studies concerning hedging strategies for cattle, hogs, or broilers normally lack the crucial information related to feeding and other production costs. Generally, these production costs have not been considered, because it is assumed that the producer has made an irrevocable decision to produce. Previous studies have concentrated on investigating hedging strategies that would increase the

Table 3. Average profits, per head, from seven alternative hedging and contracting programs, May 1965-December 1974.[a]

	Average 10 Yr. Profits	Variance	Lots Hedged
I Unhedged	9.55	1079.737	0
II Routine Hedge	0.18[b]	417.243[b]	505
III Futures ≥ Breakeven	11.81	980.095	218
IV Futures ≥ Cash	13.08[c]	732.439[b]	204
V Futures ≥ Break-even and ≥ Cash	14.43[b]	1060.335	145
VI Seasonal Hedged (Fall)	10.38	907.302[d]	174
VII Contract	2.41[b]	199.556[b]	0

[a]McCoy, John H. and Robert V. Price, Cattle Hedging Strategies, Agr. Exp. Station Bulletin 591, Kansas State University, August 1975.

[b]Indicates that difference as compared to unhedged value is statistically significant at the one percent level.

[c]Indicates that difference as compared to unhedged value is statistically significant at the ten percent level.

[d]Indicates that difference as compared to unhedged value is statistically significant at the five percent level.

price received for the final product. Ignoring the possibility of changing feed costs leaves a great deal of uncertainty with respect to the final net profit outcome even though the selling price is locked in by hedging.

This study will differ from past research in that a careful effort will be made to estimate weekly costs for a model broiler firm over a six year period. Since feed costs are approximately seventy percent of the liveweight cost of producing broilers, volatile feed prices subject the integrator to widely fluctuating profit margins. This study will test the hedging concept of locking in future profit margins by simultaneously hedging inputs and outputs, i.e., corn, soybean meal and iced broilers.

This study will look at potential profit margins for up to nine months in advance on a day-to-day basis using daily futures prices for corn, meal, and broilers. Therefore, unlike previous studies, this study will investigate the possibility of locking in profit margins several months before the actual placement of chicks on feed. This assumes that the integrator, by his commitment to contract growers, breeder flock contractors and his total capital investment in fixed assets, is committed to produce regardless of the price of broilers. The desirability of this concept will be determined by comparing its net profit margin and profit margin variance to that of a completely unhedged operation. The procedure for evaluating the profit margin hedge and the mechanics of locking in a profit margin in the futures market are discussed below.

When a broiler integrator sets his eggs, he is committing himself to feed costs, while at the same time he is at the mercy of the market twelve weeks later for the price of broilers. By simultaneously buying corn and soybean meal futures and selling iced broiler futures, the integrator is fixing a major portion of his variable costs thus reducing his uncertainty on the input side of the production process and substantially reducing output price uncertainty.

To develop a hedging strategy where inputs and outputs are simultaneously hedged in such a manner as to lock in future profit margins, the following information is needed.

(1) The feed ration composition, and the percentages of corn and soybean meal in the ration,

(2) Prices for ingredients other than corn and soybean meal,

(3) Feed conversion ratio,

(4) Dressing percentage,

(5) All other production costs,

(6) Basis estimates for corn, meal, and broilers, and

(7) Commission costs and interest charges on margin money.

Equipped with this information a formula can be derived to compute the future net profit margins available to the broiler integrator during each month of the year using price quotes for corn, soybean meal and broiler futures contracts. The actual net profit margins realized each week by utilizing the hedging strategy will be calculated and compared with the actual net profit margins of a similar unhedged operation. The margin and margin variance of the hedged operation will be compared to the margin and margin variance of the unhedged operation.

Profit Margin Hedge Example

Broiler integrators can use the futures market to simultaneously lock in the price of corn and soybean meal and the price of broilers therefore locking in a profit margin. To lock in this margin, the integrator buys corn and meal futures to help set feed costs, and sells broiler futures to set the selling price of his broilers. The mechanics of locking in profit margins using the futures market is illustrated below.

To illustrate the technique of the simultaneous hedge, three "T" accounts are set up. Illustration 1 represents a situation that actually happened in 1970. Note that the number of contracts traded for corn, meal and broilers is determined by the approximate total poundage of broiler meat sold on a weekly basis, and the amount of corn and meal needed to feed the number of birds which produce that poundage of meat. For a complete hedge, 8 corn contracts, 5 meal contracts, and 53 broiler contracts have to be traded simultaneously each week to cover the production of 500,000 birds per week.

Assume a firm grows out each bird to an average liveweight of 4 lbs. Given a dressing percentage of 74%, the average saleable weight per bird would be 2.96 lbs. The representative firm slaughters 500,000 birds or 1,480,000 lbs. per week which is equivalent to approximately 53 broiler contracts (1 broiler contract = 28,000 lbs.).[1]

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[1]Starting with the February 1977 broiler futures contract, one contract is 30,000 lbs.

ILLUSTRATION 1

Corn

Date	Cash Acc't.	Futures Acc't.	Basis
3/2/70	TP = 1.39¼	Buy 9 September contracts @ $1.21¼/bu.	Estimate +$.18/bu.
9/4/70	Cash price = $1.45	Sell 9 September contracts @ $1.56/bu. $0.3475	Actual -$.11/bu.

Net price = $1.45 - .3475 = $1.1025

Soybean Meal

Date	Cash Acc't.	Futures Acc't.	Basis
3/2/70	TP = 93.65	Buy 5 September contracts @ $72.05	Estimate $21.60/ton
9/4/70	Cash price = $104.97	Sell 5 September contracts @ 80.77 +8.72	Actual $24.70/ton

Net price = $104.97 - 8.72 = $96.25

Iced Broilers

Date	Cash Acc't.	Futures Acc't.	Basis
3/2/70	TP = $27.70/cwt.	Sell 53 September contracts @ 27.20¢/lb.	Estimate $.50/cwt.
9/4/70	Cash price = $24.82/cwt.	Buy 53 September contracts @ 24.40¢/lb. +2.80	Actual $.42/cwt.

Net price = $24.82 + 2.80 = $27.62

In order to slaughter 500,000 birds per week, approximately 518,135 new chicks have to be placed each week or 4,145,080 birds have to be on feed at any one point in time considering a 3-1/2 percent loss due to in-house mortality, condemnations and dead on arrival (D.O.A.'s) at the processing plant. Each bird eats approximately 8.00 lbs. of feed or a total of 4,145,080 lbs. of feed for each lot of birds. The feed ration consists of 57% corn (See Appendix A), therefore each lot of birds eats 2,362,696 lbs. of corn. Since a bushel of corn weighs approximately 56 lbs., 42,191 bushels will be consumed. Corn futures contracts are traded in 5,000 bushel units, therefore, 8 corn contracts would just about cover the corn requirements for 500,000 processed birds.

To calculate the number of soybean meal contracts to be hedged, the same analysis is repeated. Soybean meal consists of about 25% of the total feed consumed, and each bird eats 2.00 lbs. of meal. Therefore, to feed 518,135 birds, 1,077,721 lbs. or 539 tons of meal is required. Soybean meal contracts are traded in 100 ton units, therefore 5 soybean meal contracts would cover the meal requirements. Therefore, a profit margin hedge for 500,000 ready-to-cook birds required 8 corn, 5 meal, and 53 broiler futures contracts.

Before going into a detailed explanation of the "T" accounts shown in Illustration 1, a brief discussion on basis is required. Basis is defined as the cash price minus the futures price. Essentially basis describes the relationship of the cash price of a given commodity relative to a futures price. Looking at the corn T account in Illustration 1, the integrator has estimated a corn basis of + .18 cents per bushel, which means that the integrator feels that the cash price of corn during the first week of September will be + .18 cents greater than the September futures price. On March 2, 1970 September corn was selling at $1.21 1/4 per bushel. With this price plus an .18 cent basis, the corn price that the integrator will attempt to lock in will be $1.39 1/4 per bushel (1.21 1/4 + .18). This price will be referred to as the target price.

On the same day, September meal was trading at $72.05 per ton. With a basis estimate of $21.60, the target price that the integrator will attempt to lock in will be $93.65 (72.05 + 21.60). Assuming that all the other costs involved are some calculated amount, the total cost of producing a pound of RTC broiler meat would be $.2724 per pound using the assumptions given later in Chapter III.

Now that the integrator has calculated his costs using the corn and meal futures contracts, he looks at the September futures price for broilers. On March 2, 1970, the September broiler futures closed at 27.20 cents per pound. Assuming a broiler basis of .5 cents per pound, meaning the integrator estimates that in September the N.Y.C. cash price will be a half of a cent over the September futures price, the target price for broilers is 27.70 cents per pound. With production cost locked in at 27.24¢/lb., a profit margin of .46¢/lb. can be locked in. If the integrator feels this is a favorable profit margin, the integrator on March 2, 1970 proceeds to buy 8 September corn contracts, and 5 September meal contracts, and sells 53 September broiler contracts. Then on September 4, 1970, the integrator lifts the hedge by simultaneously selling his corn and meal contracts and buying back his broiler contracts.[2] To calculate the actual net profit margin realized with the hedge, the integrator first has to compute the weighted average prices paid for the corn and meal fed to the broilers. Once these cash prices are computed, a loss or gain in the futures market has to be added or subtracted, respectively. For this example, the cost of corn for this lot of hedged birds was $1.45/bu. minus $.3475 gain in the futures market. Hence, the net cost of corn was $1.1025/ bushel. At the same time the average cash price for soybean meal was $104.97/ton minus the $8.72/ton gain on the meal hedged results in a net price of $96.25/ton. During the same period the September broiler futures price dropped from 27.20¢/lb. to 24.40¢/lb. The cash price for broilers in N.Y.C. the first week in September was 24.82¢/lb. Therefore, the net price the integrator received for his broilers was 24.82¢/lb. plus the gain from the hedging transaction of 2.80¢/lb. results in a net price of 27.62¢/lb. With these net prices, the actual net profit margin was 1.14¢/lb. If the integrator had not hedged, the unhedged operation would have lost 2.9 cents per pound.

A quick method to determine the estimated net profit margins available in the future is given by formula (2.1).[3]

$$(2.1)\quad ENPM = IBTP - [(CTP/56) \times CCF + (SBMTP/2000) \times SCF + OC]/(.965 \times .74) + PROC + TRANS - OFFAL$$

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[2] In practice, the corn and meal futures are sold as the corn and meal are purchased during the feeding period. To simplify the presentation and concentrate on the concept of a simultaneous hedge, this detail has been omitted from Illustration 1. A detailed explanation of the hedge lifting procedure is given in Chapter V.

[3] The development of this equation will be explained in Chapter III.

where:

ENPM = estimated net profit margin,

IBTP = the target price for iced broilers,

CTP = the target price for corn,

CCF = corn conversion factor (feed conversion ratio x percent of corn in the feed ration),

SBMTP = the target price for SBM,

SCF = SBM conversion factor (feed conversion ratio x percent of soybean meal in the feed ration),

OC = summation of the chick cost, fuel cost, contract payment, fixed ration, milling charge,

.74 = dressing yield,

.965 = adjustment for in-house mortality, DOA's, and condemnations,

PROC = cost of processing,

TRANS = transportation cost to N.Y.C., and

OFFAL = value of 1 lb. of offal per bird.

Using the same numbers as in the previous example and plugging them into equation 2.1, we obtain:

$$(2.2)\quad ENPM = .2770 - [(1.39\tfrac{1}{4}/56) \times 1.14 + (93.65/2000) \times .498 + .0914] / (.965 \times .74) + .065 + .012 - .005 = + .0046 \ \$/lb.$$

Equation (2.3) is used to compute the actual net profit margin attained by hedging:

$$(2.3)\quad ANPM = NP_{IB} - [NP_C/56) \times 1.14 + (NP_{SBM}/2000) \times .498 + OC]/(.965 \times .74) + PROC + TRANS - OFFAL$$

where:

NP_{IB} = cash market price of broilers at time of delivery plus gains or minus losses in the futures market transaction,

NP_C = cost of corn fed to broilers marketed minus gains or plus losses in the futures market transaction, and

NP_{SBM} = cost of soybean meal fed to broilers marketed minus gains or plus losses in the futures market transaction.

The actual net profit margins attained with hedging is determined by inserting the appropriate net prices from Illustration 1 into equation (2.4).

$$(2.4)\quad ANPM = .2762 - [(1.1025/56) \times 1.14 + (96.25/2000) \times .498 + .0914] / (.965 \times .74) + .065 + .012 - .005 = .0112 \text{ \$/lb.}$$

To compute the profit margin of a firm that did not hedge, one would have to substitute the actual cash prices paid for corn and meal and the actual cash prices received for broilers into equation (2.3). With \$1.45/bu. corn, \$104.97/ton meal, and 24.82¢/lb. broilers, the margin without hedging would be a loss of 3.14¢/lb.

The difference between the expected net profit margin (ENPM) of + 0.0046 \$/lb. and the actual net profit margin (ANPM) of 0.0112 \$/lb. is accounted for by the difference in the estimated and actual basis for corn, soybeans, and broilers. If the actual basis is the same as the estimated basis, the ENPM will equal the ANPM. Obviously then, the estimation of accurate basis estimates is important in determining available future profit margins, especially when the margins being locked in are very small. If the basis estimates are not accurate, the estimated net profit margins may mislead an integrator when deciding to hedge or not to hedge. Chapter IV will concentrate on the procedures used to determine the basis estimates used in this study.

CHAPTER III

THE BROILER PRODUCTION BUDGET

The major emphasis of this study is to develop and compare alternative hedging strategies for a typical integrated broiler firm on the Eastern Shore of Maryland. To permit comparison of alternative strategies, weekly net profit margins of a model firm buying inputs and selling output in the cash market were developed. To accomplish this, a computer program was written to estimate weekly production costs which were compared to broiler prices to determine profit margins. These weekly profit margins will serve as a benchmark for evaluating alternative hedging strategies.

Study Area

The model firm is located in Salisbury, Maryland. The reasons for selecting this area are twofold. First, the location selected should represent an area of major concentration of broiler production, such as the Delmarva region. Second, sufficiently detailed data relating to this area were available,[1] enabling completion of the objectives of this study. However, the methods and models used in this study are applicable to any region in the country.

[1] Some of the cost data were obtained from broiler integrators located outside the Delmarva region. However, the cost estimates are assumed representative of the Virginia broiler industry.

Model Firm

The model integrated broiler-marketing firm, is assumed to have a hatchery, feed mill, and processing plant. The model firm contracts for its hatching egg production and grow-out facilities. Additionally, the following assumptions concerning the firm are made:

(1) The firm will process 500,000 birds per week. This will require approximately 4,145,070 birds on feed at all times, providing an eight-week feeding period and 3.5% loss for in-house mortality, condemnations, D.O.A.'s.

(2) The broiler production growout operation consists of 12-week production periods. The hatchery operation consists of four weeks, one week for the accumulation of eggs and three weeks for incubation. The birds are then placed in the field, grown-out, processed, and delivered in eight weeks.

(3) All the birds processed are USDA grade "A" ready-to-cook (RTC) iced broilers.

(4) All the birds are sold on the New York City (N.Y.C.) market.

(5) There are facilities for the storage of a one week supply of feed ingredients and a three day supply of finished feeds.

The Ration

The feed ingredients used in the formulation of the poultry ration are presented in Table 4. The broiler ration is divided into four sub-rations which are referred to as the starter, grower, finisher, and withdrawal feeds.

Table 4. Broiler Rations.[a]

Ingredients	Ration Number			
	1	2	3	4
	pounds per ton			
Ground yellow corn	1056	1101	1146	1222
Stabilized fat	100	100	100	100
Dehulled soybean meal	580	530	480	440
Menhaden fish meal	120	80	40	0
Poultry by product meal	60	60	60	60
Corn gluten meal (60%)	40	80	120	120
Defluorinated phosphate	24	26	28	30
Ground limestone	6	8	10	12
Salt	5	6	7	8
DL-methionine	2	2	2	2
Trace mineral mix	1	1	1	1
Vitamin premix	5	5	5	5
Coccidiostat (25%)	1	1	1	-
Total	2000	2000	2000	2000
Calculated analysis				
Protein, %	25.5	23.4	21.4	19.6
Calcium, %	1.03	.97	.91	.87
Phosphorus, %	.76	.72	.67	.63
Feeding schedule				
Weeks	0-3	3-5	5-7	7-8
Days	0-21	21-35	35-49	49-56
Metabolizable Energy (Cal/lb)	14.83	14.98	15.12	15.23

[a]Developed by Dr. L. M. Potter, Poultry Nutritionist, Department of Poultry Science, VPI&SU, October 1975.

Ration No. 1 consists of 52.8% corn and 29.0% meal. This ration is consumed during the first 3 weeks. Ration No. 2 consists of 55.05% corn and 26.5% soybean meal, and is consumed during weeks 4 and 5. Ration No. 3 consists of 57.3% corn and 24.0% soybean meal and is consumed during weeks 6 and 7. Ration No. 4 consists of 61.1% corn and 22% soybean meal and is consumed during the final feeding week.

The price of corn and soybean meal normally does not remain constant over the feeding period. The cost of corn and soybean meal fed to each bird is computed by multiplying the percentages of corn and soybean meal used in each sub-ration by the amount of feed consumed per bird from each of those rations (Table 5). To compute the price of corn per pound, the price of corn per bushel was divided by 56 lbs. The corn price during week 1 was $1.22/bu. and was increased 2¢/bu. each week until the price of corn/bu. reached $1.36 during week 8. To compute the price of soybean meal on a pound basis, the price of soybean meal per ton was divided by 2000 lbs. The price of soybean meal during week 1 was $150.00/ton and was increased $2.00/ton each week until the price of meal reached $164.00/ton during week 8. The prices used in Table 5 are for illustrative purposes only. Actual weekly prices for corn and soybean meal were used in the production cost budget.

Each bird is assumed to consume a total of 8 lbs. of feed and will convert two pounds of feed into one pound of body weight, which means the total liveweight of each bird will be 4 pounds.

The remainder of the ration costs were calculated by computing a composite ration from the four sub-rations given in Table 4. Each

Table 5. Procedure to compute cost of corn and soybean meal per bird and per pound of liveweight.

Week	Feed Consumed[a] Per Bird/Week	X	Percentage in Ration	=	Consumed Per Bird/Week	X	Price/lb.	=	Cost/Bird
	lbs.		%		lbs.		$		$
				Corn					
1	.176		.528		.09292		.02178		.00202
2	.384		.528		.20275		.02214		.00448
3	.648		.528		.34214		.02250		.00769
4	.896		.5505		.49324		.02285		.01127
5	1.104		.5505		.60775		.02321		.01410
6	1.400		.5730		.80220		.02357		.01890
7	1.568		.5730		.89846		.02392		.02149
8	1.824		.6110		1.11446		.02428		.02705
				Soybean Meal					
1	.176		.290		.05104		.075		.00382
2	.384		.290		.11136		.076		.00846
3	.648		.290		.18792		.077		.01446
4	.896		.265		.23744		.078		.01852
5	1.104		.265		.29256		.079		.02311
6	1.400		.240		.33600		.080		.02688
7	1.568		.240		.37632		.081		.03048
8	1.824		.22		.40128		.082		.03290

[a]Source: Industry Spokesman.

Total cost of corn consumed/bird = $.10700; total cost of corn consumed/lb. of liveweight = $.02675 where weight of bird = 4.00 lbs.; total cost of SBM consumed/bird = $.15863; and total cost of SBM consumed/lb. of liveweight = $.03965.

ration was weighted by the percentage of total feed consumed during each week of the feeding period. An example of the method used in computing the composite ration can be found in Appendix A. In this case, corn was used to illustrate the method. The same procedure was used for each feed ingredient. The composite ration can be found in Table 6 and the prices used to calculate the fixed ration can be found in Appendix A.

In addition to the three separate feed items (corn, meal, all other), the budget consists of seven other cost components. The sources and prices for each of these separate cost items can be found in Appendices A and B. A description of each is given below:

Milling Charge. This charge includes the cost of purchasing, grinding, mixing, and delivery of the feeds. Servicing the flocks and the cost of formulating the feed rations are also included in this cost category.

Chick Costs. This item includes the cost of hatching eggs, incubation, debeaking, vaccination (Mareks Disease, New Castle Disease, Infectious Bronchities), delivery and hatchery operation overhead. These costs were calculated by dividing the cost per chick by the finished liveweight (4 pounds).

Contract Payment. The contract payment is determined by the performance of the grower.

Fuel. The fuel charge includes the cost of fuel for brooding only. A fuel cost per pound of liveweight was obtained from a budget

Table 6. Composite Ration.[a]

Ingredient	Pounds Per Ton
Ground yellow corn	1138.488
Stabilized fat	100.000
Soybean meal	498.480
Menhaden fish meal	52.960
Poultry by-product meal	60.000
Corn gluten meal	97.920
Defluorinated phosphate	27.350
Ground limestone	9.352
Salt	6.676
DL-methionine	2.000
Trace mineral mix	1.000
Vitamin premix	5.000
Coccidiostat	.770
Total	2000.000

[a]Percentage of corn in composite ration = 57 percent; Percentage of soybean meal in composite ration = 25 percent; and Percentage of other ingredients in composite ration = 18 percent.

developed by Dr. William D. Weaver and Mr. James M. Moore in 1974.[2] The cost was then adjusted by the wholesale Price Index for fuels and related products and power over the time period 1969-75. Seasonal fluctuations in fuel use are not taken into consideration.

Offal. Offal is considered as a negative cost. It includes the value of the blood, feathers, eviscera, trims, head, shanks, D.O.A.'s and condemnations. Offal weight is assumed to be 25% of the liveweight of each bird.

Processing Cost. The processing costs are for a totally ice-packed operation. The processing costs are based on a budget developed by Dr. Lewis Wesley to represent 1975 costs. Costs for years prior to 1975 were obtained by adjusting 1975 costs downward by one-half cent a year. The budget used as a basis for determining processing costs is contained in Appendix B.

Transportation Cost. This item includes the cost of transporting a full load of broilers to the N.Y.C. market from Salisbury, Maryland.

The Cost-Profit Margin Generator

A computer program was written to generate weekly profit margins by computing weekly costs and then subtracting these costs from the weekly New York City weighted average price for Grade "A" ready-to-cook iced broilers. All birds are assumed to be Grade "A." For application to a real firm, the integrator would have to take into consideration under-grades and compute his weighted average return per pound. If

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[2]Broiler Budget submitted to the President's Council of Economic Advisors, October, 1974.

the processed birds were marketed in different cities, the profit margins would vary. The actual program is found in Figure 1, and the results are listed on a cent-per-pound basis in Table 7.

Referring to the program in Figure 1, the first four statements read in the basic input data (i.e., weekly costs and revenues). The next two statements convert corn and meal prices to a per pound basis. Then, the total cost of corn and meal fed to a given lot of birds is determined by equations 23 and 24, the total cost is computed by equation 25, and the net profit margin is calculated using equation 26.

Six basic formulas are needed to determine the final net profit margin. A detailed discussion is given below.

Equation 21: PCLB(I) = PC(I)/56

where:

PCLB = Price of corn on a per pound basis,

PC = Price of corn on a per bushel basis, and

I = Week number.

This equation computes the price of corn on a per pound basis by dividing the cost of corn per bushel by 56 pounds. The corn price was the average weekly cash price per bushel paid Eastern Shore of Maryland farmers for No. 2 yellow shelled corn.

Equation 22: PSBMLB(I) = PSBM(I)/2000

where:

PSBMLB = Price of soybean meal on a per pound basis,

PSBM = Price of soybean meal on a per ton basis, and

(I) = Week number.

```
   DO 20 I=1,365
20  READ(5,100) PC(I), PSBM(I), PB(I), MC(I), CC(I), FC(I), CPAY(I),
  1FR(1), PROC(I), TRANS(I), OFFAL(I), MONTH(I)
100 FORMAT(F4.2,F7.2,9F6.4,2X,A4)
   DO 21 I=1,365
21 PCLB(I)=PC(I)/56.
   DO 22 I=1,365
22 PSBMLB(I)=PSBM(I)/2000.
   DO 23 I=9,365
23 CSUM(I)=(.09292*PCLB(I-8)+.20275*PCLB(I-7)+.34214*PCLB(I-6)+
  1.49324*PCLB(I-5)+.60775*PCLB(I-4)+.80220*PCLB(I-3)+.89846*
  2PCLB(I-2)+ 1.11446*PCLB(I-1))/4.00
   DO 24 I=9,365
24 SBSUM(I)=(.05104*PSBMLB(I-8)+.11136*PSBMLB(I-7)+.18792*PSBMLB(I-6)
  1+.23744*PSBMLB(I-5)+.29256*PSBMLB(I-4)+.33600*PSBMLB(I-3)+.37632*
  2PSBMLB(I-2)+.40128*PSBMLB(I-1))/4.00
   DO 25 I=9,365
25 TCOST(I)=((CSUM(I)+SBSUM(I)+FR(I)+MC(I)+CPAY(I)+FC(I)+CC(I))/
  1.7141)+PROC(I)+TRANS(I)-OFFAL(I)
   DO 26 I=9,365
26 MARGIN(I)=(PB(I)-TCOST(I))*100.00
```

Figure 1. Computer program statements used to compute costs and profit margins.

Table 7. Weekly broiler profit margins, 1970-1975.

DATE	WEEK	CORN PRICES	SBOM PRICES	TOTAL COSTS	BROILER PRICE	NET PROFIT MARGIN
1970	53	1.35	112.20	0.2709	0.2768	0.59
	54	1.39	100.20	0.2726	0.2992	2.66
	55	1.35	109.20	0.2734	0.3015	2.81
	56	1.40	116.20	0.2743	0.2897	1.54
	57	1.43	110.20	0.2758	0.2791	0.33
FEB.	58	1.43	108.20	0.2767	0.2788	0.21
	59	1.42	102.20	0.2772	0.2703	-0.69
	60	1.42	106.20	0.2768	0.2722	-0.46
	61	1.42	106.20	0.2768	0.2676	-0.92
MAR.	62	1.42	98.20	0.2768	0.2636	-1.32
	63	1.42	89.70	0.2762	0.2804	0.42
	64	1.42	90.20	0.2749	0.3007	2.58
	65	1.42	90.20	0.2738	0.2883	1.45
APR.	66	1.42	89.70	0.2746	0.2766	0.20
	67	1.41	94.70	0.2738	0.2634	-1.04
	68	1.42	95.70	0.2735	0.2731	-0.04
	69	1.42	99.20	0.2735	0.2851	1.16
MAY	70	1.43	99.20	0.2738	0.2797	0.59
	71	1.43	92.70	0.2744	0.2606	-1.38
	72	1.44	91.20	0.2744	0.2711	-0.33
	73	1.46	90.20	0.2750	0.2913	1.63
	74	1.42	91.20	0.2749	0.2765	0.16
JUN.	75	1.45	93.70	0.2746	0.2711	-0.35
	76	1.45	97.30	0.2747	0.2617	-1.30
	77	1.46	95.30	0.2750	0.2719	-0.31
	78	1.47	97.80	0.2752	0.2830	0.78
JUL.	79	1.50	103.80	0.2747	0.2884	1.37
	80	1.47	103.30	0.2758	0.2753	-0.05
	81	1.48	104.80	0.2765	0.2765	-0.00
	82	1.48	107.30	0.2773	0.2645	-1.28
	83	1.48	107.30	0.2781	0.2563	-2.18
AUG.	84	1.46	107.80	0.2787	0.2444	-3.43
	85	1.46	104.30	0.2790	0.2593	-1.97
	86	1.46	107.30	0.2790	0.2812	0.22
	87	1.46	104.80	0.2791	0.2672	-1.19
SEP.	88	1.40	100.30	0.2790	0.2482	-3.08
	89	1.39	106.30	0.2781	0.2502	-2.79
	90	1.44	106.30	0.2777	0.2730	-0.47
	91	1.44	104.30	0.2777	0.2966	1.89
OCT.	92	1.44	99.80	0.2773	0.2629	-1.44
	93	1.46	99.80	0.2770	0.2454	-3.16
	94	1.49	95.80	0.2768	0.2592	-1.76
	95	1.50	96.80	0.2766	0.2686	-0.80
	96	1.52	94.80	0.2766	0.2506	-2.60
NOV.	97	1.54	94.30	0.2760	0.2292	-4.68
	98	1.54	94.80	0.2760	0.2659	-1.01
	99	1.54	95.80	0.2761	0.2662	-0.99
	100	1.53	100.00	0.2762	0.2660	-1.02
DEC.	101	1.54	99.00	0.2766	0.2935	1.69
	102	1.56	103.50	0.2769	0.2522	-2.47
	103	1.59	107.00	0.2777	0.2293	-4.84
	104	1.61	107.00	0.2787	0.2534	-2.53

Table 7. Continued.

DATE	WEEK	CORN PRICES	SBOM PRICES	TOTAL COSTS	BROILER PRICE	NET PROFIT MARGIN
1971	105	1.61	100.25	0.2833	0.2752	-0.81
	106	1.61	100.25	0.2837	0.2791	-0.46
	107	1.63	101.00	0.2839	0.2697	-1.42
	108	1.63	102.00	0.2943	0.2689	-1.54
	109	1.63	99.50	0.2845	0.2677	-1.68
FEB.	110	1.63	96.50	0.2845	0.2742	-1.03
	111	1.67	98.00	0.2841	0.2775	-0.66
	112	1.61	98.00	0.2842	0.2849	0.06
	113	1.61	95.00	0.2838	0.2953	1.15
MAR.	114	1.57	97.00	0.2834	0.2887	0.53
	115	1.59	97.00	0.2828	0.2699	-1.29
	116	1.59	98.50	0.2825	0.2711	-1.14
	117	1.59	97.00	0.2823	0.2677	-1.46
APR.	118	1.57	95.00	0.2812	0.2617	-1.95
	119	1.58	94.50	0.2808	0.2521	-2.87
	120	1.58	96.50	0.2805	0.2688	-1.17
	121	1.58	98.90	0.2805	0.2846	0.41
	122	1.58	99.40	0.2806	0.2749	-0.57
MAY	123	1.59	97.90	0.2808	0.2734	-0.74
	124	1.57	97.90	0.2809	0.2784	-0.25
	125	1.58	99.90	0.2809	0.2996	1.87
	126	1.57	101.90	0.2811	0.3093	2.82
JUN.	127	1.58	102.40	0.2814	0.3092	2.78
	128	1.60	103.40	0.2817	0.3000	1.83
	129	1.60	103.40	0.2821	0.2983	1.62
	130	1.61	102.40	0.2825	0.2981	1.56
JUL.	131	1.60	100.90	0.2817	0.3083	2.66
	132	1.62	103.90	0.2818	0.3116	2.98
	133	1.60	104.40	0.2822	0.3343	5.21
	134	1.60	104.40	0.2824	0.3132	3.08
	135	1.58	105.40	0.2825	0.2896	0.71
AUG.	136	1.49	102.90	0.2825	0.2880	0.55
	137	1.40	100.40	0.2817	0.2793	-0.24
	138	1.34	98.40	0.2803	0.2848	0.45
	139	1.32	97.90	0.2784	0.2902	1.18
SEP.	140	1.30	94.40	0.2767	0.2876	1.09
	141	1.29	94.90	0.2749	0.2785	0.36
	142	1.20	94.40	0.2734	0.2796	0.62
	143	1.15	96.40	0.2716	0.2777	0.61
OCT.	144	1.09	96.40	0.2701	0.2676	-0.25
	145	1.09	94.90	0.2674	0.2503	-1.71
	146	1.10	95.40	0.2662	0.2600	-0.62
	147	1.11	96.40	0.2654	0.2732	0.78
	148	1.13	96.40	0.2650	0.2710	0.60
NOV.	149	1.15	94.90	0.2649	0.2522	-1.27
	150	1.17	94.90	0.2650	0.2516	-1.34
	151	1.17	91.40	0.2653	0.2406	-2.47
	152	1.17	93.40	0.2653	0.2401	-2.52
DEC.	153	1.18	95.90	0.2654	0.2547	-1.07
	154	1.19	101.40	0.2657	0.2370	-2.87
	155	1.22	106.40	0.2664	0.2299	-3.74
	156	1.22	106.40	0.2676	0.2284	-3.92
	157	1.22	106.40	0.2686	0.2546	-1.40

Table 7. Continued.

