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To the Graduate Council:

I am submitting herewith a thesis written by René Gouin entitled "Some Aspects of the Temporal Structure of Prices on the Live Hog Futures Market." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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SOME ASPECTS OF THE TEMPORAL STRUCTURE OF PRICES
ON THE LIVE HOG FUTURES MARKET

A Thesis
Presented to
the Graduate Council of
The University of Tennessee

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
René Gouin
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ABSTRACT

Ten years ago most commodities traded in futures were of the storable type. It was commonly assumed that storability was a prerequisite for a commodity to be successfully traded in futures. However, several nonstorable commodities belonging to the livestock category were introduced on futures markets in the middle 1960's and have met with considerable success. Trading in live hog futures was introduced in 1966 on the Chicago Mercantile Exchange and is now a well-established market.

Since storability was until then conceptually associated with futures trading, this notion was quite central to the "classical" analysis of futures prices. A different frame of analysis is yet to be developed for nonstorable futures prices.

This study focuses on the temporal structure of hog futures prices. The prices of different futures traded at the same time for different times of delivery are considered as one price with a temporal structure, just as simultaneous prices of the same commodity on geographically dispersed market places can be considered as one price with a spatial structure. Thus, the purpose of this study was to search for, and hopefully identify, any systematic or permanent element in the temporal structure of live hog futures prices and to identify any typical reactions of the price structure to specific stimuli such as hog supply outlook news.

Graphical methods were judged appropriate for the exploratory character of this study. Particular features or behaviors in the temporal

price structure which appeared in the observations with a relative frequency greater than two-thirds were judged likely to have a systematic character and were therefore embodied in tentative generalizations termed "hypotheses."

Six hypotheses were eventually developed, pertaining to the following points:

1. the seasonal component in the temporal price structure;
2. futures prices' movements in time of unexpected, strong hog cash price movements;
3. the market's performance as a predictor of bullish or bearish cash markets;
4. the "phase" component in the temporal price structure, reflecting expectations of year-to-year supply variations;
5. the change in value of selected futures spreads over their "lives";
6. futures price changes immediately after the release of the U.S.D.A. Hogs and Pigs quarterly reports, and in the succeeding three months.

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CHAPTER I

INTRODUCTION

Futures markets have figured among American institutions for over a century now. Since the first futures market's inception in Chicago in 1867, futures trading has experienced increasing interest by speculators and hedgers¹ on an expanding number of products.

A futures market for live hogs was added to the list of commodities traded in March, 1966, by the Chicago Mercantile Exchange. The amount of interest in hog futures trading has grown steadily since then, and this market appears now to be well established.

Mechanics of Futures Trading

Futures trading can be defined as the purchase or sale of some commodity for delivery at a specified time in the future. Buyer and seller agree on the object of the transaction and on the price, but the actual transaction does not occur until a later time specified by the agreement or contract. In this sense, futures trading is not different from trading with deferred delivery and payment, or "forward selling."

However, futures trading more specifically designates such operations carried on within specialized institutions--the futures markets--and under strict sets of rules. A particularly important and always present provision is that a seller can always buy back his promise

¹Hedgers are market agents who hold actual commodities and seek to protect themselves against the risk of adverse price changes by taking part in the corresponding futures market. Speculators, on the contrary, seek profit by bearing the risks of price changes.

to deliver. Conversely, a buyer can always sell his right to receive the commodity.² Thus, a contract can be fulfilled either by actual delivery, or by an opposite contract. In the actual functioning of a futures market, however, most contracts are closed by opposite transactions rather than by delivery.

Futures trading also differs from forward selling in that contracts are impersonal. A commitment to deliver does not specify to whom the delivery is to be made; similarly, a commitment to receive delivery does not specify from whom the delivery is to be received. Thus, the holder of a short position can cancel his obligation by buying any contract of the same nature. This is possible because contracts are standardized: they carry the same provisions with respect to the nature of the commodity, to the quantity and quality, and to the time of delivery. At the time of delivery, it is the responsibility of the relevant Exchange to pair those buyers and sellers who did not close out their positions, in view of the settlement of their contracts through actual delivery.

For a given futures market and commodity, delivery is due during a specific period within the month that designates the contract. Thus, an expression such as "July 1972 live hog futures contract" completely describes a standardized contract.

²In the language of the trade, all participants in futures contracts are said to hold "open" positions. Those who contracted to deliver are said to hold "short" positions, or to "be short" on the market. Those who contracted to receive delivery are said to hold "long" positions, or to "be long" on the market. Whoever cancels his previous position by an opposite transaction is said to "close" his position; for example, if a person is "long," he later can "close" his position by going "short" in the same contract.

On the live hog futures market, trading of contracts calling for delivery in a particular month is, at present, generally opened by the Exchange about one year before the contract month. The market price of these contracts at a given time can be considered as the market's current expectation of the hog cash price during the delivery period. As the market modifies its evaluation of the future situation, futures contracts' prices are subject to change.

Background of Futures Trading

The list of commodities traded in futures markets is far from being permanently fixed. While the first commodities so traded were grains, other commodities have been introduced over the years, some of which were dropped when the experiment failed.

After the institutionalization of the first futures market in the second half of the nineteenth century, futures trading rapidly extended itself to most staple grains, to many grain derivatives, and to some other domestic agricultural commodities such as cotton, cotton products, and wool. Exotic agricultural commodities such as rubber, cocoa and coffee also became the object of active futures trading, as well as metals such as tin, platinum, silver and lead.

All the commodities mentioned above have in common a major characteristic bearing upon temporal price relationships, in that they are storable. Before 1960, only a few semi-perishable commodities were traded in futures, with uneven success. Trading in eggs and potatoes grew to relatively large volumes, but trading in onions met opposition and was stopped by law. Within the broad category of domestic

agricultural products, the volume of futures trading was not expanding over the thirty year period ending around 1960.³

By contrast, futures trading underwent a definite revival in the period beginning approximately in the early sixties, with the successful introduction of more storable commodities,⁴ and also of several major non-storable commodities which would have been considered unsuitable for futures trading only a few years before. These are live cattle, live hogs and live feeder cattle. The success met in futures trading by these three commodities neatly contradicted the idea thus far commonly held, that a commodity must be storable and standardized to be successfully traded in futures.⁵

Status of the Research on Futures Prices and Justification of the Study

Because the introduction of slaughter animals to futures trading is relatively recent,⁶ the bulk of the existing literature on futures prices deals, implicitly or explicitly, with storable commodities. Of particular importance are the writings of Holbrook Working, who developed

³According to A. B. Paul and W. T. Wesson, "The Future of Futures Trading in Our Changing Agriculture" (a paper given at Chicago Board of Trade Seminar, September, 1959), the volume of futures trading for 23 selected agricultural commodities, computed on the base 1931-1935 = 100, peaked at 121 in 1951-1955 and fell back to 100 in 1956-1958.

⁴For example, frozen pork bellies, frozen orange juice concentrate, lumber, foreign currencies.

⁵These conditions have been so commonly assumed that they are found in many textbooks. See for example Richard L. Kohls, Marketing of Agricultural Products (3rd ed.; New York: The Macmillan Company, 1967), pp. 340-341.

⁶Live cattle was introduced in November, 1964; live hogs in March, 1966; and feeder cattle in November, 1971.

a theory of temporal price structure on futures markets based on observations pertaining to wheat futures.⁷ The notion of storage is quite essential in this "classical" theory of futures prices. This feature was not considered to diminish the generality of this theory, since the concept of futures trading was closely associated with commodity storability. However, the central role played by storage in the "classical" theory makes it to a large extent unapplicable to non-storable commodities.

Since the middle 1960's, a new body of literature has begun to develop about non-storable futures. R. L. Ehrich⁸ studied the relationships between feeder cattle cash prices and the corresponding slaughter cattle futures prices. William G. Tomek and Roger Gray⁹ refined the distinction between storables and non-storables. They distinguished seasonally produced commodities with continuous inventories (corn), seasonally produced commodities with discontinuous inventories (potatoes), and continuously produced commodities with no inventory at all in the ordinary sense (live cattle). Analyzing year-to-year variations in

⁷ Among Holbrook Working's many publications on futures prices, some of the most important are: "Quotations on Commodity Futures as Price Forecasts," Econometrica, 10:39-52, January 1942; "Theory of the Inverse Carrying Charge in Futures Markets," Journal of Farm Economics, 30:1-28, February 1948; "The Theory of the Price of Storage," American Economic Review, 39:1254-1262, December 1949; "New Concepts Concerning Futures Markets and Prices," American Economic Review, 51(2): 160-163, May 1961.

⁸ R. L. Ehrich, "Cash-Futures Price Relationships for Live Beef Cattle," American Journal of Agricultural Economics, 51:26-40, February 1969.

⁹ William G. Tomek and Roger W. Gray, "Temporal Relationships Among Prices on Commodity Futures Markets: Their Allocative and Stabilizing Roles," American Journal of Agricultural Economics, 52:327-380, August 1970.

acreage planted in Maine potatoes, they found that these were reduced after the advent of a potato futures market.

However valuable the available literature may be, research on non-storable futures is still in infancy. While the structure of differences among spot prices and synchronous futures prices for various delivery periods, and its transformations over time, has been analyzed and explained in the case of storable commodities, the same task remains largely to be done in the area of non-storable commodities. Thus Leonard Haverkamp, when summarizing the status of research on futures trading,¹⁰ could state that "a void exists in the theory of cash-futures spreads for non-storable commodities." More recently, Thomas Hieronymus briefly dealt with the temporal structure of live cattle futures,¹¹ and formulated a few hypotheses about the behavior of this price structure. However, his treatment is too short to accomplish more than indicating a possible direction for more research.

Objectives of the Study

This study focuses on live hog futures prices. Although no publication, to the knowledge of this writer, has concentrated on this particular topic, it was felt that six years worth of data might yield some notion of how prices on the live hog futures market behave.

In order to make clear the general objective of this study, a

¹⁰Leonard Haverkamp, "Potential Developments in Futures Markets of Significance to Agriculture and Related Industries," American Journal of Agricultural Economics, 52:842, December 1970.

¹¹Thomas A. Hieronymus, Economics of Futures Trading for Commercial and Personal Profit (New York: Commodity Research Bureau, 1971).

few remarks about the dimensions of price seem appropriate. In a localized competitive market, there is at any one time a single prevailing price. But in a geographically dispersed market, different prices may prevail at any one time in different locations. In such a case there is a geographical price structure, and price can be said to have a spatial dimension.

The temporal dimension of a futures market can be compared with the spatial dimension of a geographically dispersed market. At any one time, the same commodity is priced for transactions scheduled to take place at different times in the future and possibly for present transactions. Thus, in a given futures market, at any one time, there exists a temporal price structure.

The general purpose of this study is to identify any systematic or permanent elements in the temporal price structure on the live hog futures market, and to identify any typical reactions of such a price structure to specific stimuli.

In the course of the development of this study, this broad purpose was gradually narrowed to the following objectives:

1. to identify a seasonal component in the temporal price structure of live hog futures prices.
2. to determine to what extent the temporal price structure is affected when strong and unexpected cash price movements occur.
3. to compare selected temporal price structures, considered as cash price forecasts, with the subsequent cash price movements when these were strong.

4. to identify a component reflecting the expectations of year-to-year variations in hog supplies.
5. to determine if there is any systematic manner in which some spreads¹² change during their "lives."¹³
6. to determine if the price structure changes in any systematic manner in the months following a major change in the hog supply outlook.

Procedure

The principal method of analysis used in this study involves a graphical representation of the temporal structure of live hog futures prices at successive points in time. At any one time, such a price structure can be represented by a line on a two-dimensional graph. Such lines will be called, for the purpose of this study, "futures profiles," or simply "profiles." For each point in time when the market is operating, a profile can be drawn to represent the market's temporal price structure at that point in time. Successive profiles are drawn at regular intervals in time, and examined for the purpose of identifying repetitive patterns or repetitive behaviors. If the frequency of occurrence of such patterns or behaviors appears sufficiently high, it will be tentatively concluded that such features are not random, but have a systematic character. For objectives 2 and 6, successive

¹²A spread is the difference in price, at a given time, between contracts for delivery in two different months.

¹³The "life" of a contract is the period during which this contract is quoted. Similarly, the "life" of a spread is the period during which the two contracts which determine the spread are simultaneously quoted.

profiles will be examined in relation with current supplies and with future supplies expectations derived from official production outlooks.

For practical purposes, a minimum relative frequency of occurrence greater than two thirds has been arbitrarily set before presenting the hypothesis that the event under consideration might have a systematic character.

Description of the Main Graphical Tool

To acquaint the reader with the mechanics of profile drawing and with the graphical presentation of the data, an example is presented here. On December 15, 1971, the following futures contracts were available for trade:¹⁴ December 1971, February, April, June, July, August, and October of 1972. The December 15, 1971, price quotations of these contracts form, when considered together, the December 15, 1971, profile. This profile can be represented, as in Figure 1, by a group of points on a graph where time is measured on the horizontal axis and price on the vertical axis. Figure 2 shows an alternative representation of the same profile, where the points from Figure 1 have been connected with straight lines. The latter representation is used in this study because of its greater readability when several profiles are represented on the same graph.

By January 15, 1972, the December 1971 contract had been terminated, and the December 1972 contract had been introduced on the market. The

¹⁴In the language of the trade, it is common to designate the set of all contracts of the same nature by the name of the element. Thus, "the December 1971 contract" designates the set of all December 1971 contracts. When no confusion is possible, this expression is abbreviated as "the December contract," or even more simply "the December."

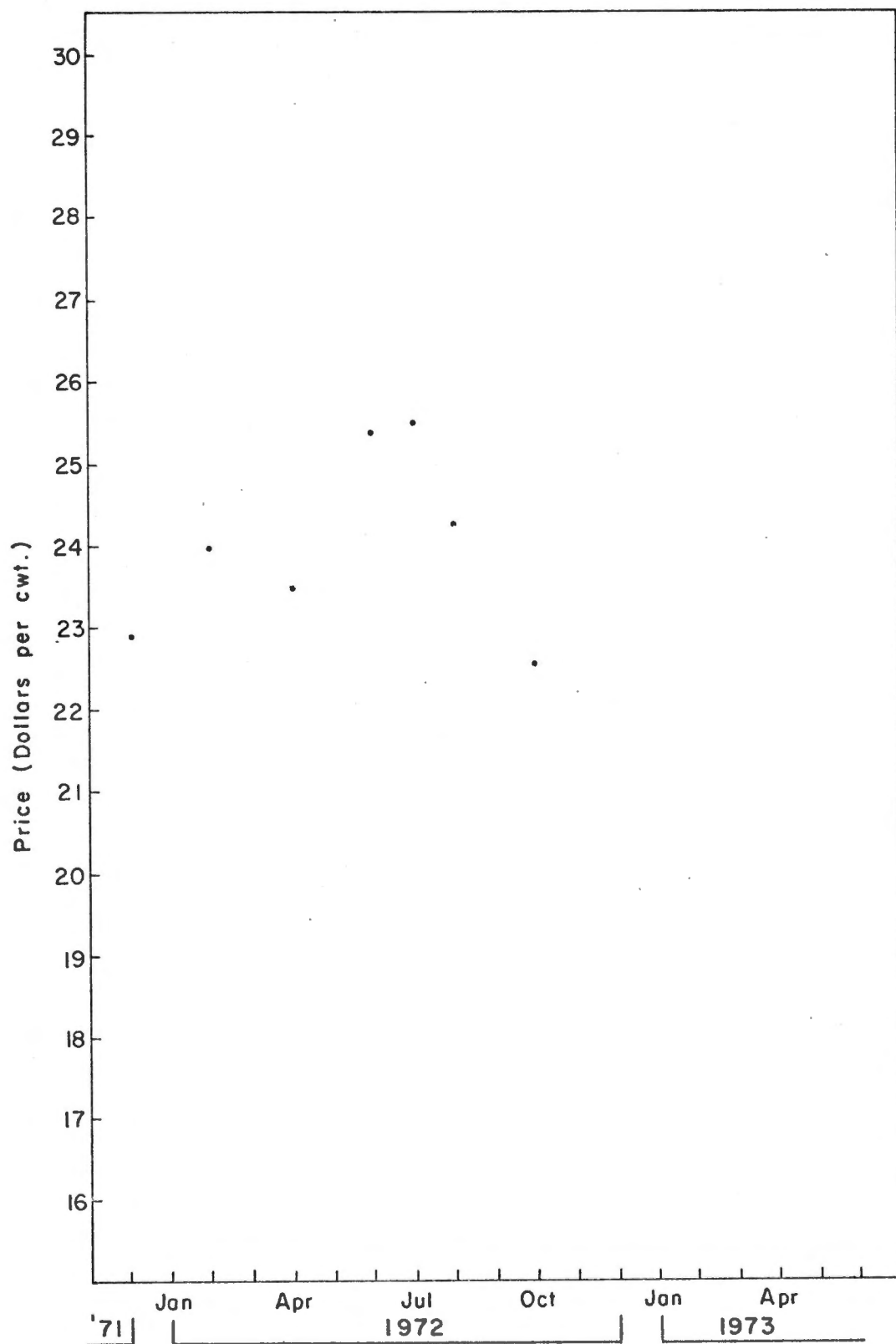


Figure 1. Point diagram of the December 15, 1971, futures profile.

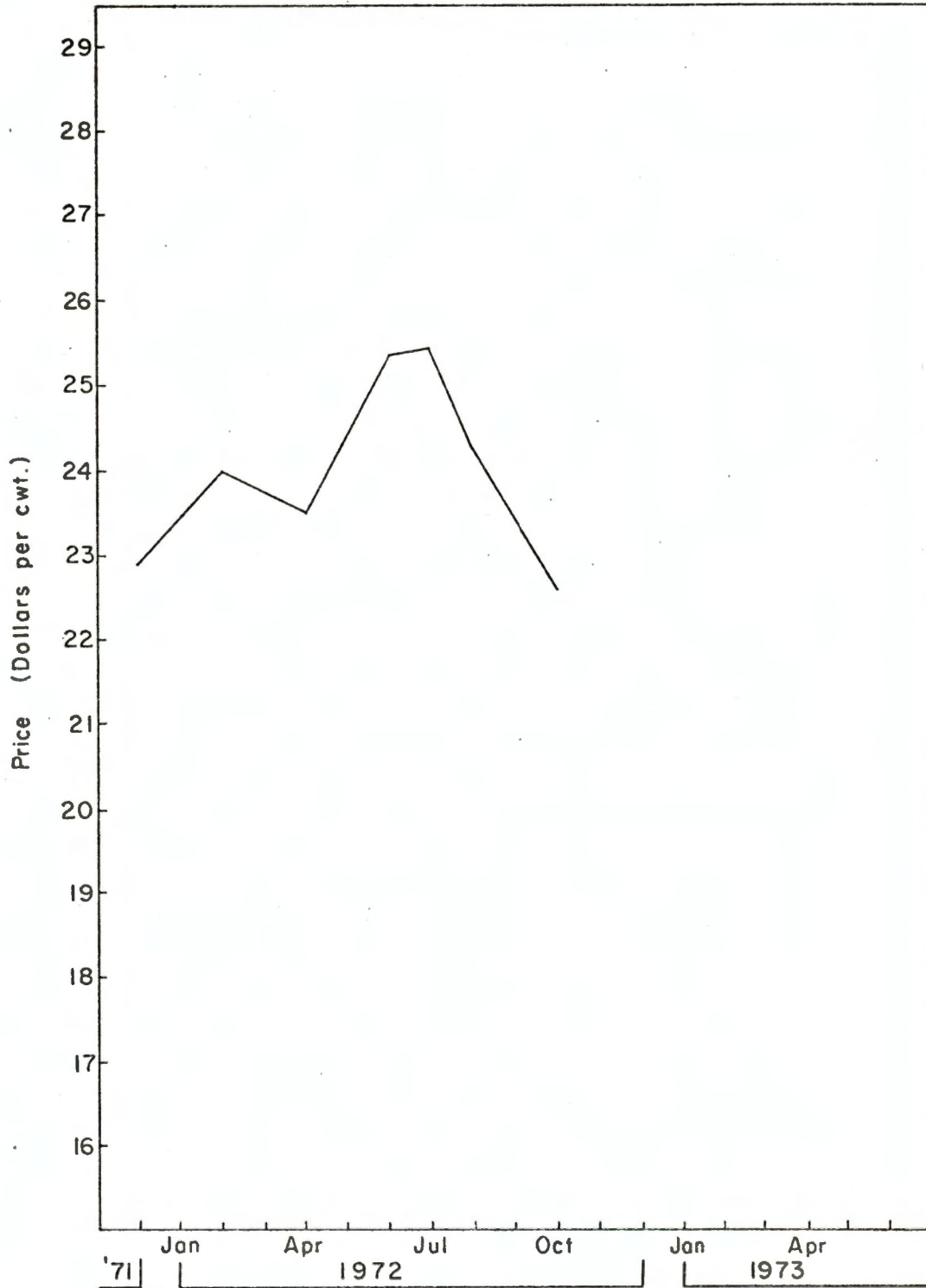


Figure 2. Line diagram of the December 15, 1971, futures profile.

January 15, 1972, price quotations of the different contracts available for trade at that time form together the January 15, 1972, futures profile. This profile can be represented on the same graph as the December 15, 1971, profile. This has been done in Figure 3, where four consecutive mid-month futures profiles are shown for simultaneous examination. Each profile is identified on the graph simply by its month. For example, the line indexed "March" and beginning in 1972 represents the March 15, 1972, profile. It is noteworthy that the January 15, 1972, profile does not begin with January, but with February, since there was no January 1972 contract. Similarly, the March 15, 1972, futures profile does not begin with March but with April.

For this study, one profile per month has been drawn for the period extending from March 1966 through March 1972. Each monthly profile was made from price quotations as of the fifteenth of the month, or the next business day in case of holiday. This series of monthly profiles is represented in Figure 20, Appendix. This figure is composed of one graph per quarter from the Spring of 1966 through the Winter of 1972. Each quarterly graph depicts the quarter's three mid-month profiles, as well as the preceding quarter's last profile, so that changes in prices of futures contracts can be seen at a glance.

Information taken from the U.S.D.A. Hogs and Pigs reports is shown in boxes superimposed on the graphs composing Figure 20, Appendix, and in Figure 4, shown below as an example. This information has been used in this study as an indication of future market supply estimates by time periods. These reports, released quarterly around the twentieth

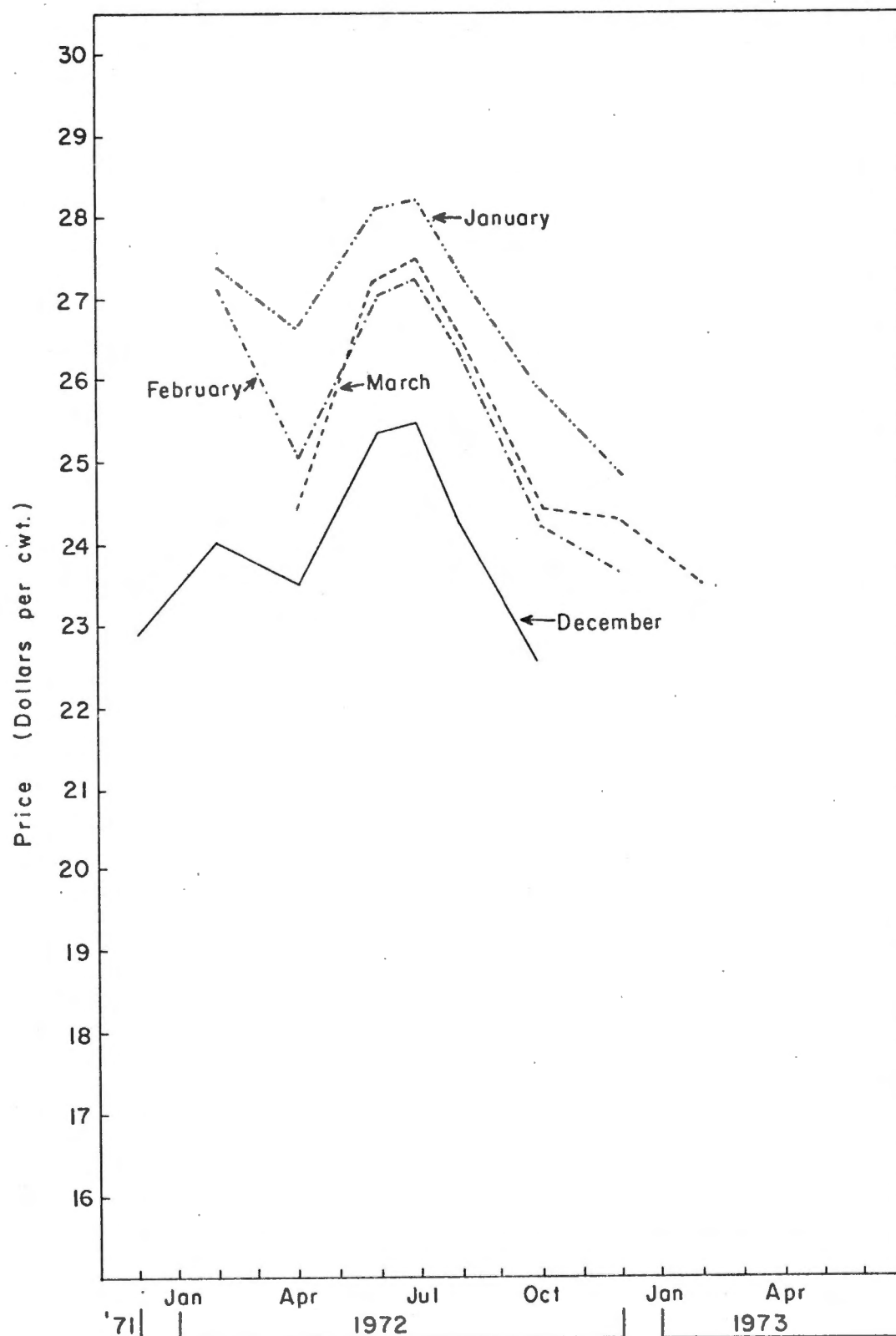


Figure 3. Representation of four different futures profiles on the same diagram.

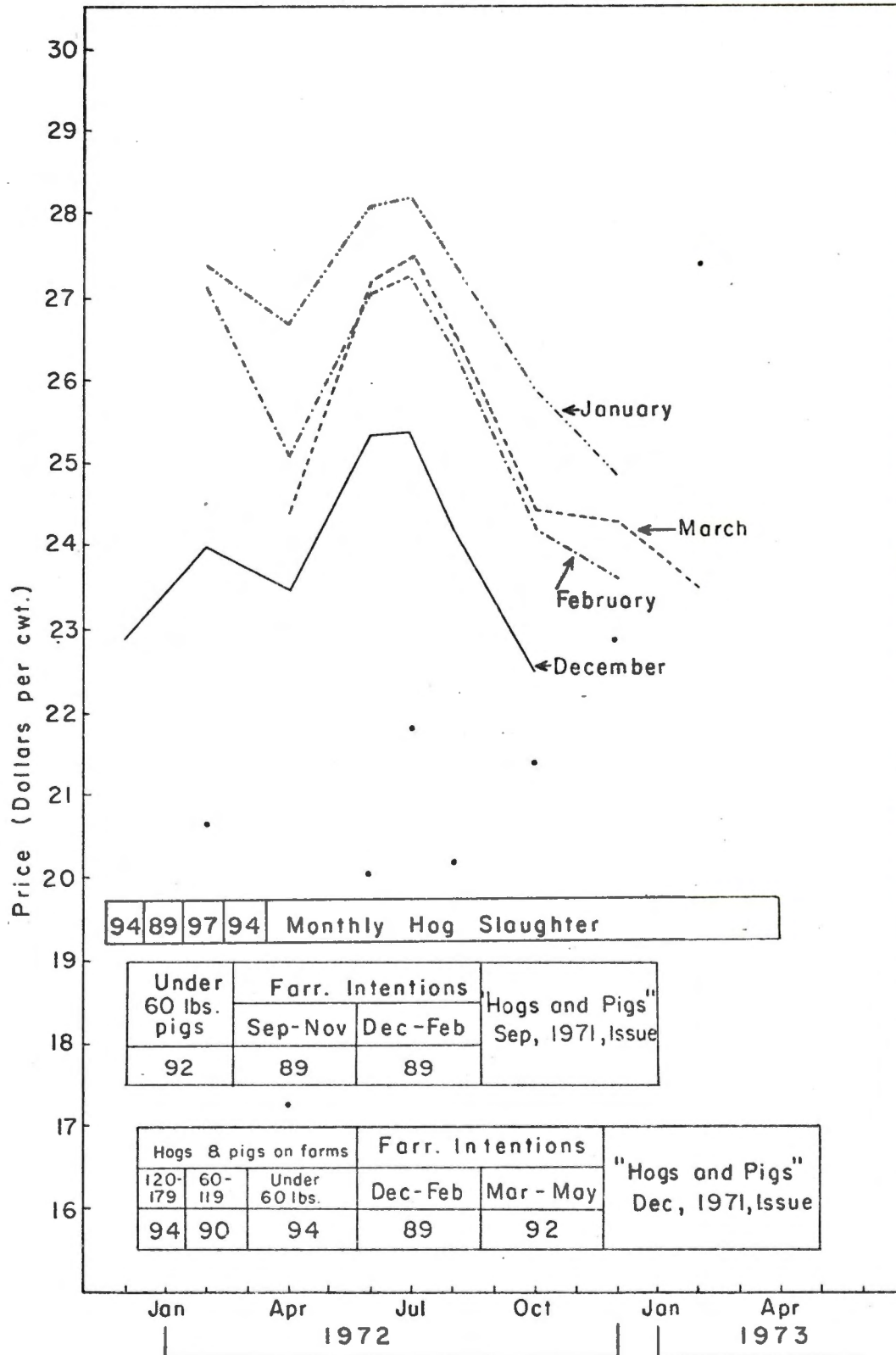


Figure 4. Example of quarterly graph : Winter, 1972.

of March, June, September and December of each year, contain essentially the following information:

- (1) a census of hogs and pigs on farms, divided into breeding and market categories. The market category is further subdivided into weight groups;
- (2) a count of farrowings and pig crops in the past quarters; and
- (3) a count of farrowing intentions for the next two quarters.

The information contained in the Hogs and Pigs reports is dated from the first day of the report month. Each quarterly issue releases information concerning ten mid-western states¹⁵ which produce about three-fourths of the hogs in the country. Information for the whole U.S. is published on a semi-annual basis in the June and December issues. This study made use of the quarterly series pertaining to the ten selected states rather than the semi-annual U.S. series because of the former's higher frequency of release. Each quarterly graph of Figure 20, Appendix, as well as the example of Figure 4, show data from the last report issued before the beginning of the considered quarter. These data are specifically the following:

- (1) the number of hogs and pigs on farms in the 120-179 lbs., 60-119 lbs., and under 60 lbs. weight groups, expressed as percentages of the same count made one year earlier;
- (2) the farrowing intentions for the two quarters following the survey, expressed as percentages of actual farrowings at the same time of the previous year.

¹⁵These are: Ohio, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, South Dakota, Nebraska and Kansas.

At the time of the January, February and March 1972 profiles, the latest issue of Hogs and Pigs was the December 1971 issue. Information from this issue is shown in the lower frame of Figure 4, page 14. However, at the time of the December 1971 profile, also represented on the figure for continuity, the December 1971 issue of Hogs and Pigs had not been released, and the latest supply outlook was still that provided by the September 1971 issue of Hogs and Pigs. To accompany the latter profile, that part of the information from the September issue of Hogs and Pigs which was still relevant on December 15 is also reproduced on Figure 4, in another frame.

All data from the Hogs and Pigs reports which are shown in the figure are percentages of last year, as mentioned above. Each percentage figure is set in a frame located on the graph to correspond, on the time axis, with the approximate marketing period of the considered group of pigs, or of the expected pig crop. For example, Figure 4 shows that, in the September 1971 issue of Hogs and Pigs, the number of pigs on farms in the under 60 lbs. weight group was estimated at 92 percent of last year's. Under assumptions explained below, pigs belonging to this weight group on September 1, 1971, would reach market weight approximately from the middle of December 1971 to early March 1972. To express this, the number 92 is set in a frame extending over the horizontal time axis from the middle of December 1971 to early March 1972.

For the purpose of this study, it has been assumed that it takes approximately 190 days (six months and one week) for a newborn pig to reach 220 lbs., considered as market weight. This time span has been further divided as follows:

birth to 60 lbs.	:	72 days
60 lbs to 120 lbs.	:	46 days
120 lbs. to 180 lbs.:	:	38 days
180 lbs. to 220 lbs.:	:	24 days

Figure 4, as well as the quarterly graphs of Figure 20, Appendix, also displays the prices of last year's "mature"¹⁶ futures contracts on the fifteenth of the contract month. The delivery period for a live hog futures contract is the two-week period ending on the twentieth of the contract month or the first business day prior to the twentieth in case of holiday. Thus, by the fifteenth of a contract month, the mature futures price and the cash market price are forced into approximate conformity by the possibility, or perhaps exercise, of arbitrage. For the purpose of this study, then, last year's mid-month futures price is taken to be last year's cash price and this year's mid-month mature futures price is taken to be this year's cash price. On the same graph, the prices of last year's mature futures contracts are represented by dots. These dots have not been connected to each other, to avoid confusion with futures profiles.

Finally, the last series of data in Figure 4, page 14, and Figure 20, Appendix, refers to the total weight of all hogs slaughtered in forty eight states, by months, expressed as a percentage of the same month last year.¹⁷

¹⁶ A futures contract is said to "mature" at the beginning of the delivery period, and is called a "mature contract" until the end of the delivery period, or termination.

¹⁷ The sources of these data are, for the period March 1966-December 1971: Livestock and Meat Statistics, 1972, Supplement for 1971 to Statistical Bulletin No. 333, Statistical Reporting Service, U.S.D.A.; and the January, February and March 1972, bulletins of Livestock Slaughter, Statistical Reporting Service, U.S.D.A.

CHAPTER II

STUDY OF MID-MONTH PROFILES

In this phase of the study, mid-month price profiles were studied in order to achieve the first four objectives. These profiles were examined and considered in relation to only that information reported on the graphs which would have been available to market participants at the time of their participation.

For the convenience of the exposition, each hypothesis developed in the text in fulfillment of the objectives is discussed prior to the evidence from which it is derived. A discussion of the evidence then follows immediately the statement of each hypothesis.

I. THE SEASONAL COMPONENT IN FUTURES PROFILES

Hypothesis I

Futures profiles generally display a seasonal pattern characterized by a summer peak, preceded by a price rise and followed by a price decline.

At the opening of the live hog futures market in March 1966, the first contract to be traded was the July 1966 contract. Contracts for delivery in every month from July through December 1966 were simultaneously introduced. Thus, the March 15, 1966, futures profile is represented on Figure 5 by a line extending from July through December 1966. Such a price decline at this season is similar, at least in its July to November portion, to the average seasonal pattern of

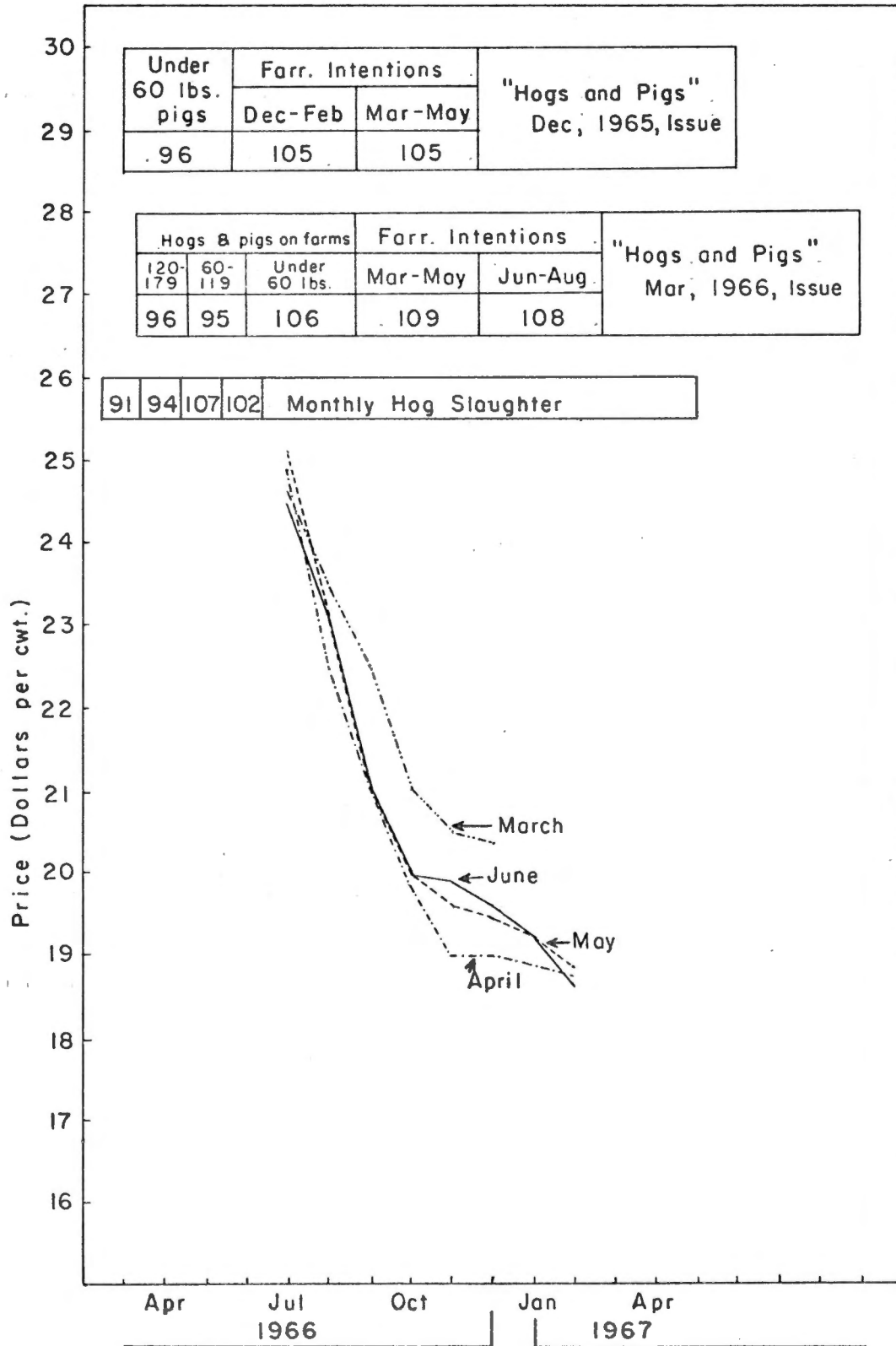


Figure 5. Spring, 1966: Monthly profiles, supply outlook, and hog slaughter.

hog cash prices,¹ represented in Figure 6.

Subsequent profiles dated from April, May and June 1966 are also shown on Figure 5. They also display a clear price decline from July on.

Examination of the complete series of graphs in Figure 20, Appendix, yields the observation that almost all relevant profiles display a price decline following the summer, with some variability in amplitude and timing. This summer peak is located in June, July or August and the price decline sometimes continues into the following winter. This feature, recurring in futures profiles for approximately the same period of the year, clearly has a seasonal character.

For the purpose of determining a frequency of occurrence, a price decline following the summer is defined as a continuous price decline of any magnitude, beginning in one of the summer contract months (June, July or August) and extending at least through October.²

Thus, only profiles extending at least from August to October were considered. It was found that, out of 43 considered profiles, 41 featured a price decline as defined above. By the criterion of a minimum frequency of two-thirds, the hypothesis that futures

¹Hog prices are subject to strong seasonal variations due to the seasonal character of the supply. In summer, reduced marketings bring about relatively high prices. The peak production period occurs in late fall and is associated with lower prices. This usual seasonality of prices is considered here as distinct from strongly bullish or strongly bearish markets. For an explanation of the supply seasonality, see, for example, B. G. Hicks, What Sets Hog Prices? The University of Tennessee Agricultural Extension Service Publication 473 (Knoxville: University of Tennessee Press, September 1969).

²After 1968, the number of contract months was reduced to seven per year. November was not among the remaining contract months.

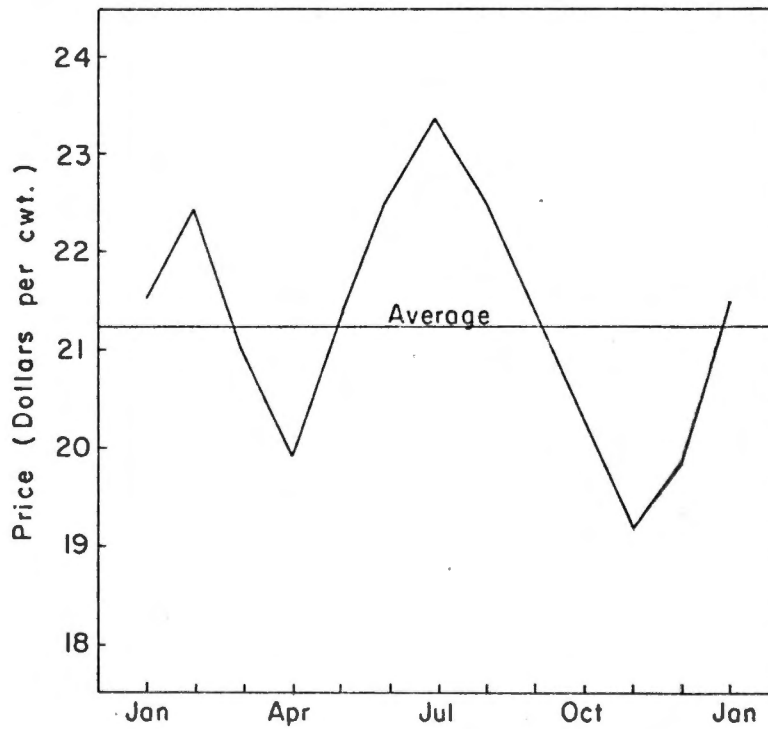


Figure 6. Average seasonal pattern of hog prices, 1966-1971.¹

¹ Derived from monthly average prices for barrows and gilts at eight midwestern markets combined.

profiles display a price decline following the summer can be retained.

Figure 6 also shows that cash prices exhibit a price rise preceding the summer which on the average extends itself from April to July. Futures profiles were examined to identify a similar seasonal pattern in the temporal structure of futures prices. For this purpose, a price rise preceding the summer was defined as a continuous price rise, of any magnitude, from April to one of the summer contract months (June, July or August). Only profiles extending at least from April to June were considered. A count made from Figure 20, Appendix, showed that out of 41 relevant profiles, 40 displayed a price rise as defined above. Thus, such a price rise can also be considered a systematic feature of futures profiles.

The average seasonal pattern of cash prices, shown in Figure 6, also shows a secondary peak in February. Unlike the primary summer peak, the February peak does not seem to have a counterpart in futures profiles. Only 15 out of 39 relevant profiles showed a price rise between December and February. And only 25 out of 39 relevant profiles showed a price decline between February and April. Since both frequencies are less than two out of three, it was determined that futures profiles cannot be considered to systematically feature a secondary maximum in February.

In conclusion, futures profiles usually display a pre-summer price rise, a summer peak, and a post-summer price decline similar to the cash price seasonality in the spring-fall period. However, futures profiles do not show a seasonality comparable to that of cash prices for the fall-spring season. Although the reason for this is not clear,

it may be worth noting that the summer peak appears clearly with a high regularity in cash price time series. By contrast, the winter peak, although showing up on the average, is characterized by a much greater variability.

II. CHANGES IN THE TEMPORAL PRICE STRUCTURE OF FUTURES PROFILES, IN RELATION TO UNEXPECTED, STRONG CASH PRICE CHANGES

Hypothesis II

When an unexpected, strong cash price rise occurs over a considered period, all futures prices rise during the same period. Inversely, when an unexpected, strong cash price decrease occurs, all futures prices fall in the same time.

Another objective assigned to this study was to determine to what extent the temporal price structure of the futures market is affected when unexpected, strong cash price movements occur, or, in graphical terms, to determine the futures profiles' behavior in such circumstances.

In order to achieve this objective, it is necessary to clarify what is meant here by unexpected cash price change. An unexpected cash price change will be said to occur over a considered period of time if the cash price at the end of this period turns out to be different from the forecast of this specific price made at the beginning of this period.

The only price forecasts with which this study is concerned are futures prices. It has been mentioned earlier that during their delivery periods, mature futures prices are forced into approximate

conformity with cash prices. Mature future prices, therefore, are in essence a particular type of cash price. Moreover, a mature futures price is precisely the specific type of cash price whose forecast was previously expressed by the price of the same futures before maturity. In keeping with this clarification, it may be said that an unexpected cash price movement occurs over a considered period when the price of a contract which is mature at the end of this period turns out to be different from its price at the beginning of the period.

Futures profiles used here are drawn at monthly intervals, as of the fifteenth of each month. However, not all calendar months are contract months,³ so that not all profiles include a mature futures price. In order to resolve this difficulty, it is necessary to slacken somewhat the above definition of an unexpected cash price change. For practical purposes, it will be said that an unexpected cash price movement occurs in the time period separating two consecutive mid-month profiles when the price of the near futures⁴ changes over that period.

In addition, such an unexpected cash price movement will arbitrarily be typified as "strong" if it equals or exceeds one dollar per hundredweight.

³After some variations in 1966, 1967 and 1968, the list of contract months has become fixed and includes February, April, June, July, August, October and December. Thus, the interval between contract months is either one or two months.