DATE	WEEK	CORN PRICES	SBOM PRICES	TOTAL COSTS	BROILER PRICE	NET PROFIT MARGIN
1972	158	1.26	103.40	0.2737	0.2614	-1.23
	159	1.27	101.40	0.2745	0.2525	-2.20
	160	1.28	107.40	0.2751	0.2705	-0.46
	161	1.29	107.40	0.2759	0.2858	0.99
FEB.	162	1.31	105.40	0.2765	0.2814	0.49
	163	1.31	104.40	0.2770	0.2817	0.47
	164	1.29	104.90	0.2772	0.2822	0.50
	165	1.32	107.90	0.2773	0.2809	0.36
MAR.	166	1.30	110.90	0.2778	0.2817	0.39
	167	1.30	114.40	0.2782	0.2819	0.37
	168	1.32	113.80	0.2788	0.2903	1.15
	169	1.32	113.80	0.2794	0.2867	0.73
	170	1.32	114.30	0.2799	0.2716	-0.83
APR.	171	1.34	115.80	0.2828	0.2663	-1.65
	172	1.34	116.80	0.2834	0.2559	-2.75
	173	1.34	116.30	0.2840	0.2559	-2.81
	174	1.35	118.80	0.2843	0.2670	-1.73
MAY	175	1.37	118.80	0.2848	0.2667	-1.81
	176	1.37	117.80	0.2853	0.2628	-2.25
	177	1.36	119.80	0.2857	0.2768	-0.89
	178	1.37	119.80	0.2860	0.2845	-0.15
JUN.	179	1.37	118.80	0.2864	0.2845	-0.19
	180	1.38	119.30	0.2865	0.2845	-0.20
	181	1.38	119.30	0.2867	0.2898	0.31
	182	1.38	119.30	0.2869	0.2910	0.41
	183	1.38	124.80	0.2870	0.3017	1.47
JUL.	184	1.38	130.80	0.2885	0.3121	2.36
	185	1.38	127.80	0.2894	0.3241	3.47
	186	1.38	127.80	0.2899	0.3062	1.63
	187	1.38	125.80	0.2903	0.2856	-0.47
AUG.	188	1.38	127.80	0.2906	0.2762	-1.44
	189	1.39	127.80	0.2909	0.2797	-1.12
	190	1.38	124.30	0.2911	0.2965	0.54
	191	1.38	125.80	0.2909	0.3098	1.89
SEP.	192	1.36	127.80	0.2908	0.3098	1.90
	193	1.36	129.80	0.2907	0.3098	1.91
	194	1.37	135.80	0.2908	0.3103	1.95
	195	1.44	129.80	0.2914	0.3106	1.92
	196	1.41	133.80	0.2920	0.3098	1.78
OCT.	197	1.40	129.80	0.2956	0.3003	0.47
	198	1.37	129.80	0.2958	0.2899	-0.59
	199	1.34	129.80	0.2957	0.2857	-1.00
	200	1.36	135.80	0.2954	0.2758	-1.96
NOV.	201	1.40	141.80	0.2955	0.2812	-1.43
	202	1.45	146.30	0.2964	0.2811	-1.53
	203	1.46	153.80	0.2978	0.2801	-1.77
	204	1.46	148.30	0.2997	0.2802	-1.95
DEC.	205	1.51	148.30	0.3010	0.2902	-1.08
	206	1.52	184.80	0.3024	0.2801	-2.23
	207	1.63	214.80	0.3062	0.2701	-3.61
	208	1.62	214.80	0.3123	0.2701	-4.22
	209	1.62	214.80	0.3175	0.3102	-0.73

Table 7. Continued.

DATE	WEEK	CORN PRICES	SBOM PRICES	TOTAL COSTS	BROILER PRICE	NET PROFIT MARGIN
1973	210	1.68	223.80	0.3525	0.3301	-2.24
	211	1.68	211.80	0.3571	0.3256	-3.15
	212	1.70	229.80	0.3600	0.3296	-3.04
	213	1.71	232.80	0.3634	0.3262	-3.72
FEB.	214	1.71	232.80	0.3756	0.3256	-5.00
	215	1.71	247.80	0.3773	0.3259	-5.14
	216	1.72	259.80	0.3795	0.3527	-2.68
	217	1.74	258.80	0.3823	0.3998	1.75
MAR.	218	1.75	253.80	0.3900	0.4352	4.52
	219	1.75	264.80	0.3917	0.4481	5.64
	220	1.75	250.30	0.3938	0.4051	1.13
	221	1.74	250.30	0.3943	0.3815	-1.28
	222	1.74	214.80	0.3945	0.4163	2.18
APR.	223	1.74	234.80	0.3904	0.4547	6.43
	224	1.69	244.80	0.3891	0.4587	6.96
	225	1.68	252.30	0.3884	0.4586	7.02
	226	1.74	282.30	0.3882	0.4362	4.80
MAY	227	1.75	303.80	0.4033	0.3952	-0.81
	228	1.81	369.80	0.4075	0.4054	-0.21
	229	1.88	339.80	0.4166	0.4386	2.20
	230	1.91	379.80	0.4233	0.4389	1.56
JUN.	231	1.90	414.80	0.4321	0.4094	-2.27
	232	2.00	402.30	0.4589	0.4185	-4.04
	233	1.98	444.80	0.4666	0.4465	-2.01
	234	2.25	444.80	0.4753	0.4488	-2.65
	235	2.27	419.60	0.4839	0.4143	-6.96
JUL.	236	2.25	314.80	0.4889	0.4537	-3.52
	237	2.29	374.80	0.4848	0.4636	-2.12
	238	2.23	374.80	0.4845	0.4921	0.76
	239	2.28	424.80	0.4831	0.5096	2.65
AUG.	240	2.33	344.80	0.4773	0.6088	13.15
	241	2.58	314.80	0.4740	0.7397	26.57
	242	2.80	314.80	0.4705	0.6012	13.07
	243	2.78	290.20	0.4693	0.5435	7.42
	244	2.53	280.20	0.4666	0.5414	7.48
SEP.	245	2.08	230.20	0.4462	0.5393	9.36
	246	2.09	215.20	0.4348	0.5124	7.76
	247	2.10	215.70	0.4240	0.5108	8.68
	248	2.09	235.20	0.4150	0.3993	-1.57
OCT.	249	2.16	235.20	0.4098	0.4010	0.02
	250	2.43	230.40	0.3972	0.4311	3.39
	251	2.32	175.40	0.3963	0.4304	3.41
	252	2.32	190.40	0.3920	0.3792	-1.28
NOV.	253	2.32	190.40	0.3879	0.3832	-0.47
	254	2.28	223.40	0.3866	0.3597	-2.69
	255	2.30	223.40	0.3875	0.3397	-4.78
	256	2.34	233.40	0.3884	0.3201	-6.83
	257	2.52	210.40	0.3901	0.3473	-4.28
DEC.	258	2.53	220.40	0.4097	0.3700	-3.97
	259	2.62	250.40	0.4118	0.3218	-9.00
	260	2.67	245.40	0.4167	0.3402	-7.65
	261	2.67	245.40	0.4205	0.3954	-2.51

Table 7. Continued.

DATE	WEEK	CORN PRICES	SBOM PRICES	TOTAL COSTS	BROILER PRICE	NET PROFIT MARGIN
1974	262	2.67	205.60	0.4299	0.4447	1.48
	263	2.76	215.60	0.4293	0.3900	-3.93
	264	2.86	208.60	0.4297	0.3400	-8.97
	265	2.90	208.60	0.4300	0.3874	-4.26
FEB.	266	2.98	208.60	0.4295	0.4176	-1.19
	267	3.00	208.70	0.4299	0.3653	-6.46
	268	3.03	198.70	0.4301	0.4462	1.61
	269	3.12	175.90	0.4300	0.3887	-4.13
MAR.	270	3.13	174.90	0.4236	0.3623	-6.13
	271	3.05	173.90	0.4227	0.3991	-2.36
	272	2.83	166.60	0.4210	0.3911	-2.99
	273	2.92	185.60	0.4175	0.3702	-4.73
	274	2.88	170.60	0.4164	0.3704	-4.60
APR.	275	2.63	163.65	0.4096	0.3790	-3.06
	276	2.63	149.65	0.4058	0.3501	-5.57
	277	2.61	152.65	0.4018	0.3787	-2.31
	278	2.68	141.65	0.3986	0.3602	-3.84
MAY	279	2.65	127.70	0.3989	0.3452	-4.37
	280	2.59	135.70	0.3854	0.3601	-2.53
	281	2.64	132.70	0.3829	0.3797	-0.31
	282	2.65	138.70	0.3809	0.3514	-2.94
	283	2.72	139.70	0.3801	0.3335	-4.66
JUN.	284	2.75	127.75	0.3756	0.3605	-1.51
	285	2.81	128.75	0.3754	0.3504	-2.50
	286	3.07	122.75	0.3758	0.3164	-5.94
	287	3.02	130.75	0.3776	0.3504	-2.72
JUL.	288	3.01	125.75	0.3759	0.3833	0.50
	289	3.09	136.75	0.3769	0.3801	0.32
	290	3.21	155.75	0.3789	0.3448	-3.40
	291	3.35	179.25	0.3825	0.3516	-3.09
AUG.	292	3.46	221.75	0.4060	0.3590	-4.80
	293	3.44	200.40	0.4149	0.3796	-3.53
	294	3.43	212.40	0.4209	0.3620	-5.89
	295	3.60	156.40	0.4266	0.3505	-7.61
	296	3.60	167.90	0.4283	0.3793	-4.90
SEP.	297	3.33	164.40	0.4143	0.4194	0.51
	298	3.33	169.40	0.4127	0.4304	1.77
	299	3.17	169.40	0.4107	0.3909	-1.98
	300	3.37	185.40	0.4075	0.3611	-4.64
OCT.	301	3.61	193.90	0.4106	0.4099	-0.08
	302	3.49	198.40	0.4131	0.4209	0.78
	303	3.60	204.40	0.4152	0.3897	-2.55
	304	3.52	205.90	0.4186	0.3794	-3.92
NOV.	305	3.35	188.40	0.4199	0.4025	-1.74
	306	3.33	187.40	0.4198	0.4196	-0.02
	307	3.37	172.90	0.4189	0.4201	0.12
	308	3.26	164.90	0.4171	0.4202	0.31
	309	3.26	161.40	0.4138	0.4198	0.60
DEC.	310	3.39	178.40	0.4051	0.4402	3.51
	311	3.38	178.90	0.4044	0.3998	-0.46
	312	3.33	179.40	0.4040	0.3602	-4.38
	313	3.33	179.40	0.4038	0.4007	-0.31

Table 7. Continued.

DATE	WEEK	CORN PRICES	SBOM PRICES	TOTAL COSTS	BROILER PRICE	NET PROFIT MARGIN
1975	314	3.30	174.70	0.4249	0.4258	0.09
	315	3.32	160.40	0.4247	0.4001	-2.46
	316	3.27	160.90	0.4238	0.4206	-0.32
	317	2.96	153.90	0.4226	0.4404	1.78
	318	3.02	149.90	0.4187	0.4207	0.20
FEB.	319	3.00	148.40	0.4130	0.4042	-0.88
	320	3.00	148.90	0.4100	0.4334	2.34
	321	2.86	146.90	0.4076	0.4400	3.24
	322	2.64	136.90	0.4047	0.4002	-0.45
MAR.	323	2.57	129.40	0.3987	0.4096	1.09
	324	2.75	144.40	0.3943	0.4101	1.58
	325	2.75	152.40	0.3931	0.4197	2.66
	326	2.84	153.90	0.3930	0.3965	0.36
APR.	327	2.88	149.90	0.3973	0.4100	1.27
	328	2.85	151.40	0.3983	0.3953	-0.30
	329	2.72	156.40	0.3993	0.4085	0.92
	330	2.72	146.40	0.3998	0.4004	0.06
MAY	331	2.77	147.70	0.4010	0.4000	-0.10
	332	2.65	144.20	0.4010	0.4141	1.31
	333	2.68	150.45	0.3996	0.4315	3.19
	334	2.66	153.70	0.3990	0.4301	3.11
	335	2.60	146.45	0.3985	0.4411	4.26
JUN.	336	2.63	148.20	0.3981	0.4547	5.66
	337	2.66	148.70	0.3975	0.4667	6.92
	338	2.73	155.20	0.3974	0.4902	9.28
	339	2.77	149.70	0.3984	0.4898	9.14
JUL.	340	2.65	145.70	0.3984	0.5285	13.01
	341	2.72	153.20	0.3979	0.5502	15.23
	342	2.78	150.20	0.3985	0.5298	13.13
	343	2.69	156.20	0.3992	0.5082	10.90
AUG.	344	2.78	166.90	0.4019	0.4990	9.71
	345	2.84	158.20	0.4036	0.4498	4.62
	346	2.79	158.70	0.4048	0.4798	7.50
	347	2.84	176.70	0.4055	0.5068	10.13
	348	2.79	166.20	0.4076	0.5302	12.26
SEP.	349	2.63	161.70	0.4094	0.5096	10.02
	350	2.59	161.20	0.4086	0.4875	7.89
	351	2.70	164.70	0.4073	0.5149	10.76
	352	2.71	170.70	0.4072	0.5105	10.33
OCT.	353	2.83	167.20	0.4074	0.4815	7.41
	354	2.74	167.20	0.4083	0.4817	7.34
	355	2.65	161.95	0.4084	0.4996	9.12
	356	2.61	156.70	0.4076	0.4791	7.15
	357	2.55	150.20	0.4064	0.4624	5.60
NOV.	358	2.51	147.20	0.4046	0.4823	7.77
	359	2.43	144.70	0.4023	0.4794	7.71
	360	2.37	143.70	0.3995	0.4508	5.13
	361	2.46	156.70	0.3967	0.4199	2.32
DEC.	362	2.49	159.20	0.3963	0.4580	6.17
	363	2.45	153.20	0.3964	0.4296	3.32
	364	2.39	151.20	0.3962	0.3812	-1.50
	365	2.45	151.20	0.3956	0.3628	-3.28

This equation computes the price of soybean meal on a per pound basis by dividing the price of soybean meal per ton by 2000 pounds. The soybean meal price used was a Decatur, Illinois price plus transportation costs by rail from Decatur to the Eastern Shore of Maryland.

Equation 23: CSUM(I) = [.09292 x PCLB(I-8) + .20275 x PCLB(I-7)
+ .34214 x PCLB(I-6) + .49324 x PCLB(I-5)
+ .60775 x PCLB(I-4) + .80220 x PCLB(I-3)
+ .89846 x PCLB(I-2) + 1.11446 x
PCLB(I-1)]/4.00

where:

CSUM = Average total cost of corn consumed per pound of liveweight.

Essentially, equation 23 computes the total cost of corn consumed by each bird and divides that cost by the liveweight of each bird (4 pounds). We assume that it takes 8 weeks to grow-out a bird and that the feed consumed in the current week was purchased the previous week. For the first lot of birds, I=9. The birds eat .09292 pounds of corn at last week's corn price (I-8) the first week; they eat .20275 pounds of corn at last week's corn price (I-7) the second week, and so on until the eighth week when they eat 1.11446 pounds at last week's price (I-1).

Equation 24: SBSUM(I) = [.05104 x PSBMLB(I-8) + .11136 x
PSBMLB(I-7) + .18792 x PSBMLB(I-6) + .23744 x
PSBMLB(I-5) + .29256 x PSBMLF(I-4) + .33600 x
PSBMLB(I-3) + .37632 x PSBMLB(I-2) + .40128 x
PSBMLB(I-1)]/4.00

Equation 24 computes the total cost of soybean meal consumed by each bird and divides that cost by the liveweight of each bird. It uses the same procedure as equation 23.

Equation 25: TCOST(I) = CSUM(I) + SBSUM(I) + FR(I) + MC(I) + CPAY(I) + FC(I) + CC(I)/(.965 x .74) + PROC(I) + TRANS(I) - OFFAL(I)

where:

TCOST(I) = Total cost of producing one pound of iced broiler meat in week (I),

CSUM(I) = Previously defined,

SBSUM(I) = Previously defined,

FR(I) = Fixed ration for each week,

MC(I) = Milling charge for each week,

CPAY(I) = Contract payment each week,

FC(I) = Fuel costs each week,

CC(I) = Chick costs each week,

PROC(I) = Processing costs each week,

TRANS(I) = Transportation costs to N.Y.C., and

OFFAL(I) = Offal revenue each week.

This equation computes the total cost of producing a pound of broiler meat. It takes the results of equations 23 and 24 and adds the fixed ration, milling charge, contract payment, fuel cost and chick costs. It then divides by .965 to cover a 3-1/2% loss due to in-house mortality, condemnations, and D.O.A.'s. This summation of costs is then divided by the dressing yield (.74%). Processing costs, transportation and offal are then added to obtain a breakeven price. Offal is treated as a negative cost.

Equation 26: MARGIN(I) = PB(I) - TCOST(I)

where:

MARGIN(I) = Weekly net profit margin,

PB(I) = Weekly N.Y.C. cash price for grade "A" broilers, and

TCOST(I) = Previously defined.

Equation 26 computes the weekly net profit margins by subtracting the total cost of producing one pound of broiler meat from the N.Y.C. broiler price. The weekly net profit margins from 1970 through 1975 are given in Table 7. Table 8 summarizes these results into monthly averages from the weekly net profit margins given in Table 7.

The average monthly net profit margins in Table 8 suggest that some months show consistent profits or losses. For a six year period during the months of October, November, December, and January, a definite loss pattern was exhibited. Only five positive profit margins were realized out of these 24 months. A priori, this may suggest that a selective hedging strategy during these four months may prove to be a profitable management decision. There are few months that actually show a consistent profit margin over the last six years, although July performed fairly well, with losses being minimal and the gains relatively significant. For fifteen consecutive months (November 1973 - January 1975), losses were experienced primarily because of high feed costs. A strategy to hedge during this period may fare well, while during 1975, when the broiler industry had the best year in its his-

Table 8. Average monthly broiler profit margins, 1970-1975.

Date	1970	1971	1972	1973	1974	1975
	¢/lb.					
Jan.	1.59	-1.18	-.73	-3.04	-3.92	-.14
Feb.	-.47	-.12	.46	-2.77	-2.54	1.06
Mar.	.78	-.84	.36	2.44	-4.16	1.42
Apr.	.07	-.97	-2.24	6.30	-3.70	.49
May	.13	.92	-1.05	.68	-2.96	2.35
June	-.30	1.95	.50	-3.59	-3.17	7.75
July	-.43	2.93	1.75	-.56	-1.42	13.07
Aug.	-1.59	.49	-.03	13.54	-5.35	8.84
Sep.	-1.11	.67	1.89	6.06	-1.09	9.75
Oct.	-1.95	-.24	-.77	1.39	-1.44	7.32
Nov.	-1.93	-1.90	-1.67	-3.81	-.15	5.73
Dec.	-2.04	-2.60	-2.37	-5.78	-.41	1.18
Avg.	-.60	-.07	-.33	.91	-2.53	4.90

tory, a hedging strategy may prove to be a barrier to the realization of windfall profits.

CHAPTER IV

THE ANALYSIS AND ESTIMATION OF BASIS FOR CORN, SOYBEAN MEAL AND ICED BROILERS

The analysis and estimation of basis for corn, soybean meal, and iced broilers play a crucial role in this study since it is the basis estimates, along with known futures prices, that determine the target price for each commodity which, in turn, determines the future net profit margins available to the integrator. A successful hedge occurs when the profit margin originally projected is actually realized. To complete a successful hedge, it is necessary to have accurate estimates of the basis, i.e., the difference between cash price and futures price at the time the hedge is completed. Once the hedger has an accurate basis estimate, he has overcome the major problem in determining what a given price quote in the futures market represents in terms of a price for the commodity in his particular location. The use and importance of basis was demonstrated and discussed using the "T" accounts in Chapter II.

This study deals with three futures market contracts: corn, soybean meal, and iced broilers. Since corn and soybean meal are storable and broilers are not storable, it will be necessary to discuss the theoretical basis patterns for storable versus non-storable commodities. Most storable commodities such as grain have a predictable seasonal pattern of price expectations. Prices are generally expected to rise from harvest through the storage season in accordance with costs of storage. As a result, basis estimates are relatively predictable for most storable commodities. In contrast, basis estimates for non-storable commodities such as live hogs, cattle and iced broilers are less predictable because cash prices may be above or below futures prices depending upon the current and expected supply-demand relationship. This chapter will present the basis theory for both storable and non-storable commodities and examine the cash and futures price relationships for corn, soybean meal, and iced broilers.

Basis Theory

Temporal Price Relationships in Storage Markets

The relationship of cash and futures prices for grains is based on the theory of the carrying charge. This theory rests on three facts: (1) storable commodities are produced at one time of year and consumed at fairly constant rates throughout the year so that inventories must be carried forward from harvest; (2) there are costs in storing and maintaining the quality of commodities; and (3) there is virtually no cost in holding futures contracts. [2] Thus, cash prices should increase in relation to futures prices as the storage season progresses. Working [9] defines the price of storage as the difference between the price of a futures contract and the current cash price (or as the difference between the prices of two futures contract delivery months).

Basis patterns for a storable commodity can best be illustrated by examining the price relationships for corn. The futures contract delivery months for corn are December, March, May, July and September. Basis theory suggests that at harvest the cash price of corn should be below the December futures price by the cost of carrying corn from harvest to December, that December should be less than March by the cost of storage from December to March, etc. September is not expected to fit the pattern because it is a transition month between crop years. At the end of a normal crop year, the cash price should fall to reflect the value of the new crop. This relationship is shown graphically in Figure 2.

Theory also suggests that the cash and futures prices must come together at the par delivery point during the delivery month. If the futures price was greater than the cash price, the cash commodity would be bought, the futures contract sold, and delivery made. If the cash price was above the futures price, users would buy futures and stand for delivery as the cheapest source of supply. Thus, arbitrage in cash and futures markets tends to force the two prices to converge at the par delivery point.

Since we are dealing with non-par delivery points for each commodity, basis will not be zero in the delivery month. The basis estimates will be the differential between a local cash market and a futures contract delivery point. This raises the question of location basis variability arising from fluctuations from this differential. Hedgers who have access to the delivery market tend to be more insulated from its effect by the delivery option and the consequent tendency for cash and futures prices to converge as the futures contracts mature. For hedgers in distant markets, however, delivery is not a

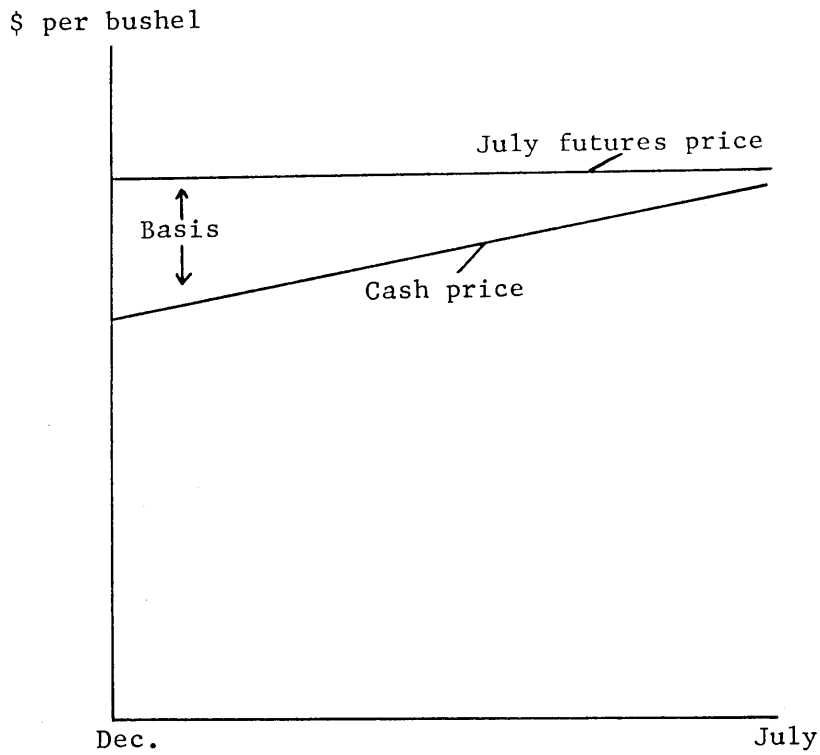

Figure 2. Theoretical basis pattern for a storable commodity.

practical option, so that any difference between the expected basis at the placement of the hedge and the actual basis experienced upon lifting the hedge causes a deviation in results from those anticipated. As a result, location basis variability may add an increment of risk for the distant hedger, reducing the effectiveness of hedging.

Location basis variability depends on the nature of spatial competition. In perfectly competitive spatial markets, cash price changes will be reflected simultaneously across the spatial price surface. In the real world, however, leads and lags in price change can and do occur, and some markets may be isolated from minor price fluctuations that occur in others.

Temporal Price Relationships in Nonstorage Markets

The essential characteristic of price relationships in the futures markets for nonstorable commodities is that there is no consistent relationship between cash and futures prices in non-delivery months. It is not possible to carry product forward to a time in the future. For a storable commodity, the basis is fairly predictable in delivery and non-delivery months because of the carrying charge theory and the fact that free trade between regions exists. Transportation costs are essentially the basis stabilizer.

For a nonstorable commodity, basis is not very predictable except during the delivery month. Cash prices for livestock exhibit both seasonal and cyclical price patterns. It is essentially the production decisions that determine the price patterns for a nonstorable commodity. For this reason, cash prices may approach the futures prices from above or below. This phenomenon is shown graphically in Figure 3. The relationship between cash and futures prices for nonstorable commodities at any given time depends upon the current supply and demand situation which may be considerably different than that expected six weeks to two months in the future. Basis is especially difficult to predict during non-delivery months, since the threat of delivery is non-existent, and therefore cash and futures are not forced to converge. For example, a February contract for iced broilers was not available until 1972. To calculate the February basis when a February contract is not available, the March futures contract must be used. During 1970, the February N.Y.C. basis ranged from \$-.13/cwt. to \$-1.06/cwt. with an average of \$-.55/cwt., while in 1971 the weekly basis ranged from \$+.14/cwt. to \$+2.31/cwt. with an average of \$.98/cwt. Yet in 1972, when a February contract was available the weekly basis variability was relatively narrow with a range from \$-.09/cwt. to \$+.11/cwt. with an average of \$.01/cwt.

To illustrate the importance of basis in estimating target prices, refer to the "T" accounts in Chapter II. With a basis estimate of \$.50/cwt. for iced broilers, a future net profit margin of \$.46/cwt. can be locked in. But suppose the basis estimate was \$0.0/cwt., therefore, the future net profit margin would be \$-.04/cwt. Assume that the hedging strategy was, hedge if the expected net profit margin (ENPM) is greater than zero. As a result, the integrator would not hedge and as a consequence, he would eventually lose 2.9 cents per pound. In the broiler industry where every fraction of a cent is important, the accuracy of the basis estimate becomes crucial.

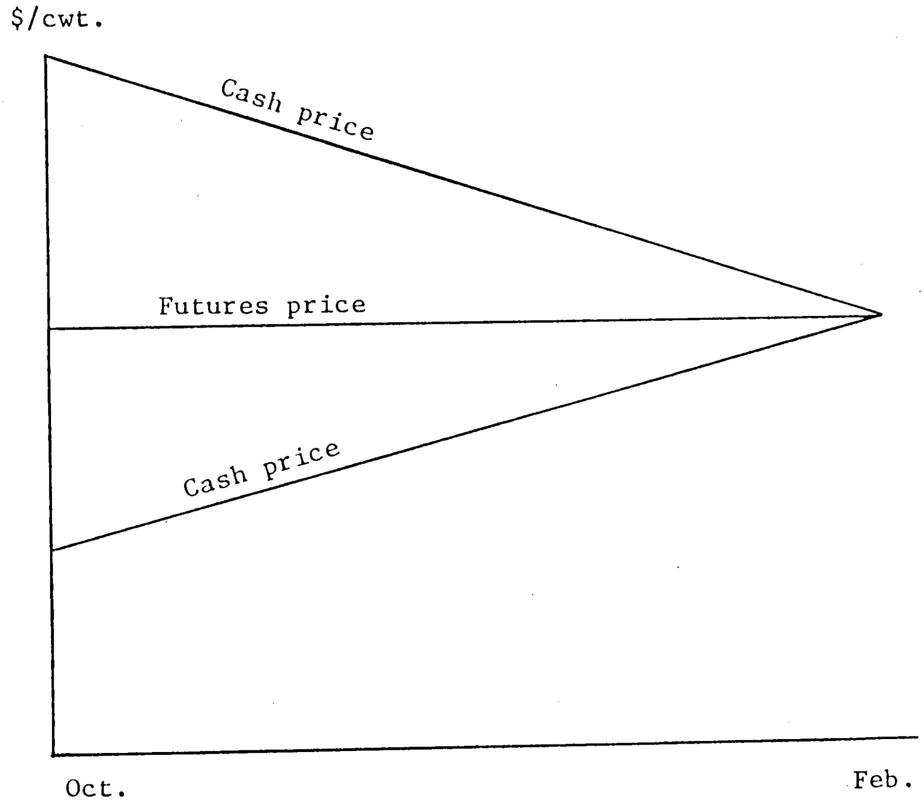

Figure 3. Theoretical basis pattern for a non-storable commodity.

The basis is the price of a cash commodity in relation to the nearby or dominant future. For example: If in February the corn basis is 2 over, this means that the cash price of No. 2 yellow corn is 2 cents more than the March futures since a February contract is not traded. Statements of basis can be modified by location. For example, one can say that the Salisbury, Maryland basis is 10 under, thereby designating a location different from the delivery point but again referring to the nearby futures.

Basis Estimates for Corn

Since all birds marketed are on feed for approximately eight weeks, a particular method of calculating the basis for corn was used in calculating target prices. A given lot of birds marketed during the first week of March consume corn that was bought in January and February. The hedging strategy will be such that if the integrator wants to hedge in a March profit margin he will sell March broilers and buy March corn and soybean meal futures contracts. Birds eat approximately 25% of the total corn consumed during the first four weeks and 75% during the last four weeks. To calculate a basis to be used in computing a target price for corn and hence calculations of a future net profit margin for March, a monthly basis was calculated by subtracting the average monthly March futures price from the January cash price during the month of January. This basis was then weighted by multiplying it by 25%. Added to this figure was the March futures price relative to the average monthly February cash price weighted by multiplying that basis by 75%. The basis during February should be weighted heavier than the January basis since most of the corn is purchased and consumed during the month of February. More specifically, in equation form, the weighted basis estimate is:

$$(4.1) \quad B_j = [(CP_{j-2} - FP_{j-2}) \times WT_1] + [(CP_{j-1} - FR_{j-1}) \times WT_2]$$

where:

B_j = the weighted corn basis for birds to be sold in the jth month,

CP_{j-2} = the average monthly cash price of corn during the first month of feeding the birds marketed in month j,

FP_{j-2} = the average monthly futures price of the nearby futures contract during month j-2,

WT_1 = the percentage of total corn consumed during the first month of feeding the birds marketed in month j,

CP_{j-1} = the average monthly cash price of corn during the last month of feeding the birds marketed in period j,

FP_{j-1} = the average monthly futures price of the nearby futures contract during month j-1, and

WT_2 = the percentage of total corn consumed during the second month of feeding the birds marketed in month j.

To calculate a March corn basis, cash prices are compared to the March futures for corn:

$$B_{Mar.} = [(CP_{Jan.} - FP_{Jan.}) \times .25] + [(CP_{Feb.} - FP_{Feb.} \times .75]$$

To calculate an April corn basis, cash prices are compared to the May futures for corn:

$$B_{Apr.} = [(CP_{Feb.} - FP_{Feb.}) \times .25] + [(CP_{Mar.} - FP_{Mar.}) \times .75]$$

This method was used to calculate the basis each month for the years 1969-1975.

Equipped with historical basic patterns, the next step was to estimate a corn basis that will actually be used to calculate the target prices for corn. Although we already know the actual basis figures for each month, we cannot use these basis figures to calculate the target prices. For example, during 1970, we might want to predict a future net profit margin in 1971. To do this, we need to compute a basis that will prevail in the future. A three-year moving average was used to compute the basis estimates. This method was used primarily for two reasons. First, there seems to have been a structural change in the basis patterns over the last five years - the basis remains positive as the harvest season approaches during the years 1970, 1971, and 1972, while during the last three years observed, the basis became negative as the harvest season approached. A five-year moving average would weight the earlier years with relatively stable economic conditions with the generally unpredictable years of 1972, 1973, 1974, and 1975. The actual weighted monthly corn basis of 1969 was used as an estimate for 1970. An average of the weighted basis by months of 1969 and 1970 was used to compute an estimate for 1971. The dashed lines in Figures 4 and 5 show the monthly basis estimates compared to the actual basis.