⁴The near futures is understood here as the futures which matures at the end of the considered one-month span or, by default, as the futures which is closest to maturity.

An example of such an unexpected, strong cash price change between two consecutive months is illustrated in Figure 7. This figure shows four mid-month profiles from December 1968 to March 1969. The January profile shows that on January 15, 1969, the nearest futures was the February, quoted \$19.40. On February 15, this futures was mature and, as shown by the graph, was worth \$21.00. Thus, during the January 15-February 15 period, the near futures rose by \$1.60. This is taken to mean that an unexpected, strong cash price change occurred during this period.

During the following period, between February 15-March 15 period, the near futures was the April, because there was no March futures. Comparison of the February profile with the March profile shows that, during this one-month period, the near futures rose by \$1.85. Again, this is taken to indicate that an unexpected, strong cash price change occurred during this period.

On the same graph one can see that between December 15, 1968, and January 15, 1969, the near futures, that is the February futures, rose by \$.45. By the above stated criterion, this is an unexpected cash price movement, but is not considered "strong."

Figure 7 illustrates a rather typical market behavior when unexpected, strong cash price changes occur. Between January 15 and February 15, all futures rose by amounts approximately equal to the near futures price rise (\$1.60). Thus, the February profile seems to be approximately generated from the January profile through an upward translation.⁵

⁵However, the February profile includes the August futures, while the January profile does not extend beyond July. The comparison, therefore, applies only to the February-to-July portions of the profiles.

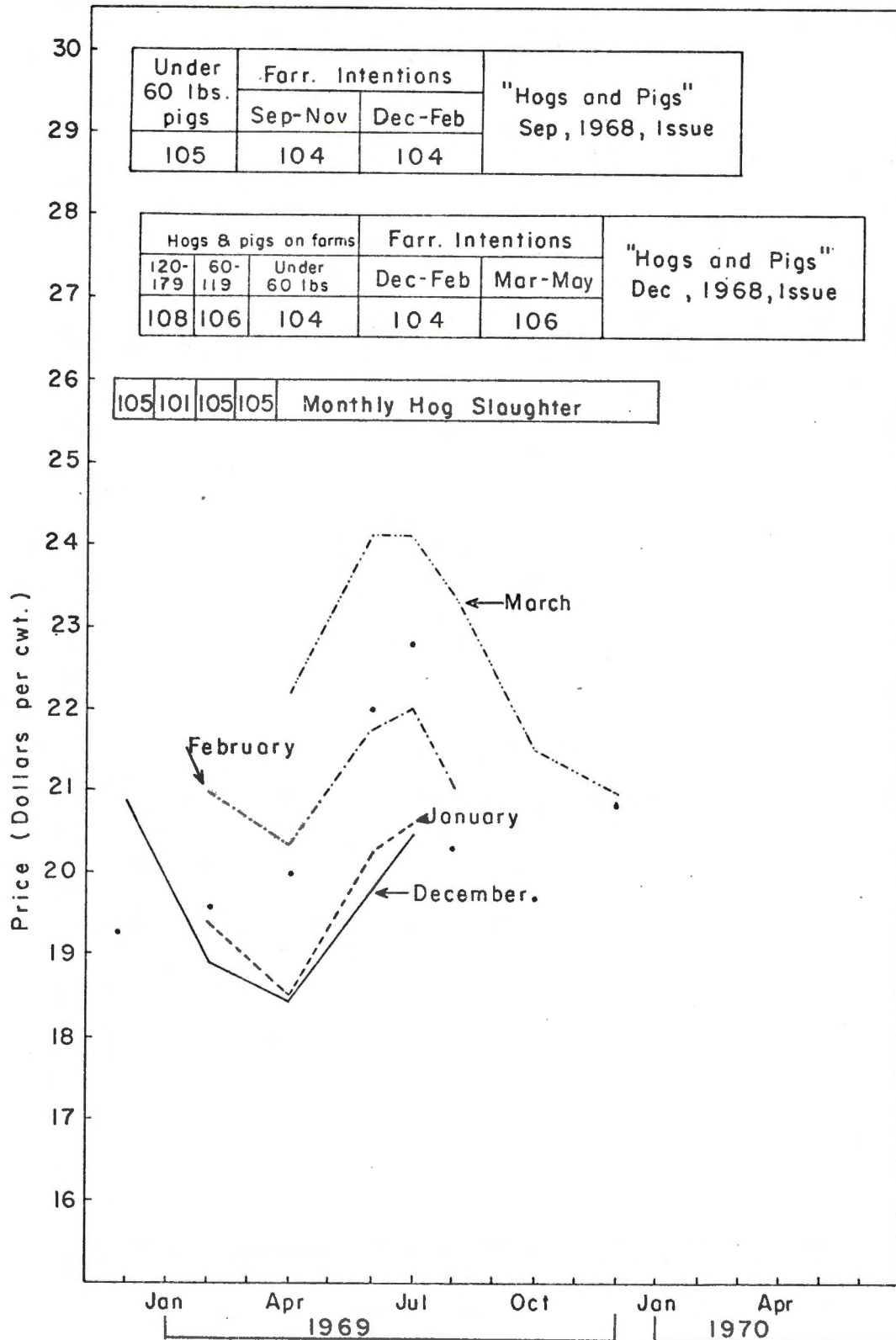


Figure 7. Winter, 1969: Monthly profiles, past years' cash prices, supply outlook, and hog slaughter.

Similarly, the March profile is apparently related to the February profile by an unward shift. Alternatively, it can be said that the February and March profiles are roughly parallel.

When several such shifts occur in successive months, the graph displays a "scaling up" configuration, as in Figure 7. Examination of the graphs covering the Winter 1969 to Winter 1970 period shows that such an escalation of the profiles by successive upward steps is typical of the profiles' behavior during this period.

In a similar manner but in the opposite direction, a succession of downward shifts occurred from March through June 1970, and from September to November 1970. From October 1971 to January 1972 a new series of upward shifts or scaling up occurred again.

The profiles' transformations described above are not, however, strict translations. There are some independent variations among futures prices, so that these do not rise by exactly the same amounts.

To summarize the qualitative observation derived by a visual examination of the mid-month profiles, it can be said that futures profiles tend to undergo approximately parallel shifts when unexpected, strong cash price movements occur. The confirmation of such an observation, however, calls for a frequency count. Because it is difficult to define precisely an "approximately parallel shift," the question under examination was reformulated in a more readily definable fashion: do the prices of all futures rise when an unexpected, strong cash price rise occurs, and do they fall when an unexpected, strong cash price decrease occurs?

A precise count, based upon the definitions above, was made from

the complete series of mid-month futures profiles represented in Figure 20, Appendix. In 26 cases, the nearest futures changed by \$1.00 or more over a one-month period. Among these, there were 20 observations where all other futures prices changed in the same direction as the near futures price, and 6 observations where the two considered profiles crossed each other. Thus, the relative frequency of positive observation was about .77. It appears, therefore, that Hypothesis II as stated above can be retained by the two-thirds criterion.

III. FUTURES PRICES AS PRICE FORECASTS: PERFORMANCE IN TIMES OF BULLISH AND BEARISH⁶ MARKETS

Hypothesis III

The futures market does not correctly forecast major bull or bear markets.

The discussion of Hypothesis II drew attention to the "scaling up" configuration of futures profiles from the Winter of 1969 to the Winter of 1970, and again from the Fall of 1971 to the Winter of 1972. It was also mentioned that futures profiles displayed a "scaling down" configuration in the Spring and in the Fall of 1970. Such configurations present two major characteristics. First, cash prices rise persistently, month after month, or fall persistently. And, second, successive futures profiles generally behave in conformity with Hypothesis II. Thus, in such circumstances futures prices are

⁶When cash prices rise persistently, the market is said to be a "bull market," or to be "bullish." Inversely, when prices fall persistently the market is said to be a "bear market," or to be "bearish." The present section will elaborate on this notion.

repeatedly adjusted in the same direction. This observation suggests the idea that futures prices do not accurately forecast cash prices in times of bull or bear markets. In order to determine the validity of this hypothesis, it seems necessary to first discuss the notion of bull or bear markets.

It has been said above that hog cash prices feature seasonal variations. Aside from irregular movements, they also are known to have variations generally termed "cyllical." By this it is meant that hog prices go with some degree of regularity through wide oscillations, each of which is completed in about three to five years. On the upswing of such an oscillation, the seasonal rises are emphasized, while the seasonal decreases are minimized, cancelled or even inverted. If such a rising phase lasts for a year or more, there is an important price rise from a given season to the same season in the following year. Alternatively, the rising phase of a hog price "cycle" can be called a "bull market" if the price rise is evident and strong.⁷ Similarly, the downswing phase of such a wide price oscillation can be called a "bear market." To exemplify the notion of bull or bear markets, Figure 8 shows the series of mature futures prices, taken as cash prices, from July 1966 to February 1972. On this graph, a seasonality comparable to that of Figure 6, page 21, can be discerned, with prices rising each year in the Spring, reaching a peak in the Summer and falling

⁷These oscillations are irregular in amplitude as well as in duration. For example, from 1961 through 1964, the "cyllical" component of hog prices was unnoticeable or quite weak. Prices never changed by as much as \$3.00 from any given month to the same month in the following year. Then prices rose sharply and suddenly, from about \$16.00 in January 1965 to about \$28.00 in January 1966.

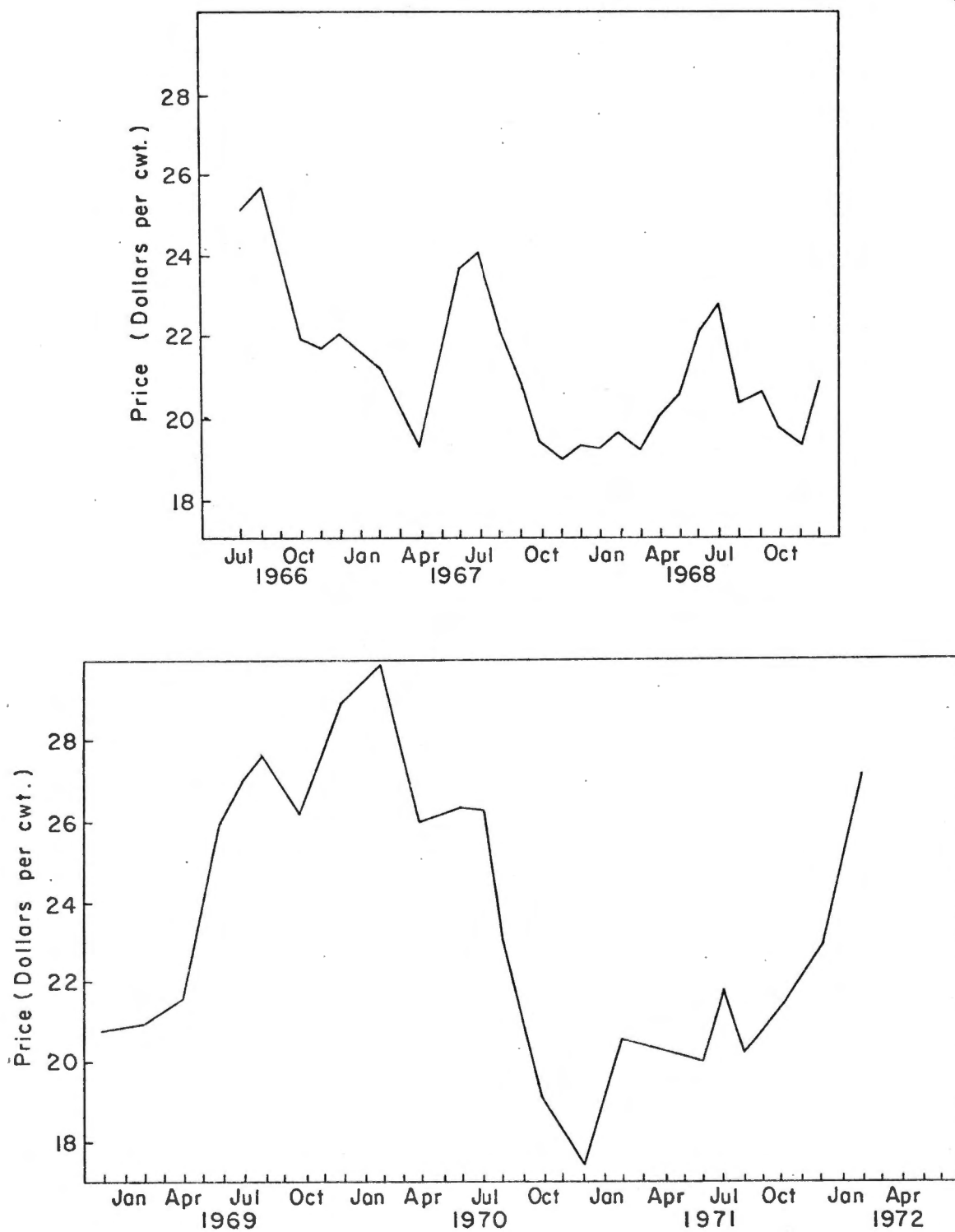


Figure 8. Mature hog futures prices, July 1966 to February 1972.

in the Fall. But the lower part of this graph also displays strong oscillations of the "cyllical" type, from 1969 to 1972. A bull market practically covered the whole year 1969, as prices rose by about \$8.00 between December 1968 and December 1969. This was followed in 1970 by a bear market, with prices falling by \$11.50 from December 1969 to December 1970. Another bull market began in late 1971. While the average seasonality generally yields prices which are higher in August than in February, actual prices in this instance rose from August 1971 to February 1972 by about \$6.00. Thus, two bull markets and a bear market can be identified in hog cash prices since the futures market's inception.

As a rough measure of the performance of the futures market as a predictor of bull or bear markets, the price of the most distant futures quoted at the beginning of the bull or bear market will be compared with the maturity price of the same futures. The forecast will be considered accurate if within \$1.00 of the actual price, fair if within \$5.00, and poor otherwise.

For the purpose of applying this criterion to the 1969 bull market, it is necessary to locate, at least approximately, the time of its beginning. Through comparison of Figure 8 with the average seasonality shown in Figure 6, page 21, one can see that prices had risen between December 1968 and February 1969 by an amount smaller than the average seasonal rise. On the other hand, between February and April 1969, prices rose in a season during which they usually fall. Thus, the 1969 bull market will be considered to have begun in February 1969.

Figure 9 shows that the actual cash price evolution did not

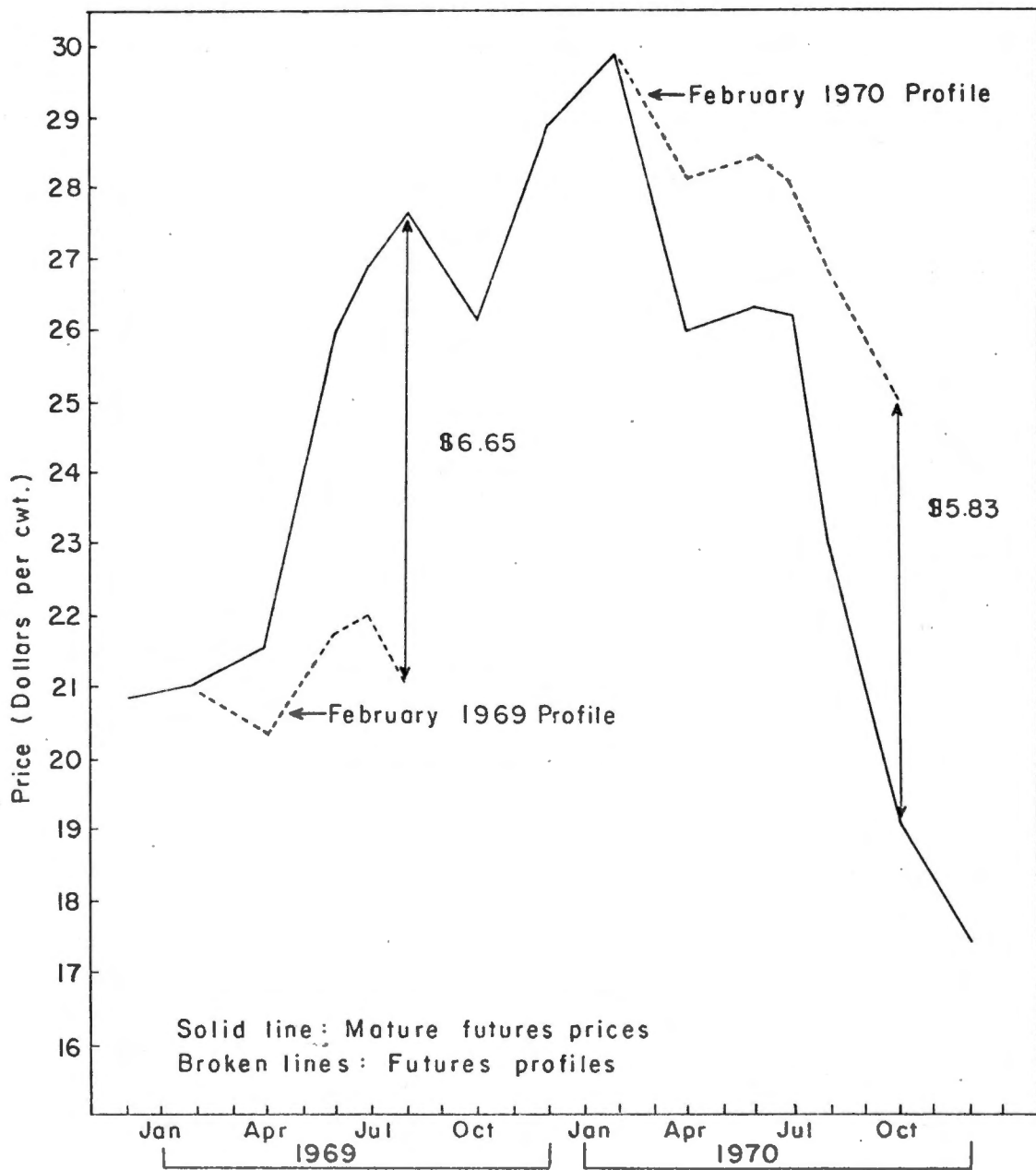


Figure 9. Mature futures prices,¹ December 1968 thru February 1972, and selected futures profiles.

¹ Quotations as of the fifteenth of the delivery month.

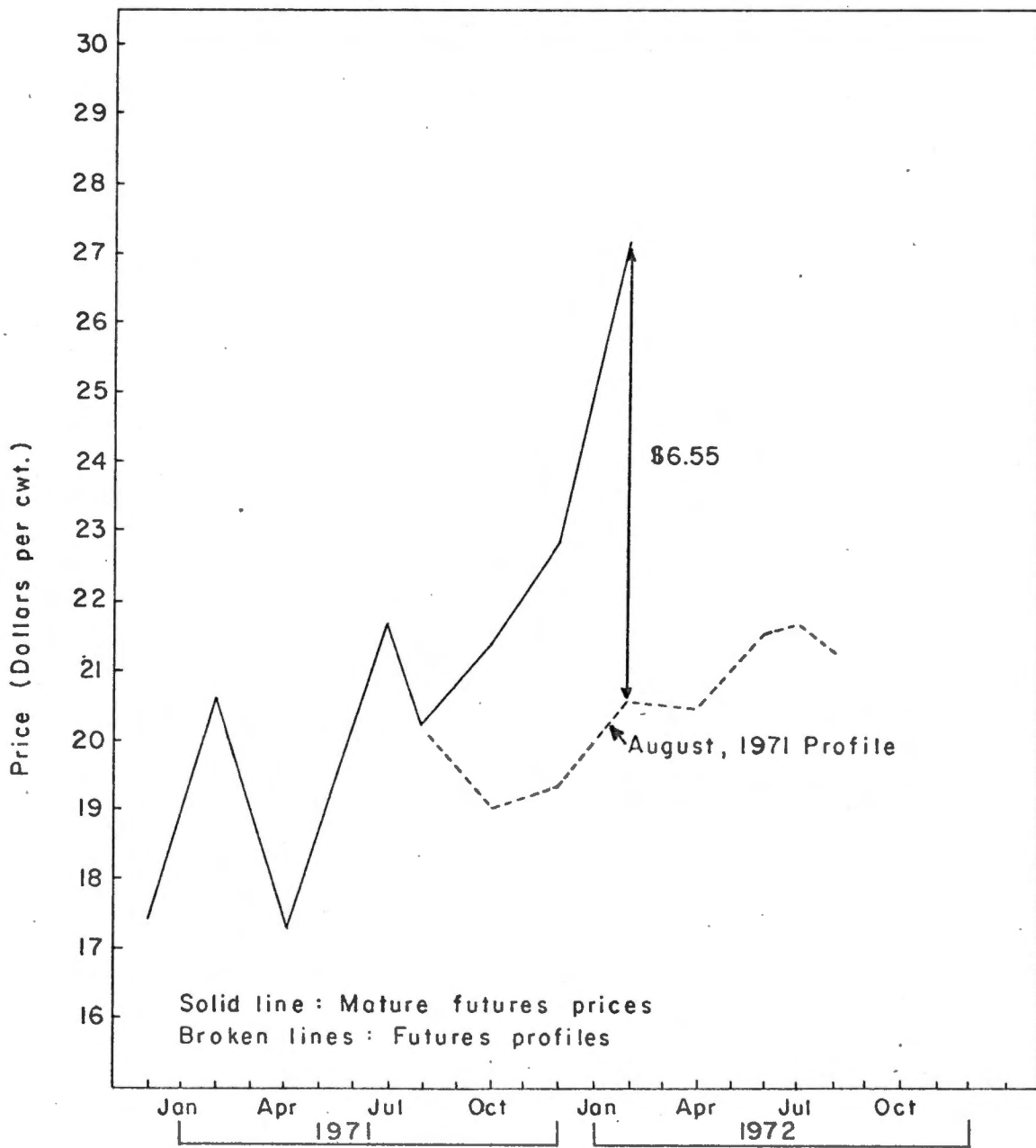


Figure 9. (continued)

coincide at all with the February 1969 profile. In fact, the most distant futures quoted in February, that is the August futures, was undervalued by \$6.65. The 1969 bull market, therefore, was poorly forecast.

The beginning of the 1970 bear market will be located in February 1970, after a seasonal price rise from December 1969 to February 1970, and before an exceedingly sharp price decline from February 1970 to April 1970. The February 1970 profile, also shown in Figure 9, again does not coincide with the eventual cash price evolution. The October 1970 futures, which was the most distant futures in February, was overvalued by \$5.83. The conclusion is, therefore, that the 1970 bear market was also poorly forecast.

After the first half of the year 1970 had featured seasonal price variations seemingly accentuated by irregular movements, the beginning of the second bull market can be located in August 1971.⁸ In this case, the most distant futures from the August 1971 profile which can be effectively compared with its maturity price is the February 1972 profile.⁹ From Figure 9, one can see that, in August 1971 the February 1972 futures was undervalued by \$6.55. It must be concluded that this bull market was not correctly forecast.