The basis estimates normally overestimate the actual basis figures. An overestimation of the basis would mean that the target price used to calculate the total cost of corn fed to a given lot of birds was higher than the actual cost. Hence, if a future corn cost was locked in with a hedge, and the basis was overestimated, the actual profit margin attained would be higher than the margin originally locked in. Therefore, it would be considered more conservative to overestimate the basis than to underestimate the basis. Table 9 indicates the performance of the basis estimates. A positive number indicates

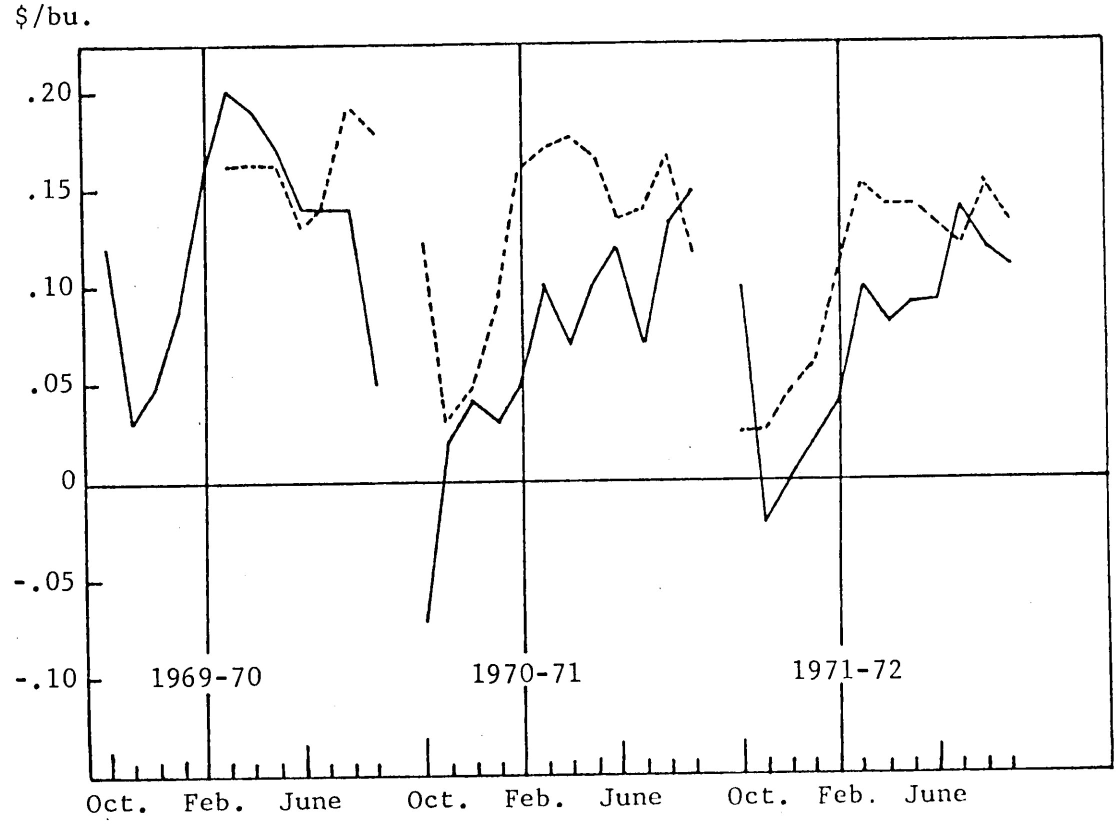

Figure 4. Actual and estimated basis for corn (f.o.b.) Salisbury, Maryland, 1969-72.

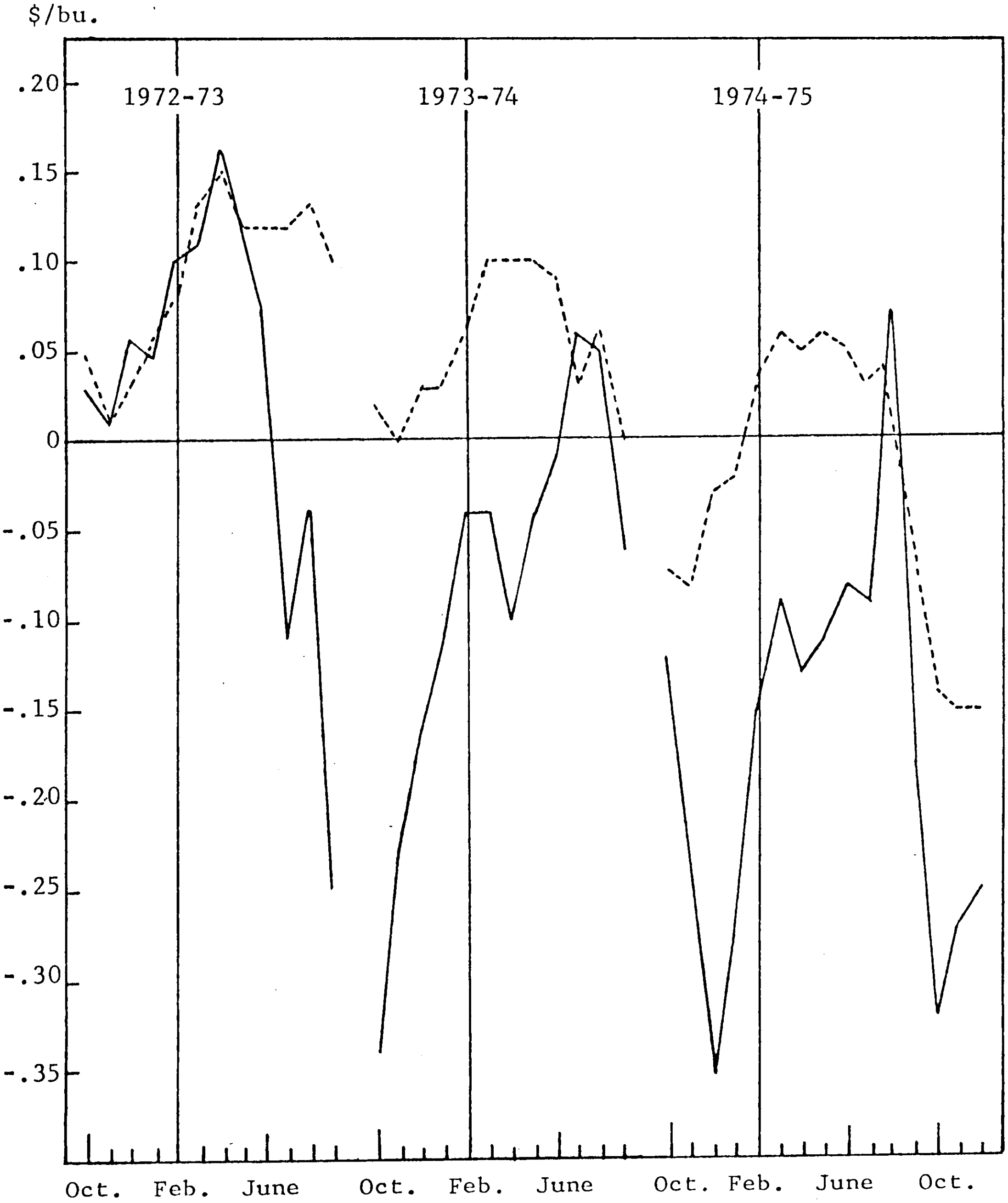

Figure 5. Actual and estimated basis for corn (f.o.b.), Salisbury, Maryland, 1972-75.

Table 9. Average monthly and yearly errors in the basis estimates for corn.

Month	1970	1971	1972	1973	1974	1975
	¢/bu.					
Jan.		6.0	4.0	1.0	14.0	26.0
Feb.		11.0	7.5	-2.0	10.0	18.0
Mar.	-4.0	7.0	5.0	2.0	14.0	15.0
Apr.	-3.0	10.5	6.0	-1.0	20.0	18.0
May	-1.0	6.5	5.0	0.0	14.0	17.0
June	-1.0	1.5	4.0	6.0	10.0	13.0
July	0.0	7.0	-2.0	24.0	-3.0	12.0
Aug.	5.0	3.5	3.0	17.0	2.0	-3.0
Sept.	13.0	-3.5	2.0	35.0	7.0	11.0
Oct.	19.0	-7.5	2.0	36.0	-5.0	18.0
Nov.	1.0	4.5	0.0	23.0	16.0	12.0
Dec.	1.0	4.5	-3.0	19.0	32.0	10.0
Avg. Basis Errors	2.75	4.25	2.79	13.33	11.75	13.92

an overestimation and a negative number indicates an underestimation of the actual basis figures. If a basis estimate for corn is in error by ± 24¢/bu., it will effect the actual profit margin from hedging by a ± 1/2¢/lb. The annual averages indicate that the basis estimates consistently overestimated the actual basis figures. During the 1970-72 period, the error in estimating corn basis was so small it had no appreciable impact on the profit margins being locked in. However, during 1973-75, the average error of 13¢ per bushel meant that the profit margins were consistently being underestimated by about 1/4¢ per pound.

Basis for Soybean Meal

The relationship of cash and futures prices for soybean meal is not based on the theory of the carrying charge as in the case of corn. Usually very little meal is stored. It is ordinarily shipped directly from the manufacturing plant to feed mills for blending into mixed feeds.

Basis patterns for any commodity depend on grade, the point of delivery, and the time of year. The contract grade for delivery on futures contracts is 44% protein soybean meal in bulk. All prices for delivery on futures contracts of soybean meal shall be basis free on board cars Decatur, Illinois.

The Decatur, Illinois (f.o.b.) price for 49% protein soybean plus transportation cost from Decatur to the Eastern Shore, Maryland was used as the cash price in determining the basis. Freight cars were supplied by the Penn Central Transportation Company. The applicable rate used for the transportation of meal is the E-772-G tariff (150,000 lbs. - minimum weight).

The same procedure was used in calculating the basis for soybean meal as was used for corn. More specifically, the equation is:

$$B_j = [(CP_{j-2} - FP_{j-2}) \times WT_1] = [(CP_{j-1} - FP_{j-1}) \times WT_2]$$

where:

B_j = the weighted soybean meal basis for birds to be sold in the jth month,

CP_{j-2} = the average monthly cash price of soybean meal during the first month of feeding the birds marketed in month j,

FP_{j-2} = the average monthly futures price of the nearby futures contract during month j-2,

WT_1 = the percentage of total soybean meal consumed during the first month of feeding the birds marketed in month j,

CP_{j-1} = the average monthly cash price of corn during the last month of feeding the birds marketed in period j,

FP_{j-1} = the average monthly futures price of the nearby futures contract during month j-1, and

WT_2 = the percentage of total soybean meal consumed during the second month of feeding the birds marketed in month j.

The same method that was used to calculate the basis estimates for corn was used to compute basis estimates for soybean meal. Each lot of birds consumes approximately 30% of the total soybean meal ration the first four weeks of feeding and 70% the second four weeks of feeding, therefore, WT_1 = .3 and WT_2 = .7. The dashed lines in Figures 6 and 7 show the estimated basis figures and the solid line indicates the actual basis figures. In the first three years, the basis estimates generally overestimated the actual basis figures and were relatively accurate. Table 10 indicates the degree by which the basis estimates overestimated or underestimated the actual basis figures. A

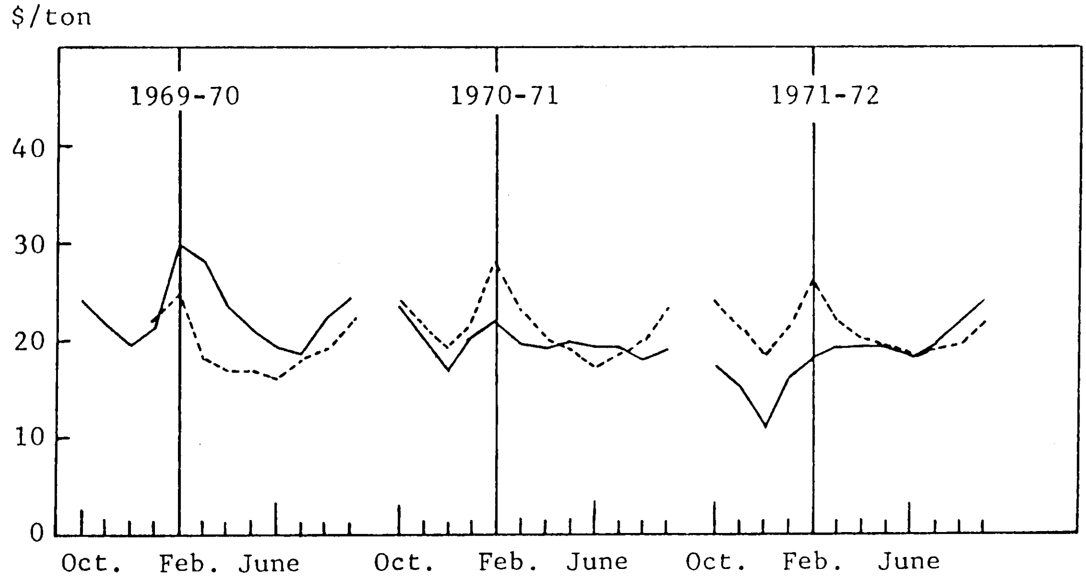

Figure 6. Actual and estimated basis for soybean meal, Salisbury, Maryland, 1969-72.

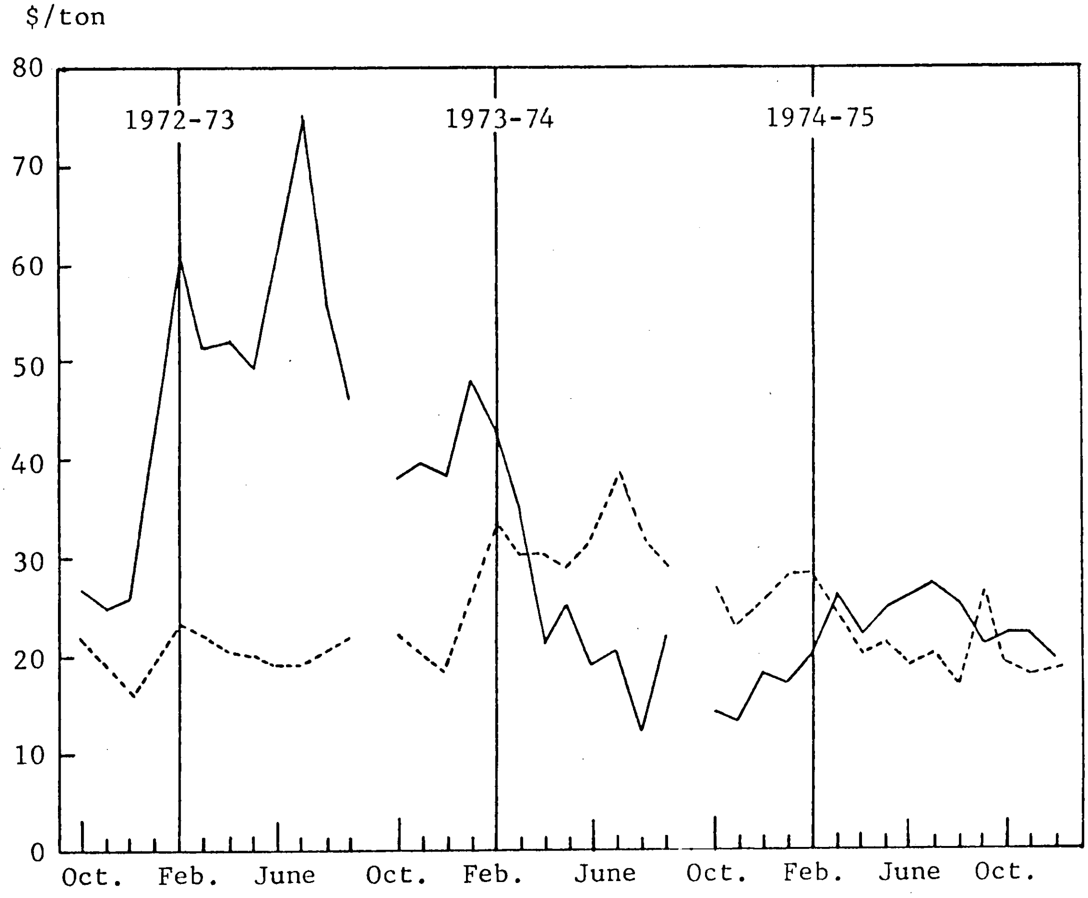

Figure 7. Actual basis patterns for soybean meal (f.o.b.), Salisbury, Maryland for the crop years 1972-75.

Table 10. Average monthly and yearly errors in the basis estimates for soybean meal.

Month	1970	1971	1972	1973	1974	1975
	$/ton					
Jan.	-1.00	1.50	5.31	-23.67	-22.08	11.18
Feb.	-4.83	5.66	7.33	-36.67	-9.93	7.88
Mar.	-10.08	3.17	2.48	-29.36	-3.76	-1.62
Apr.	-6.98	1.15	.64	-31.09	9.03	-1.97
May	-4.20	-.43	-.24	-29.29	4.44	-3.42
June	-3.08	-1.53	-1.02	-40.91	13.53	-6.89
July	-.49	-.85	-.67	-56.54	17.36	-7.40
Aug.	-2.74	2.28	-2.16	-35.72	19.70	-8.05
Sept.	-2.81	4.50	-2.15	-23.88	7.07	5.86
Oct.	.40	6.40	-4.80	-15.76	13.16	-2.66
Nov.	.84	6.17	-6.57	-10.46	10.48	-4.50
Dec.	2.71	7.24	-10.65	-20.64	6.87	-.97
Avg. Yearly Error	-2.61	2.94	-1.04	-29.50	5.49	-1.05

positive number indicates an overestimation and a negative number indicates an underestimation. If a soybean basis estimate is in error by $\pm$ 20 dollars per ton, it will affect the profit margin by $\pm$ 1/2¢/lb. Table 10 indicates that, except for 1973, the three-year moving average method of estimating basis was very accurate. In 1973, the shortage of fish meal and government price freezes temporarily interrupted normal basis patterns, therefore considerable error exists in estimating the 1973 basis for soybean meal. These errors are in the magnitude of $30-50 per ton underestimation, which means actual profit margins per bird were overestimated by 1/2 to 1¢ per pound in 1973.

Basis Estimates for Iced Broilers

All broilers processed were assumed to be USDA Grade A and sold in the New York City market. Therefore, the cash price used to calculate the basis was the final negotiated weighted average prices for truckload sales of ready-to-cook iced broiler-fryers delivered to the New York City market. The specifications of the broiler futures contract state that the grades for delivery on futures contracts shall be whole, ice-packed, eviscerated, ready-to-cook broiler-fryer chickens USDA Grade A. [1] All prices of broiler futures contracts shall be basis regular delivery plant in seller's truck with freight to Chicago, Illinois. Essentially we are calculating a basis by subtracting a futures price tied to the Chicago cash market from the New York City cash price. More specifically, in equation form basis was calculated as follows:

$$B_{ij} = CP_j - FP_{ij} \qquad j = 1, 4 \qquad i = 1, 12$$

where:

B_{ij} = basis for the ith month on the jth week,

CP_j = N.Y.C. cash price for iced broilers for the jth week, and

FP_{ij} = average weekly futures price of the nearby ith option month on the jth week.

The basis for poultry and other livestock is quite unpredictable except during the delivery month. Theory suggests that a primary economic force which pushes the futures price and the cash prices together at the par delivery point is the threat of delivery. Theory also suggests that the difference between the cash prices in Chicago and N.Y.C. will not exceed the cost of transporting broilers between the two locations. Smith and Jones [8] stated that the N.Y.C. cash price averaged $.67 per hundredweight above the Chicago cash price for the years 1968-1973. Figure 8 illustrates the fluctuations from month to month of the difference between the cash prices of the two markets. Since the broiler futures contract is tied to Chicago cash price, these week to week fluctuations between cash prices in Chicago and N.Y.C. indicate that the N.Y.C. broiler basis will fluctuate widely. The spread between the high and low N.Y.C. cash price for a given month is compared to the spread between the high and low basis in N.Y.C. for the same month in Table 11. The basis fluctuates over a larger range than cash price, and frequently, there are no consistent patterns between the cash and basis ranges from year to year. A priori, the basis was expected to be more stable than cash prices during delivery months since the basis is a difference between cash and futures prices which should move up and down together during the delivery month. Since no weekly

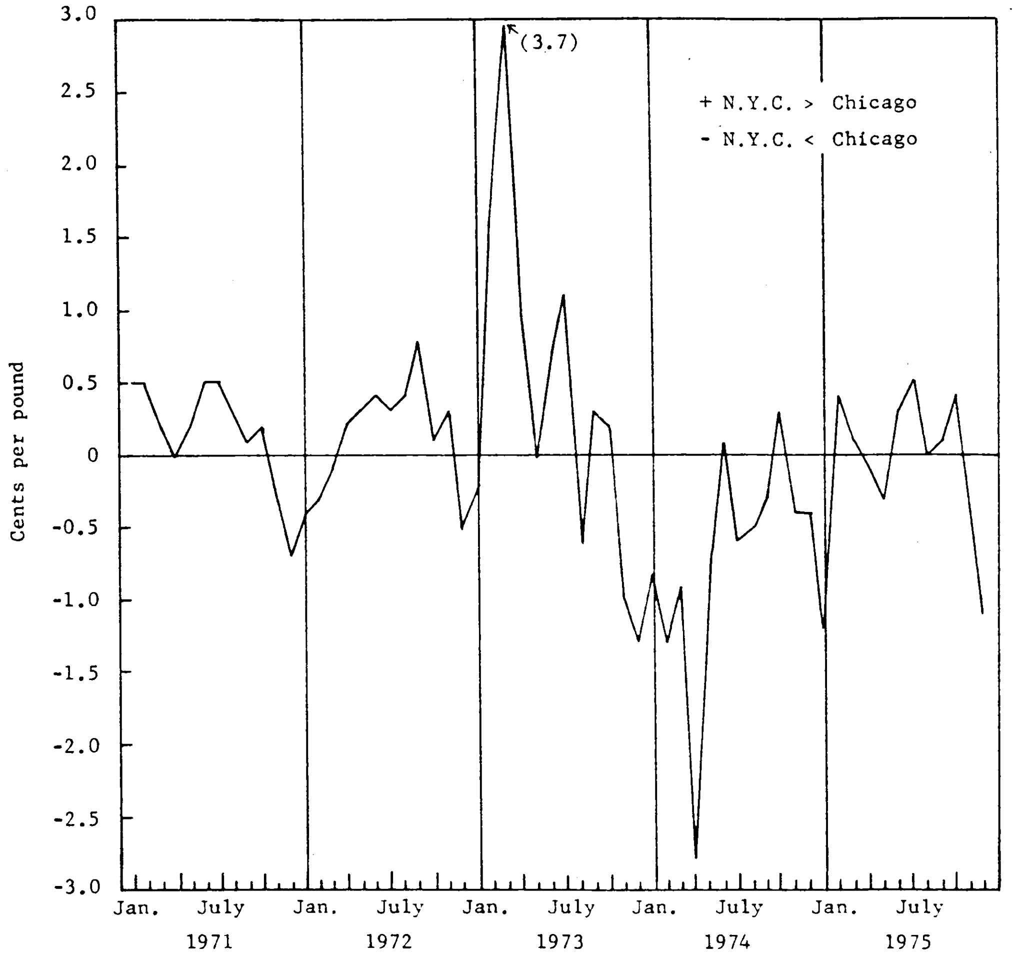

Figure 8. Monthly wholesale price differences between N.Y.C. and Chicago for Grade A iced broilers, 1971-1975.

Table 11. Spreads between the high and low N.Y.C. cash prices and the high and low basis figures for each month for the period 1969-1975.[a]

Month	1969	1970	1971	1972	1973	1974	1975
	¢/lb.						
Jan.	1.16	2.47	1.14	3.33	.45	10.47	4.03
	.40	2.55	2.49	3.12	3.10	10.58	3.37
Feb.	1.63	1.08	3.25	.13	7.42	8.09	3.98
	.33	.93	2.17	.30	1.87	8.97	3.74
Mar.	.90	3.71	2.10	1.87	6.64	3.68	2.31
	1.52	2.73	2.70	1.35	5.49	4.03	2.78
Apr.	1.32	2.17	3.25	1.11	2.25	2.89	1.47
	1.12	2.88	2.34	2.01	2.12	3.87	1.66
May	3.18	3.07	3.59	2.17	4.37	4.62	4.11
	2.51	2.88	2.84	1.88	5.78	4.02	1.41
June	1.75	2.13	1.11	1.72	3.94	4.41	3.55
	.82	1.80	.89	1.42	5.52	5.63	1.86
July	5.34	3.21	4.47	3.85	5.59	3.61	4.20
	4.36	1.54	3.57	2.20	9.00	4.99	6.58
Aug.	2.27	3.68	1.09	3.36	19.83	2.91	8.04
	5.11	3.59	2.26	4.93	16.15	3.56	9.61
Sept.	1.18	4.84	.99	.08	14.05	6.93	2.74
	4.45	5.00	.95	1.78	6.28	9.08	7.98
Oct.	2.56	2.32	2.28	2.45	5.19	4.15	3.72
	2.05	2.71	2.45	2.48	6.42	3.67	4.45
Nov.	1.83	4.70	1.23	.11	6.33	1.77	6.24
	2.75	2.08	2.17	2.28	9.53	2.95	5.10
Dec.	3.05	6.42	2.63	4.01	7.36	8.00	9.52
	3.35	6.44	3.95	3.75	6.79	7.31	8.77

[a]The top figure is the spread between the high and low cash prices for broilers while the lower figure indicates the spread between the high and low basis figures.

patterns over the years were discernible, actual monthly basis figures for the last seven years were computed (Table 12).

Although there are wide swings in the basis figures for each month from year to year, definite patterns exist that can aid in predicting a basis to be used to calculate target prices. For example, note that for each year studied, the December basis is always negative. A December broiler futures contract does not exist; therefore, the basis was calculated by subtracting the January futures from December cash prices. Since broiler prices are normally weak during the holiday season and generally pick up in January, a negative basis exists. For the months July, August, September and November, a consistent pattern of positive basis figures occurred except in three instances. Also, with the exception of 1969, the monthly basis for May showed consistent negative figures.

To emphasize the N.Y.C. basis fluctuations, a daily basis was computed. The daily futures price of the nearby contract month was subtracted from the daily cash price for dressed Grade A broilers in N.Y.C. as quoted in the Wall Street Journal. The cash prices are for less than truckload lots of broilers. Figures 9 through 20 show the daily basis for each month over a six year period. These basis charts are designed so that the basis is measured in cents per pound on the vertical axis. The horizontal line signifies a zero basis.

In general, the basis patterns during a futures contract delivery month differ from the basis patterns of a non-contract month. Basis patterns of contract months generally approach zero after the first two

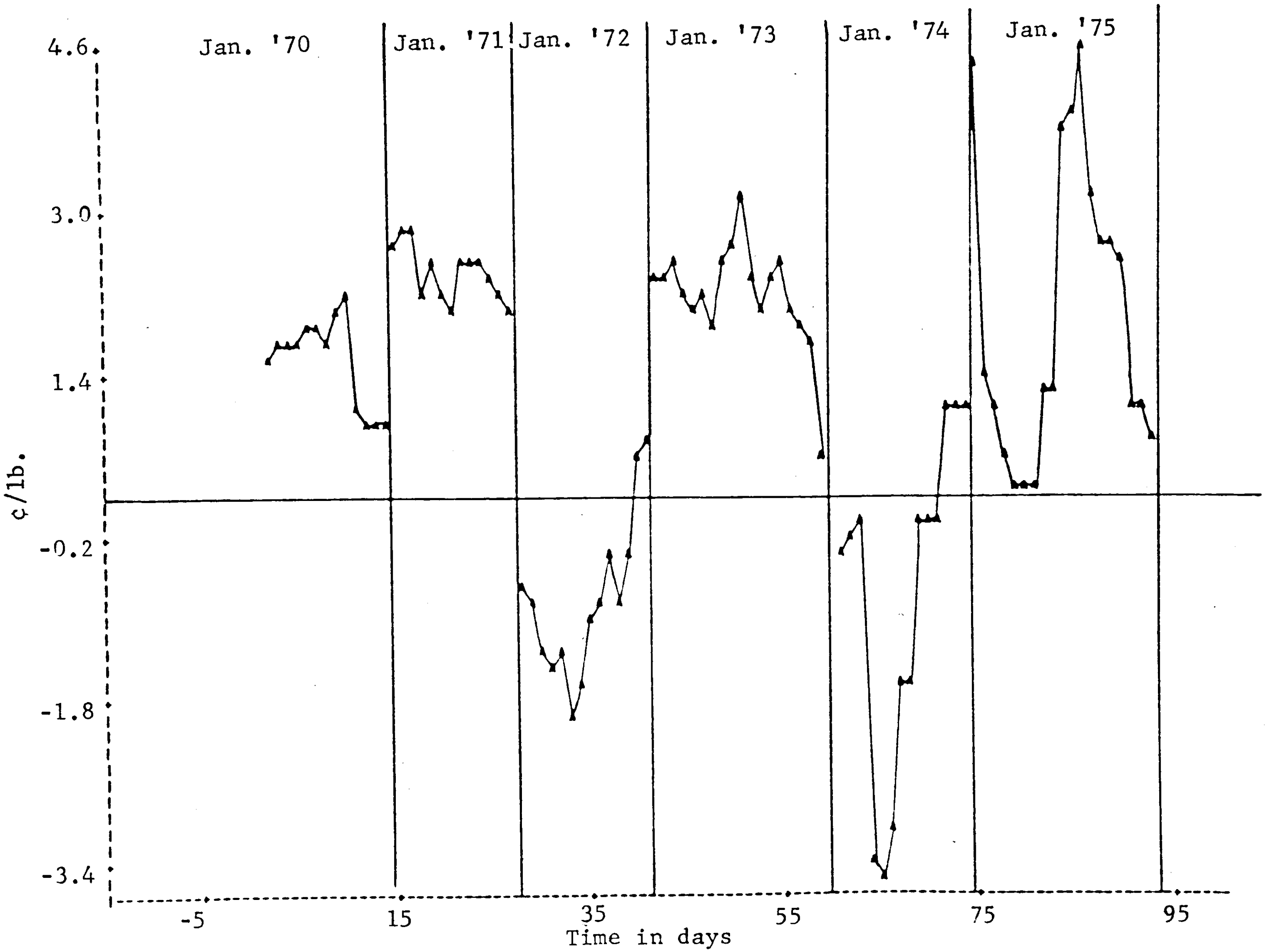

Figure 9. New York City daily broiler basis for January, 1970-75.

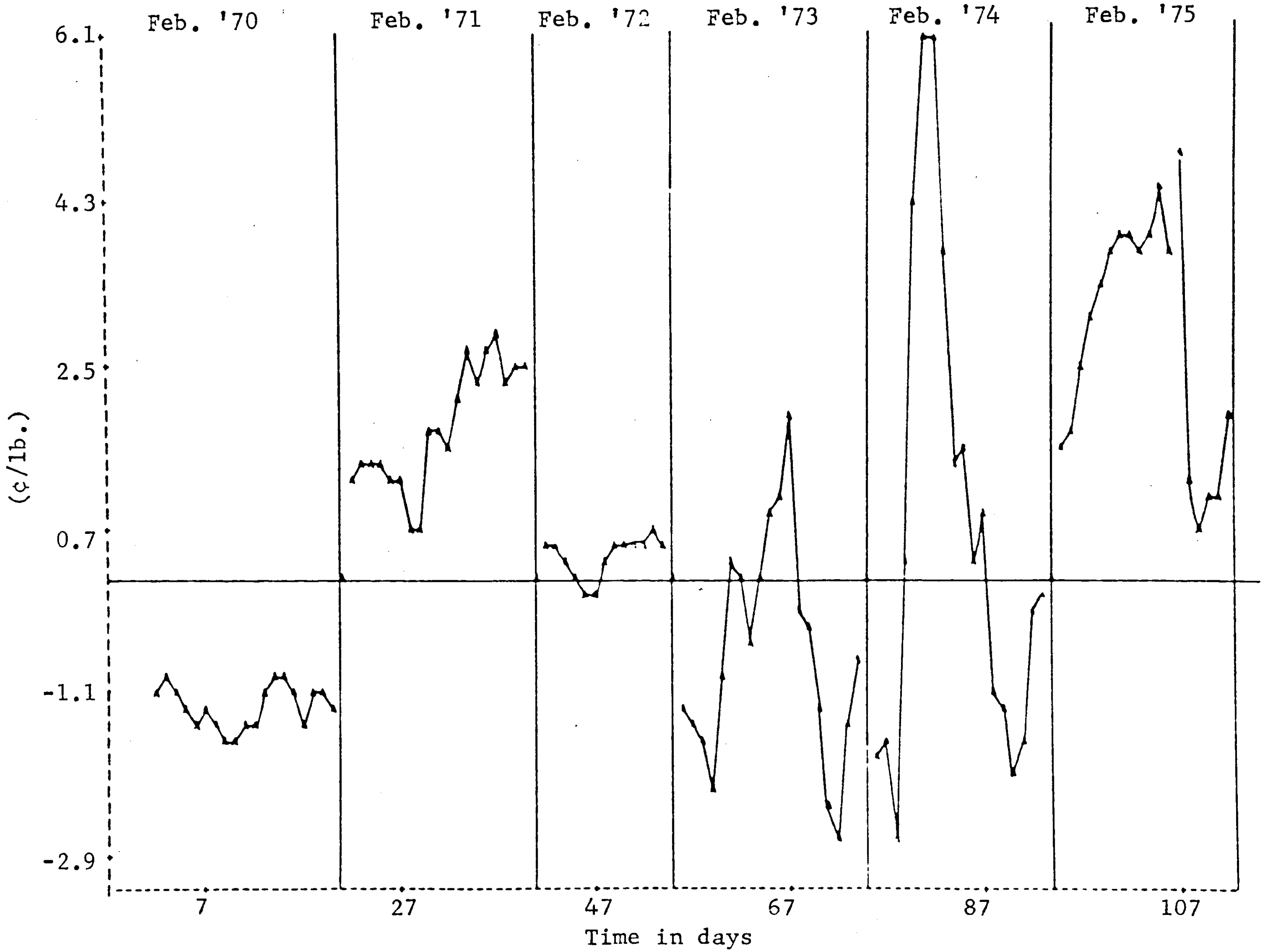

Figure 10. New York City daily broiler basis for February, 1970-75.

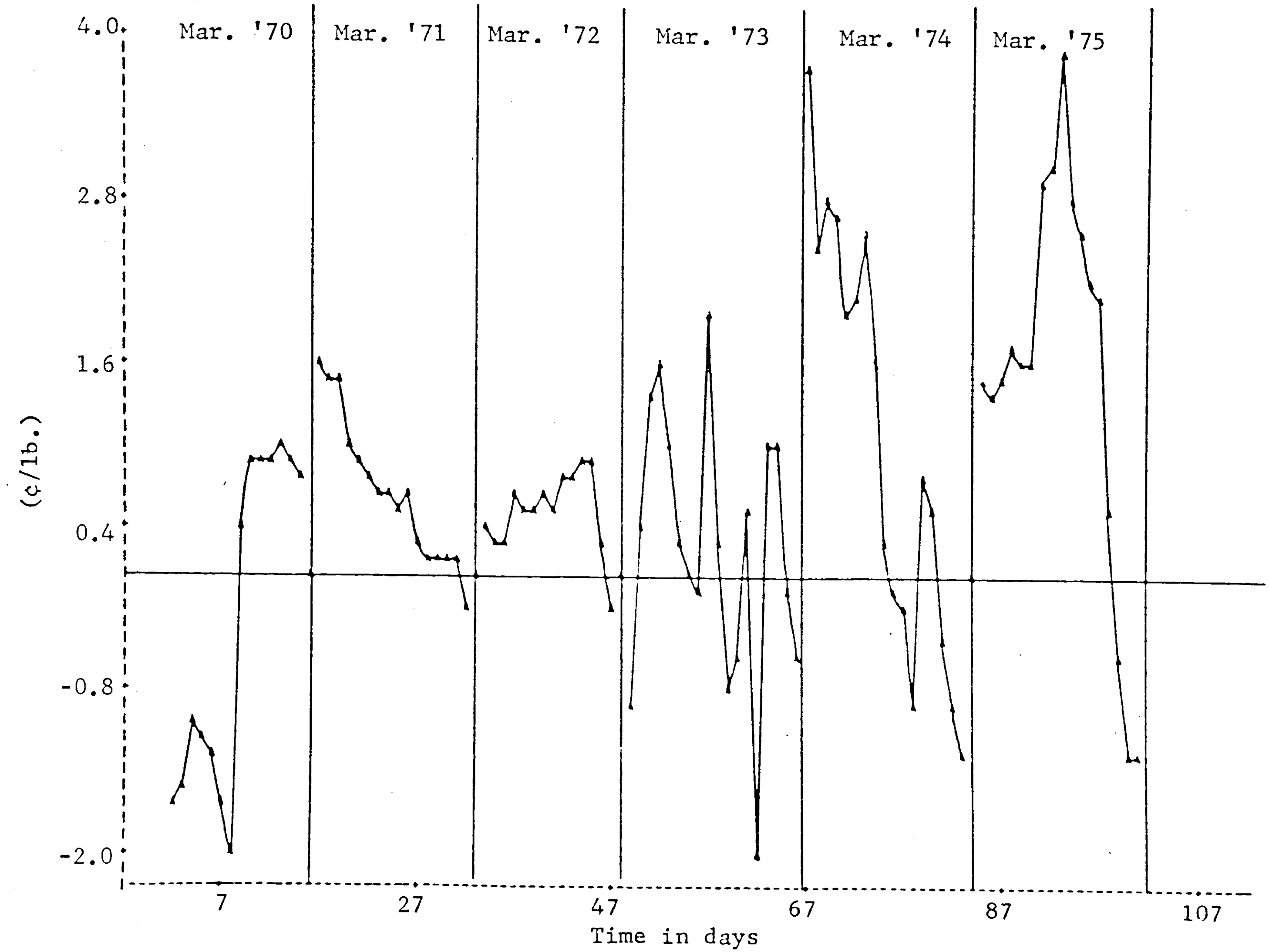

Figure 11. New York City daily broiler basis for March, 1970-75.

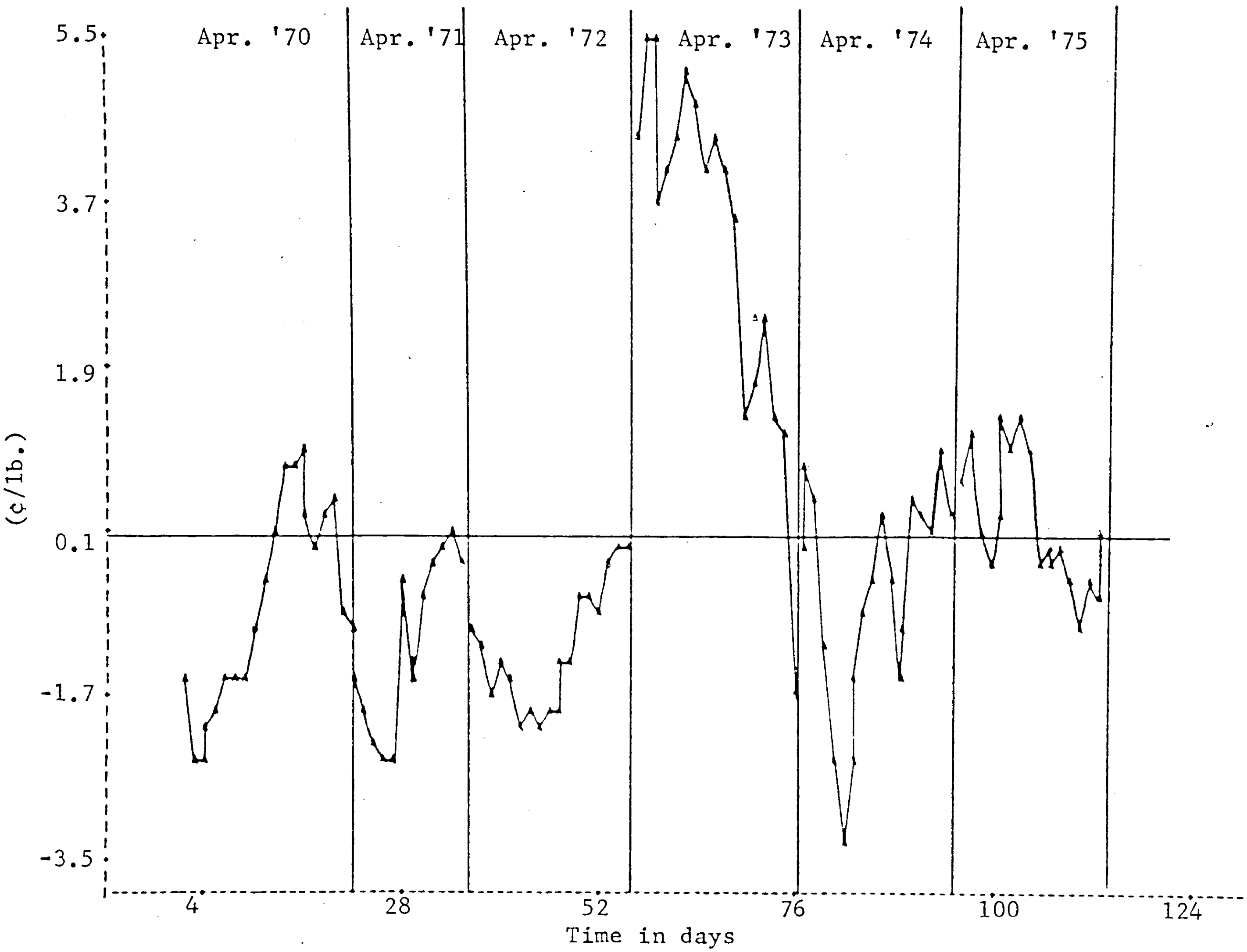

Figure 12. New York City daily broiler basis for April, 1970-75.

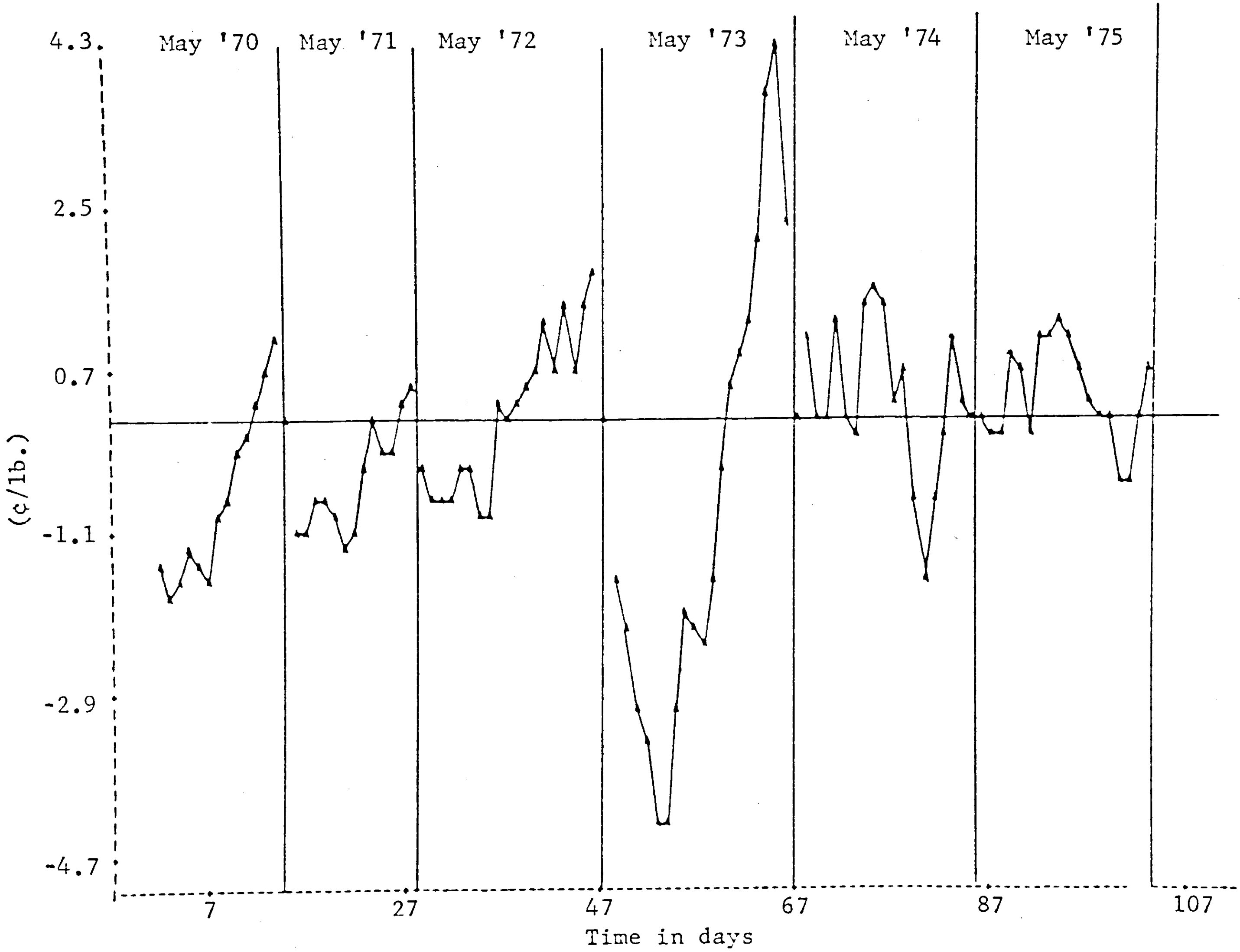

Figure 13. New York City daily broiler basis for May, 1970-75.

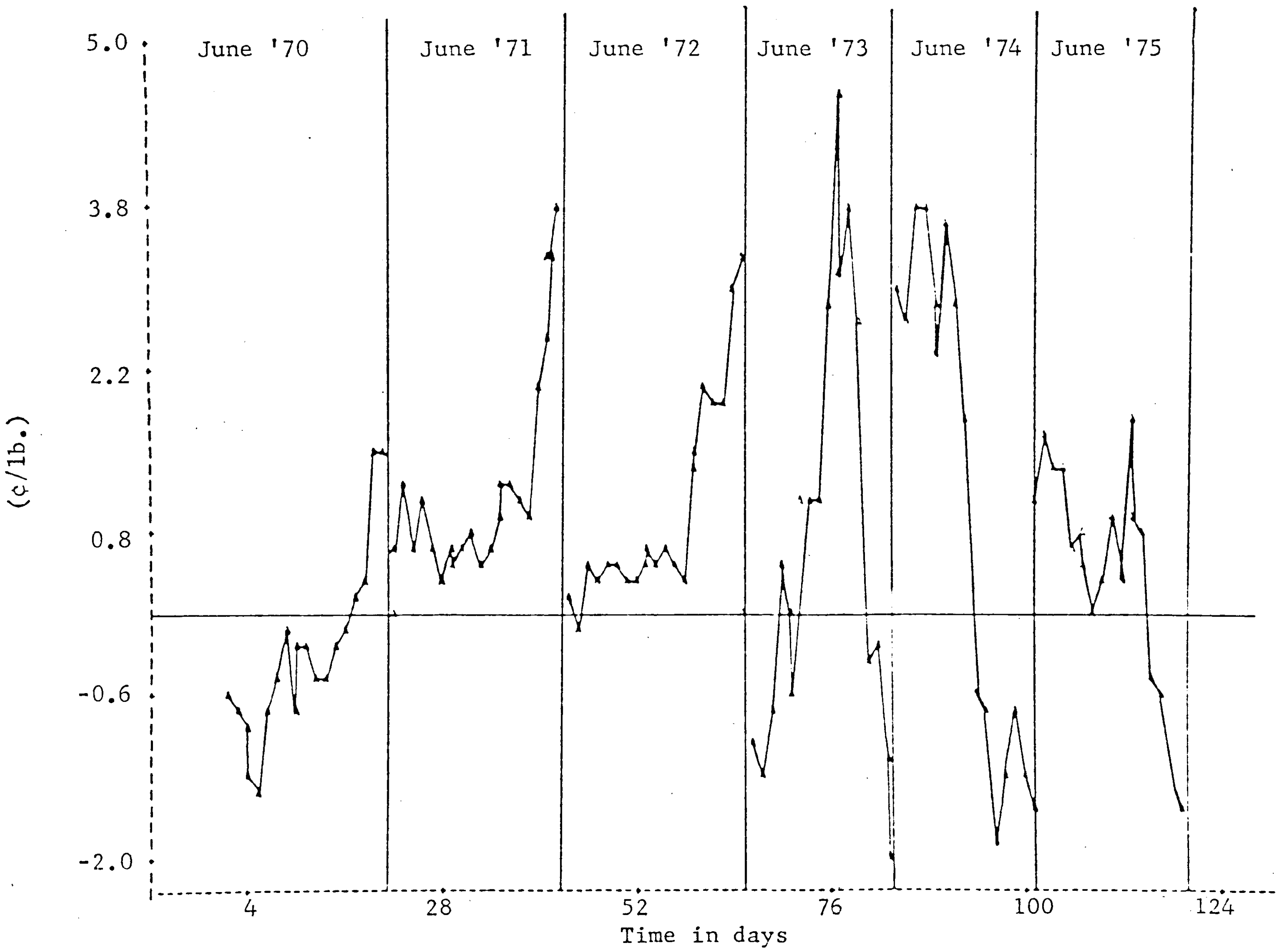

Figure 14. New York City daily broiler basis for June, 1970-75.

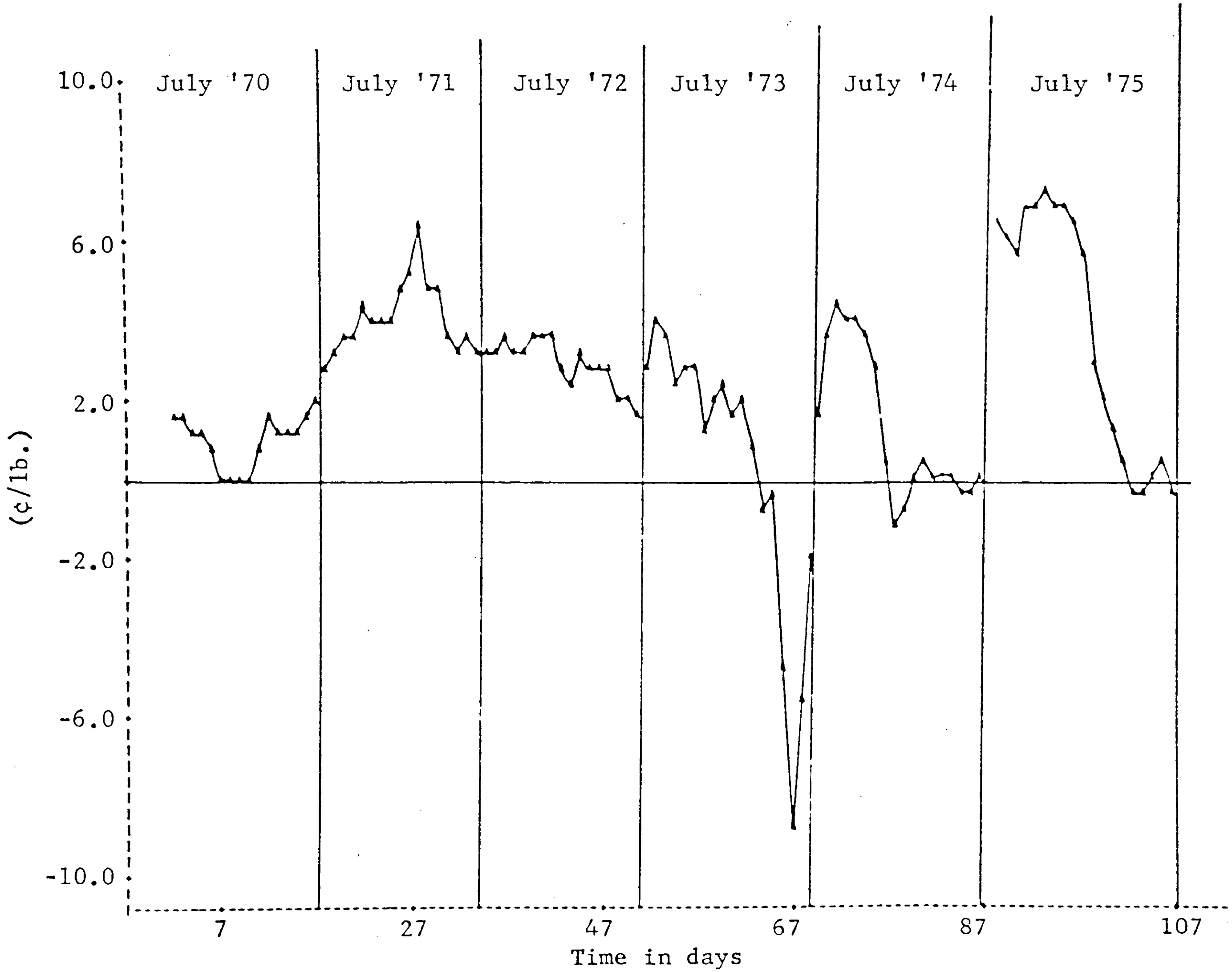

Figure 15. New York City daily broiler basis for July, 1970-75.

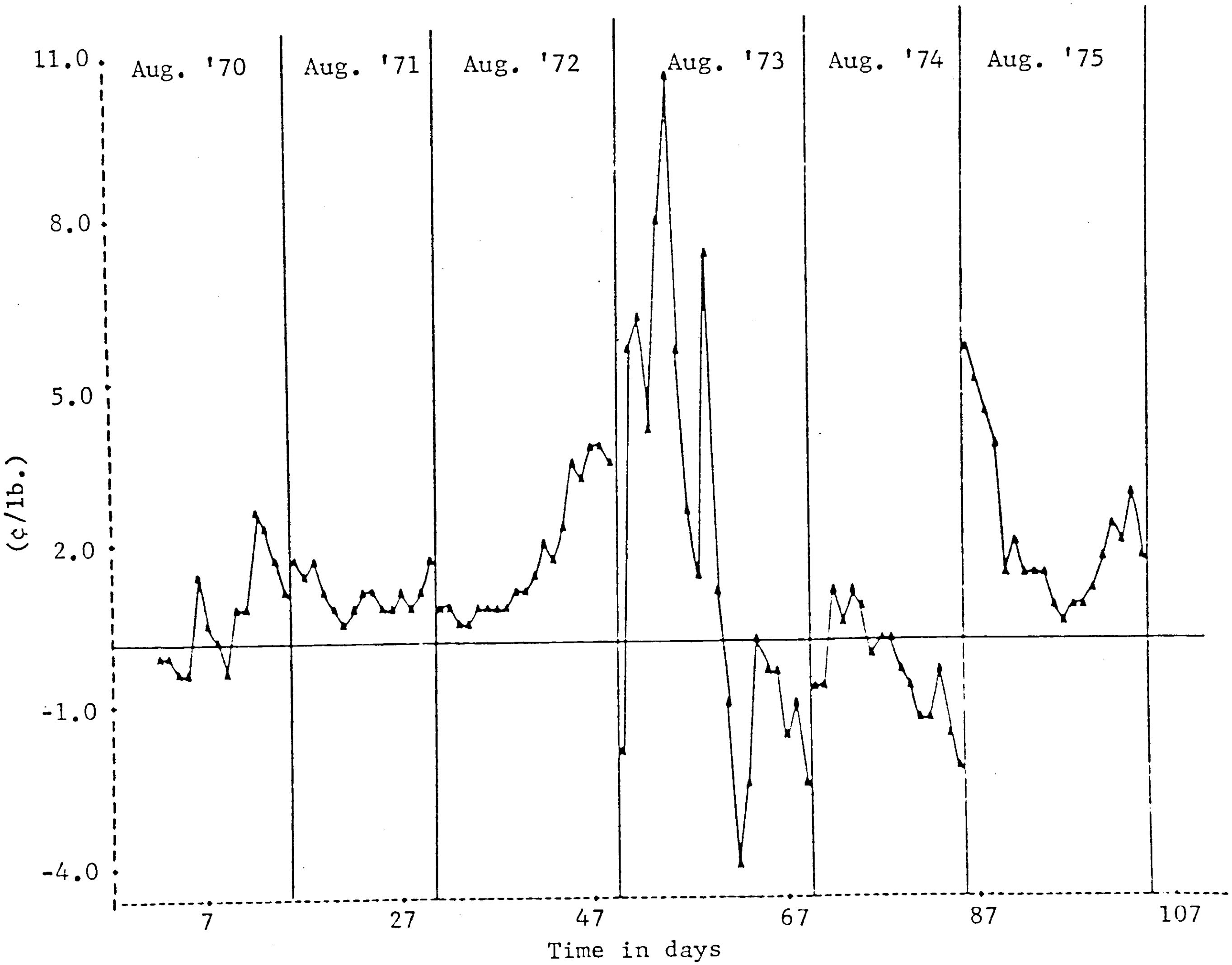

Figure 16. New York City daily broiler basis for August, 1970-75.

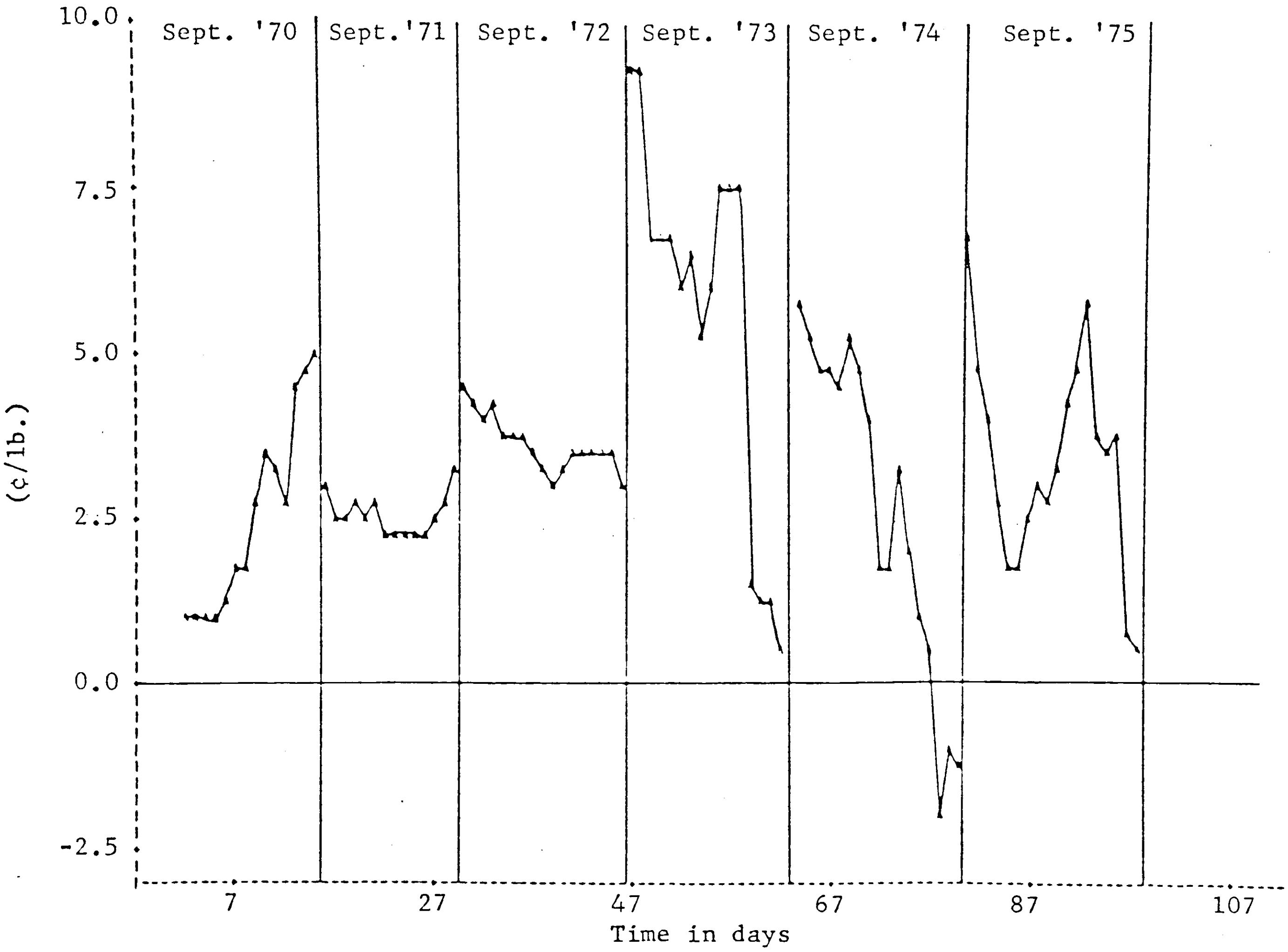

Figure 17. New York City daily broiler basis for September, 1970-75.

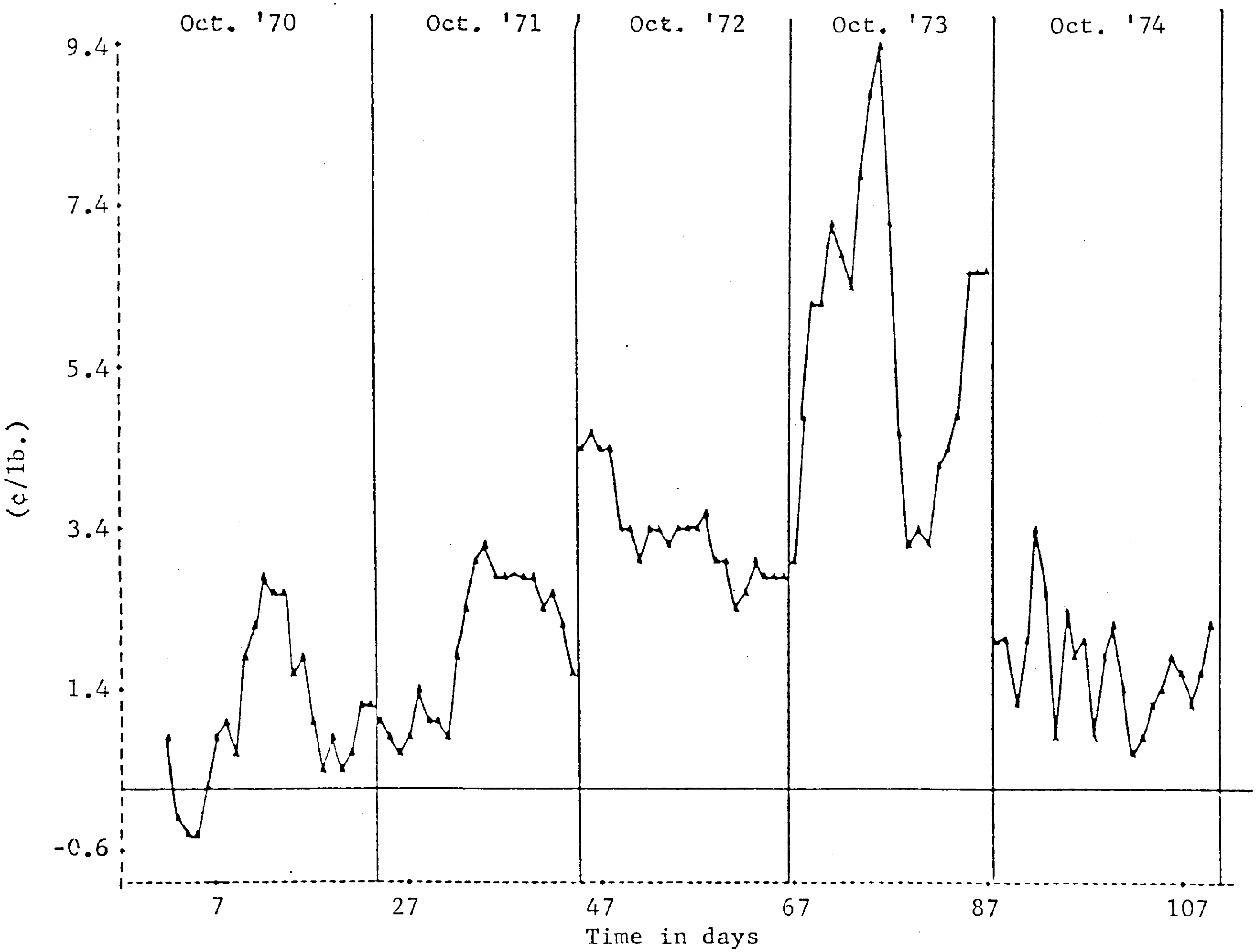

Figure 18. New York City daily broiler basis for October, 1970-75.

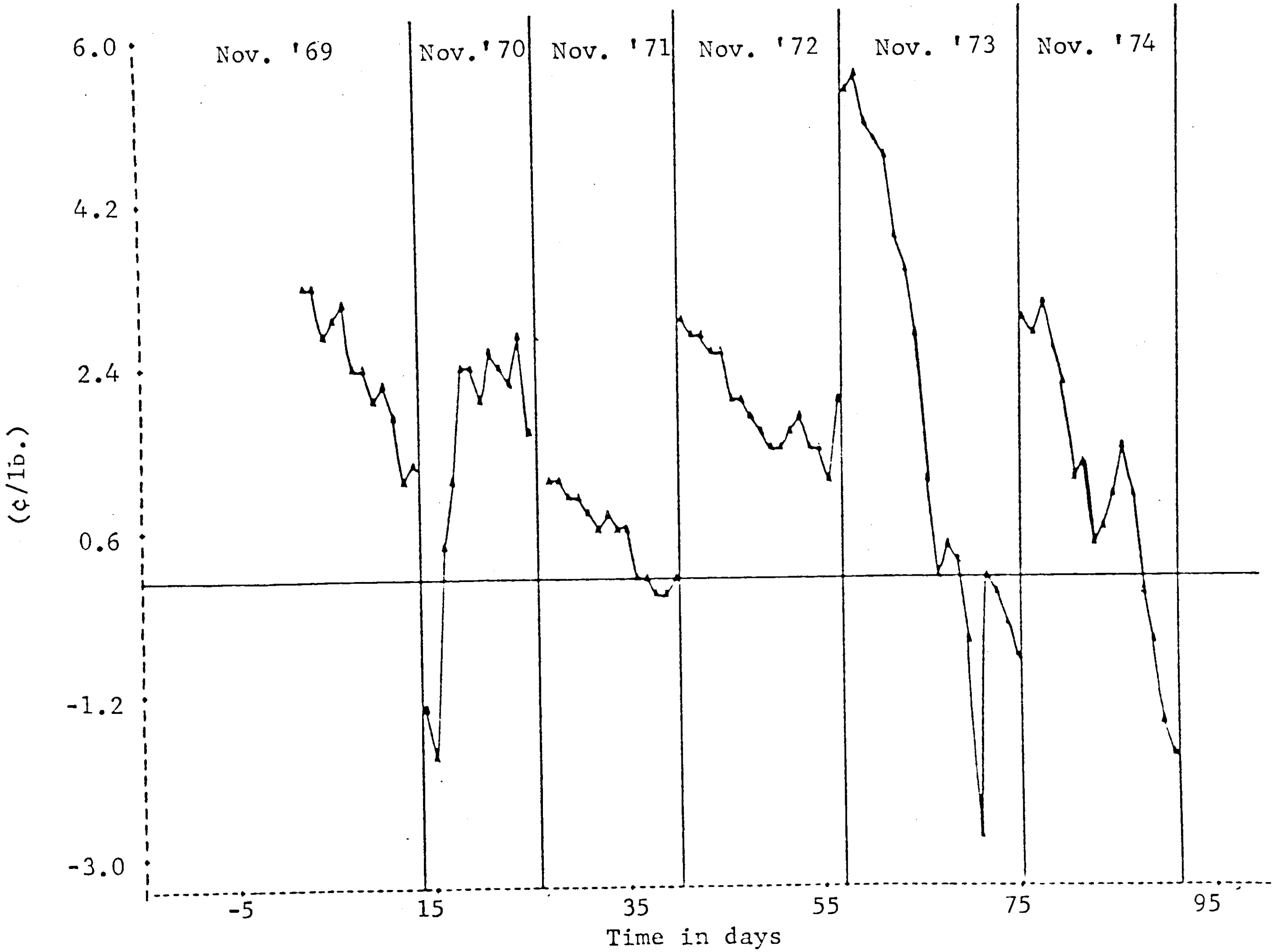

Figure 19. New York City daily broiler basis for November, 1970-75.