Three bull or bear markets were considered here. In all three cases, the price forecasts represented by the most distant futures

⁸ Prices had fallen from July to August, as in the average seasonal pattern, but then rose instead of falling from August to October.

⁹ This study uses only the information which was available before April 1, 1972. Thus, maturity prices of futures more recent than the February 1972 futures are considered unknown.

turned out to be wrong by more than \$5.00 and were typified as poor. Thus, it is tentatively generalized that the futures market does not accurately forecast bull or bear markets.

IV. REFLECTIONS IN FUTURES PROFILES OF EXPECTED YEAR-TO-YEAR SUPPLY VARIATIONS

Hypothesis IV

In combination with irregular and seasonal components, futures profiles possess another component reflecting expectations of year-to-year supply variations.

The observation that the futures market does not correctly forecast major bull or bear markets does not imply that it never anticipates such markets. It seems, on the contrary, that the futures market can, and at times does, show expectations of price movements other than seasonal or irregular. However, the incorrect timing and magnitude of such expectations, if they exist, results in major bull or bear markets not being correctly forecast.

It is the purpose of this section to demonstrate that the temporal structure of hog futures prices does indeed possess a component other than seasonal or irregular, which reflects expectations of year-to-year supply variations.

Such a component would be the counterpart in futures prices of the "cyclical" components of cash prices.¹⁰ However, it cannot materialize as cyclical, because a futures profile spans only one year,

¹⁰Cyclical variations in hog prices are linked to inverse variations in supplies, in a fashion known as the "cobweb theorem."

approximately, and therefore cannot display a feature whose period is about four years. The futures market may, nevertheless, display one phase of a cycle; that is, a portion of an oscillation lasting several years. For example, if the futures market expects prices to go through a rising phase during the coming year, the relevant futures profile would display an upward general slope in combination with seasonal and irregular features.¹¹ In keeping with this analogy, and for the convenience of the discussion, the component reflecting expectations of year-to-year variations will be called "phase component." The manifestations of the phase component will be discussed over the 1969-1972 period, because such a component was more in evidence during this period of strong cash price fluctuations. At the same time, the phase component will be interpreted by reference to supply expectations. Finally, a frequency count will be made, on the whole 1966-1972 period, of the profiles which seem to display a phase component related to expected year-to-year supply variations.

During the bull market which began in late 1968 or early 1969, the futures profile started displaying a seasonality imposed on, or combined with, a falling phase component. This component gradually became stronger as the cash market confirmed itself as bullish, and can first be seen clearly in the September 1969 profile, represented in Figure 10. As can be noted in Figures 10 and 11, the profiles from September 1969 through February 1970 have in common a downward slope with a small price rise before the summer months. Data from the

¹¹In this case, the seasonal rises could be emphasized while the seasonal falls would be reduced, or even cancelled if the upward general slope is sufficient.

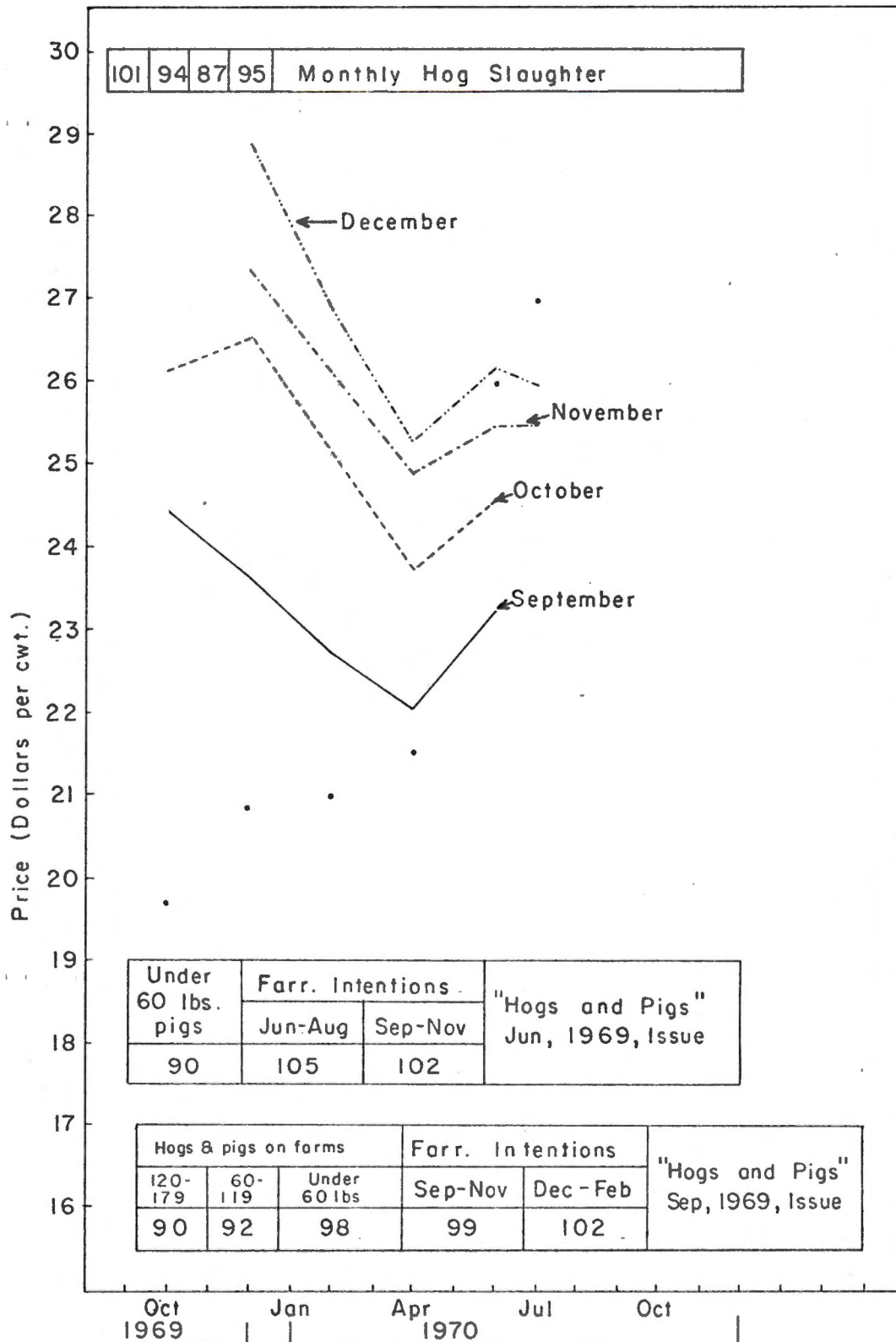


Figure 10. Fall, 1969: Monthly profiles, past year's cash prices, supply outlook, and hog slaughter.

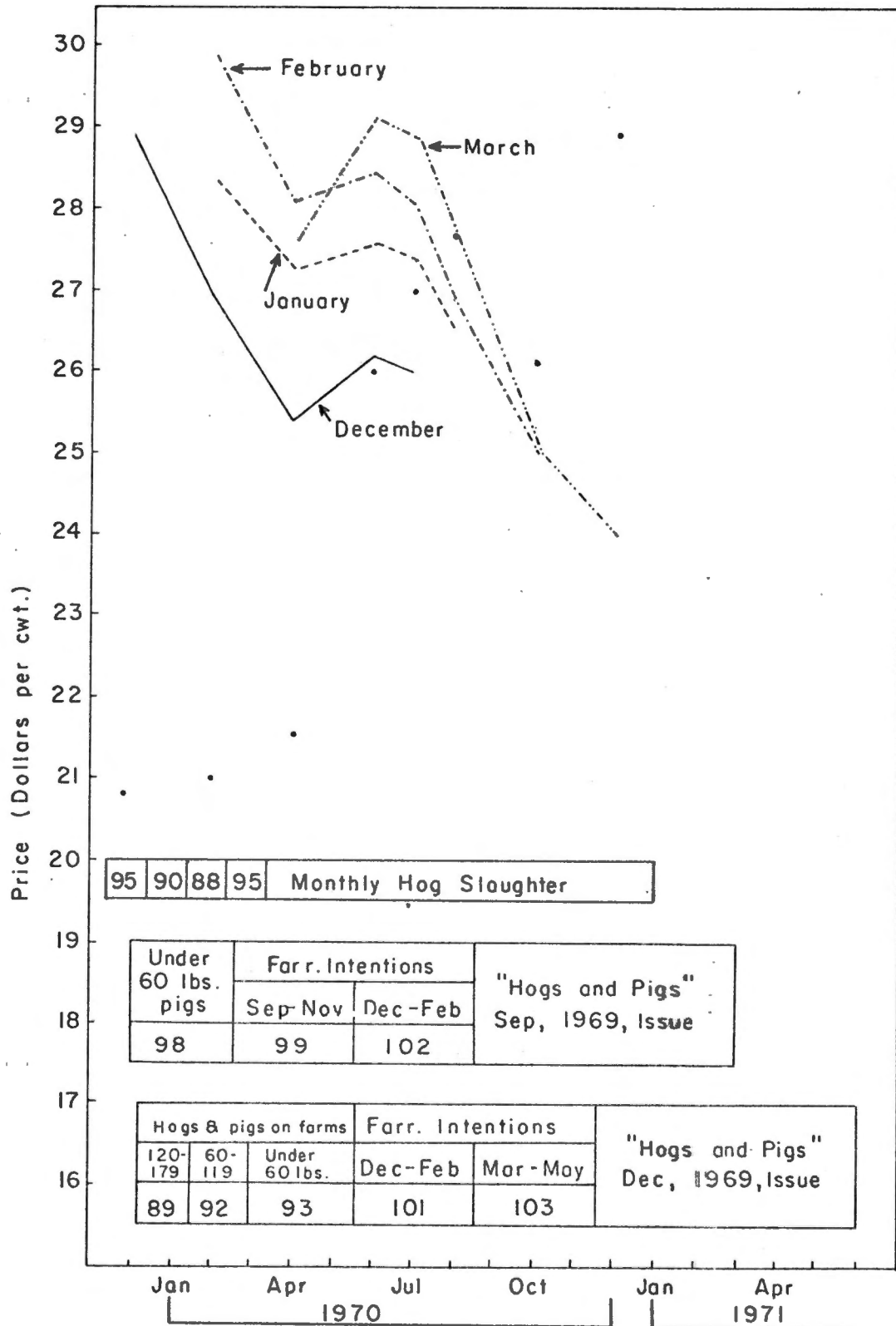


Figure II. Winter, 1970: Monthly profiles, past year's cash prices, supply outlook, and hog slaughter.

Hogs and Pigs reports, reproduced on Figures 10 and 11, generally indicated that supplies were likely to increase from below last year's levels to above last year's levels. With indicated supplies below last year's, futures prices are above last year's prices; and inversely, with indicated supplies above last year's, futures prices are below last year's prices. Thus, the general slope of these profiles is consistent with the Hogs and Pigs supply outlook. The seasonal pattern, however, is still in evidence; but, due to the profiles' general downward slope, the seasonal price rises are minimized and the seasonal price drops are emphasized. This same general profile shape can be seen throughout the bear market which started during the late Winter of 1970. For example, the seasonal drop from June to December 1970, indicated by the June 1970 profile, represented in Figure 12, is about \$6.15; this is considerably more than the average of about \$2.70. The market, during this period, appeared to determine the futures profiles general slope, or phase component, by looking to the Hogs and Pigs reports as the best indication of relative supplies. This is indicated by the fact that the profiles have a decided tendency to cross last year's cash prices from above to below when the data from Hogs and Pigs indicate a change in supplies from less-than to greater-than last year.

The Spring 1971 set of profiles, represented in Figure 13, is a good example of seasonality imposed on a rising phase component. Both the December 1970 and March 1971 Hogs and Pigs reports suggested that supplies would progressively change from larger to smaller than last year during the year 1971. Consistently, the futures profiles displayed an upward general slope, with early 1971 futures prices well below the

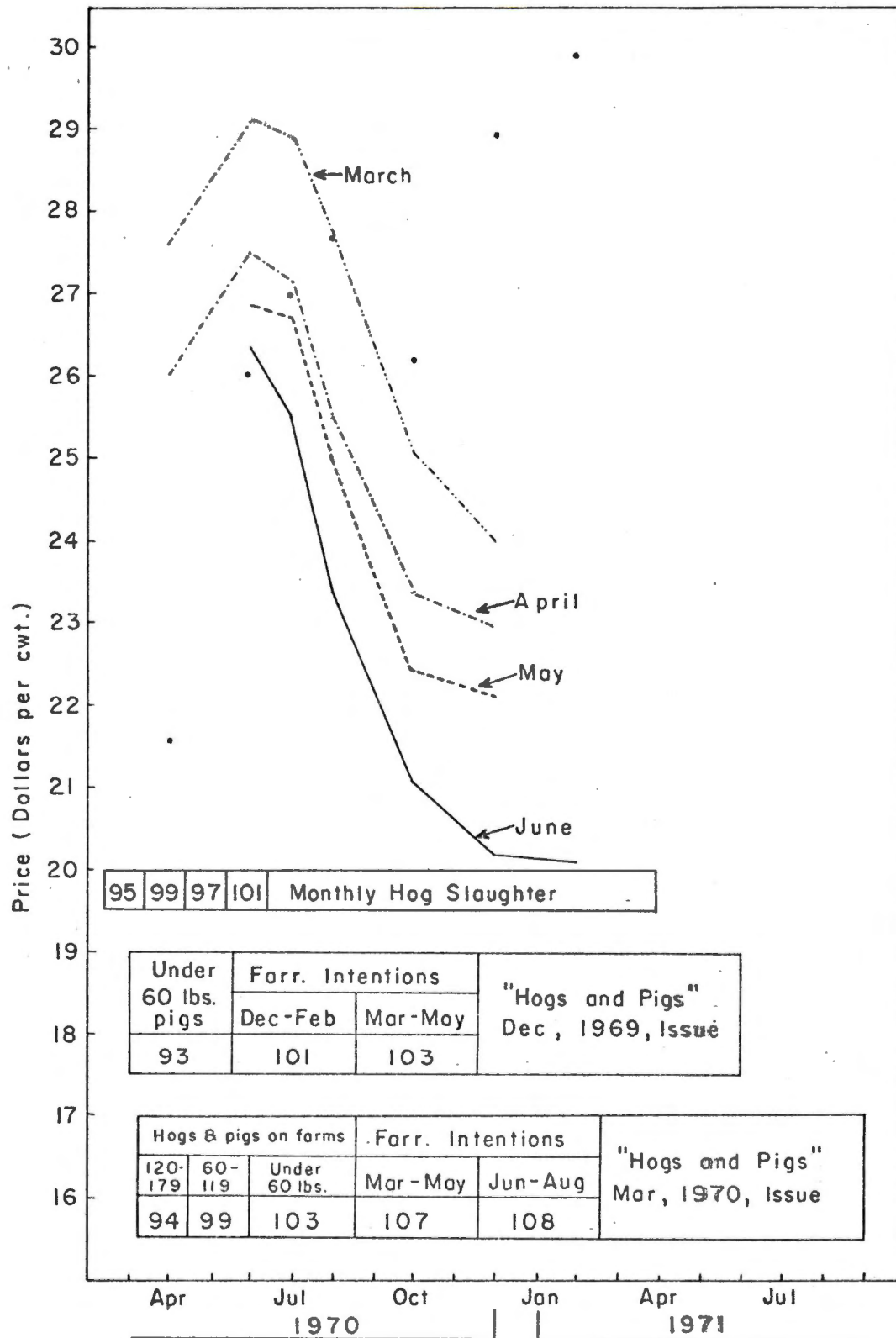


Figure 12. Spring, 1970: Monthly profiles, past year's cash prices, supply outlook, and hog slaughter.

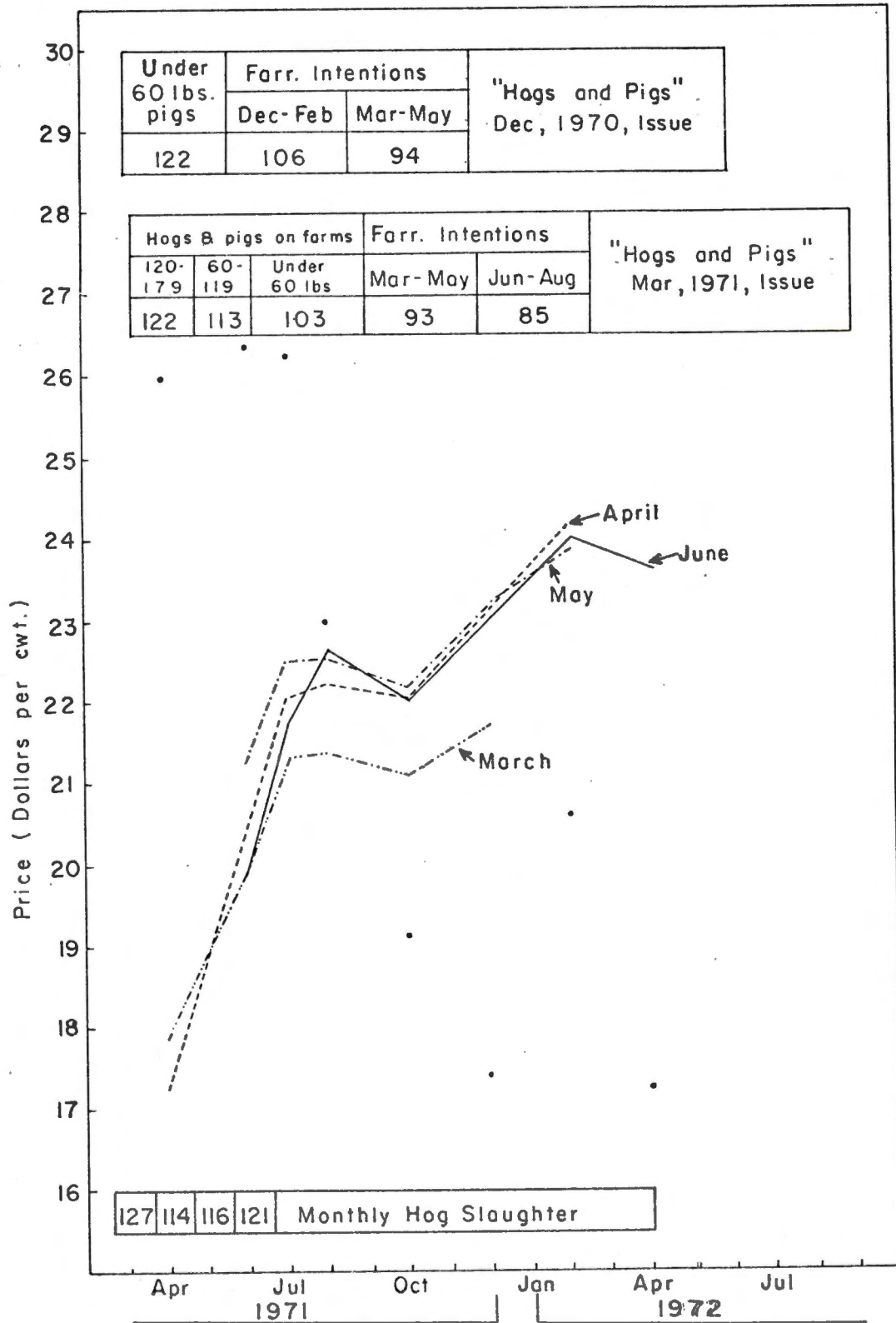


Figure 13. Spring, 1971: Monthly profiles, post year's cash prices, supply outlook, and hog slaughter.

preceding year's prices and late 1971 futures prices well above the preceding year's. Due to the upward slope, the usually-rising portions of the seasonal pattern were emphasized, and the usually-dropping portions were minimized to the point that the Fall "low" was as high as, or even higher than, the preceding Summer "high." The seasonality is nevertheless clearly discernible, with a short period of price recession or price stability in the late summer and early fall, which temporarily interrupted a persistently rising profile. Such a shape is, historically, unusual, but the Hogs and Pigs reports indicated severe cuts in supplies during this period. The June 1971 Hogs and Pigs reports tempered somewhat the severity of the expected cut in supplies, and immediately the profiles took on a shape closer to an average seasonality. This change can be seen in Figure 14. The profiles shown in this figure show a seasonality combined with a mild rising phase component; that is, a Summer 1971 high, a Fall 1971 low, and a Summer 1972 high above that of 1971. This expectation is consistent with the June 1971 Hogs and Pigs, which indicated reduced supplies in the future. The expectation was more than fulfilled; it turned out to be a very strong bull market and, during the Fall of 1971, the futures profiles reacted by upward shifts in reaction to the rising cash market just as the market had done during the bull market of 1969.

By January 1972, in the midst of this bull market, the profiles represented on Figure 15 started taking the shape of a seasonality imposed on a falling phase component similar to the profiles of Fall 1969 (Figure 10, page 37), even though the Hogs and Pigs report did not indicate increasing supplies.

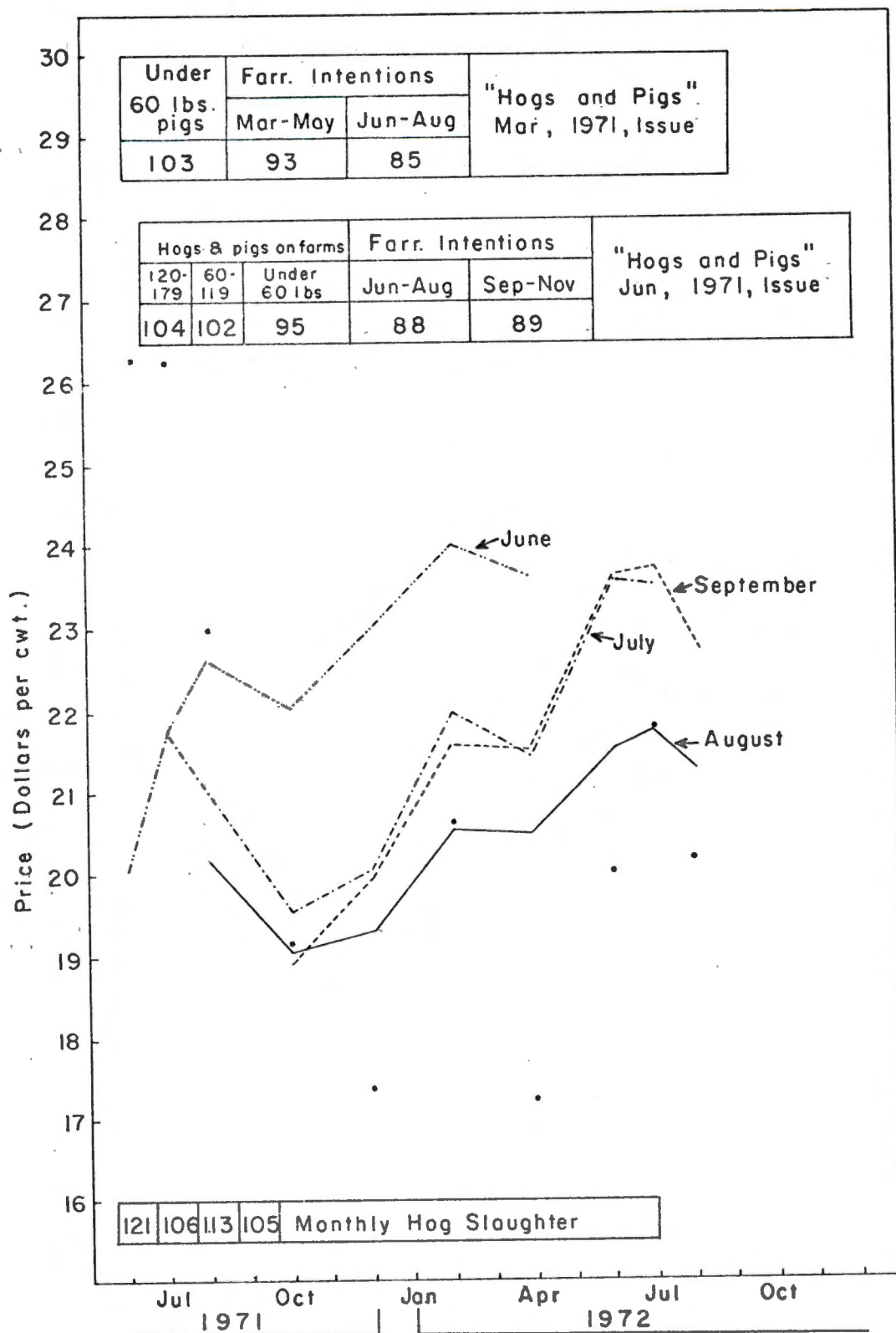


Figure 14. Summer, 1971: Monthly profiles, past year's cash prices, supply outlook, and hog slaughter.

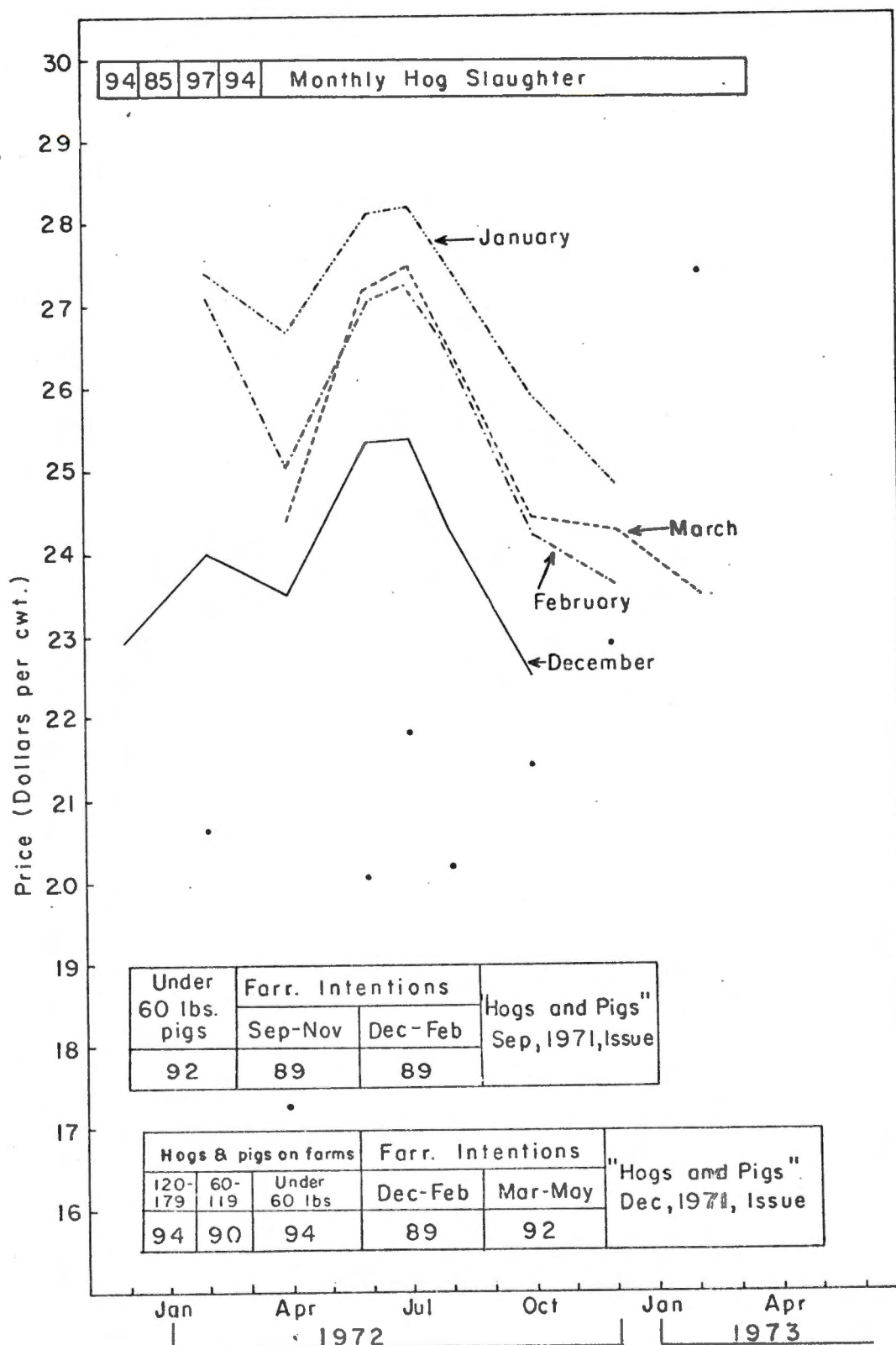


Figure 15. Winter, 1972: Monthly profiles, past year's cash prices, supply outlook, and hog slaughter.

While it is beyond the data presented here, cash hogs were in the \$28 to \$30 range from May to November 1972; the falling phase component displayed in Figure 15 by the Winter 1972 profiles did not materialize into a bear market.

The above discussion suggests that futures profiles actually featured, from 1969 to 1972, a phase component whose nature varied according to supply expectations. Following this discussion, it is necessary to determine the relative frequency of profiles featuring such a component. For this purpose, current cash and futures prices, considered relatively to last year's cash prices, are compared with present and expected supplies expressed in relative value to last year's supplies. If supplies, expressed as a percentage of last year's, are expected to decrease over a given upcoming period, other things being equal, then prices should be expected to rise relatively to last year's prices during the considered period, and inversely. In order to determine whether a profile behaves according to this assumption, the nearest and the most distant futures of the profile are compared with last year's cash prices in the same months. Intermediate futures are disregarded for the sake of simplicity. By this means, it is possible to state whether prices are expected to rise or fall, in relation to last year's prices, over the upcoming period situated between the near futures and the most distant futures. On the supply side, current supplies, expressed as a percentage of last year's, are compared with supplies expected for the time of the distant futures, expressed in the same fashion. In this way, it is determined whether supplies are expected to rise or fall relative to last year's over the considered

period. Thus, if the futures market expects prices to go through a relatively¹² rising period when supplies are expected to go through a relatively¹³ falling period, it will be considered that the market's behavior complies with the hypothesis. Upon count, it was found that out of a total number of 58 futures profiles, 47 or 81% complied with the hypothesis, which therefore can be tentatively retained.

¹²This means relatively to last year's prices.

¹³This means relatively to last year's supplies.

CHAPTER III

SPREADS VARIATIONS OVER TIME

As noted earlier, the difference in price, at a given time, between contracts for delivery in two different months is called a "spread" in the language of the trade. For example, on October 15, 1969, the April 1970 hog futures were \$1.20 less than the February 1970 futures; said differently, the February-minus-April spread was \$1.20 on that day.

It has been pointed out that the futures profiles have a definite tendency to shift up or down in more or less parallel fashion in response to the cash market's unexpected price rises or falls. A strictly parallel shift would change the level of the profile but not its shape. Alternatively, one can say that the spread between any two of the futures contracts which form the profile would not be changed in a parallel shift of the profile. However, profiles do not behave strictly in this way, and the spread between any two futures does vary more or less over time.

It has also been pointed out that the particular shape of seasonality displayed in the profiles does change as the phase component varies, apparently in response to the Hogs and Pigs reports. In other words, spreads are affected by general expectations.

It is the purpose of this chapter to determine whether spreads vary over time in any general fashion, aside from particular variations related to changes in general expectations.

Not all definable¹ spreads were studied, but rather only those between the consecutive extremes of the usual seasonal price pattern represented in Figure 6, page 21. This figure shows that such a pattern is dominated by:

- (1) a secondary maximum in February,
- (2) a secondary minimum in April,
- (3) a primary maximum in July, and
- (4) a primary minimum in November.

However, since November was not a contract month from 1969 on, December was used instead to represent the Fall minimum. Thus, the following spreads were studied:

- (1) February minus April of the same year,
- (2) July minus April of the same year,
- (3) July minus December of the same year, and
- (4) February minus December of the previous year.

From the analysis of the variations of these spreads at monthly intervals, it appeared possible to formulate the following hypothesis:

Hypothesis V

Spreads between February futures and April futures of any particular year generally tend to become larger from the first mid-month to the last mid-month of the period where such a spread is defined. The July minus April spread and the July minus December spread also behave in this general manner. The

¹A spread is defined from the time that both contracts become simultaneously available for trade until the termination of the first contract. Thus a spread is definable if the considered contracts are simultaneously quoted at least once.

February minus December spread does not show any general pattern of behavior.

For the purpose of evidencing first the facts leading to the initial proposition of this hypothesis, successive spreads between February futures and April futures of the same year have been calculated at monthly intervals. Six such series, for the years 1967 through 1972, are shown in Table 1. The data in the column headed "1970," for example, are spreads between the February 1970 and the April 1970 contracts, taken on the dates indicated on the same line of the first column. Thus, at the intersection of the line "February 15" and of the column "1970," one can read that the February minus April 1970 spread was \$1.80 on February 15, 1970; that is, on February 15, 1970, the February 1970 futures were priced \$1.80 above the April 1970 futures. The other figures in the same column are spreads between the same two contracts, at monthly intervals before February 15, 1970. The first spread in this column is dated September 15.² The reason for this is that one month before this date, the April 1970 contract had not yet been introduced, and therefore the February-April 1970 spread was not defined.³ Also, the last spread in this column is quoted for February 15 since this is the delivery month during which the February contract is terminated. The February-April spread thus ceases to be definable around February 20.

²This refers to September 15, 1969.

³Both contracts must be simultaneously available for trade on a given date for the spread to be defined on that date.

TABLE 1

FUTURES SPREADS AT MONTHLY INTERVALS, FEBRUARY MINUS APRIL FUTURES
OF THE SAME YEAR, 1967-1972

Spread As Of:	Year					
	1967	1968	1969	1970	1971	1972
	----- Dollars per cwt. -----					
June 15						.40
July 15					.07	.12
August 15	-.12				-.15	.10
September 15	.00			.70	-1.15	.53
October 15	-.20	.00		1.20	-1.00	.70
November 15	-.10	-.05	-.10	1.17	-.42	1.05
December 15	.10	.12	.50	1.65	-.70	.50
January 15	-.15	.35	.90	1.10	.05	0.77
February 15	-.05	1.00	.65	1.80	2.18	2.10
Change from Earliest to Latest Spread	+.07	+1.00	+.75	+1.10	+2.11	+1.70

The other columns in Table 1 are similar listings of the February minus April spreads at monthly intervals, but in other years. Since contracts for a given delivery month are not introduced at the same time in every year, the yearly series of spreads are of unequal lengths. The earliest date on which April futures were introduced was June 1971 for the April 1972 futures. Thus, the longest series pertains to the year 1972 and begins on June 15, 1971.

Upon examination, it appears that, within each year, the February minus April spread tended to become larger over time, from the beginning to the end of its "life." The last line in Table 1 shows, as a simple summary measure, how the spread changed from its earliest quoted value to its latest quoted value within each year. In every year out of six, this change has been positive, ranging from \$.07 for the 1967 spread to \$2.11 for the 1971 spread. Thus, by the two-thirds criterion, it can be stated that the futures market generally seems, every year, to enlarge its estimation of the February minus April spread as February draws closer. This means, for example, that had a person bought an April contract and simultaneously sold a February contract on October 15, 1969, and then closed each position on February 15, 1970, his profit would have been 60¢/cwt. minus commissions of about 13¢/cwt. The other figures in the bottom row of Table 1 have similar meaning.

Similar tabulations have been done for the following spreads:

July minus April of the same year;

July minus December of the same year; and

February minus December of the previous year.

These spreads are shown in Tables 2, 3 and 4, which follow the presentation of Table 1.

Examination of Figures 2 and 3, pages 11 and 13, shows that the July minus April and the July minus December spreads also tended to increase over time, in the same way as the February minus April spread discussed above. For the July minus April spread, the change from the earliest value to the latest value was negative in only one year, 1969; and yet this negative change was rather small by comparison with the positive changes which occurred in all other years. The July over December spread widened in every year by margins ranging from \$1.35 in 1966 and 1967 to \$2.30 in 1971. Thus, the hypothesis applies to the July minus December and to the July minus April spreads with relative frequencies of 1.00 and 0.83, respectively. Both figures are greater than two-thirds, and therefore are considered sufficient evidence for presenting the hypothesis.

Table 4 shows the February minus December spreads widened in four years and narrowed in two years, out of a total of six. The relative frequency of widening is thus equal to, but not greater than, two-thirds. This is not considered sufficient for presenting a hypothesis regarding this spread.

In conclusion, the observations made about three of the four spreads under examination seemed to form a sufficient basis for Hypothesis V. Although this study did not provide an explanation for the behavior described in this hypothesis, it was felt that the mere observation of such presumed biases in the market could be of interest to market participants.

TABLE 2
FUTURES SPREADS AT MONTHLY INTERVALS, JULY MINUS APRIL
FUTURES OF THE SAME YEAR, 1967-1972

Spread As Of:	Year					
	1967	1968	1969	1970	1971	1972
----- Dollars per cwt. -----						
July 15						2.05
August 15		1.50				1.20
September 15		1.60			2.30	2.23
October 15		1.65			2.50	1.93
November 15		1.32		.60	3.38	1.60
December 15	1.30	1.57	2.05	.75	3.55	1.92
January 15	1.05	1.90	2.10	.15	2.85	1.55
February 15	1.35	2.05	1.65	-.03	2.33	2.20
March 15	2.00	2.25	1.88	1.27	3.47	3.08
April 15	3.05	2.38	1.85	1.13	4.83	N.A. ^a
Change from						
Earliest to						
Latest Spread	+1.75	.88	-.20	+.53	+2.53	+1.03

^aNot available.

TABLE 3

FUTURES SPREADS AT MONTHLY INTERVALS, JULY MINUS DECEMBER
FUTURES OF THE SAME YEAR, 1966-1971

Spreads As Of:	Year					
	1966	1967	1968	1969	1970	1971
	----- Dollars per cwt. -----					
January 15						-0.55
February 15		1.35				-0.55
March 15	4.25	2.18		3.10	4.87	-0.38
April 15	4.90	1.65		3.35	4.18	-1.15
May 15	5.62	1.95	2.00	3.87	4.60	-0.75
June 15	5.95	2.60	3.07	4.00	5.28	-1.27
July 15	5.60	2.70	3.80	4.95	6.32	1.75
Change from						
Earliest to						
Latest Spread	+1.35	+1.35	+1.80	+1.85	+1.45	+2.30

TABLE 4

FUTURES SPREADS AT MONTHLY INTERVALS, FEBRUARY MINUS DECEMBER
OF PREVIOUS YEAR, 1967-1972

Spread As Of:	Year					
	1967	1968	1969	1970	1971	1972
----- Dollars per cwt. -----						
April 15	-0.95					0.95
May 15	-0.65					0.65
June 15	-0.25				-0.12	1.03
July 15	-0.15			.05	-0.43	1.57
August 15	-0.15			-.80	0.15	1.25
September 15	-0.05	-0.47		-0.90	0.83	2.03
October 15	-0.20	-0.05	-0.35	-1.62	0.55	0.92
November 15	0.30	-0.20	-0.90	-1.30	0.85	0.98
December 15	-0.12	-0.28	-1.90	-2.00	0.00	1.10
Change from						
Earliest to						
Latest Spread	+0.82	+0.39	-2.25	-2.05	+.12	+.15

CHAPTER IV

IMPACT OF THE HOGS AND PIGS REPORTS ON FUTURES PROFILES

In the development of Hypothesis IV, the general slope of futures profiles was explicitly related to the information released by the Hogs and Pigs reports. It was shown that the general shape of a futures profile can generally be explained by the combination of a regular seasonal pattern with variable expectations attributed to the Hogs and Pigs information. However, the method of analysis used in Chapter II, which was based on the examination of futures profiles at monthly intervals, does not permit the isolation of the particular impact of the Hogs and Pigs information. Over a one-month period, other relevant factors are likely to change enough to influence the futures market. The particular effect of the Hogs and Pigs information release, if any, might then be confounded with other effects. Thus, one of the purposes of this chapter is to establish as positively as possible whether the Hogs and Pigs reports can have an observable impact on futures prices, and, if such an impact exists, to determine the nature of the impact.

It was also pointed out earlier that, although futures profiles can display a general slope expressing expectations other than that of the usual seasonality, the futures market did not correctly forecast the strong bull or bearish markets which occurred from 1969 on. Rather, futures profiles seemed to shift up or down in response to cash market fluctuations. This was the substance of Hypothesis II, derived by the study of futures profiles at mid-month intervals.

If, however, it is possible to observe a specific impact on the Hogs and Pigs reports, it seems legitimate to ask whether this impact anticipates to some extent the subsequent profile shifts; that is, whether some hint can be derived from the impact of the Hogs and Pigs release as to the nature of futures profile movements in the following months. Thus, another purpose of this chapter is to determine if the immediate impact, if any, of the Hogs and Pigs release is generally confirmed or contradicted during the three-month period elapsing before the next Hogs and Pigs release.

For these purposes, profiles taken shortly before and after the Hogs and Pigs release dates have been drawn and compared. Specifically, two profiles were drawn to correspond to each Hogs and Pigs report. The first profile of each pair was made from the Hogs and Pigs release date's quotations. Since the Exchange closes at 12:50 p.m., Central Time, while the report is released at 3:00 p.m., Eastern Time, these quotations precede the report's release. The second profile of each pair was made from the quotations at the end of the next trading day.

Such quarterly pairs of futures profiles were drawn for the whole time period considered in this study, that is, March 1966 through March 1972. It was observed that in 1966, 1967 and 1968, futures price changes within a day of the Hogs and Pigs release were generally small and never exceeded \$.50. This did not allow for the conclusion that the Hogs and Pigs reports issued during this period had any observable impact on futures profiles. Such a negative conclusion is not surprising, since the supply outlook never changed drastically from one Hogs and Pigs issue to the next. The period 1966-1968 was, as has been mentioned,

one of relative price stability; that is, there was neither a strong bull market nor a strong bear market, and price fluctuations were mostly seasonal. Because of this inconclusiveness, the quarterly pairs of profiles defined above are not shown for the period 1966-1968.¹

For the period 1969-1972, however, the examination of the quarterly pairs of futures profiles seemed conclusive enough to derive the following hypothesis:

Hypothesis VI

The Hogs and Pigs reports can have an immediate impact on the slope and level of the price profile. When the impact is strong,² futures prices' changes in the next three months are usually in the same direction as the price changes occurring within one day of the report's release.

This hypothesis will be illustrated first by the market's behavior during the 1969 bull market, shown in Figure 16. Four pairs of futures profiles, corresponding to the four Hogs and Pigs reports issued in 1969, have been drawn in this figure, and labelled according to the report's release month. Within each pair, the profile labelled "I" is the one which precedes the report's release, and the profile labelled "II" is the one which follows the report's release. In

¹It might also be mentioned that the hog futures market was not yet very active during this period. Futures contracts were often introduced only a few months before the contract month, and were irregularly traded and quoted. Thus, the profiles taken immediately before and after the Hogs and Pigs release were often short and interrupted.

²For the purpose of this study, the impact will be qualified as "strong" when a change of at least \$1.00 is observed in the price of more than one contract within a day of the report's release.

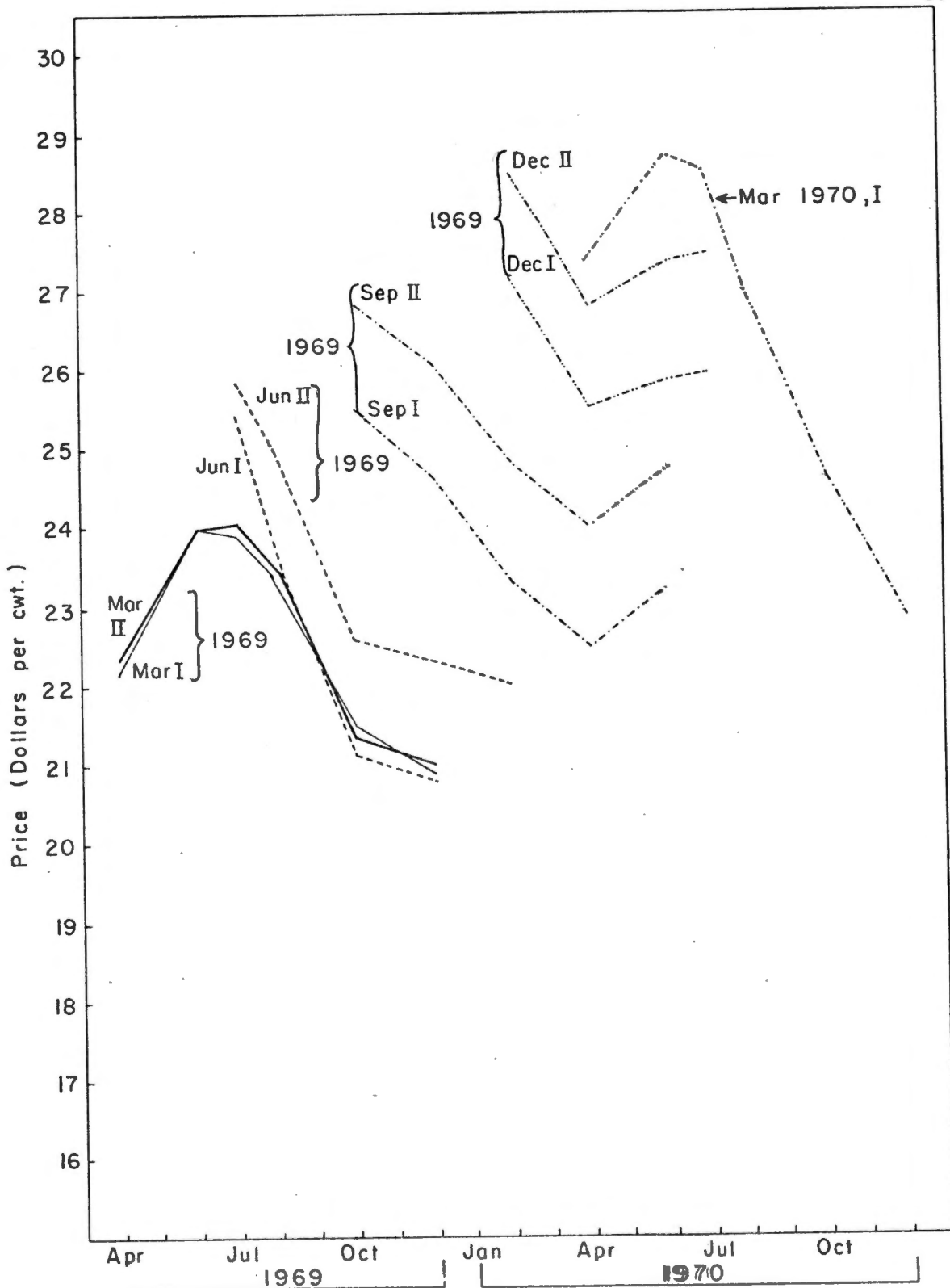


Figure 16. Futures profiles before and after release of the Hogs and Pigs reports, March 1969 - December 1969.

addition, the profile "March 1970, I," which is the first profile in the next figure, has also been represented on Figure 16 for continuity.