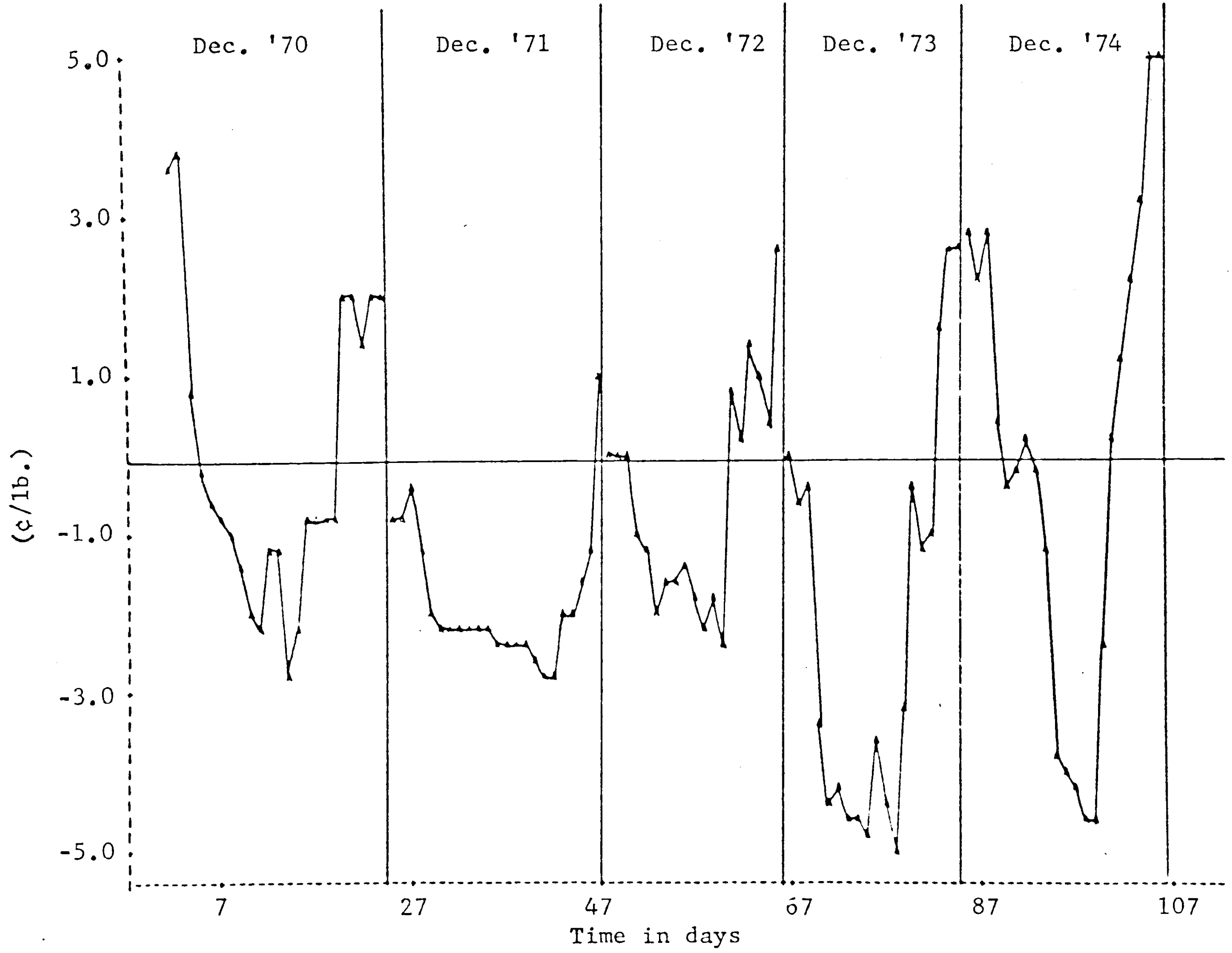

Figure 20. New York City daily broiler basis for December, 1970-75.

Table 12. Monthly N.Y.C. average basis for RTC iced broilers, 1969-1975.

Month	1969	1970	1971	1972	1973	1974	1975	Avg.
	----------	----------	----------	---------- ¢/lb.	----------	----------	----------	----------
Jan.	.91	1.19	.81	-1.57	1.08	-.54	1.50	0.38
Feb.	1.31	-.55	.98	-.01	-2.84	.90	1.94	0.25
Mar.	1.52	.08	.02	.30	-.18	-.47	1.19	0.35
Apr.	1.16	.19	-1.77	-1.62	3.26	-.82	-.12	0.04
May	.42	-.26	-1.01	-1.14	-2.37	-1.17	-.37	-0.84
June	.39	-.32	.44	.12	-.28	-.07	.88	0.17
July	2.29	1.68	2.62	2.28	-1.60	.48	6.94	2.10
Aug.	5.63	1.66	1.11	1.30	2.92	-1.02	2.91	2.07
Sept.	4.27	1.76	2.13	4.10	6.50	.95	3.40	3.30
Oct.	3.61	.73	1.17	3.12	4.97	-.15	5.04	2.64
Nov.	1.54	.80	-1.04	1.32	.40	.53	1.89	0.77
Dec.	-.77	-.60	-2.79	-1.13	-3.92	-.96	-.50	-1.52

weeks of trading. This characteristic does not generally prevail during non-contract months.

Equipped with the actual basis figures given in Table 12 and basis characteristics derived from Figures 9 through 20, an integrator should be able to develop a method of estimating the broiler basis. He must keep in mind the effect of overestimating or underestimating the broiler basis on expected profit margins. If an integrator overestimates the broiler basis for a given month, he may be misled into hedging by computing a high future net profit margin. The integrator may attempt to lock in a one cent net profit margin, but when the hedge is lifted, the actual net margin realized may be much less than the margin originally anticipated. On the other hand, if an integrator underestimates a broiler basis, he may be misled into not hedging when he should have.

On the assumption that integrators would place a higher cost on locking in overestimated profit margins as compared to underestimated profit margins, an attempt was made to compute conservative broiler basis estimates. That is, the basis estimates try to minimize the number of times the actual profit margin is overestimated.

Since 1970 is the first year that the hedging strategy will be tested and the only prior observations of basis are those calculated for November and December 1969, basis estimates of zero were used to calculate the broiler target prices for each month in 1970. To calculate the monthly basis estimates for 1971, the lowest actual weekly basis figures of 1969 and 1970 were used to estimate basis for 1971. Since basis patterns differ between contract months and non-contract months, the following method was used to compute basis estimates. During contract months, the basis generally approached zero after the first two weeks of trading. Therefore, once a basis estimate was estimated for a contract month, that basis estimate would prevail during the first two weeks of the contract month, then a basis of zero would prevail during the last two weeks of the contract month. During a non-contract month, it was assumed that the computed basis estimate would prevail during the entire month. For example, when calculating the basis estimates for January of 1971, the more conservative estimate of +$.91/cwt. was used as an estimate for the first two weeks of January 1971 and zero was used as an estimate for the last two weeks. Therefore, the monthly average basis prediction for January of 1971 is $.45/cwt. (i.e., ($.91 + .0)/2 = $.45). To calculate monthly basis estimates for 1972, the two most conservative actual basis figures were averaged together, although we have three observations. In order to calculate the monthly basis estimates for 1973, the three most conservative (or lowest) actual basis figures of the previous four years were averaged together. This method was developed so that all the data available could be used to compute a basis estimate since the broiler contract is relatively new compared to corn or soybean meal. The most conservative figures were used to insure that the basis estimate would probably underestimate the actual basis figures. The basis estimates used to calculate broiler target prices are shown in Table 13. The performance of these estimates are given in Table 14. A positive figure means that the basis estimate underestimated the actual basis while a negative figure indicates an overestimate. Table 14 indicates that

Table 13. Monthly average basis estimates for broilers, N.Y.C.

Month	1970	1971	1972	1973	1974	1975
	¢/lb.					
Jan.	0	.45	.43	.03	.15	.07
Feb.	0	-.55	.22	.14	-.60	-.30
Mar.	0	.04	.03	.07	.03	-.03
Apr.	0	.10	-.40	-1.06	-.51	-.57
May	0	.04	-.32	-.40	-.60	-.60
June	0	-.07	-.14	.04	-.08	-.07
July	0	.84	.99	1.04	.58	.51
Aug.	0	.83	.69	.68	.87	.60
Sept.	0	.88	.97	1.33	1.53	1.32
Oct.	0	.73	.95	1.67	2.16	2.13
Nov.	0	.40	-.12	.18	.19	.20
Dec.	0	-.77	-1.78	-1.56	-2.15	-1.91

Table 14. Average monthly and yearly errors in the basis estimates for broilers.

Month	1970	1971	1972	1973	1974	1975
	¢/lb.					
Jan.	1.19	.36	-2.00	1.05	-.69	1.43
Feb.	-.55	1.53	-.23	-.30	1.50	2.24
Mar.	.08	-.02	.27	-.25	-.50	1.22
Apr.	.19	-1.86	-1.22	4.32	-.31	.45
May	-.26	-1.05	-.82	-1.97	-.57	.23
June	-.32	.51	.16	-.32	.01	.81
July	1.68	1.78	1.29	-2.64	-.10	6.43
Aug.	1.66	.28	.61	2.24	-1.89	2.31
Sept.	1.76	1.25	3.13	5.17	-.58	2.08
Oct.	.73	.44	2.17	3.30	-2.31	2.91
Nov.	.80	-1.44	1.44	.22	.34	1.69
Dec.	-.60	-2.02	.65	-2.36	1.19	1.41
Average Monthly Error	.53	-.02	.45	.48	.33	1.93

the basis estimates used consistently underestimated the actual basis figures except for 1971. During 1975 the estimates dramatically underestimated the actual basis figures. This is explained by the sharp and quick increases in cash prices during the summer months and the inability of the futures contracts to react stride for stride with the N.Y.C. cash price. The basis estimates overestimated by as much as $6.43/cwt. and underestimated by as much as $-2.64/cwt. This means that a hedger may have originally locked in a two cent profit margin and ended up with a $8.42/cwt. profit or maybe a $-.64/cwt. loss.

CHAPTER V

PROCEDURES FOR COMPUTING EXPECTED NET PROFIT MARGINS

Introduction

A computer simulation model was developed to compute the future net profit margins using the corn, soybean meal and iced broiler futures prices. The model calculates for each day all the available future net profit margins for up to nine months into the future for the years 1970-1975.

Data Requirements

The data needed for the computer simulation model was as follows:

(1) Daily closing futures prices for each available contract month for iced broilers, corn and soybean meal for the years 1970-1975.

(2) Monthly basis estimates for corn, soybean meal, and iced broilers for the years 1970-1975.

(3) Monthly production costs of RTC broilers produced in Salisbury, Maryland, and sold on the N.Y.C. market for the years 1970-1975.

Futures Price Matrix

The futures price matrix is 2510 rows by 160 columns. The matrix contains the daily closing futures prices on the Chicago Board of Trade for the corn, soybean meal, and iced broiler contracts. The matrix contains corn and soybean futures prices from January 2, 1969 through

September 30, 1965, and iced broiler futures prices from August 1, 1969 through September 30, 1975.

Although there are 401,600 elements in the futures price matrix, there are only approximately 30,000 futures prices. The matrix is constructed so that each day the closing prices of every available contract for each commodity can be used without "backing up" in the program. For example, on November 3, 1969 the following closing futures prices for all the available contracts of each commodity are shown below:

CORN

Date	Dec. 69	Mar. 70	May 70	July 70	Sept. 70
11/3/69	$1.18	1.23	1.26 1/2	1.28 1/2	1.24 3/4

SOYBEAN MEAL

Date	Dec. 69	Jan. 70	Mar. 70	May 70	July 70	Aug. 70
11/3/69	$69.25	68.75	69.60	70.50	71.50	71.35

ICED BROILERS

Date	Nov. 69	Jan. 70	Mar. 70	May 70	July 70
11/3/69	25.77	26.65	27.47	27.55	28.55

Given these data future net profit margins as far out as July 1970, eight months before the actual marketing of broilers, can be computed by selecting the appropriate contracts as explained in Chapter II.

The model computes future net profit margins daily for up to nine months in the future for the years 1970-1975. First, the model retrieves the correct contracts for a given month. For example, to compute a February profit margin, the February iced broiler contract price, the February corn contract price, and the February soybean meal contract price are selected. If a February futures contract does not exist, the program selects the price of the nearby futures contract. Once the correct contract months and prices are selected, the program locates the basis for each commodity for that particular month. The basis estimates are added to the futures prices to determine the target prices for each commodity. These target prices are inserted into equation (2.1) found in Chapter II to determine the future net profit margins. The program prints out on a daily basis the profit margins for the next six to nine months. A sample of the computer print-out is given in Figure 21. The column on the far left indicates the month, day, and year. The headings (FEB 70, MAR 70, etc.) indicate the months for which the future net profit margins are computed. Lines not containing future net profit margins indicate no trading due to holidays and weekends.

Equipped with the daily future net profit margins, alternative hedging strategies can be developed and tested. Two essential criteria are needed when testing a hedging strategy: (1) the hedge placing policy, and (2) the hedge lifting policy.

The Hedge Placing Policy

The hedge placing policy is essentially the decision of the integrator. The integrator may decide to place a hedge if the future net profit margin is greater than .25¢/lb. or greater than .50¢/lb. Many hedging strategies are available. Once a hedging strategy is determined, the integrator looks at the future net profit margins on a day-

DATE	FEB70	MAR70	APR70	MAY70	JUN70	JLY70	AUG70	SEP70
20170								
20270	0.8010	1.0583	1.5505	1.5450	1.9711	1.9006	-0.1491	-0.1785
20370	0.6580	0.9154	1.4429	1.4373	1.8864	1.8159	-0.1690	-0.1966
20470	0.2636	0.5210	1.2266	1.2210	1.6541	1.5836	-0.3136	-0.3395
20570	0.4614	0.7187	1.3641	1.3585	1.8681	1.7976	-0.1832	-0.2126
20670	0.6758	0.9332	1.6091	1.6035	2.0630	1.9925	-0.1924	-0.2148
20770								
20870								
20970	0.5132	0.7705	1.4247	1.4191	1.9111	1.8406	-0.1925	-0.2149
21070	0.7322	0.9896	1.6044	1.5989	2.0541	1.9835	-0.1461	-0.1702
21170	0.8121	1.0694	1.6655	1.6599	2.0969	2.0263	-0.1566	-0.1790
21270	0.7197	0.9770	1.6016	1.5960	2.0760	2.0054	-0.1213	-0.1395
21370	0.6593	0.9166	1.5394	1.5338	2.0419	1.9713	-0.0847	-0.1054
21470								
21570								
21670	0.6104	0.8677	1.5202	1.5146	2.1688	2.0983	-0.1276	-0.1518
21770	0.2459	0.5033	1.2583	1.2527	2.0356	1.9651	-0.1703	-0.1892
21870	-0.1110	0.1464	1.0237	1.0181	1.8614	1.7908	-0.2911	-0.3135
21970	-0.0893	0.1681	1.0797	1.0742	1.8677	1.7972	-0.2629	-0.2853
22070	0.0031	0.2605	1.1466	1.1410	1.9791	1.9086	-1.2374	-1.2598
22170								
22270								
22370								
22470	-0.1936	0.0638	1.0636	1.0580	1.9260	1.8555	-0.2338	-0.2579
22570	-0.3729	-0.1155	0.8112	0.8056	1.7148	1.6443	-0.3767	-0.4026
22670	-0.4075	-0.1502	0.8940	0.8884	1.7567	1.6862	-0.4595	-0.4958
22770	-0.2349	0.0224	1.0063	1.0007	1.8425	1.7720	-0.3183	-0.3495
22870								
22970								
23070								
23170								
30170								
30270	0.2283	0.4856	1.4949	1.4894	2.1706	2.1000	-0.0508	-0.0767
30370	0.2468	0.5041	1.3605	1.3550	2.0671	1.9966	-0.1596	-0.1855
30470	0.2334	0.4907	1.3209	1.3154	2.0686	1.9981	-0.0973	-0.1250
30570	0.5249	0.7822	1.5310	1.5254	2.2411	2.1706	-0.0531	-0.0860
30670	0.6465	0.9038	1.6232	1.6226	2.4513	2.3808	0.1500	0.1171

Figure 21. Daily expected net profit margins for future months.

by-day basis, and when the profit criteria decision rule is met, a hedge is placed by buying and selling the appropriate number of corn, meal, and iced broiler contracts.

The Hedge Lifting Policy

To completely hedge a week's broiler production and lock in a future net profit margin, 53 broiler contracts, 8 corn contracts and 5 meal contracts have to be traded. One lifts the broiler hedge by simply buying back 53 broiler contracts each Friday of a given month.

Lifting the corn and soybean meal side of the hedge is not so simple. For corn and soybean meal, the contracts should be lifted when the cash commodity is actually purchased. To accomplish this, the integrator has to know how much corn and soybean meal each lot of birds (518,135 birds/lot) consumes each week. If an integrator knows how many bushels of corn and tons of soybean meal a given lot of birds consumes each week, he can calculate when to lift a hedge and how many contracts to lift. Table 15 indicates that a given lot of birds consumes 5,903 bushels of corn during the first three weeks on feed. Assuming the integrator buys the corn one week before he actually uses it, he would actually buy 5,903 bushels during week 0, therefore, he would lift a portion of his eight contracts by selling one corn contract during week 0. This will cover his corn requirements for the first three weeks. During week 4, a given lot of birds consumes 4,564 bushels of corn which is nearly equivalent to one corn contract. Given that the integrator will always buy his corn one week before it is actually fed, he lifts another contract during week 3.

Table 15. Hedging lifting policy for corn and soybean meal.

Week	Lbs. Consumed/Bird	Total/Lbs. Consumed/Week	Total Bushels Consumed/Week	Cumulative total of bushels	Contract(s) Lifted
Corn Requirements Per Lot of Birds					
0					1
1	.09292	48,145	860		
2	.20275	105,052	1,876	2,736	
3	.34214	177,275	3,167	5,903	1
4	.49324	255,565	4,564	10,467	1
5	.60775	314,896	5,623	16,090	1
6	.80220	415,648	7,422	23,512	2
7	.89846	465,523	8,313	31,825	2
8	1.11446	577,441	10,311	42,136	

Week	Lbs. Consumed/Bird	Total/Lbs. Consumed/Week	Total/Tons Consumed/Lot	Cumulative Total of Tons	Contract(s) Lifted
Soybean Meal Requirements Per Lot of Birds					
0					1
1	.05104	26,446	13.22		
2	.11136	57,699	28.84	42.06	
3	.18792	97,367	48.68	90.74	1
4	.23744	123,026	61.51	152.25	
5	.29256	151,586	75.79	228.04	1
6	.33600	174,093	87.05	315.09	1
7	.37632	194,985	97.49	412.58	1
8	.40128	207,917	103.96	516.54	

Once the integrator calculates when and how many corn contracts to lift, he must compute his weighted average future corn price to be applied to that given lot of birds. When one contract is lifted, the price is multiplied by .125 since one contract is 12.5% of the eight contracts hedged. When two contracts are lifted, the futures price is multiplied by .25. An example is given below.

Week	Futures price of corn on day of lifting contracts	Weights	Weighted prices
	($/bu.)		
0	2.50	.125	.31250
1			
2			
3	2.55	.125	.31875
4	2.60	.125	.32500
5	2.65	.125	.33125
6	2.70	.25	.67500
7	2.75	.25	.68750
8			
	Weighted average corn futures price $2.65/bu.		

When lifting the corn hedge at the above dates and prices, the weighted average corn futures price is $2.65/bu. This price is then compared to the corn futures price on the day the hedge was placed to determine whether profits or losses were realized in the futures market. Profits made on the corn futures transactions are subtracted from the weighted average cash price for corn fed to the broilers to be marketed during week 8. Similarly, losses on the corn futures transactions are added to the weighted average cash price for corn fed to the broilers marketed during week 8 to determine a net cost for corn fed to that given lot of birds.

The same analysis is repeated for soybean meal. Since there are five meal contracts hedged for a given week's broiler production and one contract is lifted on each hedge lifting date, each soybean meal futures price is weighted equally. The soybean section of Table 15 indicates when the meal contracts should be lifted for broilers to be marketed during week 8. To compute the actual net profit margin from hedging, equation 5.1 is used:

$$(5.1)\quad ANPM = NP_{IB} - (NP_C \div 56 \times 1.14) + (NP_{SM} \div 2000 \times .498) + OC/(.74 \times .965) + PROC + TRANS - OFFAL$$

where:

ANPM = the weekly actual net profit margin realized from hedging,

NP_{IB} = the net price for iced broilers. NP_{IB} is the cash price received for broilers plus the futures price when the hedge was placed minus the futures price when the hedge was lifted,

NP_C = the net price for corn. NP_C is the weighted average cash price of corn fed to that given lot of birds minus the weighted average corn futures price at which the hedge was placed, and

NP_{SM} = the net price of soybean meal. NP_{SM} is the weighted average cash price for soybean meal fed to that given lot of birds minus the weighted average soybean meal futures price at which the hedge was lifted plus the futures price of meal when the hedge was placed.

The remaining terms in equation (5.1) were defined in Chapter II. Once the hedge lifting dates are determined, the development and analysis of alternative selective hedging strategies can be investigated.

With the calculated future net profit margins and the weighted average cash prices and hedge lifting futures prices, each strategy could be analyzed manually for the six year period in about two days. After the first strategy was analyzed, some of the computations did not have to be repeated for subsequent strategies so they took less time to compute. The results of analyzing five different strategies are presented in Chapter VI.

CHAPTER VI

THE DEVELOPMENT AND ANALYSIS OF SELECTIVE HEDGING STRATEGIES

Introduction

Before the actual testing of selective hedging strategies, the ability of the futures market to accurately forecast net profit margins using the corn, soybean meal, and iced broiler contracts was examined. Once the selective hedging strategies were developed, each was tested over a time period of six years, 1970-1976. Approximate hedging costs, including commissions and interest on initial margin money was calculated to give integrators and bankers a feel for the amount of capital required for strategies when three different commodities are hedged simultaneously. The amount of money required for margin calls due to adverse price movements was also calculated.

The Development of Selective Hedging Strategies

In order to gain some insight into the selection of hedging strategies, the ability of the futures market to forecast actual net profit margins (ANPM's) was examined. Two procedures were used to complete this examination. First, the difference between the actual monthly net profit margins (given in Table 8 of Chapter III) and the expected net profit margins (ENPM's) generated by the computer simulation model were calculated to determine whether the ENPM's underestimated, overestimated, or correctly forecasted the ANPM's.

The difference between actual and expected net profit margins up to eight months in advance for the years 1970-1975 are plotted on Figures 22 through 33 for the months January-December. Each line indicates the difference between the forecasted profit margins through hedging for that month and the actual cash profit margin for that month. The ENPM's computed each Friday were summed and averaged to obtain one observation for that month. The daily ENPM's generated could not be clearly plotted to illustrate the results.

On Figure 22, during the month of August 1969, a profit margin of .16¢/1b. for the month of January could have been locked-in by hedging. Since the actual profit margin for January 1970 was 1.59¢/1b., the futures market underestimated the actual profit margin by 1.43¢/1b. Therefore, negative numbers indicate underestimation of the actual profit margin, while positive numbers indicate overestimation of the actual profit margin. The actual cash profit margin for designated month by years is shown on each figure.

Table 16 indicates whether the ENPM's tend to overestimate or underestimate actual profit margins in various months. The existence of bias was determined by counting the number of months the futures market over or underestimated the ANPM. For the purpose of illustration, the months of March and July are examined more closely. For each year in Table 17, the futures market forecast (five months before the actual marketing of birds), does not accurately forecast actual profit margins. Instead, the futures market forecast and the actual profit

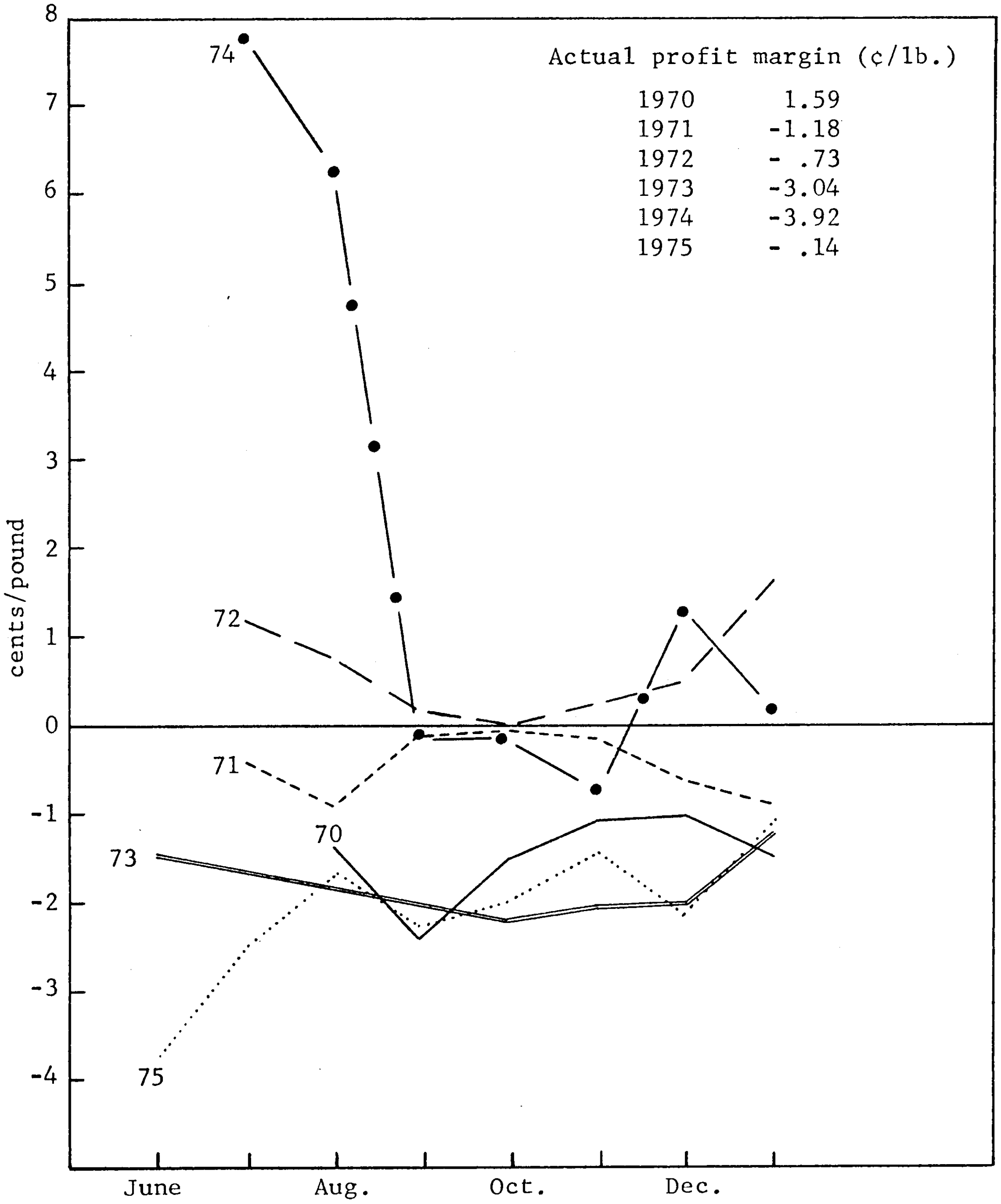

Figure 22. Difference between forecasted and actual profit margins for January, 1970-75.

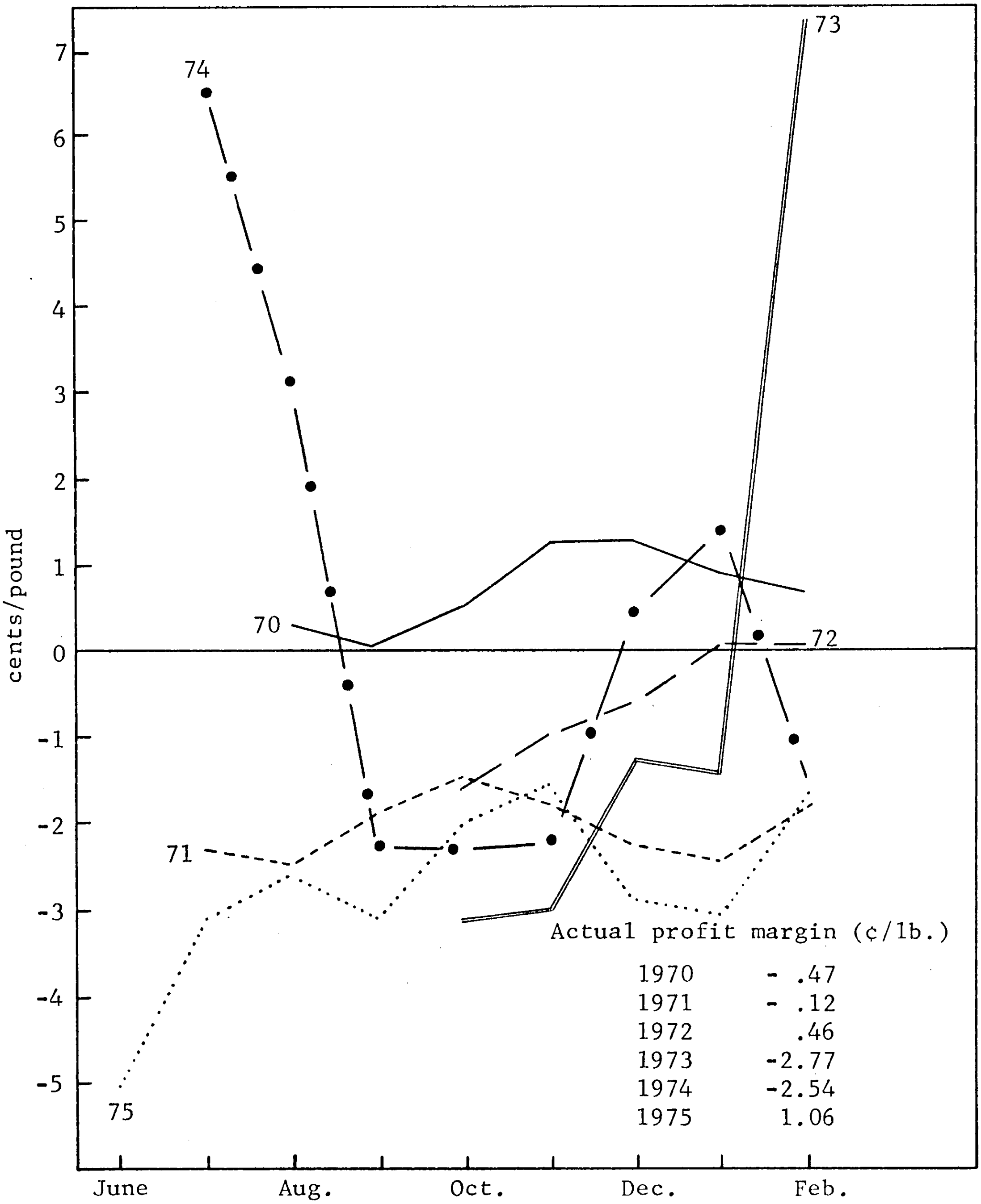

Figure 23. Difference between forecasted and actual profit margins for February, 1970-75.

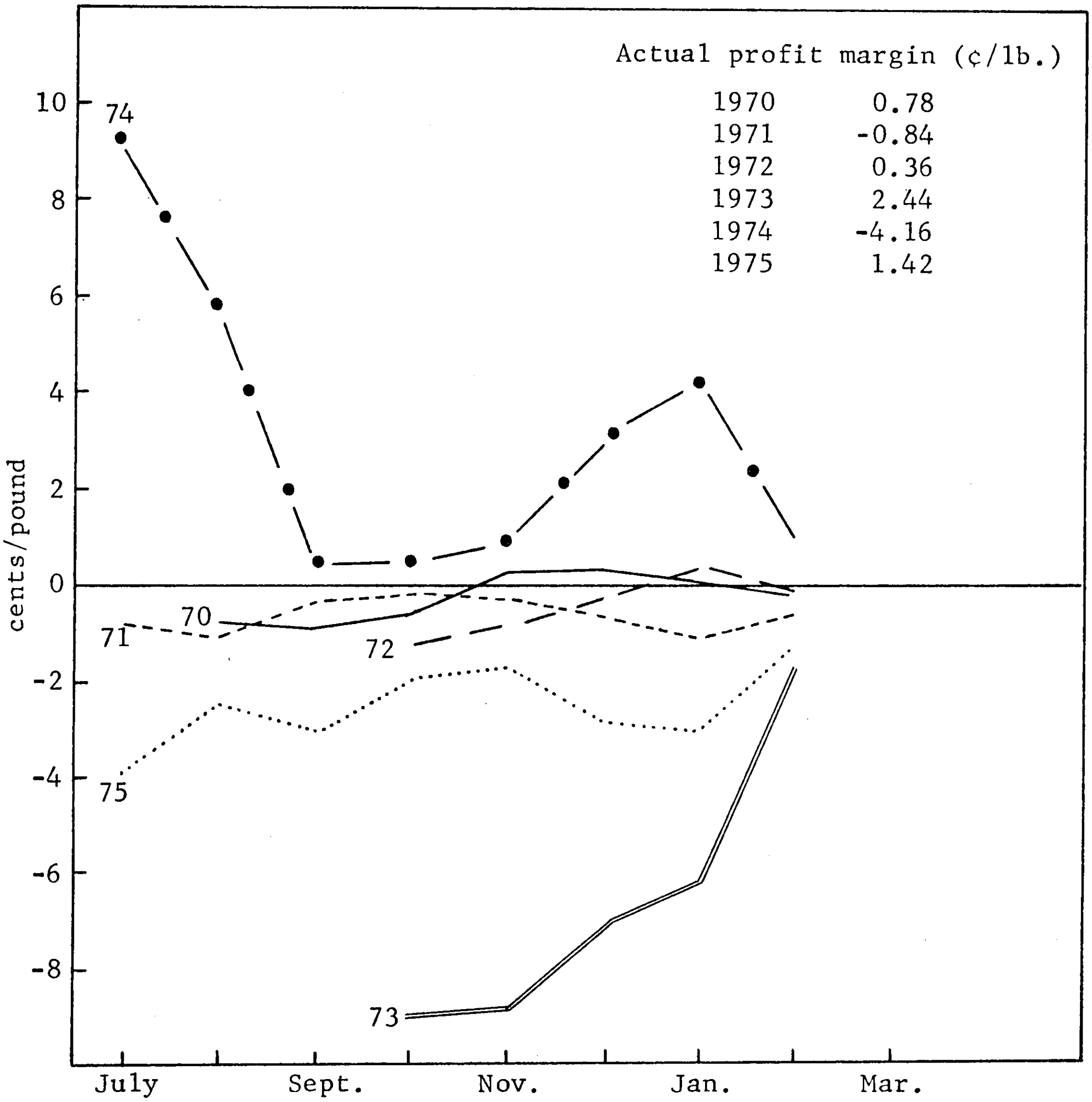

Figure 24. Difference between forecasted and actual profit margins for March, 1970-75.

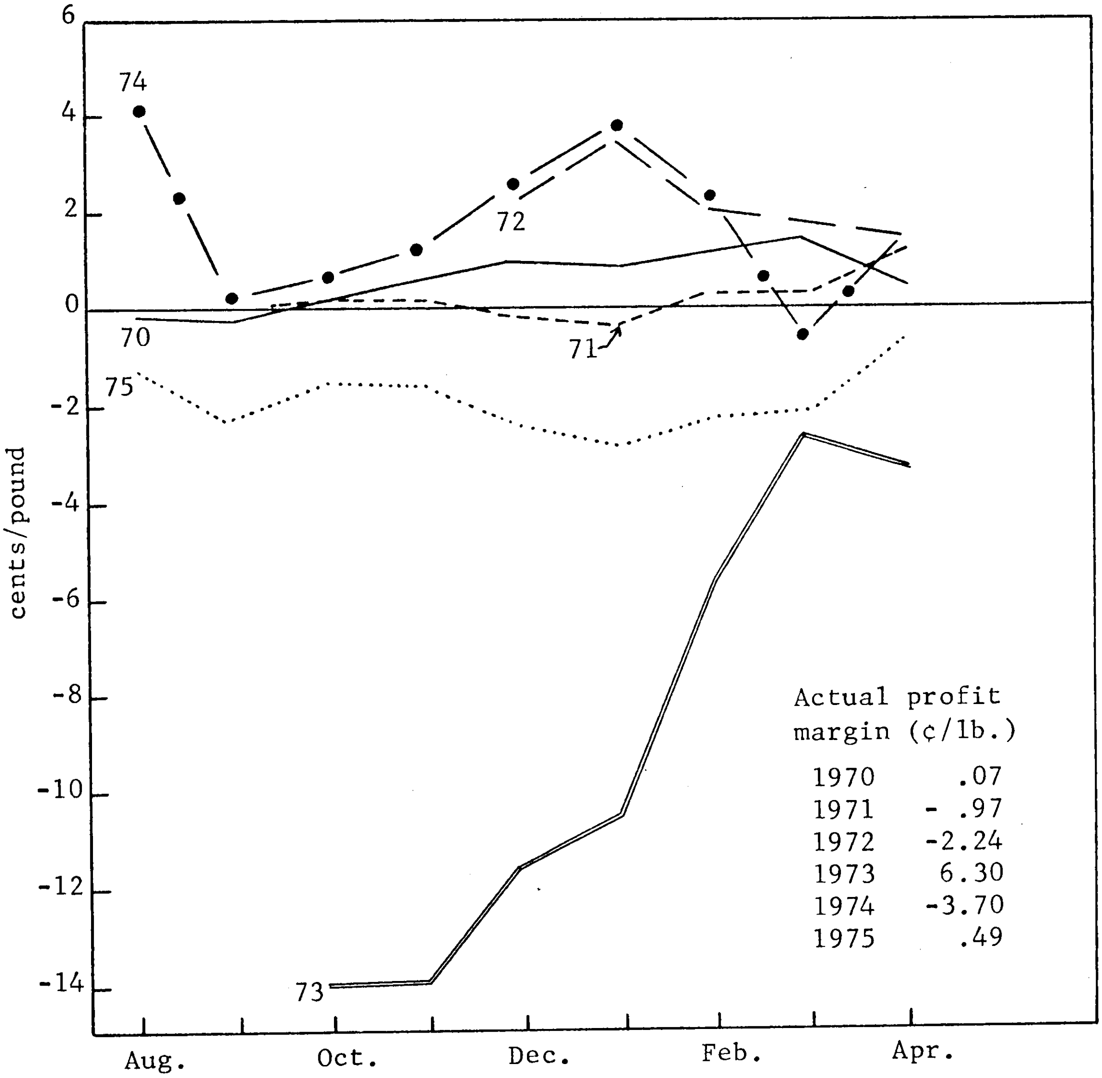

Figure 25. Difference between forecasted and actual profit margins for April, 1970-75.

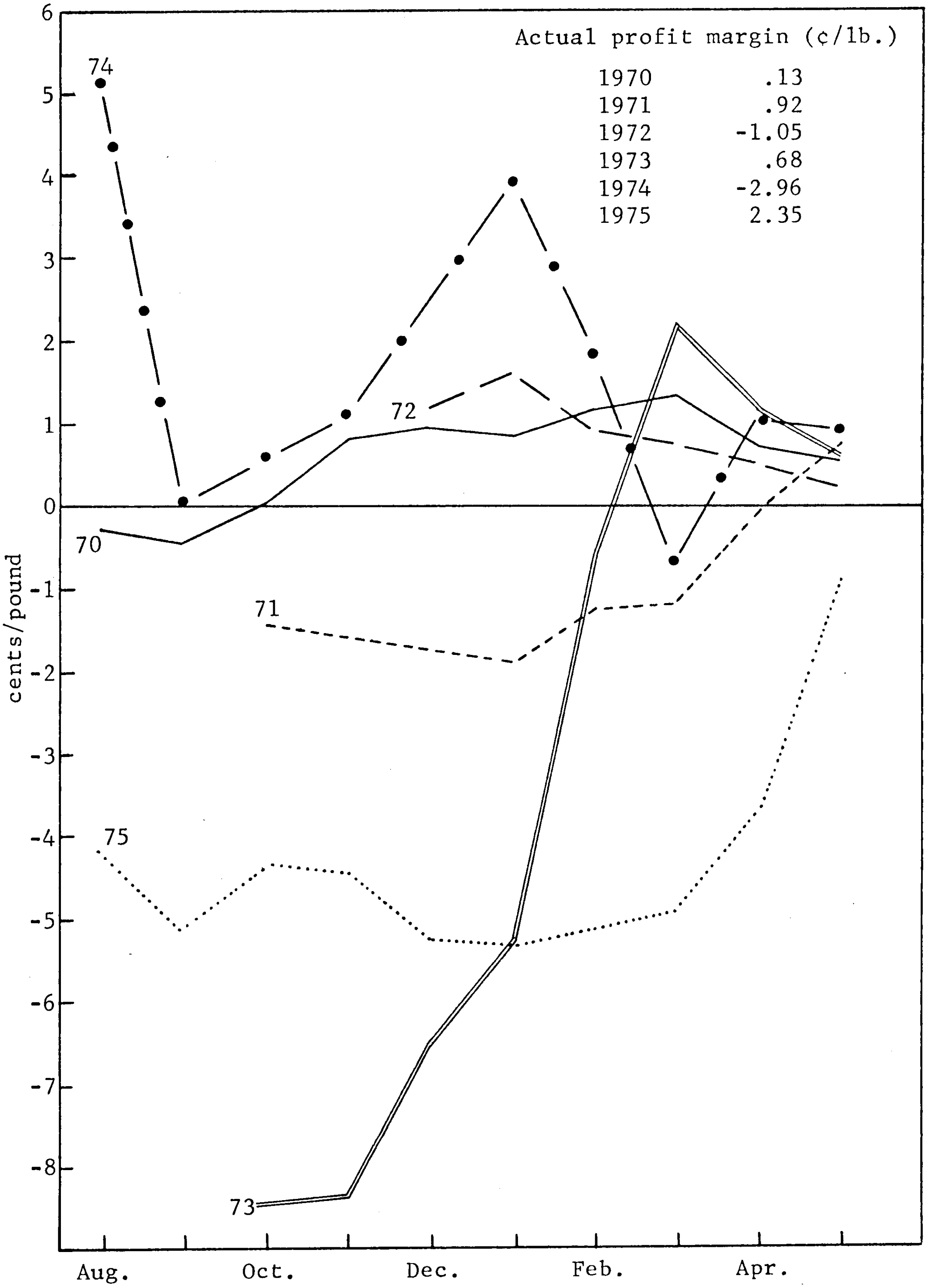

Figure 26. Difference between forecasted and actual profit margins for May, 1970-75.

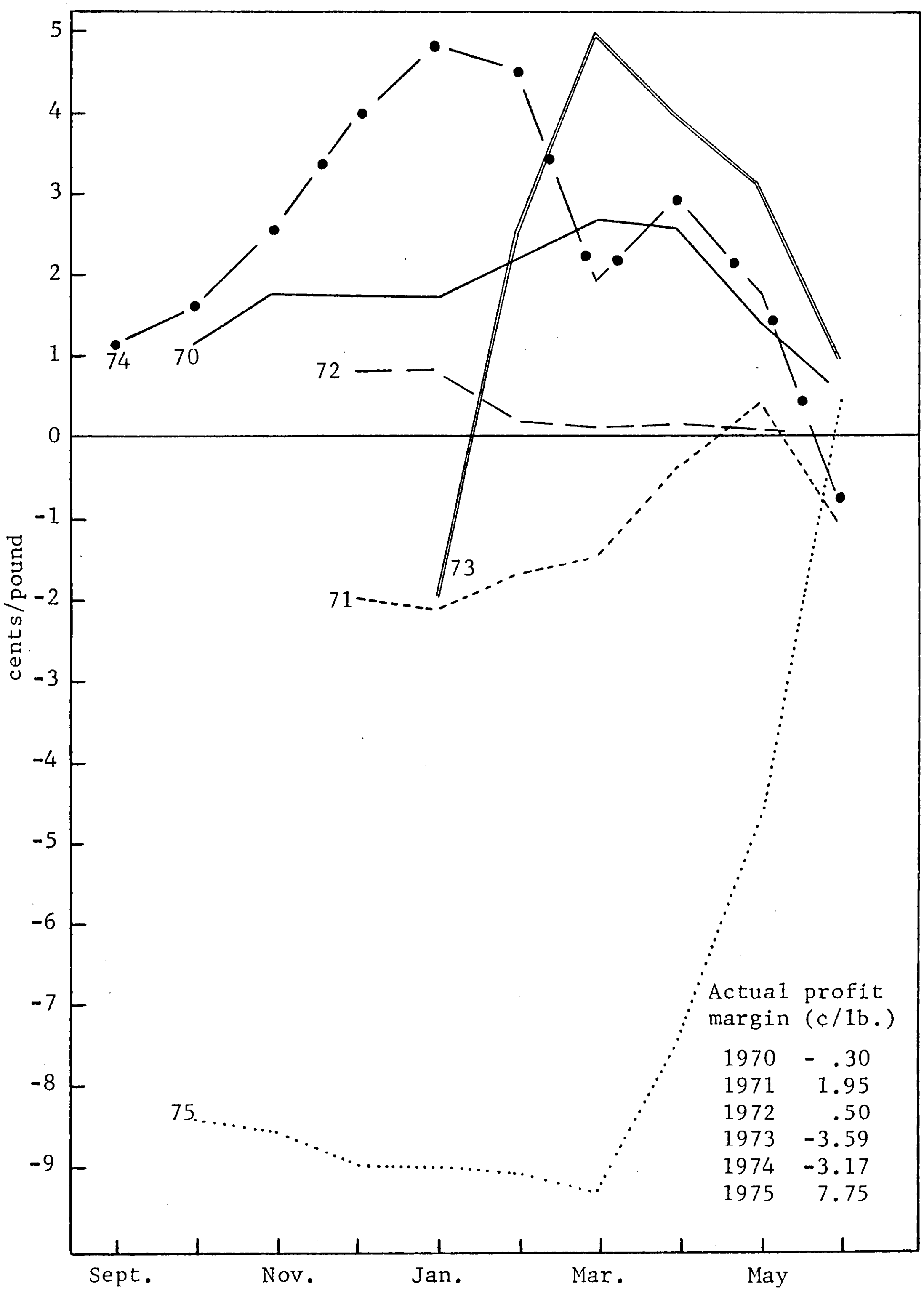

Figure 27. Difference between forecasted and actual profit margins for June, 1970-75.

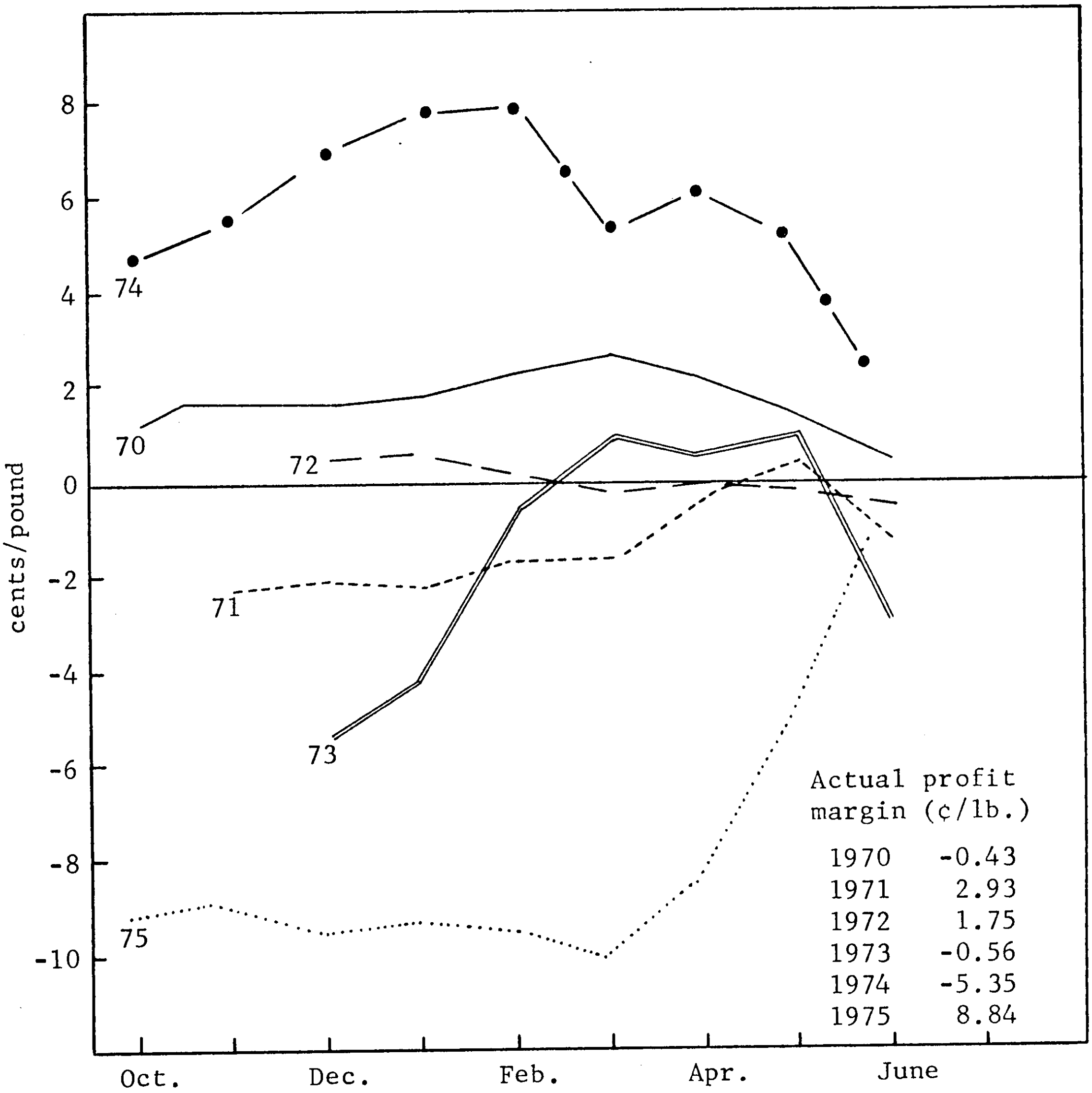

Figure 28. Difference between forecasted and actual profit margins for July, 1970-75.

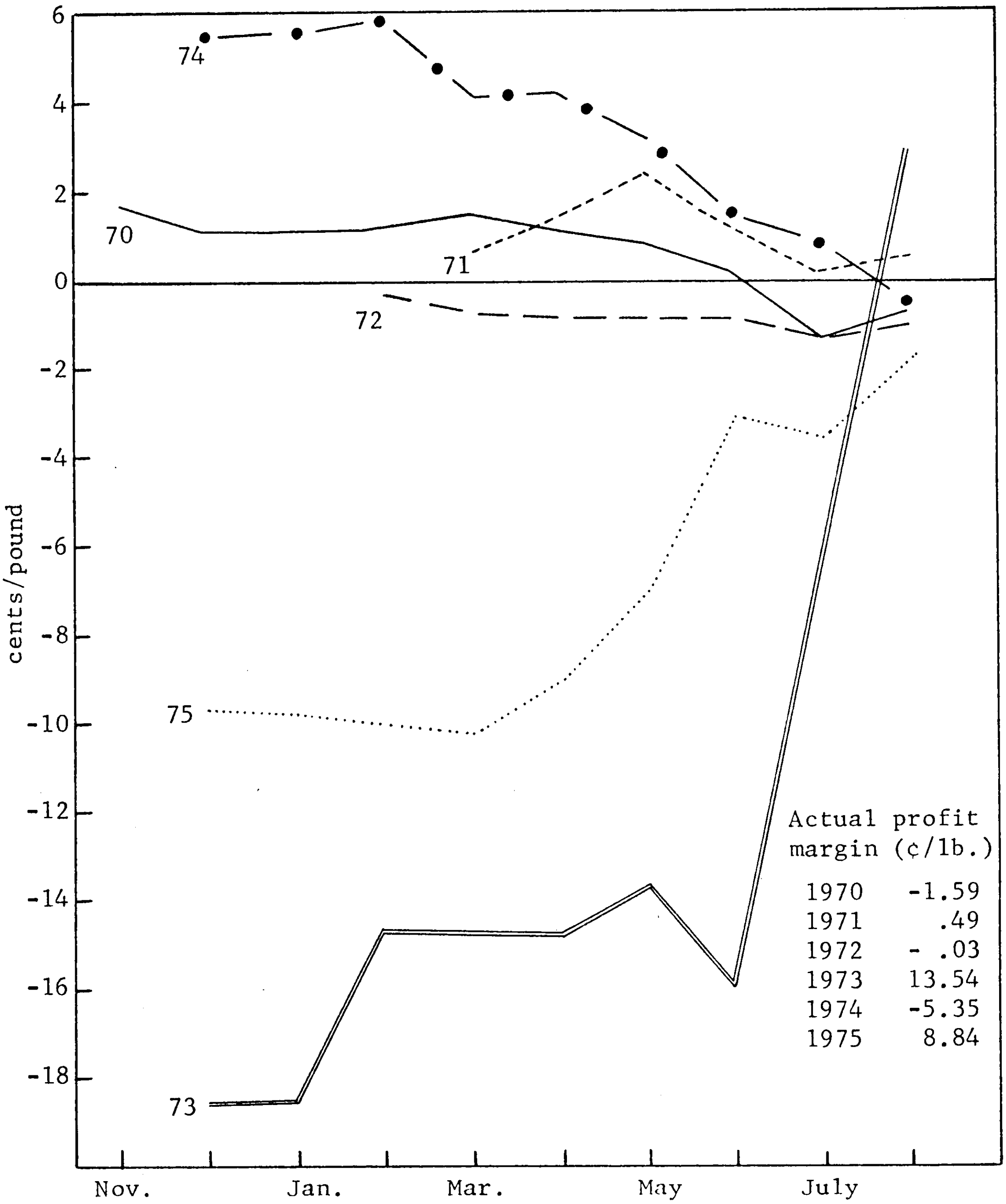

Figure 29. Difference between forecasted and actual profit margins for August, 1970-75.

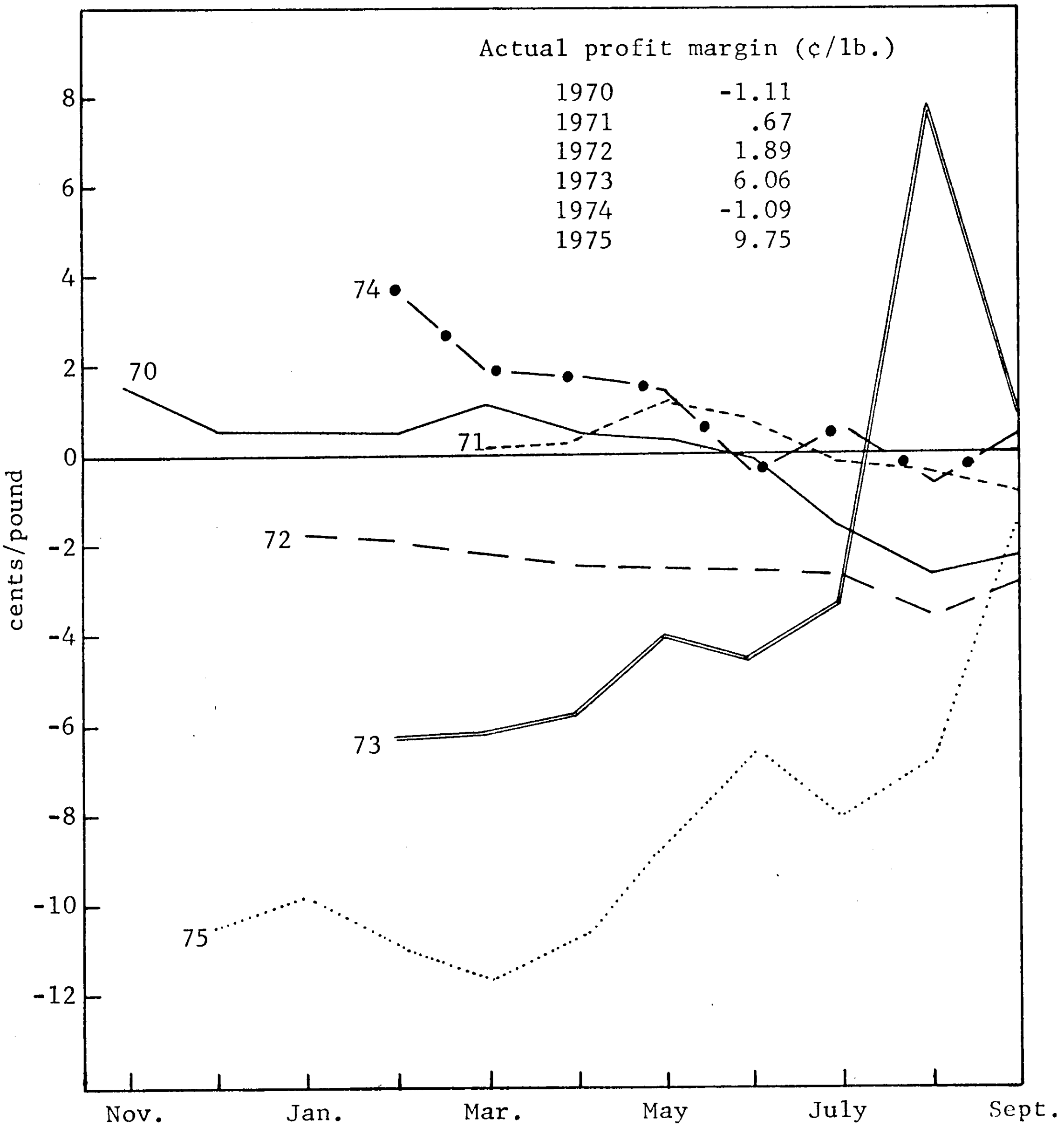

Figure 30. Difference between forecasted and actual profit margins for September, 1970-75.

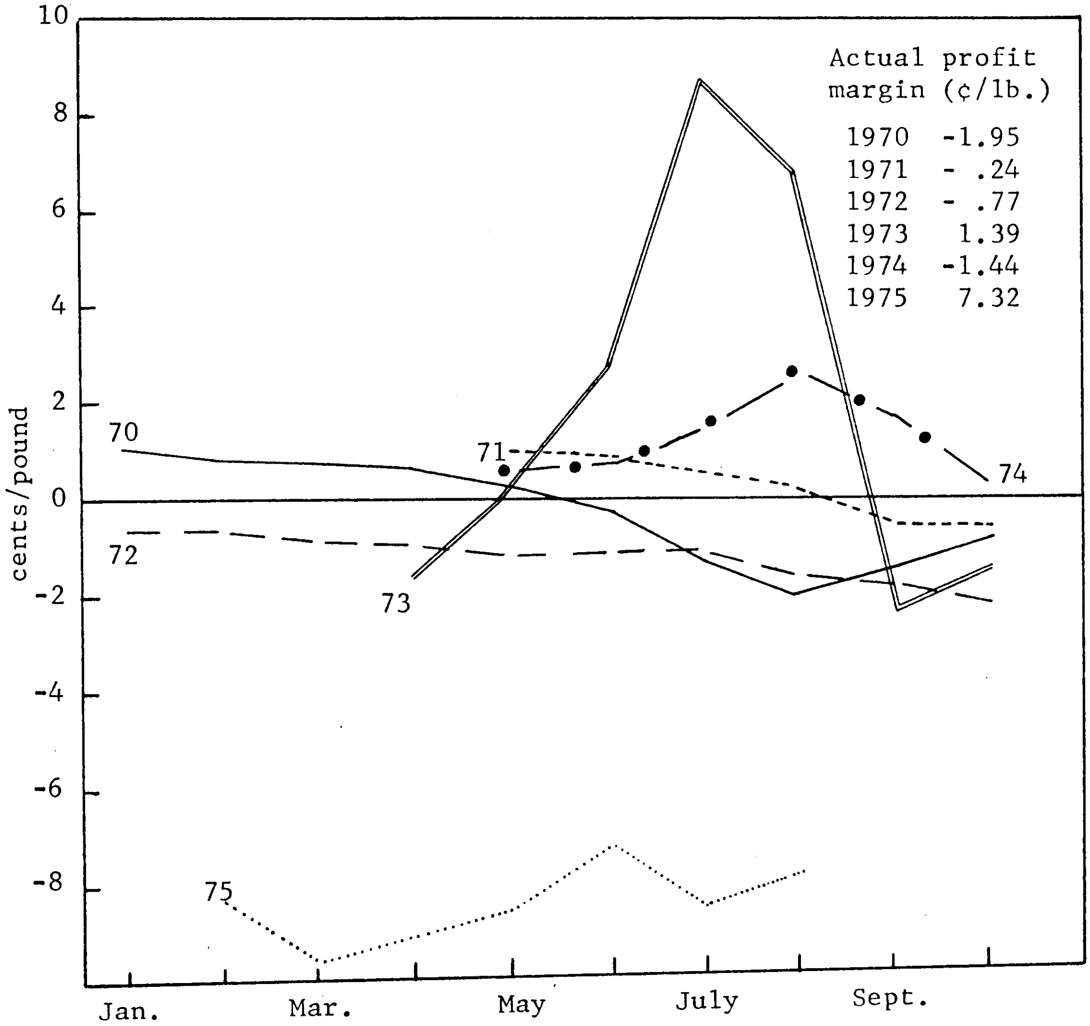

Figure 31. Difference between forecasted and actual profit margins for October, 1970-75.

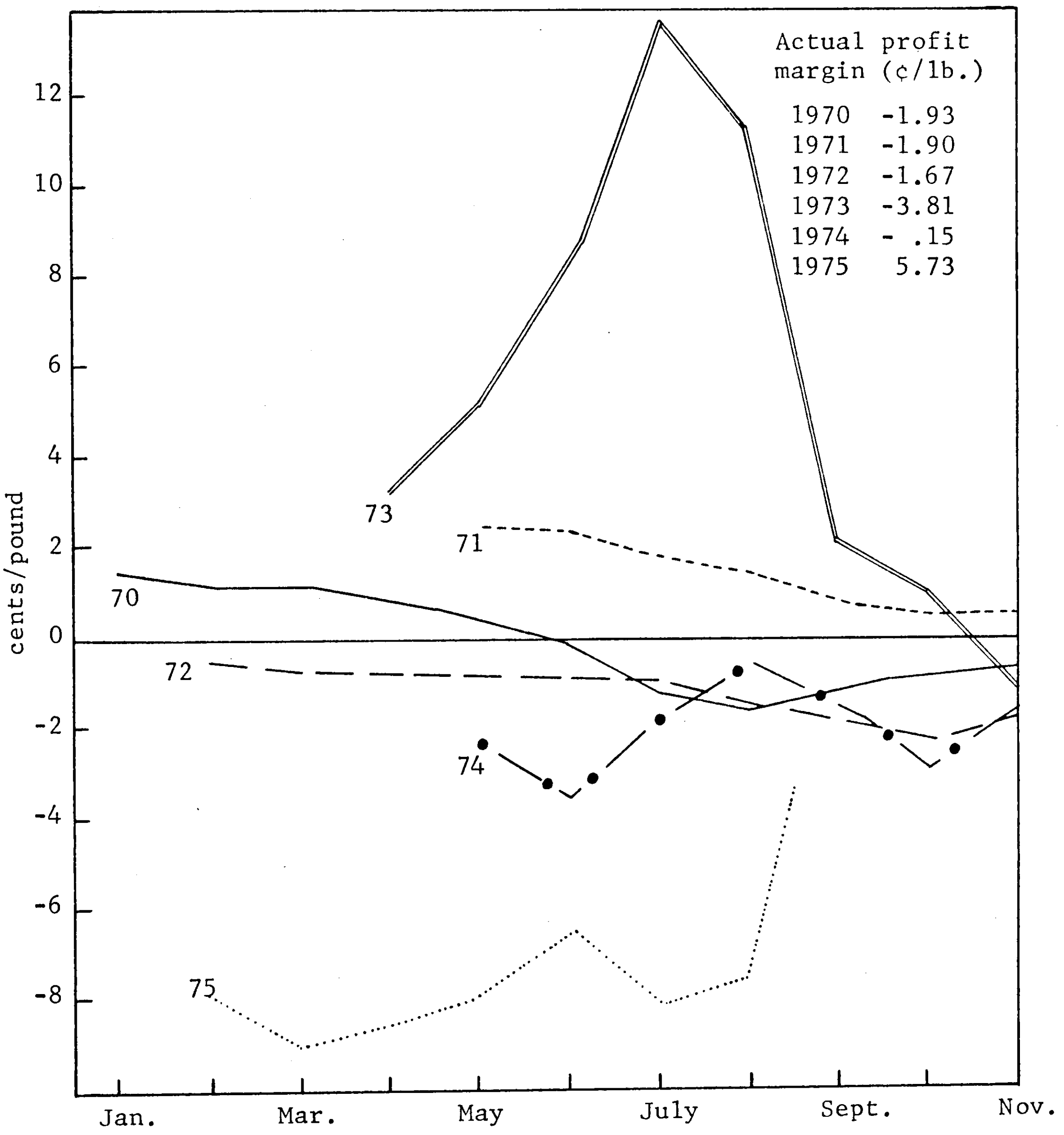

Figure 32. Difference between forecasted and actual profit margins for November, 1970-75.