As mentioned earlier, a bullish period started on the hog cash market in December 1969, seemingly due to a shift in demand. Upon release of the March 1969 issue of Hogs and Pigs, the futures market did not react. This can be seen by comparison of the profiles March 1969, I, and March 1969, II. These profiles are nearly identical. Price changes within a day of the report's release were less than \$.30. This lack of response is consistent with the fact that the Hogs and Pigs March report brought very little change to the supply outlook.

As the bull market continued, cash prices rose more than expected between March and June 1969. This pulled upwards the nearest futures; that is, the July futures. However, the more distant futures remained steady, as shown by the June 1969, I, profile overlapping the March profiles in Figure 16. After such a period of price stability, the August, October and December rose suddenly by \$1.50 following the June release of Hogs and Pigs. This is the maximum daily fluctuation allowed by the Exchange. The occurrence of an exceptional price variation within a day of the Hogs and Pigs release strongly suggests a causal relationship between the two events. In fact, the June 1969 report released the information that the March-May 1969 farrowings had been only 89% of last year, instead of the expected 105%. Such news severely curtailed the Fall supply expectations, and Fall price expectations rose in consequence. Thus, the consistency between the nature of the information released and the futures profile immediate response reinforces further the hypothesis that the Hogs and Pigs report caused the futures profile's

upward shift. As mentioned earlier, however, the impact was more marked on the distant futures than on the near futures.

The September 1969 pair of futures profiles, represented on the same figure, shows that all futures rose by amounts ranging from \$1.30 to \$1.50 immediately after the release of the September report. A similar phenomenon occurred again following the December Hogs and Pigs release. In both of these cases, the profile's movement was an approximately parallel shift.

Thus far, profiles have been compared within each quarterly pair. Figure 16, page 59, however, allows one to consider the general behavior of the market during the whole 1969 bull market. Thus, one can notice the regular arrangement of the futures profiles in chronological order as the bull market developed. For example, the futures profile shifted upward immediately after the June release of Hogs and Pigs; this shift was confirmed and carried further during the following three-month period, as shown by the position of the September 1969, I, profile. Similarly, after the futures profile had shifted upward within a day of the September Hogs and Pigs release, a further shift in the same direction occurred during the following three-month period. The same phenomenon occurred again after the December 1969 Hogs and Pigs release and before the March 1970 release. Thus, Figure 16 pictures a continuous escalation of futures profiles as the bull market continued. During this period, the reactions of the market to the Hogs and Pigs releases were in the correct direction. Further, the changes in the profiles in one trading day were relatively large by comparison with

the subsequent changes occurring in the following three months.³ If such a regular behavior could be evidenced as well in the following years, one might hypothesize that, when the impact of the Hogs and Pigs release is strong, the direction of this impact can be taken as an indication of the direction of futures price movements in the following three months.

As shown in Figure 17, the March 1970 pair of profiles marks the downturn of the bull market and the beginning of a strong bear market. The March 1970 issue of Hogs and Pigs was immediately followed by a strong downward shift of the futures profiles. This shift was confirmed and carried further during the following three months, as shown by the position of the June profiles relatively to the March profiles.

In June and September 1970, the Hogs and Pigs releases were not followed by a strong reaction. In December 1970 the Hogs and Pigs impact was strong by the criterion, but the downward shift was not carried further in the following months, as shown by the position of the March 1971, I, profile relative to the December 1970 pair of profiles. This particular case is an exception to the hypothesis presented.

Figure 18 illustrates the impact of only the March and June 1971 issues of Hogs and Pigs. Subsequent pairs of profiles have been drawn in Figure 19, to improve the readability of Figure 18.

³This would perhaps be more vividly perceived if the mid-month profiles used in Chapter I were also represented in Figure 16. These profiles would be inserted between the second profile of a quarterly pair and the first profile of the following pair.

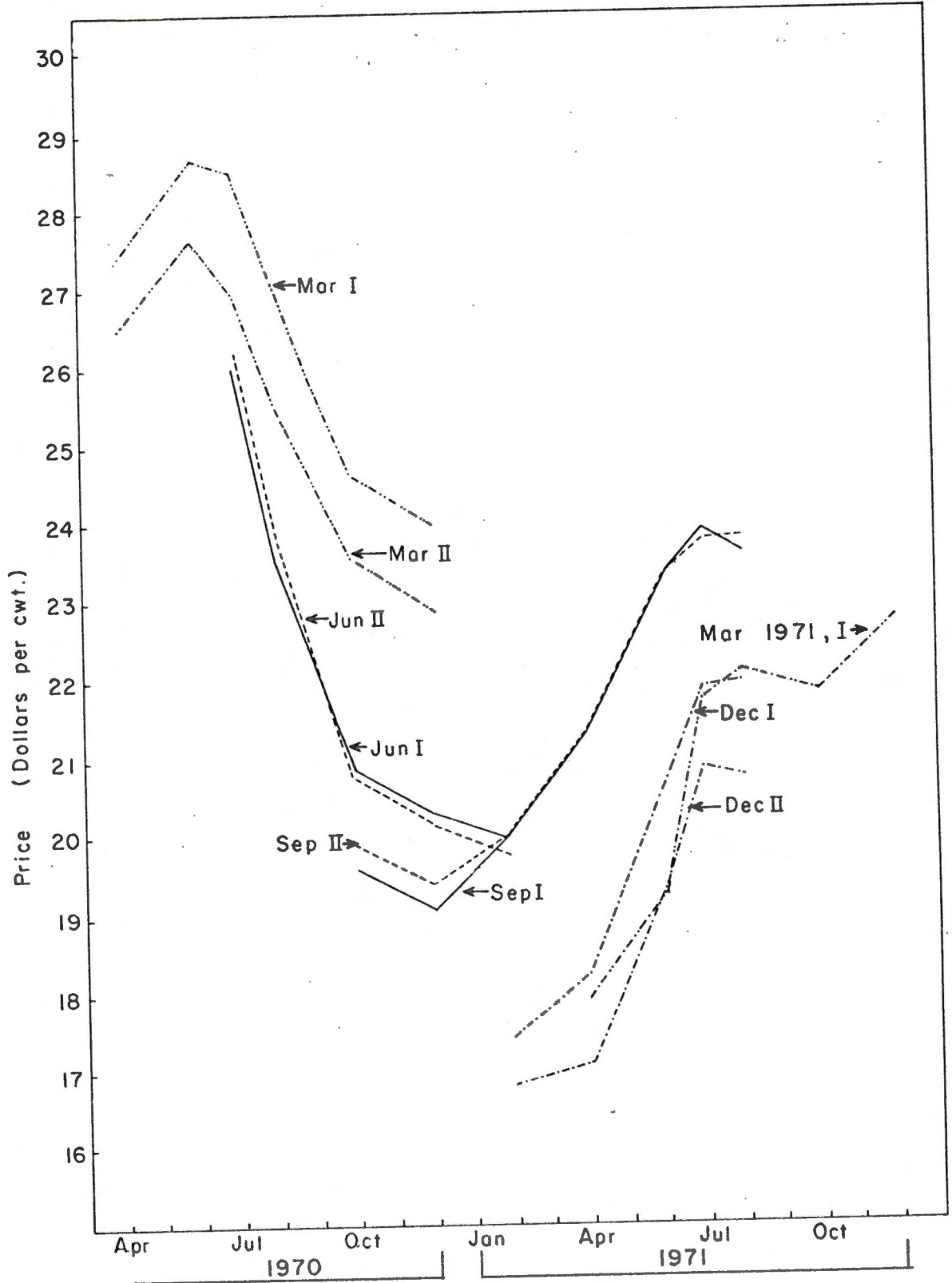


Figure 17. Futures profiles before and after release of the Hogs and Pigs reports, March 1970 - December 1970.

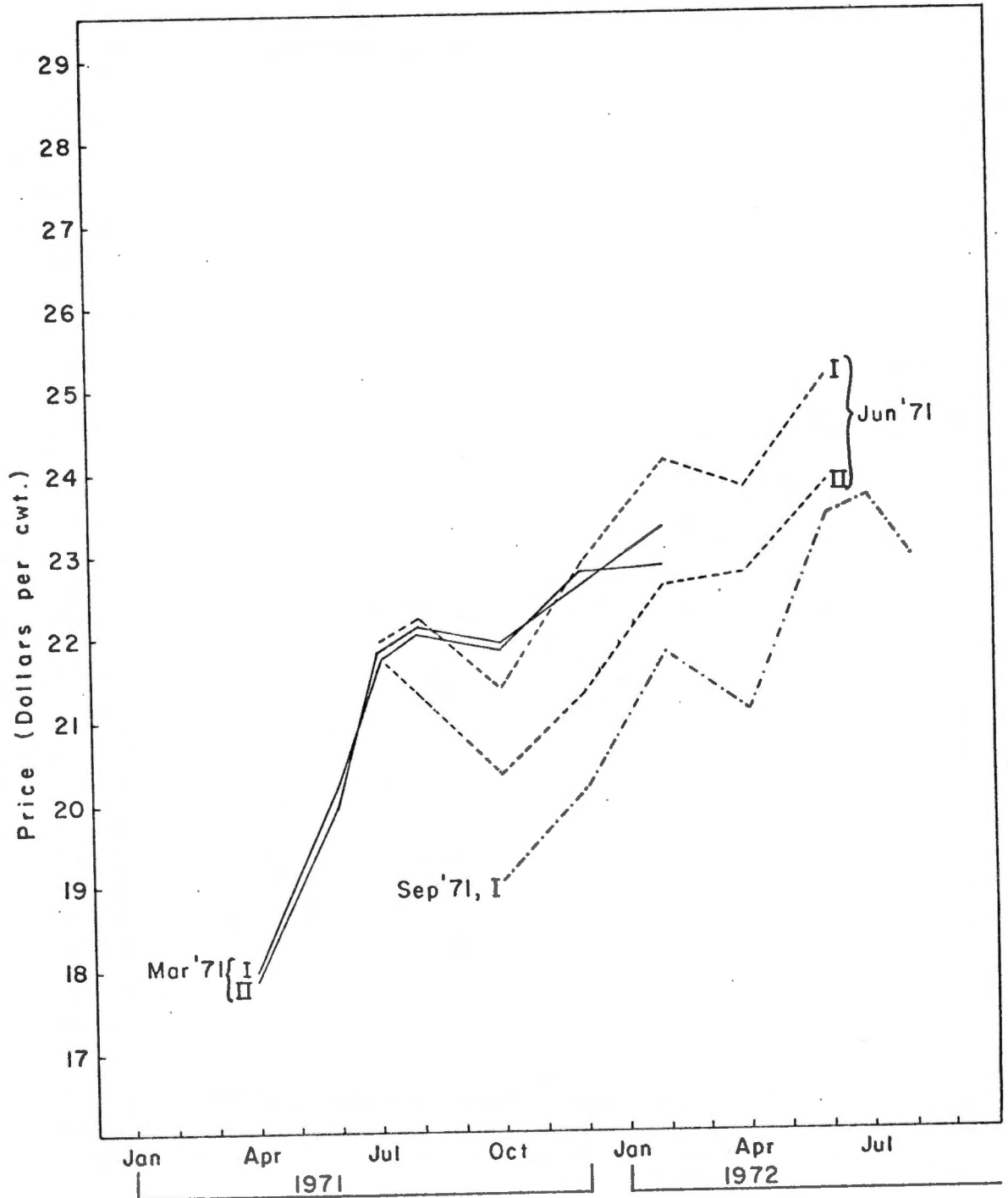


Figure 18. Futures Profiles before and after release of the Hogs and Pigs reports, March - June, 1971.

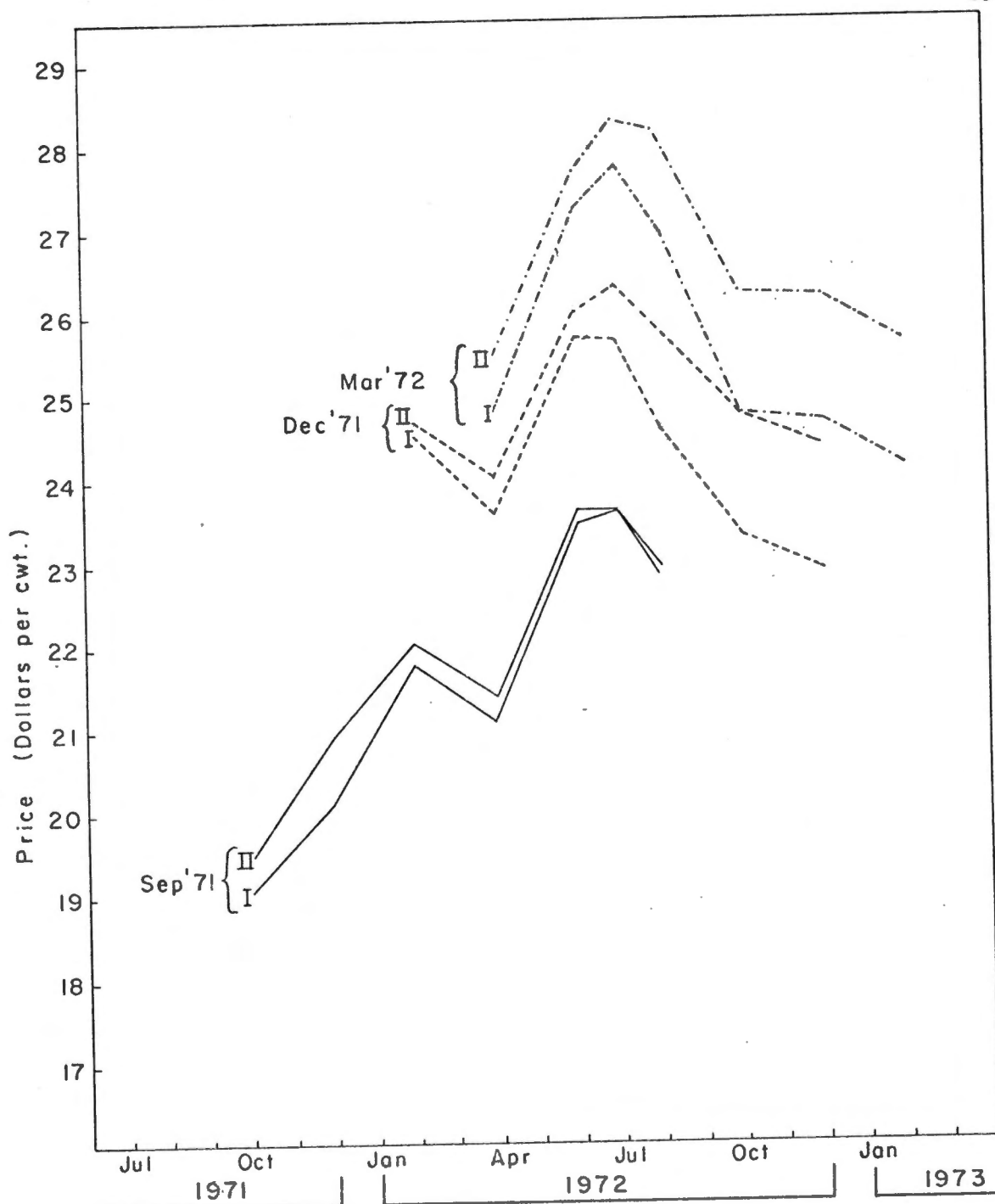


Figure 19. Futures Profiles before and after release of the Hogs and Pigs Reports, September, 1971 - March, 1972.

Figure 19 shows that the March 1971, I, and March 1971, II, profiles were almost identical. In June 1971, however, the Hogs and Pigs report had a strong impact on the futures profile in the form of a downward shift. Subsequently, as shown in Figure 18, the futures profile shifted further downward and confirmed the impact of the June report.

The market's reaction to the September 1971, December 1971, and March 1971 Hogs and Pigs reports is illustrated in Figure 19. This period was dominated by another strong bull market. No observable impact followed the September 1971 report. In December 1971, however, the distant futures rose sharply following the Hogs and Pigs release; and all futures but one rose further in the following three-month period. As mentioned earlier, the bull market eventually⁴ continued after March 1972 in such a way that the strong impact of the March 1972 profile was also confirmed later.

In summary, eight Hogs and Pigs issues had on futures prices an immediate impact typified as strong. These were the issues released in June, September and December 1969, March and December 1970, June and December 1971, and March 1972. Within one day of these reports' releases, all futures rose or fell simultaneously, and the price change was \$1.00 or more for several of the futures. This immediate impact could be compared with subsequent futures price changes in the following three-month period in seven of the eight cases.⁴ In five of these seven cases, that is, with a relative frequency of .72, the immediate

⁴Following the March 1972 pair of profiles, no June 1972 profile was available for comparison.

impact of Hogs and Pigs was followed over the next three months by a further price change of all futures in the direction of the original impact. This happened after the following releases: June, September and December 1969, March 1970, and June 1971. This frequency is high enough, by the two-thirds criterion, for the purpose of presenting Hypothesis IV. One can also notice that the near futures never rose or fell more than the distant futures when the impact of Hogs and Pigs was strong, while, in several instances, the distant futures rose or fell more than the near futures. It can thus be said that the impact of the Hogs and Pigs release, when strong, is either felt over the whole profile, or by the more distant futures mainly, but never by the nearest futures only.

CHAPTER V

SUMMARY

Although the scope and importance of futures trading have been rapidly expanding in recent years, little is known about the behavior of futures prices of non-storable commodities and about the factors which influence them. While some authors predict that futures pricing will eventually become extremely common in many types of transactions, the bulk of futures price analysis is still in the domain of storable commodities. Although commodities traditionally traded in futures, such as grains, have been the object of much research, futures markets of more recent creation remain scarcely investigated. Among these is the live hog futures market, which is less than seven years old. This market is perhaps especially interesting, because hog prices are subject to considerable variability, resulting in hazardous forecasts.

This study focused on the temporal structure of hog futures prices, that is, on the relationship between prices of different futures traded at the same time for different times of delivery. It was the intention of this study to search for any systematic elements of this price structure, and to identify any typical reactions of the price structure to specific stimuli, such as cash price fluctuations and supply outlook news.

Central to the method of analysis was the notion of the futures profile, a graphical representation of the temporal price structure of futures prices at a particular point in time. Comparison of successive futures profiles taken at chosen times was the primary method of analysis

utilized, with the purpose of detecting any features or behaviors having an appearance of regularity. Those particular features or behaviors which, after being precisely defined, were found to occur with a relative frequency greater than two-thirds were developed into hypotheses.

The first specific objective was to search for, and hopefully identify, a seasonal component in the temporal price structure of hog futures prices. From the analysis of futures profiles at monthly intervals throughout the period March 1966-March 1972, it was observed that futures profiles generally display a seasonal pattern characterized by a summer peak, preceded by a price rise and followed by a price decline. Such a pattern is comparable, for the same reason, to that of the average cash price seasonality. It seems, however, that the winter portion of the cash price seasonality does not have a clear counterpart in futures prices.

As a second objective, it was intended to determine how the price structure of futures profiles is affected when strong, unexpected cash price changes occur. From the same series of monthly profiles, it seemed possible to hypothesize that such cash price changes are generally accompanied by changes in the same direction of all futures prices.

A comparison of selected temporal structures of futures prices with subsequent cash price fluctuations was the third objective. Said differently, an evaluation of the market's performance as a price predictor, in selected circumstances, was sought. It was observed that the most distant futures quoted at the beginning of bull or bear markets

consistently turned out to be erroneous by more than five dollars per hundredweight. This led to the hypothesis that the futures market does not correctly forecast major bull or bear markets.

Another objective of this study was the identification in the temporal price structure of hog futures prices of a component reflecting expectations of year-to-year variations in supplies. Such a component was termed "phase component" by analogy with the cyclical component of hog cash prices. From the study of futures prices in relation to last year's cash prices, and by comparison with current and expected supplies expressed as a percentage of last year's supplies, it seemed possible to hypothesize that a phase component is indeed present in futures profiles.

In fulfillment of the fifth objective, spreads between adjacent seasonal "highs" and "lows" were studied from the viewpoint of their changes in value through time, over their "lives." It was found that spreads between February and April, between April and July, and between July and December generally seem to become larger during their lives. The spreads between December and February, however, did not clearly show the same tendency.

Finally, an attempt was made to isolate the immediate impact of the U.S.D.A.'s Hogs and Pigs quarterly reports, which are the official source of supply outlook information. Comparison of pairs of quarterly profiles drawn immediately before and after the Hogs and Pigs releases showed that a quite strong impact is not uncommon. Moreover, it was found that the nature and direction of the impact, when strong, is generally confirmed in the following three-month period by further price changes of all futures in the same direction.

In concluding, it must be emphasized that the hypotheses presented in this study are only tentative rules which seemed to be valid during the considered period; and that these hypotheses could be either confirmed or contradicted by the market's behavior at other times. Thus, the hypotheses presented in this study are as yet untested by future events. In all likelihood, these hypotheses would not perfectly fit the market's behavior over an extended time period. Nevertheless, the present hypotheses will have been useful if they facilitate the derivation of a new set of modified or amended hypotheses to fit a longer time period.

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APPENDIX

Figure 20. Monthly profiles, past year's cash prices, supply outlook and hog slaughter, March 1966 to March 1972.

The figure is composed of the 24 following pages, one per quarter from Spring 1966 to Winter 1972.

Each curve on the graphs is a futures profile, constructed from all available contract month's quotations on the fifteenth of the month labeling the profile.