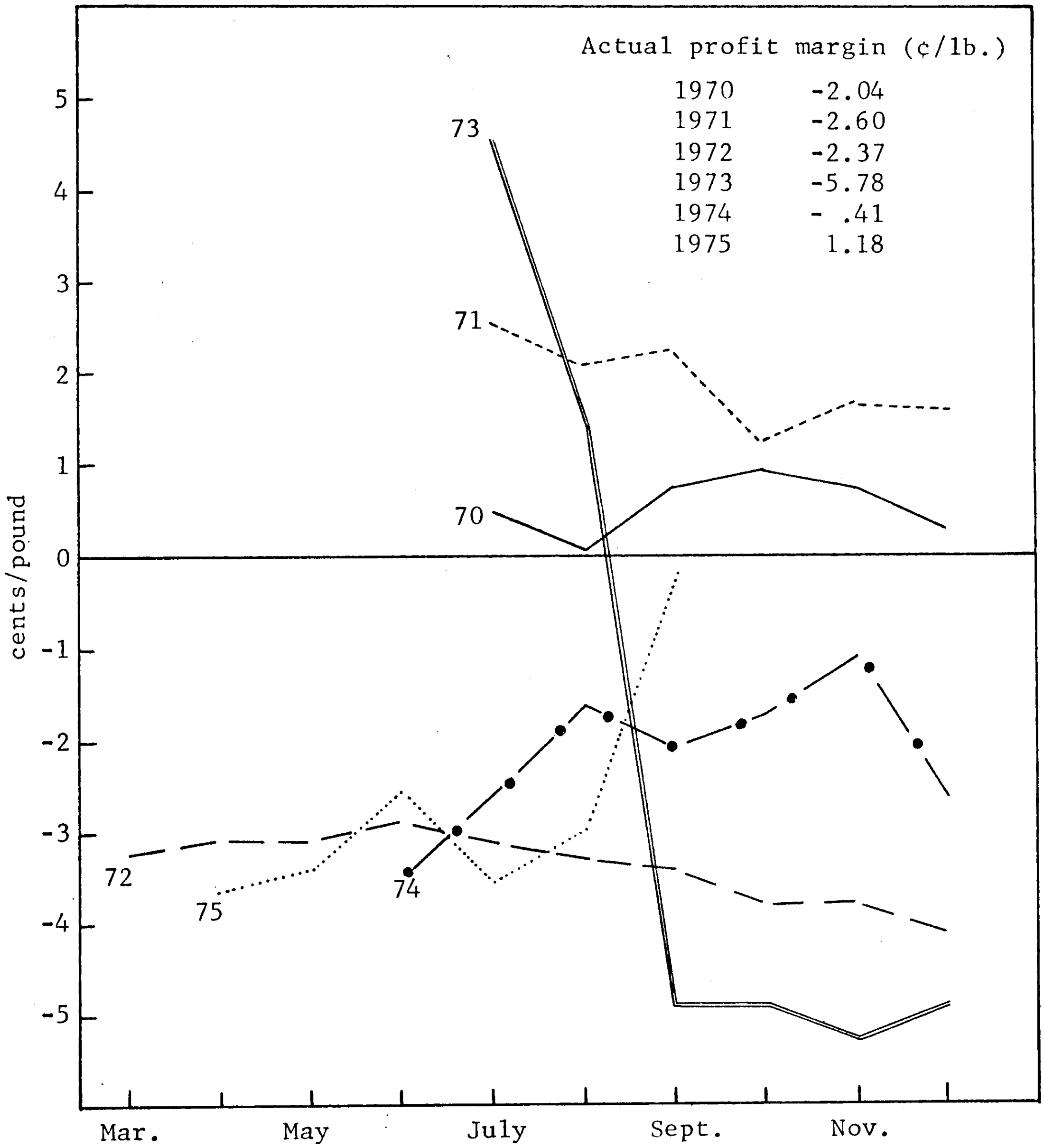

Figure 33. Difference between forecasted and actual profit margins for December, 1970-75.

Table 16. Bias in futures market forecast of actual profit margins by months, 1970-1975.

Month	Nature of Bias
January	Under
February	Under
March	Under
April	Neutral
May	Neutral
June	Over
July	Over
August	Neutral
September	Under
October	Neutral
November	Neutral
December	Under

Table 17. Futures market five month forecast compared to actual profit margin for March and July, 1970-1975.

Year	March		July	
	August Forecast	March Actual	December Forecast	July Actual
	¢/lb.			
1970	0.17	+0.78	1.20	-0.43
1971	-1.87	-0.84	0.91	2.93
1972	-0.85	+0.36	2.22	1.75
1973	-6.71[a]	+2.44	-5.66	-0.56
1974	5.12	-4.16	1.58	-5.35
1975	-2.40	+1.42	-0.67	8.84

[a]October forecast (future prices not available in August and September).

margin are inversely related with the exception of March 1970 and July 1971. This relationship indicates that the seven month forecast period is long enough for broiler integrators to respond to expected profit margins. In other words, if seven months in advance of the actual sale of broilers a large negative profit margin is indicated by the futures market, the actual profit margin will likely be less negative or positive. The reverse is also true. If the futures market estimates a large positive profit margin seven months in advance, generally the actual profit margin will be negative. This striking feature suggests that when selecting hedging strategies, the integrator should place a hedge when the ENPM's are positive, since the ANPM will generally end up negative. On the other hand, if the ENPM's are negative, the integrator should refrain from placing a hedge since the actual net profit margin generally will end up positive.

The second most striking feature of Figures 22-33 is the big change in profit margins from 1970, 1971 and 1972 compared to 1973, 1974, and 1975. Rapidly increasing corn, soybean meal, and fish meal prices and price freezes in 1973 set in motion a set of circumstances which were still being felt in 1975 in the form of widely fluctuating prices and profit margins. As a result, the futures market tended to forecast negative profit margins in the future when current margins were negative. For example, in October, November, December 1972, when increased feed cost made broiler production very unprofitable, the futures market underestimated by a wide margin the actual profit margin for March 1973 (Figure 24). Likewise, in July and August 1973, when profit margins in broiler production were very favorable, the futures market substantially overestimated the actual profit margin of March 1974. This same pattern exists in July (Figure 28).

With the apparent inverse relationship between the ENPM's as indicated by the futures market, and the ANPM's, the next logical step was to investigate in more detail strength of this relationship. To test this relationship, the following model was hypothesized:

$$(6.1)\quad ANPM_t = \beta_o + \beta_1\ ENPM_{t-i} + \varepsilon_t$$

where:

$ANPM_t$ = actual net profit margin for month t, and

$ENPM_{t-i}$ = expected net profit margin for month t during month t-i where i = 3 - 7.

This model was estimated statistically by ordinary least squares (OLS) using monthly observations for the years 1970-75. The scatter diagram of these observations and the estimated relationships clearly indicated no statistically significant relationship existed between these two variables. None of the t-test were significant at the 5% level, and the R^2's were all less than 0.10.

Careful observation of Figures 34-38 indicated that the magnitude of under and overestimation of profit margins appeared to be related to actual profit margin levels. Large errors in forecasting ANPM seemed to be correlated with larger than average negative and positive profit margins. The original model was reformulated as:

$$(6.2)\quad ANPM_t = \beta_o + \beta_1\ (ENPM_{t-i} - ANPM_t) + \varepsilon_t$$

A priori, the sign of β_1 is expected to be negative. That is, positive ANPM's will be underestimated by ENPM's and negative ANPM's will be overestimated by ENPM's.

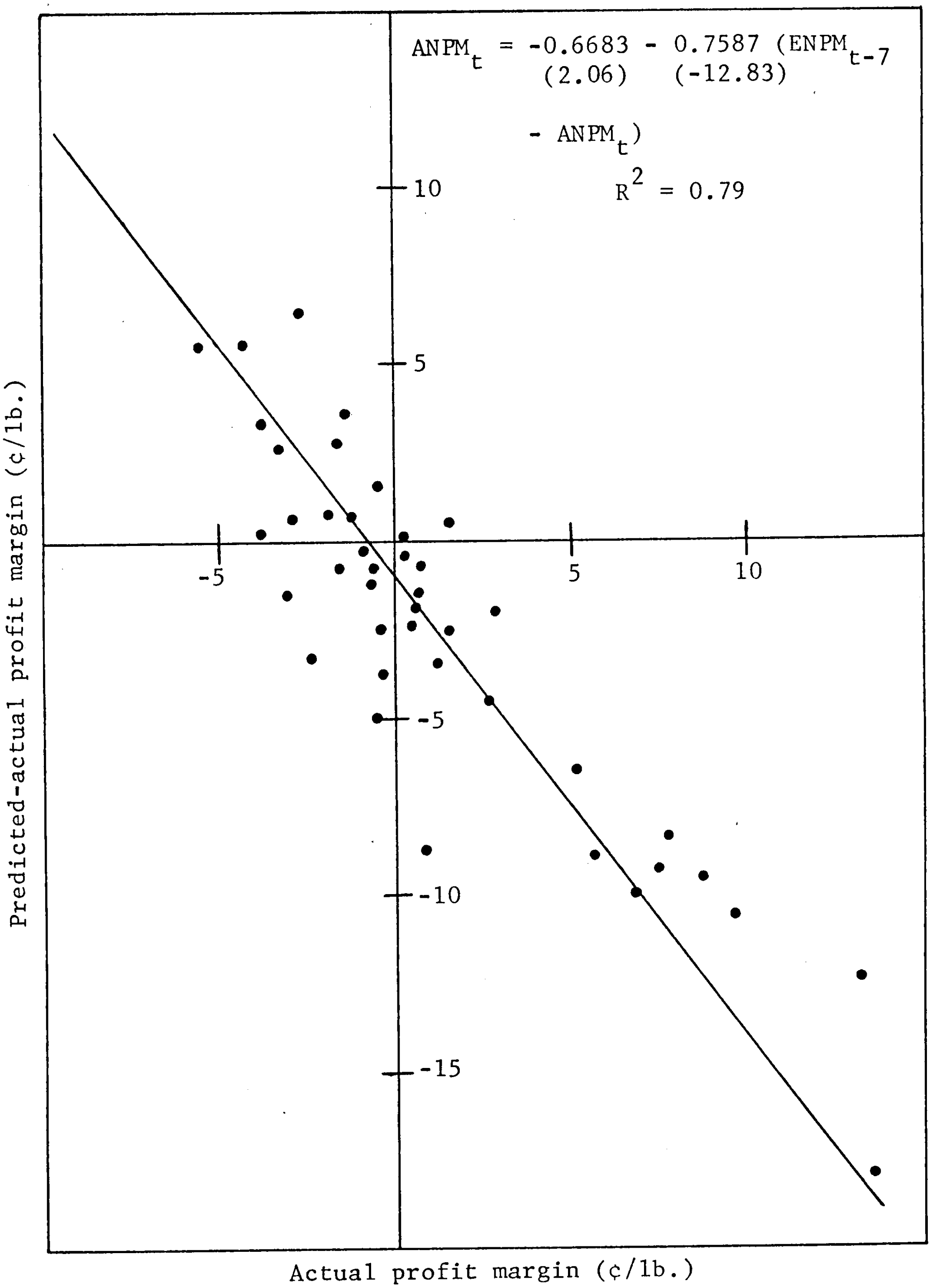

Figure 34. Expected net profit margin (ENPM) forecasting error in predicting actual net profit (ANPM) 7 months in advance, 1970-75.

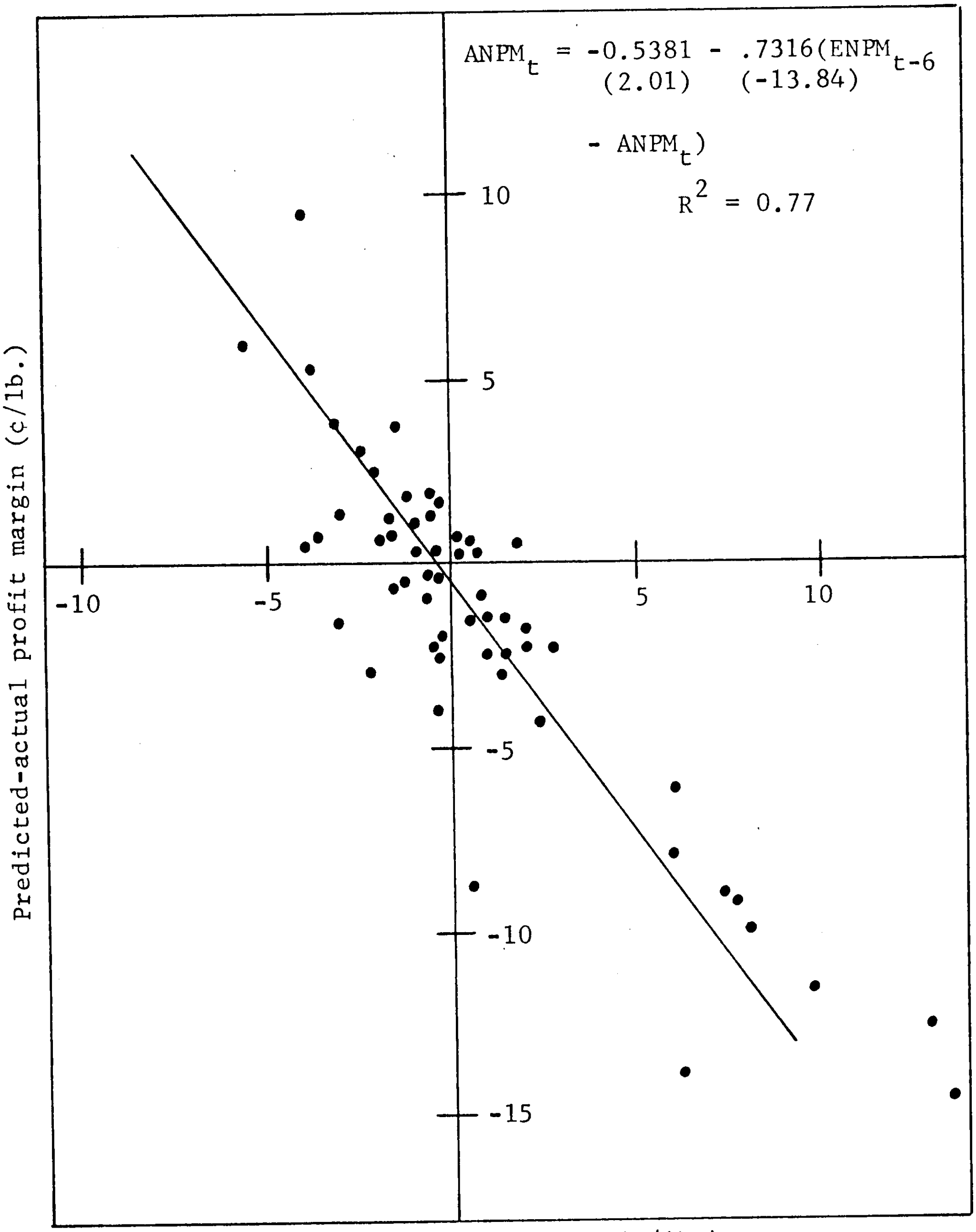

Figure 35. Expected net profit margin (ENPM) forecasting error in predicting actual net profit (ANPM) 6 months in advance, 1970-75.

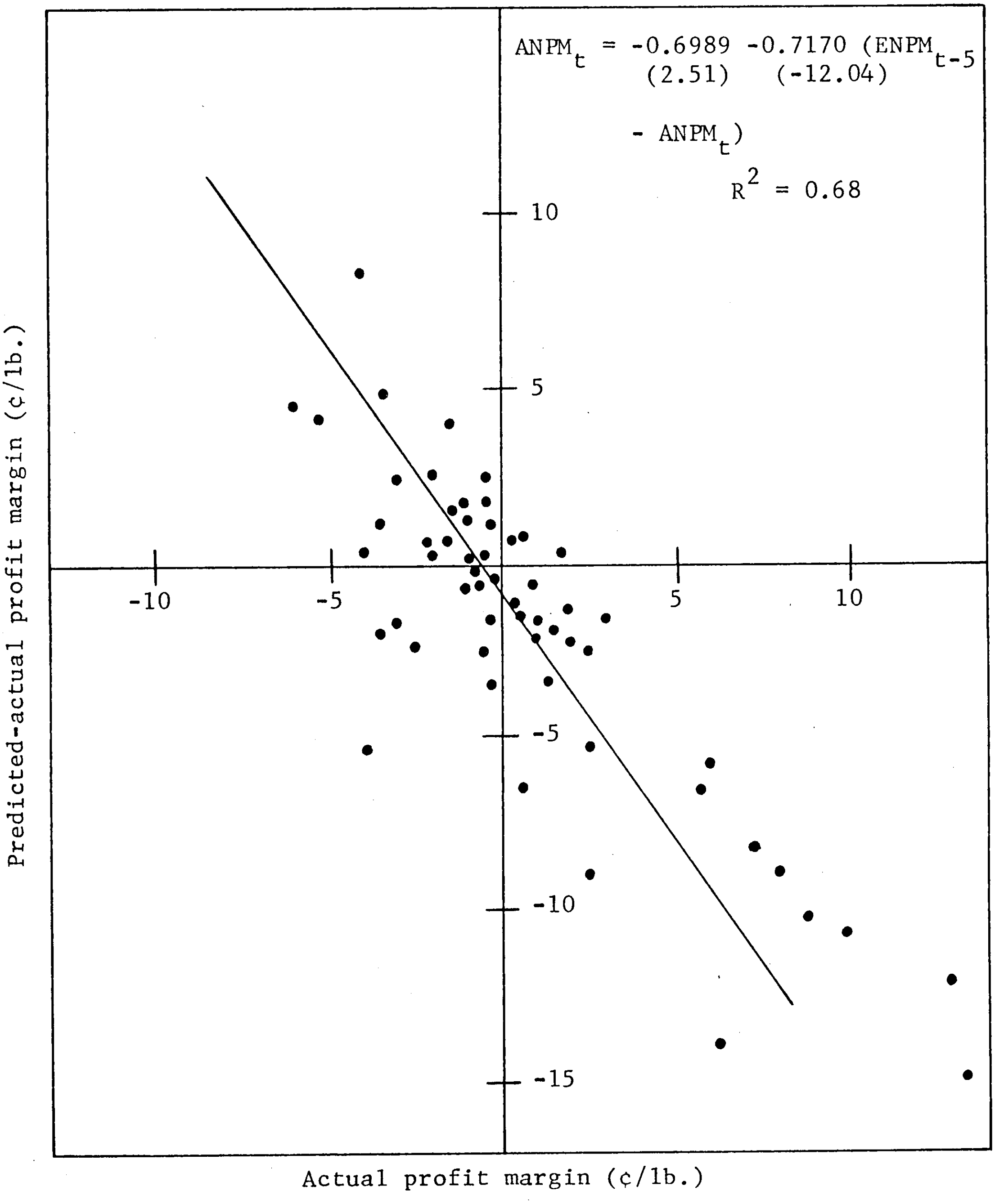

Figure 36. Expected net profit margin (ENPM) forecasting error in predicting actual net profit (ANPM) 5 months in advance, 1970-75.

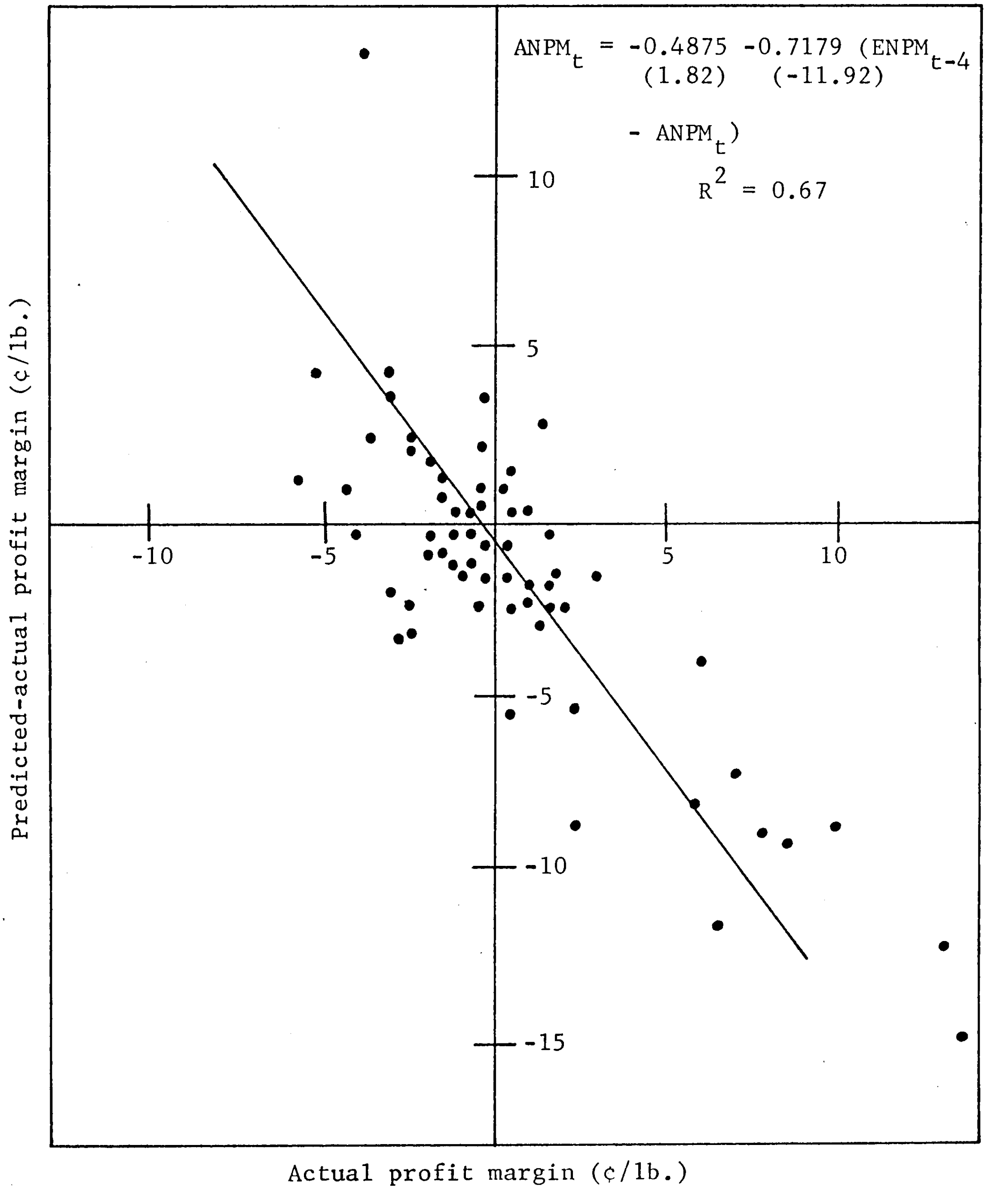

Figure 37. Expected net profit margin (ENPM) forecasting error in predicting actual net profit (ANPM) 4 months in advance, 1970-75.

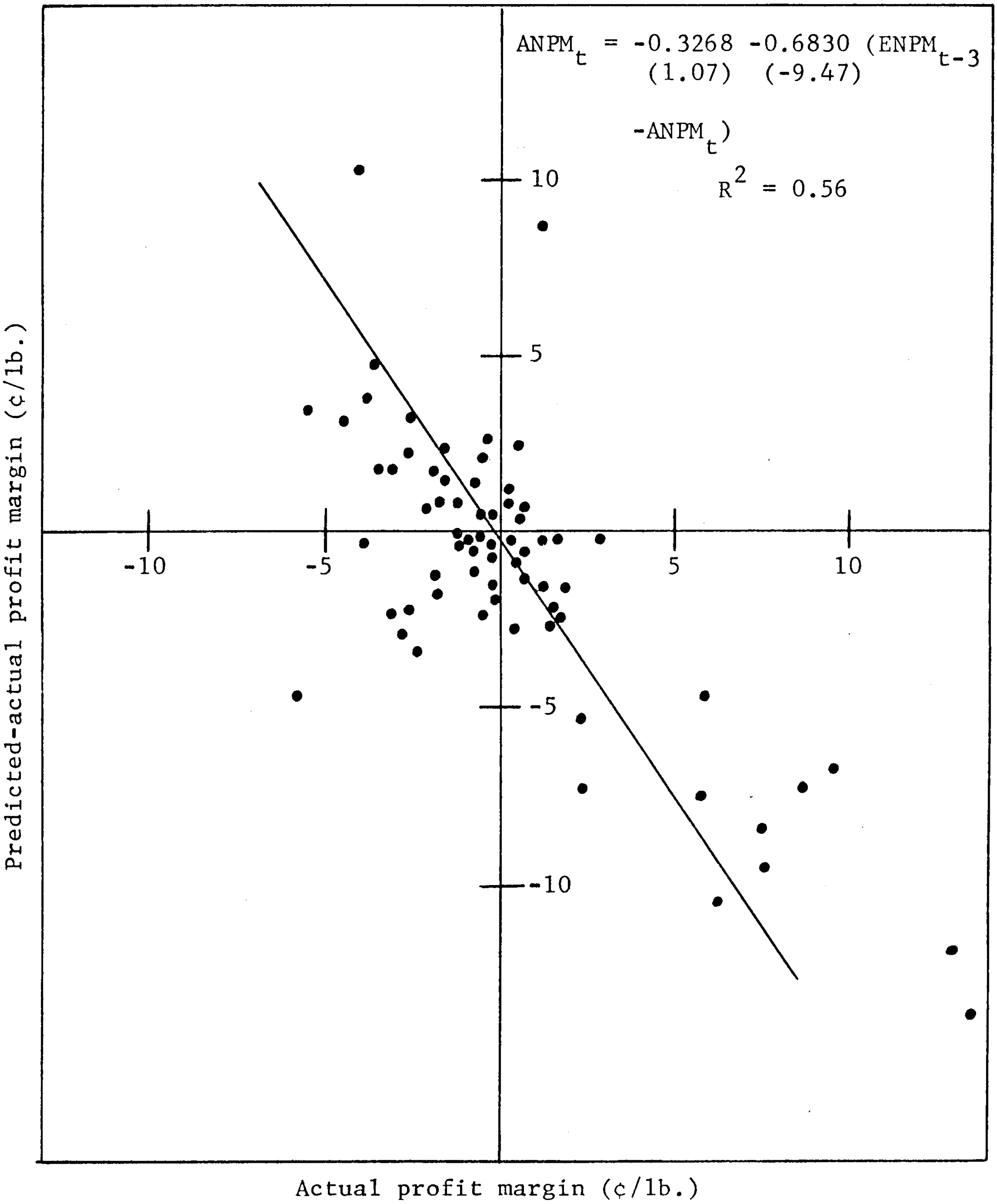

Figure 38. Expected net profit margin (ENPM) forecasting error in predicting actual net profit (ANPM) 3 months in advance, 1970-75.

The scatter diagrams of the data and OLS estimates of equation (6.2) are presented in Figures 34-38. Most of the observations fall within the second and fourth quadrants, collaborating the inverse relationship between magnitude of over and underestimation of ANPM and the level of ANPM. Fifty-six to seventy-nine percent of the variation in ANPM's is explained by the equations with the estimate of β_1 being statistically significant at the one percent level in each equation.

These estimated relationships clearly indicate that the futures market consistently overestimates negative ANPM's and underestimates positive ANPM's. This phenomenon exists because 5 - 7 months is a sufficiently long time period to allow integrators to adjust their production schedules. Therefore, when ENPM's for seven months into the future are positive, integrators expand production with the general result that ANPM's are smaller positive margins or more frequently negative. The reverse is also true. Positive ANPM's are usually underestimated. On many occasions during the 1970-75 period, 5 - 7 month forecast of actual profit margins were negative, when in fact the actual profit margins were positive. In fact, the error in direction of underestimation is considerably larger than the errors of overestimation. This can be partially explained by the relative ease of cutting back production when large negative profit margins are expected, therefore generating positive profit margins.

This relationship between the ENPM's and ANPM's signals the hedger to place a hedge when the ENPM's are positive because generally a negative profit will actually be realized, and to refrain from hedging when the ENPM's are negative.

The Hedging Strategies

The objective of this section will be to analyze the performance of alternative profit margin hedging strategies. Six strategies will be evaluated in terms of average net profit margin and variation in average net profit margin for a six year period, 1970-1975.

I. The cash market operation - The cash market operation will serve as a base for evaluating the other profit margin hedging strategies. The monthly profit margins can be found in Table 8 of Chapter III.

II. Hedge if the ENPM $\geq$ .25¢/lb. - The average profit margin for the years 1967 through 1974 was .25¢/lb. The year 1975 was eliminated from the calculation to determine the historical average profit margin since it was considered an unusually profitable year in the broiler industry.

III. Hedge if the ENPM $\geq$ 1.00¢/lb. - The 1.00¢/lb. criteria was selected after Strategy II had been analyzed. Using Strategy II, many months were hedged prematurely. A higher profit margin criteria was used to take advantage of possible higher ENPM's.

IV. The seasonal hedge - Hedge if ENPM for October $\geq$ .005¢/lb., hedge November if ENPM $\geq$ -1.23¢/lb. and/or hedge December if the ENPM $\geq$ -1.68¢/lb. Each of these profit margin criteria were derived by taking a seven year average of the average profit margins for each of these months. This strategy was designed to see if hedging could improve profit margins in the traditionally low profit months.

V. Hedge if the ENPM for the months January through September is $\geq$ .25¢/lb., and hedge October if ENPM $\geq$ .005¢/lb., hedge November if ENPM $\geq$ -1.23¢/lb., and hedge December if ENPM $\geq$ -1.68¢/lb. This strategy is a combination of Strategies II and IV.

VI. Hedge if the ENPM for the months January through September is $\geq$ 1.00¢/lb. plus the seasonal hedge.

The results of each strategy over the six year period are given in Table 18. The all cash operation had an average net profit margin of .38¢/lb. with a standard deviation of 3.77¢/lb. The net profit margin for the cash operation ranged from -5.78¢/lb. to +13.54¢/lb. Under strategy II, the average net profit margin was .81¢/lb. with a standard deviation of 2.44¢/lb. Profit margins more than doubled and the variance of profit margin was reduced by more than half. The reduction in profit margin variance is largely a result of eliminating some large positive profit margins rather than reducing losses. However, the yearly average profit margin for each year was positive under strategy II. On the average, when a hedge was placed, the realized profit margin from hedging was greater than the unhedged profit margin for that month. Since negative margins were never locked in, hedging seldomly resulted in losses greater than unhedged losses. Therefore, overall, hedging produced higher average net profit margins.

Strategy III generated higher average net profit margins than strategies I or II, because the profit margin objective was much higher at $\geq$ 1.00¢/lb. This strategy was able to take advantage of higher iced broiler futures prices, therefore, locking in higher revenues, thus higher net profit margins. For strategy IV, profit margins were increased slightly over the cash operation, and the variance was reduced. The futures market for broilers anticipates lower prices in October,

Table 18. Average net profit margin, variance, standard deviation, and ranges for six hedging strategies, 1970-1975.

Strategy	Average[a] (¢/lb.)	Variance	Standard Deviation (¢/lb.)	Range	
				Lower	Upper
I	.38	14.25	3.77	-5.78	13.54
II	.81	5.98	2.44	-5.48	5.74
III	.96	6.35	2.52	-3.40	5.74
IV	.48	12.71	3.56	-4.16	13.54
V	.78	5.59	2.36	-5.48	5.74
VI	.77	5.42	2.33	-3.40	5.74

[a]Hedging costs have been subtracted from strategies II-VI.

November, and December, therefore improving profit margins during these three months is difficult.

Strategies V and VI, the combination of strategies II and IV and III and IV, respectively, improved profit margins, but not as much as strategies II and III. This provides further evidence that locking in negative ENPM's in an attempt to minimize losses does not seem to work effectively in the broiler industry.

More details of the results of strategies I-VI can be found in Table 19. These results show which months were hedged for each hedging strategy each year. The profit margin generated by the all cash operation was used in calculating the yearly average profit margin.

Table 19 indicates that the margins generated by strategies II-VI out performed the cash operation for the year 1970. Similar results were repeated for the years 1971 and 1972. The margins for each strategy were higher than that of the all cash operation. Even in 1973, when the industry experienced windfall profits during the months of August and September, strategies III, IV, and VI generated higher margins than the cash operation. During 1974, when the broiler industry experienced one of the worst years in the history of the industry, again each strategy out performed the cash operation. During 1975, when the industry experienced its best year in its history, each hedging strategy produced greater than or equal to 2.26¢/lb., which would still be considered a very profitable year, although considerably less than an all cash operation.

Table 19. Monthly net profit margins for six selective hedging strategies for the years 1970-1975.

Month and Year	Strategies I	II	III	IV	V	VI
	¢/lb.					
Jan. '70	1.59	1.77	a	a	1.77	a
Feb. '70	-.47	-.25	.18	a	-.25	.18
Mar. '70	.78	.74	1.19	a	.74	1.19
Apr. '70	.07	.18	.18	a	.18	.18
May '70	.13	.68	.59	a	.59	.59
June '70	-.30	.25	.46	a	.25	.46
July '70	-.43	2.46	2.60	a	2.46	2.60
Aug. '70	-1.59	2.53	a	a	2.53	a
Sept. '70	-1.11	2.34	a	a	2.34	a
Oct. '70	-1.95	a	a	a	a	a
Nov. '70	-1.93	a	a	-.60	-.60	-.60
Dec. '70	-2.04	a	a	-2.11	-2.11	-2.11
Average Margin	-.60	.39	-.15	-.50	.49	-.05
Number of Months Hedged	0	9	6	2	11	8
Avg. Length a hedge was placed (mo.)	0	6.34	7.40	7.50	8.19	7.44

[a]Indicates no hedge was placed for that month. The profit margin of Strategy I, the all cash operation, was used in calculating the average yearly net profit margin.

Table 19. (continued)

Month and Year	Strategies I	II	III	IV	V	VI
	¢/lb.					
Jan. '71	-1.18	a	a	a	a	a
Feb. '71	-.12	a	a	a	a	a
Mar. '71	-.84	a	a	a	a	a
Apr. '71	-.97	a	a	a	a	a
May '71	.92	a	a	a	a	a
June '71	1.95	1.17	a	a	1.17	a
July '71	2.93	2.94	3.22	a	2.94	3.22
Aug. '71	.49	1.05	1.05	a	1.05	1.05
Sept. '71	.67	1.23	1.63	a	1.23	1.63
Oct. '71	-.24	1.20	1.86	1.38	1.38	1.38
Nov. '71	-1.90	-.85	-.83	-1.28	-1.28	-1.28
Dec. '71	-2.60	a	a	-2.09	-2.09	-2.09
Average Margin	-.07	.16	.34	.15	.18	.30
Number of Months Hedged	0	6	5	3	7	6
Avg. Length a hedge was placed (mo.)	0	6.5	5.5	5.3	5.86	5.58

[a]Indicates no hedge was placed for that month. The profit margin of Strategy I, the all cash operation, was used in calculating the average yearly net profit margin.

Table 19. (continued)

Month and Year	I	II	III	IV	V	VI
	Strategies					
	¢/1b.					
Jan. '72	-.73	-1.36	a	a	-1.36	a
Feb. '72	.46	a	a	a	a	a
Mar. '72	.36	.20	a	a	.20	a
Apr. '72	-2.24	-1.27	a	a	-1.37	a
May '72	-1.05	-.11	.46	a	-.11	.46
June '72	.50	.86	1.24	a	.86	1.24
July '72	1.75	2.55	2.55	a	2.55	2.55
Aug. '72	-.03	2.19	a	a	2.19	a
Sept. '72	1.89	2.78	a	a	2.78	a
Oct. '72	-.77	a	a	a	a	a
Nov. '72	-1.67	a	a	a	a	a
Dec. '72	-2.37	a	a	a	a	a
Average Margin	-.33	.13	.07	.33	.12	.07
Number of Months Hedged	0	8	3	0	8	3
Avg. Length a hedge was placed (mo.)	0	5.87	5.67	0	5.87	5.67

[a]Indicates no hedge was placed for that month. The profit margin of Strategy I, the all cash operation, was used in calculating the average yearly net profit margin.

Table 19. (continued)

Month and Year	Strategies I	II	III	IV	V	VI
	¢/lb.					
Jan. '73	-3.04	a	a	a	a	a
Feb. '73	-2.77	a	a	a	a	a
Mar. '73	2.44	a	a	a	a	a
Apr. '73	6.30	a	a	a	a	a
May '73	.68	-.68	-.68	a	-.68	-.68
June '73	-3.59	-.91	-.91	a	-.91	.51
July '73	-.56	-5.48	-5.48	a	-5.48	-3.40
Aug. '73	13.54	.94	.94	a	.94	2.80
Sept. '73	6.06	6.76	6.76	a	6.76	6.76
Oct. '73	1.39	4.78	4.78	4.78	4.78	4.78
Nov. '73	-3.81	.66	.66	2.08	2.08	2.08
Dec. '73	-5.78	-.55	-.55	-.55	-.55	-.55
Average Margin	.91	.73	1.31	2.11	.82	1.28
Number of Months Hedged	0	8	8	3	8	8
Avg. Length a hedge was placed (mo.)	0	4.75	5.31	6.50	4.87	5.56

[a]Indicates no hedge was placed for that month. The profit margin of Strategy I, the all cash operation, was used in calculating the average yearly net profit margin.

Table 19. (continued)

Month and Year	Strategies I	II	III	IV	V	VI
	¢/lb.					
Jan. '74	-3.92	2.59	2.59	a	2.59	2.59
Feb. '74	-2.54	4.74	4.74	a	4.74	4.74
Mar. '74	-4.16	4.17	4.17	a	4.17	4.17
Apr. '74	-3.70	4.03	4.03	a	4.03	4.03
May '74	-2.96	2.99	2.99	a	2.99	2.99
June '74	-3.17	.95	1.66	a	.95	1.66
July '74	-1.42	1.07	2.38	a	1.07	2.38
Aug. '74	-5.35	-.78	-.03	a	-.78	-.03
Sept. '74	-1.09	2.24	2.24	a	2.24	2.24
Oct. '74	-1.44	-.84	-.26	-.84	-.84	-.84
Nov. '74	-.15	1.43	a	-.40	-.40	-.40
Dec. '74	-.41	a	a	.47	.47	.47
Average Margin	-2.53	1.85	2.00	-2.42	1.77	2.00
Number of Months Hedged	0	12	11	3	12	12
Avg. Length a hedge was placed (mo.)	0	7.41	7.35	4.33	7.29	6.96

[a]Indicates no hedge was placed for that month. The profit margin of Strategy I, the all cash operation, was used in calculating the average yearly net profit margin.

Table 19. (continued)

Month and Year	Strategies I	II	III	IV	V	VI
	------	------	------	¢/lb.	------	------
Jan. '75	-.14	a	a	a	a	a
Feb. '75	1.06	2.09	a	a	2.09	a
Mar. '75	1.42	1.08	a	a	1.08	a
Apr. '75	.49	.90	a	a	.90	a
May '75	2.35	a	a	a	a	a
June '75	7.75	a	a	a	a	a
July '75	13.07	5.74	5.74	a	5.74	5.74
Aug. '75	8.04	.95	1.75	a	.95	1.75
Sept. '75	9.75	1.35	2.80	a	1.35	2.80
Oct. '75	7.32	4.02	a	3.90	3.90	3.90
Nov. '75	5.73	a	a	1.50	1.50	1.50
Dec. '75	1.18	a	a	-.33	-.33	-.33
Average Margin	4.90	2.75	3.12	4.14	2.26	2.34
Number of Months Hedged	0	7	3	3	9	6
Avg. Length a hedge was placed (mo.)	0	7.35	5.50	6.83	7.67	6.17

[a]Indicates no hedge was placed for that month. The profit margin of Strategy I, the all cash operation, was used in calculating the average yearly net profit margin.

The Cost of Hedging

An approximate cost of each hedging strategy for each year was calculated by computing the initial margin money required for each strategy, commission charges, and interest charges on the initial margin money. Table 20 indicates the initial margin needed to place all the hedges for each year, the interest charges on the initial margin, the commissions, the total cost of the hedge, and the cost of hedging per pound of broiler meat hedged. The interest charge was computed by multiplying the average length of time (in months) a hedge was placed times the monthly interest rate.

Although this study ignores the daily margin calls or daily profits due to adverse or favorable price changes, weekly margin calls and gains were computed for hedging strategy II during 1973 when broiler prices rose to record levels. The weekly margin calls or gains realized for hedging strategy II were computed by taking the closing prices for each commodity every Friday.

On February 20, 1973, hedges were placed for the months July, August, and September of 1973. Table 21 gives the integrator and the banker an idea of the magnitude of margin calls that may have to be paid out or profits realized. A minus figure indicates a margin call while a positive figure indicates profits gained. Note that for six consecutive weeks from June 22 through August 3, the margin calls totaled $3,284,482. Although this money was regained during the last quarter of 1973, the banker and integrator should be prepared to make margin calls of this magnitude. The margin calls could have been even greater if a larger number of months would have been hedged.

Table 20. The cost of hedging for Strategies II-VI for the years 1970-1975.

Year	Initial Margin	Interest Charges	Commis-sions	Total Cost	Cost/lb. of Broilers Hedged
			STRATEGY II		
1970	$ 881,566	$ 60,974	$ 78,741	$129,715	.240
1971	437,762	19,065	57,304	76,369	.200
1972	514,360	19,259	77,569	96,828	.197
1973	1,126,077	36,105	84,207	120,312	.240
1974	2,364,365	140,159	125,009	265,168	.34
1975	1,059,930	57,650	85,140	142,790	.22
			STRATEGY III		
1970	$ 449,878	$ 27,731	$ 52,494	$ 80,225	.20
1971	370,414	13,650	48,488	62,138	.19
1972	200,720	7,109	30,368	37,477	.19
1973	1,059,107	37,979	79,165	117,143	.25
1974	2,197,085	129,189	116,361	245,550	.31
1975	459,303	18,693	36,894	55,588	.29
			STRATEGY IV		
1970	$ 138,424	$ 9,120	$ 16,152	$ 25,272	.21
1971	235,718	8,418	30,856	39,274	.19
1972	0	0	0	0	0
1973	435,305	19,099	32,770	51,869	.27
1974	664,235	23,009	35,711	58,720	.30
1975	459,303	23,214	36,894	60,108	.29
			STRATEGY V		
1970	$ 588,302	$ 36,010	$ 68,646	$104,656	.21
1971	437,762	16,375	57,304	73,679	.19
1972	200,720	7,109	30,368	37,477	.19
1973	1,059,107	39,766	79,165	118,931	.26
1974	2,656,940	147,896	140,712	288,608	.37
1975	918,606	41,919	73,788	115,707	.30
			STRATEGY VI		
1970	$ 813,241	$ 55,487	$ 94,893	$150,380	.216
1971	521,947	20,482	68,324	88,806	.190
1972	514,360	19,259	77,509	96,828	.200
1973	1,126,077	37,055	84,207	121,262	.248
1974	2,656,940	154,987	140,712	295,699	.384
1975	1,287,250	73,030	107,844	180,874	.190

Table 21. Value of weekly margin calls or gains for hedging July, August, and September 1973.

Week Ending	Value Due to Price Changes	Week Ending	Value Due to Price Changes
2/23/73	$-642,540	6/15/73	$ 219,846
3/2/73	916,034	6/22/73	21,832
3/9/73	194,096	6/29/73	-130,137
3/16/73	74,060	7/6/73	-527,193
3/23/73	-662,731	7/13/73	-470,424
3/30/73	158,216	7/20/73	-429,109
4/6/73	165,761	7/27/73	-926,019
4/13/73	111,733	8/3/73	-801,600
4/19/73	-131,825	8/10/73	523,626
4/27/73	77,785	8/17/73	420,324
5/4/73	-350,236	8/24/73	290,930
5/11/73	110,284	8/31/73	268,239
5/18/73	-194,967	9/7/73	-9,252
5/25/73	395,298	9/14/73	28,331
6/1/73	78,416	9/21/73	190,112
6/8/73	-175,658	9/28/73	4,452
		Net Gain or (Loss)	($1,202,299)

Summary and Conclusions

The results of this research have indicated that in the long run, profit margin increased and profit margin variance was reduced by following the given hedging strategies. The primary cause of these results lies in the ability of the futures market to forecast actual net profit margins. By setting positive profit margin objectives, hedges were placed for months when actual net profit margins generally turned out to be negative, and hedges were not placed for months when the ANPM's generally turned out positive. Except for strategy IV (the seasonal hedge), each strategy more than doubled the net income of the all cash operation and reduced the variance of income by more than 50%.

The cost of hedging measured in ¢/lb. of broiler meat hedged ranged from .19¢/lb. to .38¢/lb. If the total cost of hedging as indicated in Table 20 were spread over the total pounds of broiler meat produced in each year, the cost of hedging would generally be much less. The figures given in Table 22 can be subtracted from the net income of each strategy for each year to determine the actual net income after hedging costs. Considering the additional incomes from the given hedging strategies, the cost of hedging is relatively minimal.

There are an infinite combination of hedging strategies available to the integrator. The integrator must carefully select his profit margin objective. If he sets his objectives too high (i.e., hedge if the ENPM $\geq$ 2.00¢/lb.), his objective may never be reached. If the objective is set too low, the integrator may miss the opportunity of taking advantage of increasing iced broiler future prices. A strategy such as, hedge if the ENPM $\geq$ .25¢/lb. and the five-day moving aver-

Table 22. Cost of hedging per hedging strategy (total cost of hedging ÷ total amount of lbs. produced per year).[a]

Year	Strategies					
	I	II	III	IV	V	VI
	¢/lb.					
1970	0	.180	.10	.033	.13	.195
1971	0	.099	.08	.051	.09	.115
1972	0	.125	.048	.0	.048	.125
1973	0	.156	.15	.067	.15	.157
1974	0	.34	.31	.076	.37	.384
1975	0	.18	.07	.078	.15	.235

[a]Broiler production = 76,960,000 lbs./yr.

age of ENPM's has turned down may prove to be beneficial. A strategy of this sort would enable the integrator to possibly lock in higher profit margins by taking advantage of steep upward trends in the broiler futures prices or declining corn and soybean meal prices.

Future Research

The concept of locking in profit margins by hedging inputs and outputs simultaneously can be applied to other agricultural enterprises. Possible research directly paralleling this study could be applied to the shell egg industry whereby profit margins could be locked in by buying corn and soybean meal futures contracts, and simultaneously selling shell egg futures contracts, which are traded on the Chicago Mercantile Exchange. The concept could be extended to a hog operation, by buying corn and meal futures contracts, thus locking in a portion of the feed costs, and selling live hog futures contracts thus locking in revenues. A feedlot operator could lock in a major portion of his costs by buying feeder cattle and corn futures contracts and locking in a selling price by selling live cattle futures contracts simultaneously.

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APPENDIX A

METHOD OF COMPUTING THE COMPOSITE RATION

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METHOD OF COMPUTING THE COMPOSITE RATION

The composite ration was computed by weighting the rations fed to the birds each week by the percentage of total feed consumed in a given week (Table A). An example is given below to illustrate the procedure. The average amount of corn per ton of composite ration for the 8-week production period was 1138.488 lbs. The same procedure was used for each ingredient. The composite ration is given in Table 6 in Chapter III.

The reasons for computing a composite ration are twofold. First, a fixed ration had to be developed to compute a total cost of feeding broilers. It was stated in the beginning of Chapter III that the feed costs were divided into three parts, the cost of corn, soybean meal, and other ingredients. To compute the weekly net profit margins, prices for corn and meal were changed weekly, while the cost of the other ingredients were changed quarterly for the years 1969-1972 and monthly for the years 1973-1975. An actual fixed ration cost was computed by multiplying the amount of an ingredient used in the composite ration by the cost per pound of that ingredient. The sources and prices for each ingredient used in calculating the fixed ration can be found in Table B.

Table A. Method of computing composite rations.

Week	Percentage of[a] Total Feed Consumed	X	Ration No.	Lbs. of Corn/ Ton of Ration	=	Total Lbs. of Corn Consumed
1	2.2		1	1056		23.232
2	4.8		1	1056		50.688
3	8.1		1	1056		85.536
4	11.2		2	1101		123.312
5	13.8		2	1101		151.938
6	17.5		3	1146		200.550
7	19.6		3	1146		224.616
8	22.8		4	1222		278.616
						1138.488

[a]Broiler integrator.

Table B. Prices of ingredients in the fixed ration

Period	Stabilized[a] fat	Menhaden[b] fishmeal	Poultry[b] by-product meal	Corn[b] gluten meal (60%)	Defluorinated[c] phosphate	Ground[d] limestone	Salt[e]	DL-[a] methionine	Trace[e] mineral mix	Vitamin[e] premix	Coccidiostat[e]
	$/lb.	----	----	$/ton	----	----	----	$/lb.	----	$/ton of ration	----
July	.1600	518.00	382.60	324.00	83.00	10.00	40.00	1.03	.08	1.75	2.75
August	.1600	475.00	438.62	289.50	83.00	10.00	40.00	1.03	.08	1.75	2.75
September	.1475	467.50	256.75	223.02	83.00	10.00	40.00	1.03	.08	1.75	2.75
October	.1181	430.00	193.60	217.20	83.00	10.00	40.00	1.03	.08	1.75	2.75
November	.1190	412.50	193.75	194.00	83.00	10.00	40.00	1.03	.08	1.75	2.75
December	.1471	525.00	341.50	236.00	130.00	10.00	40.00	1.03	.08	1.75	2.75
1974											
January	.1575	562.50	364.25	246.00	136.00	10.00	40.00	1.12	.08	1.75	3.70
February	.1875	520.00	268.25	263.00	122.00	10.00	40.00	1.12	.08	1.75	3.70
March	.1925	417.50	199.50	270.00	125.00	10.00	40.00	1.10	.08	1.75	3.70
April	.1850	371.66	172.00	258.66	128.00	10.00	40.00	1.30	.08	1.75	3.70
May	.1810	275.00	173.12	207.50	132.00	10.00	40.00	1.30	.08	1.75	3.70
June	.1653	266.50	163.12	180.00	132.00	10.00	40.00	1.30	.08	1.75	3.70
July	.1435	227.50	156.12	192.50	164.00	10.00	40.00	1.30	.08	1.75	3.70
August	.1594	340.00	279.00	282.50	164.00	10.00	40.00	1.30	.08	1.75	3.70
September	.1288	281.66	167.33	220.00	164.00	10.00	40.00	1.30	.08	1.75	3.70
October	.1330	295.00	204.50	225.00	184.00	10.00	40.00	1.26	.08	1.75	3.70
November	.1325	302.50	183.00	222.50	182.00	10.00	40.00	1.205	.08	1.75	3.70
December	.1066	285.00	185.50	205.00	184.00	10.00	40.00	1.205	.08	1.75	3.70
1975											
January	.1131	272.50	181.38	203.77	184.00	10.00	45.40	1.205	.13	1.50	3.82
February	.1131	242.50	171.50	192.50	181.00	10.00	45.40	1.205	.13	1.50	3.82
March	.1081	216.00	165.30	194.40	182.00	10.00	45.40	1.205	.13	1.50	3.82
April	.1175	228.75	180.56	210.00	182.00	10.00	45.40	1.20	.13	1.50	3.82
May	.1294	227.50	171.25	213.00	187.00	10.00	45.40	1.15	.13	1.50	3.82
June	.1319	225.00	179.25	213.20	192.00	10.00	45.40	1.15	.13	1.50	3.82
July	.1244	237.50	180.00	214.00	182.00	10.00	45.40	1.15	.13	1.50	3.82

Table B. Prices of ingredients in the fixed ration

Period	Stabilized[a] fat	Menhaden[b] fishmeal	Poultry[b] by-product meal	Corn[b] gluten meal (60%)	Defluorinated[c] phosphate	Ground[d] limestone	Salt[e]	DL-[a] methionine	Trace[e] mineral mix	Vitamin[e] premix	Coccidiostat[e]
	$/lb.	----------	----------	$/ton	----------	----------	----------	------- $/lb.	------	---- $/ton of ration	----
1969											
1st Quarter	.0581	147.00	93.00	120.00	74.00	8.00	32.00	.80	.07	1.75	2.20
2nd Quarter	.0680	161.66	98.50	130.00	74.00	8.00	32.00	.80	.07	1.75	2.20
3rd Quarter	.0780	176.33	111.42	134.00	74.00	8.00	32.00	.80	.07	1.75	2.20
4th Quarter	.0808	192.00	105.83	125.33	74.00	8.00	32.00	.80	.07	1.75	2.20
1970											
1st Quarter	.0792	188.33	128.75	130.00	83.00	8.00	32.00	.80	.07	1.70	2.20
2nd Quarter	.0892	195.00	114.08	139.66	83.00	8.00	32.00	.80	.07	1.70	2.20
3rd Quarter	.0875	181.33	111.58	137.00	83.00	8.00	32.00	.80	.07	1.70	2.20
4th Quarter	.0850	188.32	108.50	137.33	83.00	8.00	32.00	.80	.07	1.70	2.20
1971											
1st Quarter	.0812	190.66	113.60	132.66	83.00	8.00	32.00	.80	.07	1.70	2.20
2nd Quarter	.0790	175.33	108.00	133.86	83.00	8.00	32.00	.80	.07	1.70	2.20
3rd Quarter	.0750	159.66	109.66	134.33	83.00	8.00	32.00	.80	.07	1.70	2.20
4th Quarter	.0733	161.66	104.00	122.33	83.00	8.00	32.00	.80	.07	1.70	2.20
1972											
1st Quarter	.0638	167.00	115.63	124.66	83.00	8.00	32.00	.800	.07	1.70	2.75
2nd Quarter	.0712	173.53	133.83	141.66	83.00	8.00	32.00	.755	.07	1.70	2.75
3rd Quarter	.0683	186.23	136.88	148.33	83.00	8.00	32.00	.65	.07	1.70	2.75
4th Quarter	.0708	226.85	169.81	141.89	83.00	8.00	32.00	.725	.07	1.70	2.75
1973											
January	.0800	324.00	225.20	186.00	83.00	10.00	40.00	.75	.08	1.75	2.75
February	.0910	385.00	298.10	228.00	81.00	10.00	40.00	.75	.08	1.75	2.75
March	.1072	422.50	300.00	261.00	81.00	10.00	40.00	.82	.08	1.75	2.75
April	.1200	397.00	228.90	258.67	81.00	10.00	40.00	.82	.08	1.75	2.75
May	.1350	442.50	341.75	316.00	83.00	10.00	40.00	.82	.08	1.75	2.75
June	.1600	558.75	424.87	400.00	83.00	10.00	40.00	.82	.08	1.75	2.75

Table B. Continued

Period	Stabilized[a] fat	Menhaden[b] fishmeal	Poultry[b] by-product meal	Corn[b] gluten meal (60%)	Defluorinated[c] phosphate	Ground[d] limestone	Salt[e]	DL-[a] methionine	Trace[e] mineral mix	Vitamin[e] premix	Coccidiostat[e]
	$/lb.	---------- $/ton ----------						------ $/lb. ------		----$/ton of ration ----	
August	.1359	242.50	184.81	221.52	182.00	10.00	45.40	1.10	.13	1.50	3.82
September	.1366	259.00	183.85	225.60	182.00	10.00	45.40	1.10	.13	1.50	3.82
October	.1313	265.00	178.63	237.00	182.00	10.00	45.40	1.07	.13	1.50	3.82
November	.1325	270.00	174.25	240.00	183.00	10.00	45.40	1.00	.13	1.50	3.82
December	.1333	275.00	174.75	240.84	182.00	10.00	45.40	0.96	.13	1.50	3.82

Source: [a]The Ingredient Gazzette, published by Harris-Crane, weekly issues, (1969-1975).
[b]Feedstuffs: Feed Situation, weekly issues, (1969-1975).
[c]Virginia Market News Service, weekly issues (1969-1975).
[d]Daugherty Bros., Inc. Market Quotations, Volumes 18-24.
[e]Broiler integrators.

The second reason for computing a composite ration was to establish conversion factors for the corn, meal, and fixed ration. The conversion factor is essentially the rate at which an ingredient can be converted into a pound of live broiler meat. This study assumes a 2.00 feed conversion rate. Therefore, the conversion factors for corn, meal and fixed ration were calculated as:

CCF = (percentage of corn in composite ration x feed conversion ratio.)

where:

CCF = corn conversion factor.

Hence, CCF = (.57 x 2.00) = 1.14.

SCF = (percentage of soybean meal in composite ration x feed conversion ratio.)

where:

SCF = soybean meal conversion factor.

Hence, SCF = (.25 x 2.00) = .5.

FRCF = (percentage of fixed ration in composite ration x feed conversion ratio.)

where:

FRCF = fixed ration conversion factor.

Hence, FRCF = (.18 x 2.00) = .36. The fixed ratio conversion factor is incorporated in the fixed ration costs given in Table C of this appendix.

Table C. Prices of cost components.

Date	Milling Charge[a]	Chick Cost[b]	Fuel Cost[c]	Contract Payment[a]	Fixed Ration[d]	Processing Cost[e]	Transportation cost[a]	Offal[a]
	¢/lb.							
1969								
1st Quarter	.79	2.75	.24	2.19	2.69	6.00	1.20	.50
2nd Quarter	.79	2.75	.24	2.19	2.86	6.00	1.20	.50
3rd Quarter	.79	2.75	.24	2.19	3.09	6.00	1.20	.50
4th Quarter	.79	2.75	.24	2.19	3.10	6.00	1.20	.50
1970								
1st Quarter	.79	2.75	.26	2.10	3.17	6.50	1.20	.50
2nd Quarter	.79	2.75	.26	2.10	3.29	6.50	1.20	.50
3rd Quarter	.79	2.75	.26	2.10	3.22	6.50	1.20	.50
4th Quarter	.79	2.75	.26	2.10	3.20	6.50	1.20	.50

[a] Broiler integrators.

[b] Agricultural Statistics: 1970-1975.

[c] Survey of Current Business: Yearly average Wholesale Price Indexes for fuel and relation power products; various issues.

[d] Previously computed.

[e] Supplied by Dr. Lewis Wesley, VPI&SU, Blacksburg, Virginia.

Table C. (continued)

Date	Milling Charge[a]	Chick Cost[b]	Fuel Cost[c]	Contract Payment[a]	Fixed Ration[d]	Processing Cost[e]	Transportation cost[a]	Offal[a]
	¢/lb.							
1971								
1st Quarter	.72	2.73	.27	2.10	3.16	7.00	1.21	.50
2nd Quarter	.72	2.73	.27	2.10	3.09	7.00	1.21	.50
3rd Quarter	.72	2.73	.27	2.10	3.01	7.00	1.21	.50
4th Quarter	.72	2.73	.27	2.10	2.93	7.00	1.21	.50
1972								
1st Quarter	.72	2.85	.28	2.18	2.94	7.50	1.22	.90
2nd Quarter	.72	2.85	.28	2.18	3.11	7.50	1.22	.90
3rd Quarter	.72	2.85	.28	2.18	3.19	7.50	1.22	.90
4th Quarter	.72	2.85	.28	2.18	3.41	7.50	1.22	.90

[a] Broiler integrators.

[b] Agricultural Statistics: 1970-1975.

[c] Survey of Current Business: Yearly average Wholesale Price Indexes for fuel and relation power products; various issues.

[d] Previously computed.

[e] Supplied by Dr. Lewis Wesley, VPI&SU, Blacksburg, Virginia.

Table C. (continued)

Date	Milling Charge[a]	Chick Cost[b]	Fuel Cost[c]	Contract Payment[a]	Fixed Ration[d]	Processing Cost[e]	Transportation Cost[a]	Offal[a]
	¢/lb.							
1973								
January	.77	3.20	.32	3.05	4.20	8.00	1.35	1.35
February	.77	3.20	.32	3.05	4.85	8.00	1.35	1.35
March	.77	3.20	.32	3.05	5.23	8.00	1.35	1.35
April	.77	3.20	.32	3.05	5.13	8.00	1.35	1.35
May	.77	3.20	.32	3.05	6.02	8.00	1.35	1.35
June	.77	3.20	.32	3.05	7.25	8.00	1.35	1.35
July	.77	3.20	.32	3.05	6.68	8.00	1.35	1.35
August	.77	3.20	.32	3.05	6.56	8.00	1.35	1.35
September	.77	3.20	.32	3.05	5.55	8.00	1.35	1.35
October	.77	3.20	.32	3.05	4.94	8.00	1.35	1.35
November	.77	3.20	.32	3.05	4.79	8.00	1.35	1.35
December	.77	3.20	.32	3.05	6.08	8.00	1.35	1.35

[a] Broiler integrators.

[b] Agricultural Statistics: 1970-1975.

[c] Survey of Current Business: Yearly average Wholesale Price Indexes for fuel and relation power products; various issues.

[d] Previously computed.

[e] Supplied by Dr. Lewis Wesley, VPI&SU, Blacksburg, Virginia.

Table C. (continued)

Date	Milling[a] Charge	Chick[b] Cost	Fuel[c] Cost	Contract[a] Payment	Fixed[d] Ration	Processing[e] Cost	Transportation[a] Cost	Offal[a]
	¢/lb.							
1974								
January	.77	3.38	.50	2.06	6.52	8.50	1.50	1.09
February	.77	3.38	.50	2.06	6.48	8.50	1.50	1.09
March	.77	3.38	.50	2.06	6.09	8.50	1.50	1.09
April	.77	3.38	.50	2.06	5.76	8.50	1.50	1.09
May	.77	3.38	.50	2.06	5.26	8.50	1.50	1.09
June	.77	3.38	.50	2.06	4.92	8.50	1.50	1.09
July	.77	3.38	.50	2.06	4.68	8.50	1.50	1.09
August	.77	3.38	.50	2.06	5.94	8.50	1.50	1.09
September	.77	3.38	.50	2.06	4.84	8.50	1.50	1.09
October	.77	3.38	.50	2.06	5.08	8.50	1.50	1.09
November	.77	3.38	.50	2.06	5.00	8.50	1.50	1.09
December	.77	3.38	.50	2.06	4.62	8.50	1.50	1.09

[a]Broiler integrators.

[b]Agricultural Statistics: 1970-1975.

[c]Survey of Current Business: Yearly average Wholesale Price Indexes for fuel and relation power products; various issues.

[d]Previously computed.

[e]Supplied by Dr. Lewis Wesley, VPI&SU, Blacksburg, Virginia.

Table C. (continued)

Date	Milling[a] Charge	Chick[b] Cost	Fuel[c] Cost	Contract[a] Payment	Fixed[d] Ration	Processing[a] Cost	Transportation[a] Cost	Offal[a]
	¢/lb.							
1975								
January	.79	3.00	.59	2.65	5.05	9.00	1.65	.70
February	.79	3.00	.59	2.65	4.88	9.00	1.65	.70
March	.79	3.00	.59	2.65	4.76	9.00	1.65	.70
April	.79	3.00	.59	2.65	5.00	9.00	1.65	.70
May	.79	3.00	.59	2.65	5.10	9.00	1.65	.70
June	.79	3.00	.59	2.65	5.15	9.00	1.65	.70
July	.79	3.00	.59	2.65	5.10	9.00	1.65	.70
August	.79	3.00	.59	2.65	5.27	9.00	1.65	.70
September	.79	3.00	.59	2.65	5.34	9.00	1.65	.70
October	.79	3.00	.59	2.65	5.34	9.00	1.65	.70
November	.79	3.00	.59	2.65	5.35	9.00	1.65	.70
December	.79	3.00	.59	2.65	5.37	9.00	1.65	.70

[a] Broiler integrators.

[b] Agricultural Statistics: 1970-1975.

[c] Survey of Current Business: Yearly average Wholesale Price Indexes for fuel and relation power products; various issues.

[d] Previously computed.

[e] Supplied by Dr. Lewis Wesley, VPI&SU, Blacksburg, Virginia.

APPENDIX B

COST OF TURKEY AND CHICKEN PROCESSING

APPENDIX B

COST OF TURKEY AND CHICKEN PROCESSING[a]

Based on Live Weights
Compiled by
Dr. R. Lewis Wesley, Professor and Extension Project Leader
Food Science and Technology, VPI&SU
October 24, 1975

	Turkeys	Chickens
Labor	3.00	2.50
Facilities & equipment . . .	2.00	2.00
Interest on investment . . .	.50	.50
Taxes & insurance	.50	.50
Utilities		
Electricity		
Water		
Sewerage		
Fuel	.75	1.25[b]
Grading & inspection	.25	.10
Packaging materials	2.50	1.50
Administrative & sales . . .	.50	.30
Miscellaneous	.50	.40
Total	10.50[c]	9.05[c]

[a]These figures are based on the assumption that the chicken plant processes about 50,000 birds/8 hour shift. Average broiler weights are 3.5 lbs. dressed; and turkey plant processes about 20,000 birds/8 hour shift. Average turkey weights are 15 lbs. dressed. All above information is based on average costs/lb. in Virginia: cost range for turkeys is 9.2 to 11.50, and cost range for broilers is 7.4 to 9.10.

[b]Utilities for the broiler plants are somewhat higher since included is the cost of establishing and operating waste treatment facilities. Final effluents are discharged directly into receiving streams.

[c]These figures include all costs, beginning at the growing facility (includes live-haul), and into the cooler (polyethylene bag). Shipping department costs are not included.

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AN ANALYSIS OF PROFIT MARGIN HEDGING STRATEGIES

IN THE BROILER INDUSTRY

by

Neil P. Shapiro

(ABSTRACT)

The focus of this study on hedging strategies differs from previous studies in four major ways: 1) both costs and selling price are simultaneously hedged, 2) profit margins are computed daily for up to nine months into the future, 3) hedges can be placed five to six months in advance of production, and 4) production costs and profit margins are computed on a weekly basis.

Weekly RTC iced broiler production costs were estimated using weekly changes in corn and meal prices and monthly changes in other feed costs, processing costs, transportation and offal value. Weekly production costs were compared to weekly N.Y.C. wholesale broiler prices to determine profit margins. These estimated weekly profit margins served as a benchmark for evaluating alternative hedging strategies.

Expected future monthly net profit margins (ENPM) using futures prices and basis estimates for corn, meal, and iced broilers were estimated daily using the production cost formula. The daily ENPM were analyzed to determine their ability to forecast actual profit margins. The ENPM's were poor predictors of actual profit margins. They

demonstrated seasonal biases and substantial over and under estimation of actual margins. Forecasted and actual profit margins varied inversely, so positive profit margins were locked in, while negative profit margins were not.

Five hedging strategies were developed based on the relationship discovered between expected and actual profit margins. Over the time period 1970-1975, these strategies doubled profit margins and cut profit margin variation substantially.