Dots on the graphs represent past year's mature futures prices, considered as cash prices.

Two of the small tables at the bottom or the top of each graph reproduce information from the relevant issues of Hogs and Pigs. All figures are percentages of previous year's counts. They are located on the graph so as to correspond on the time axis to the approximate market impact of the considered crop.

The other small table shows the liveweight of slaughter hogs by months, also expressed as a percentage of last year.

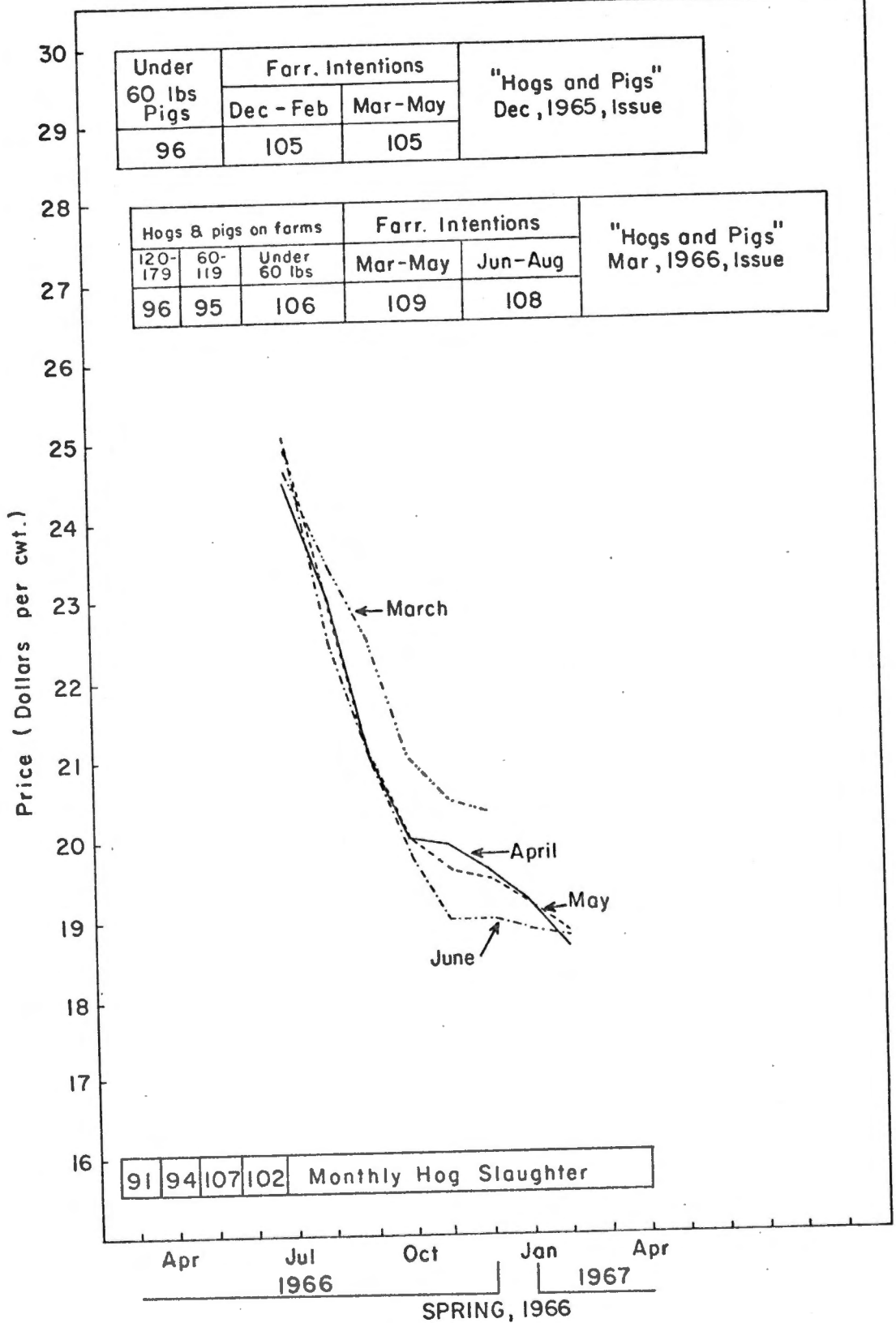


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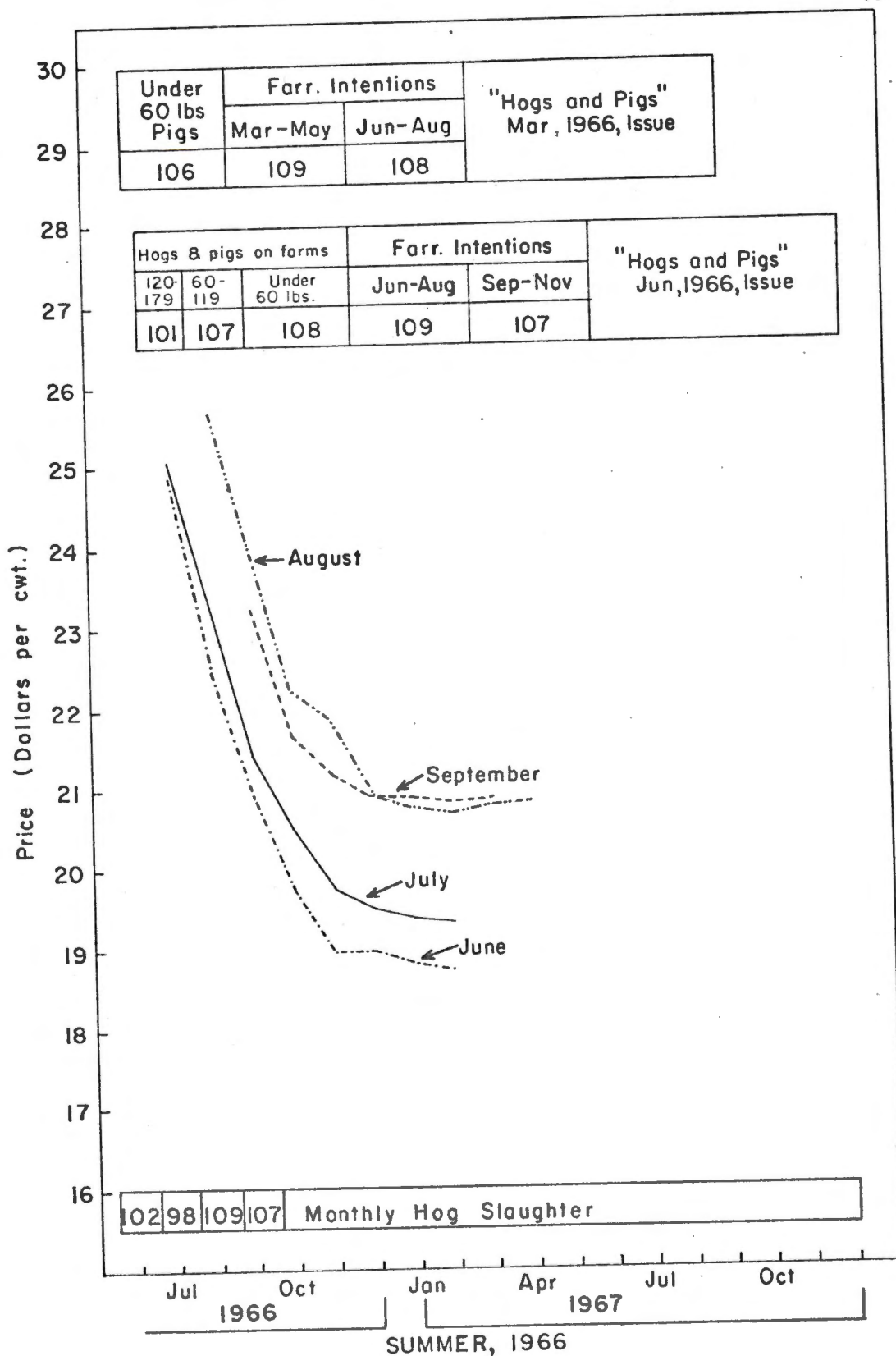


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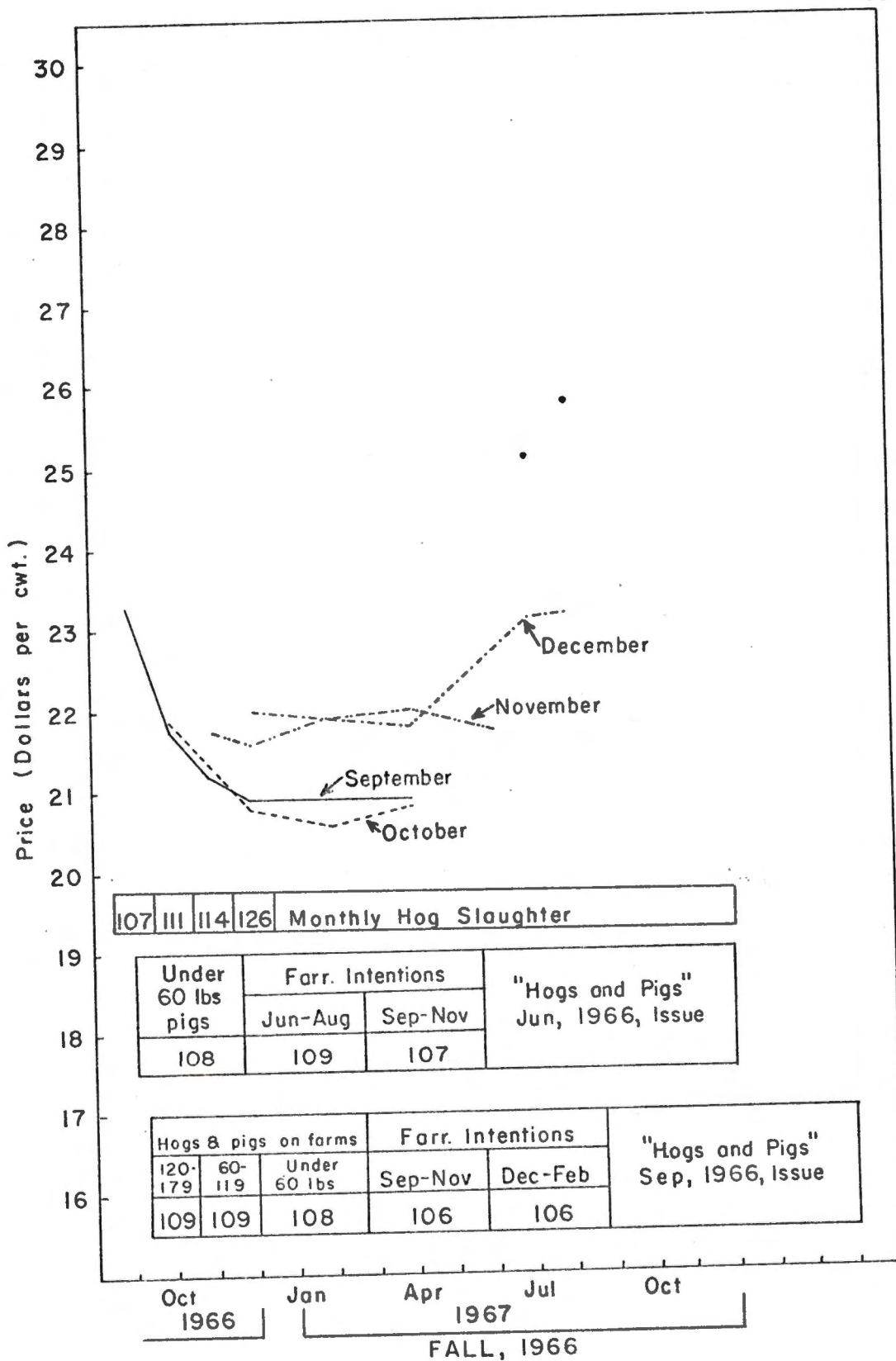


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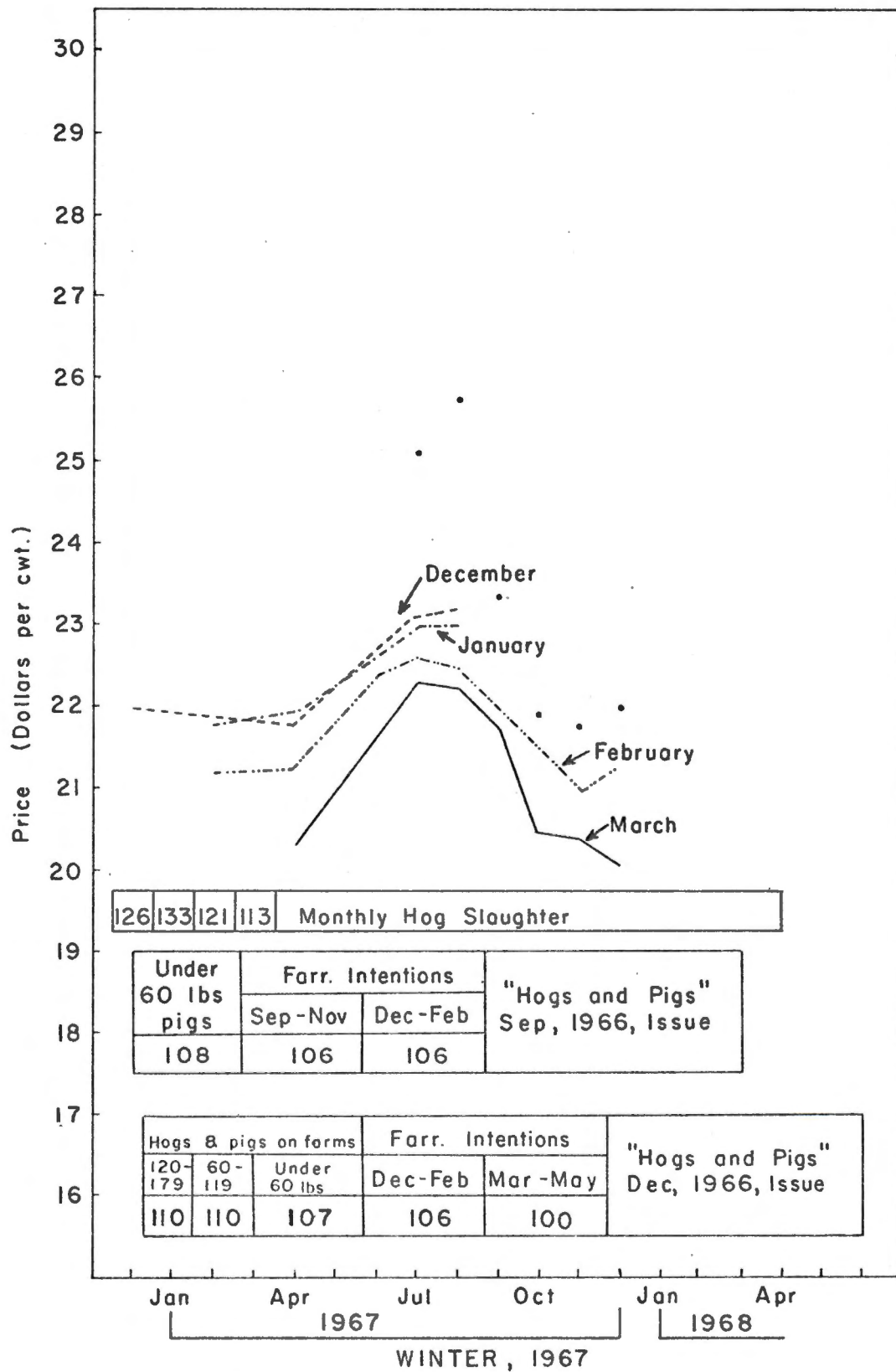


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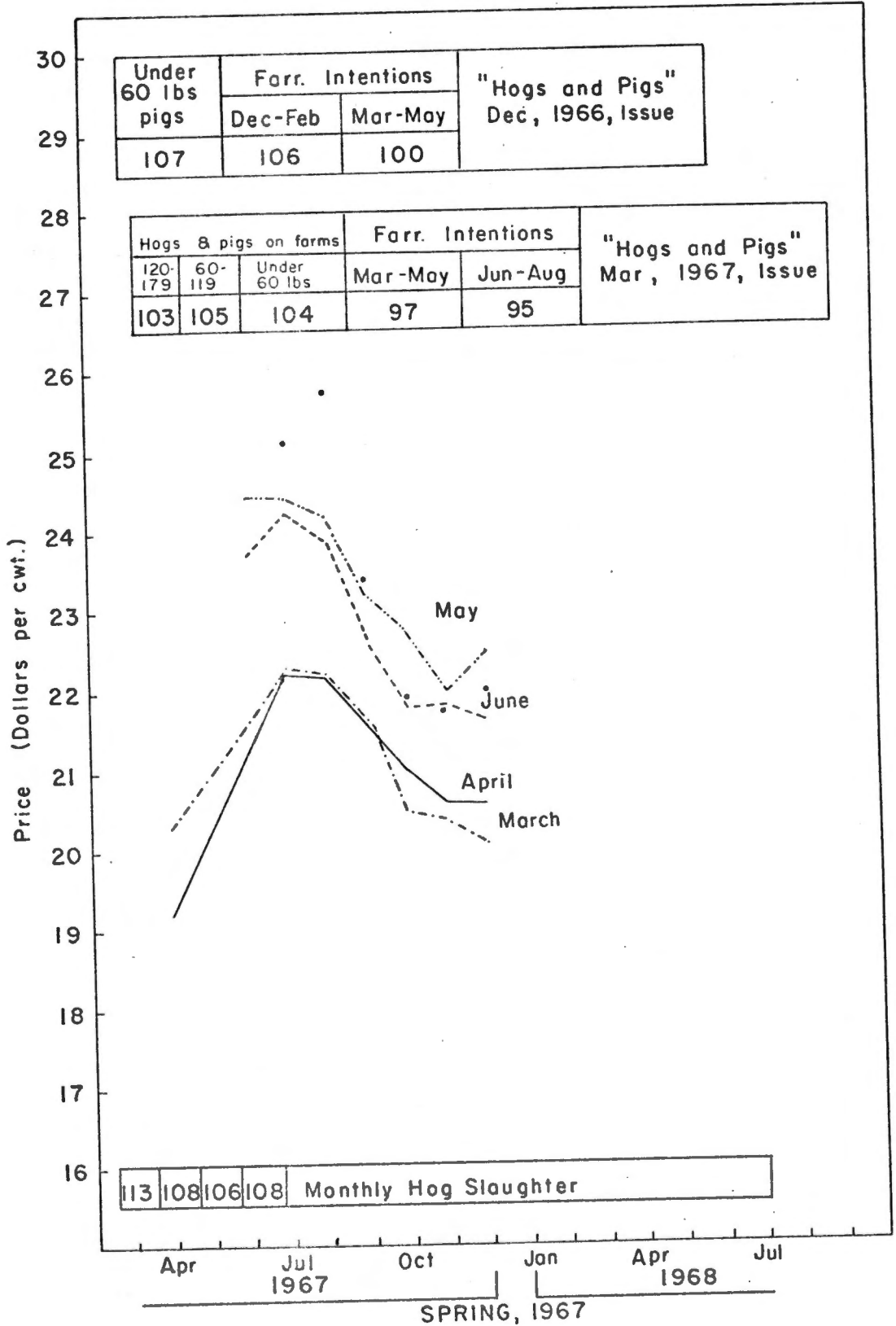


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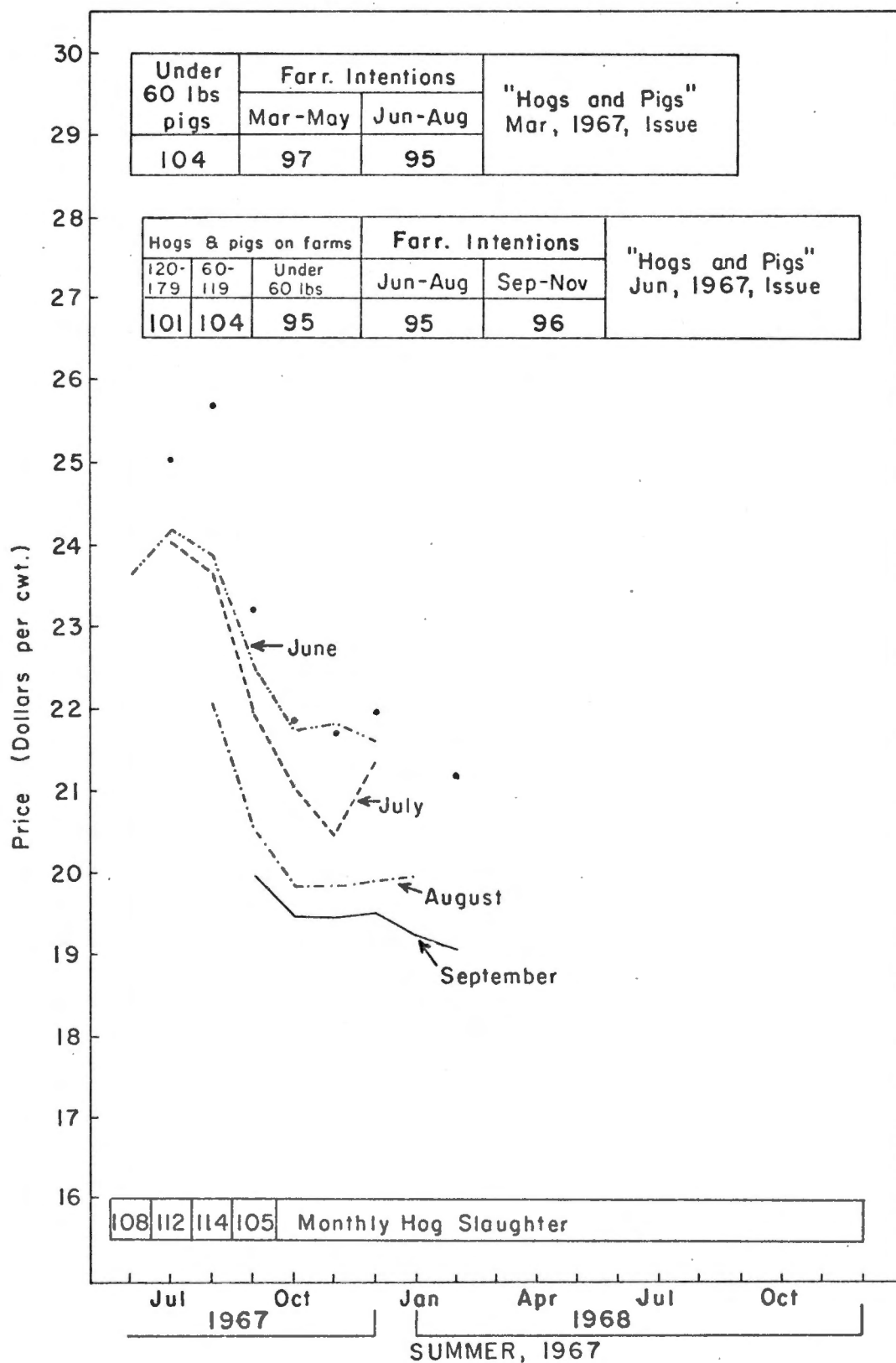


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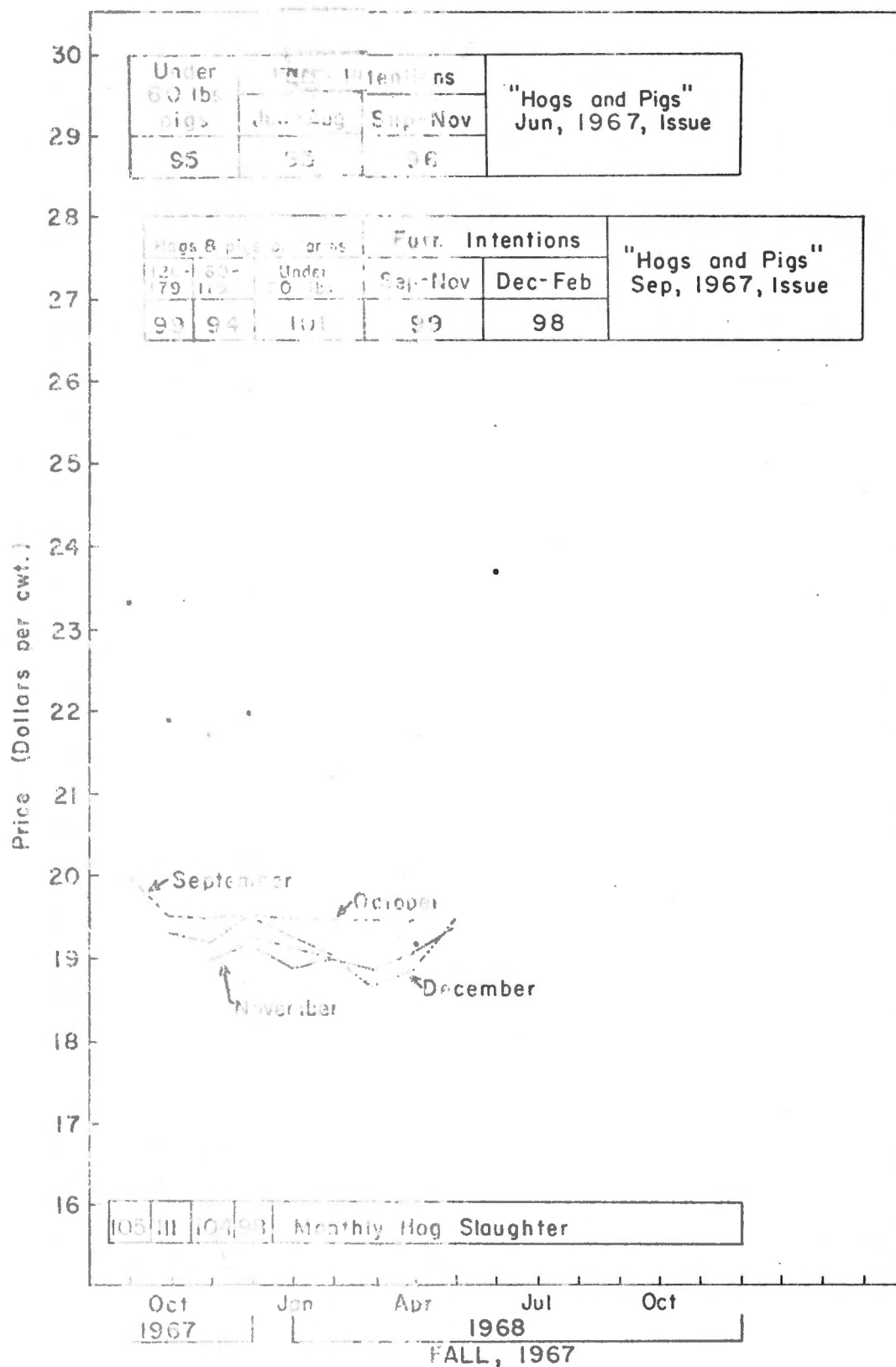


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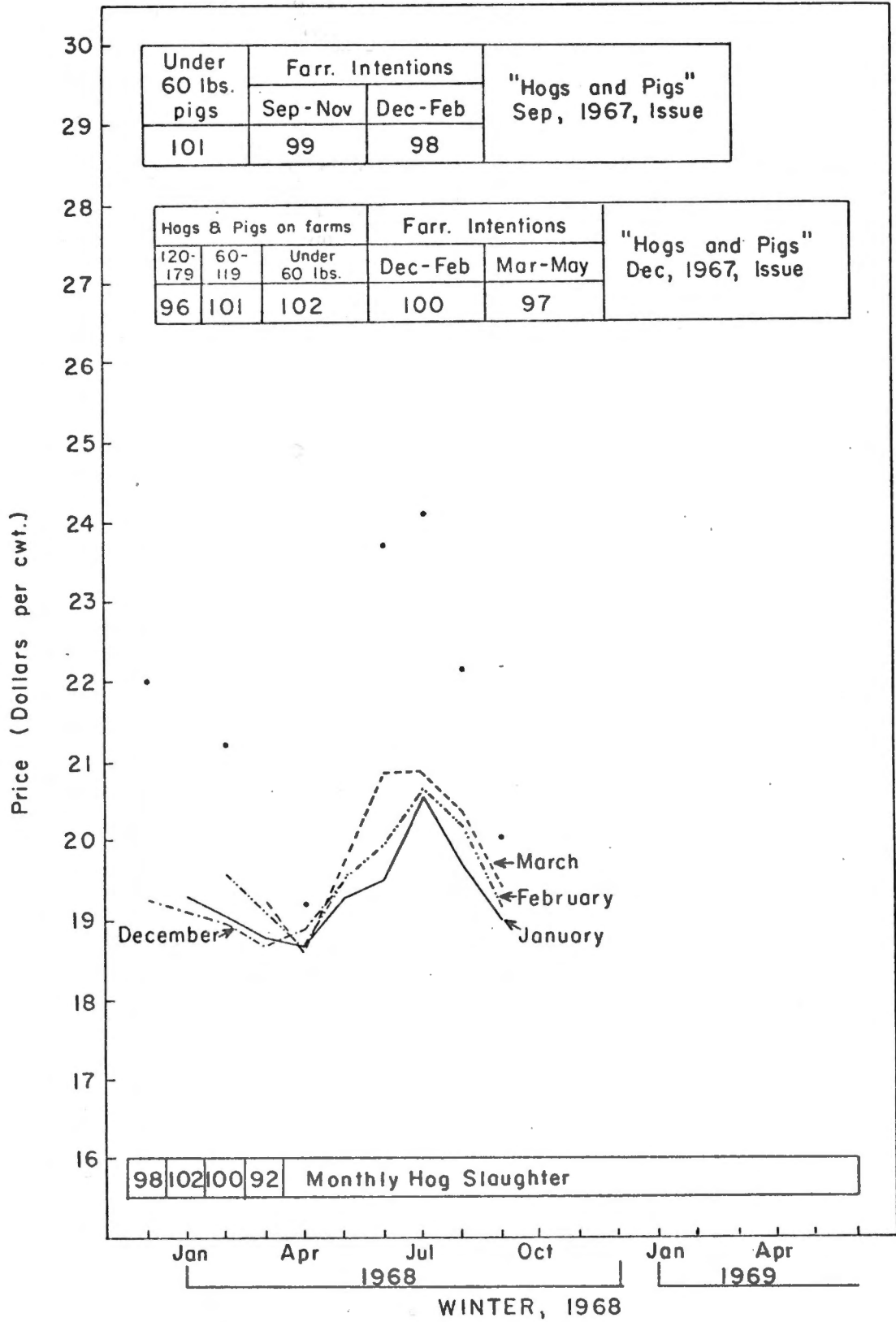


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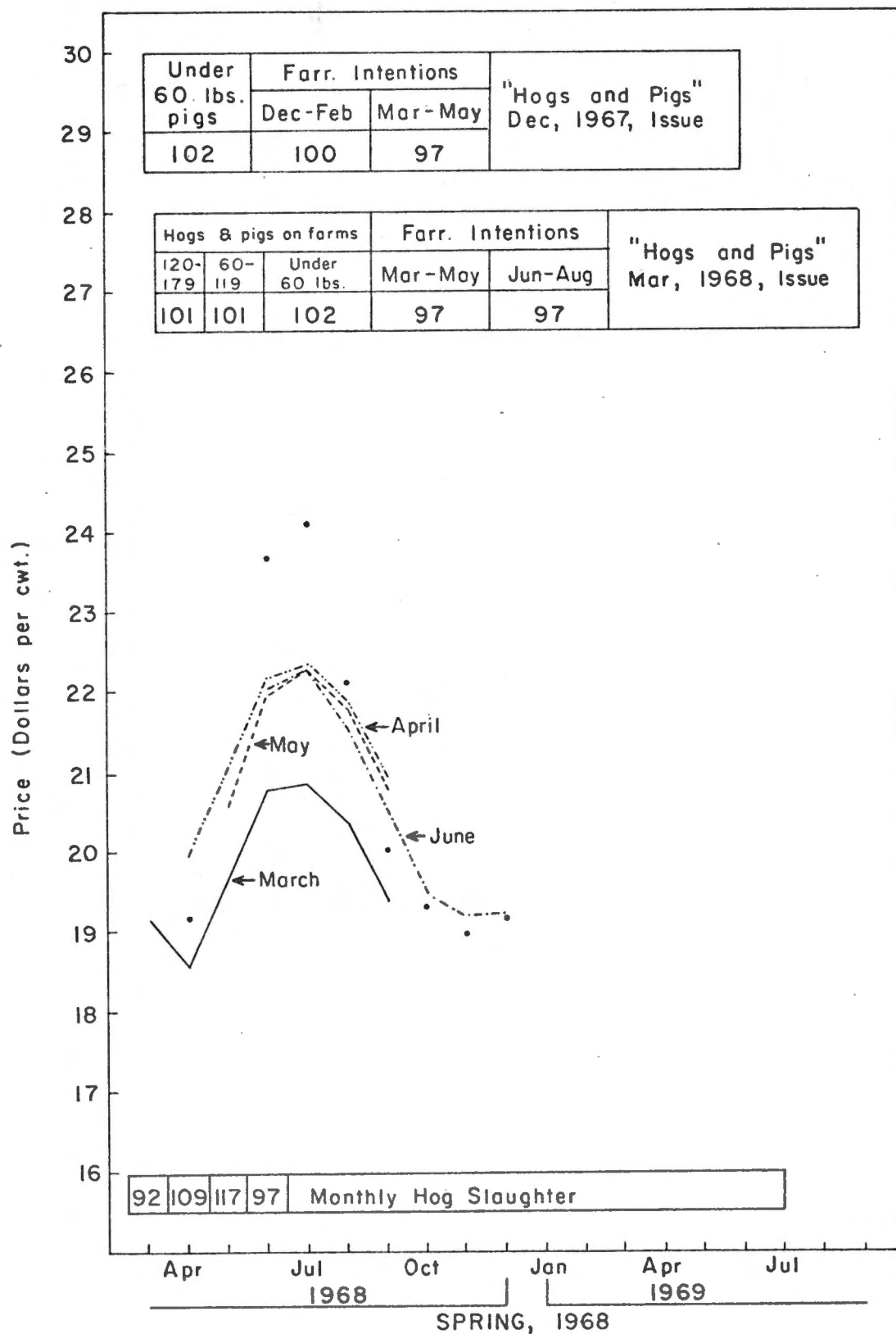


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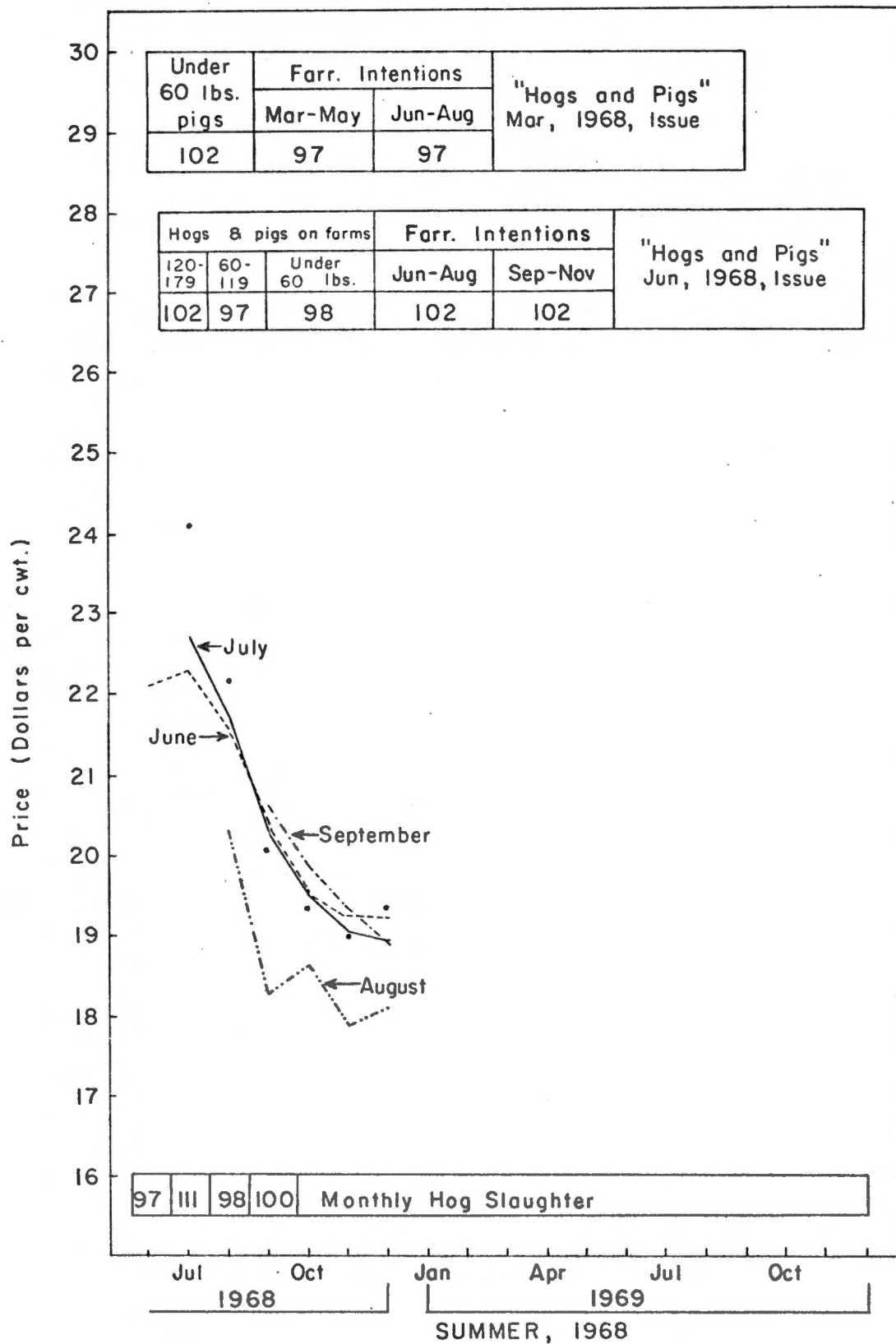


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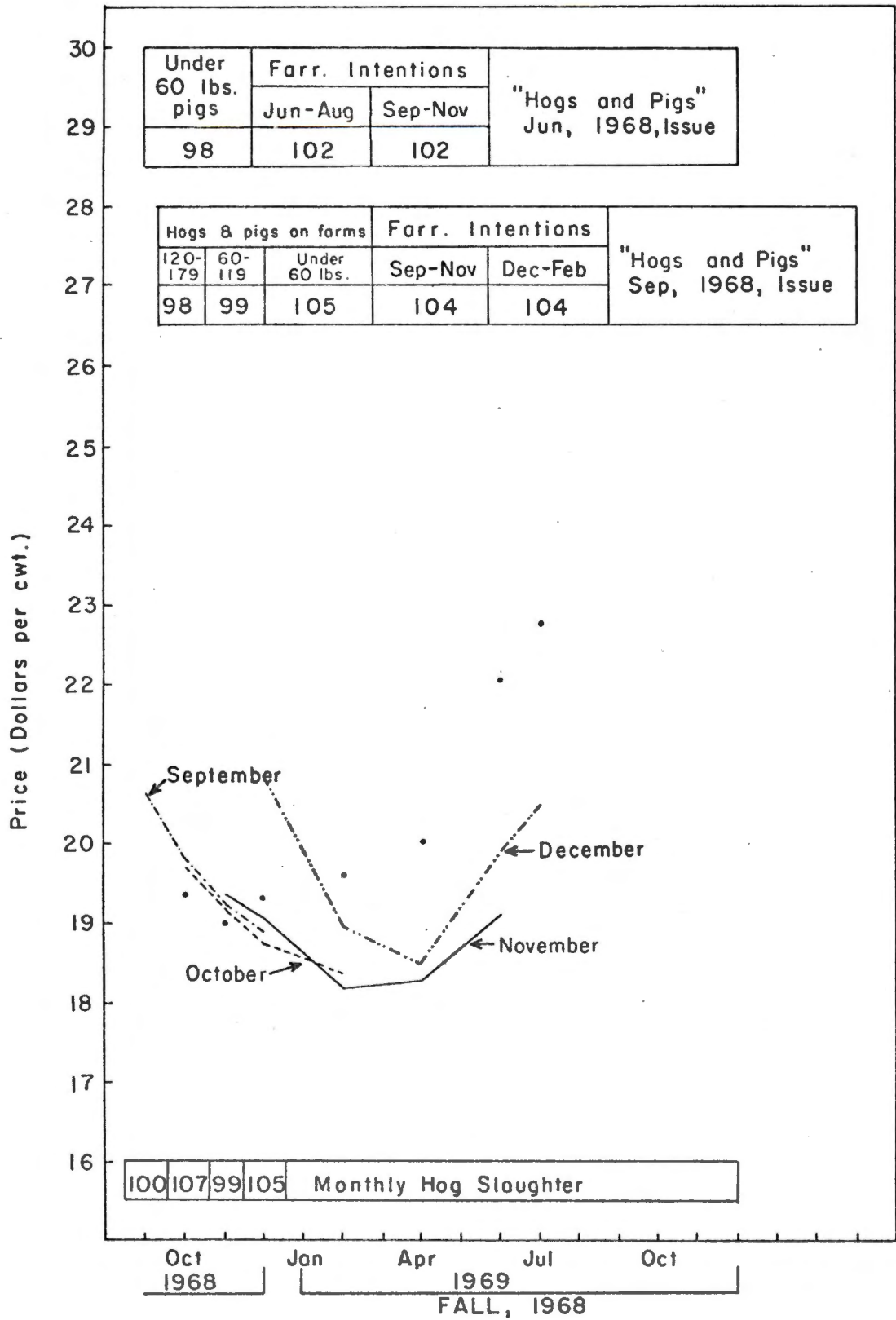


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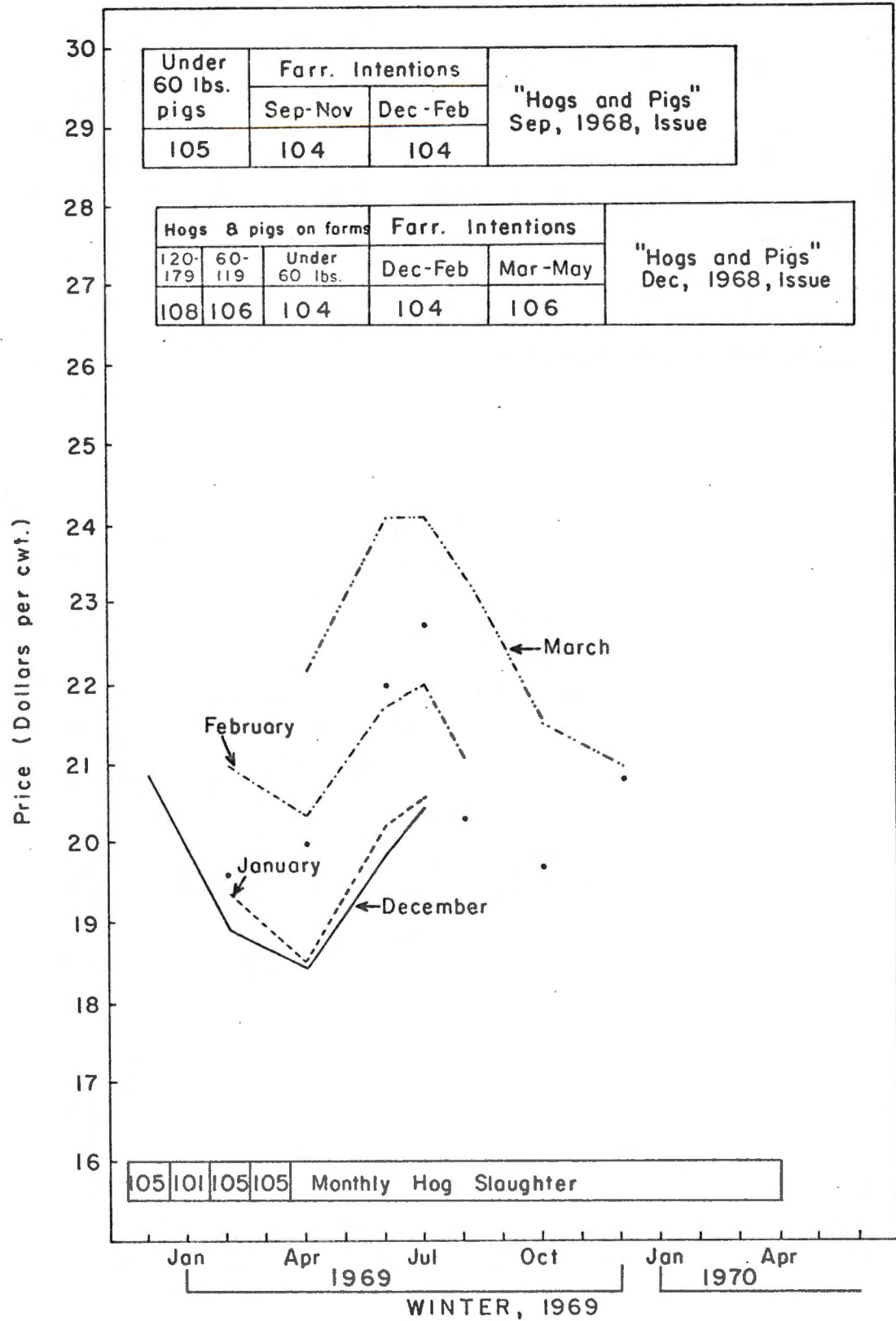


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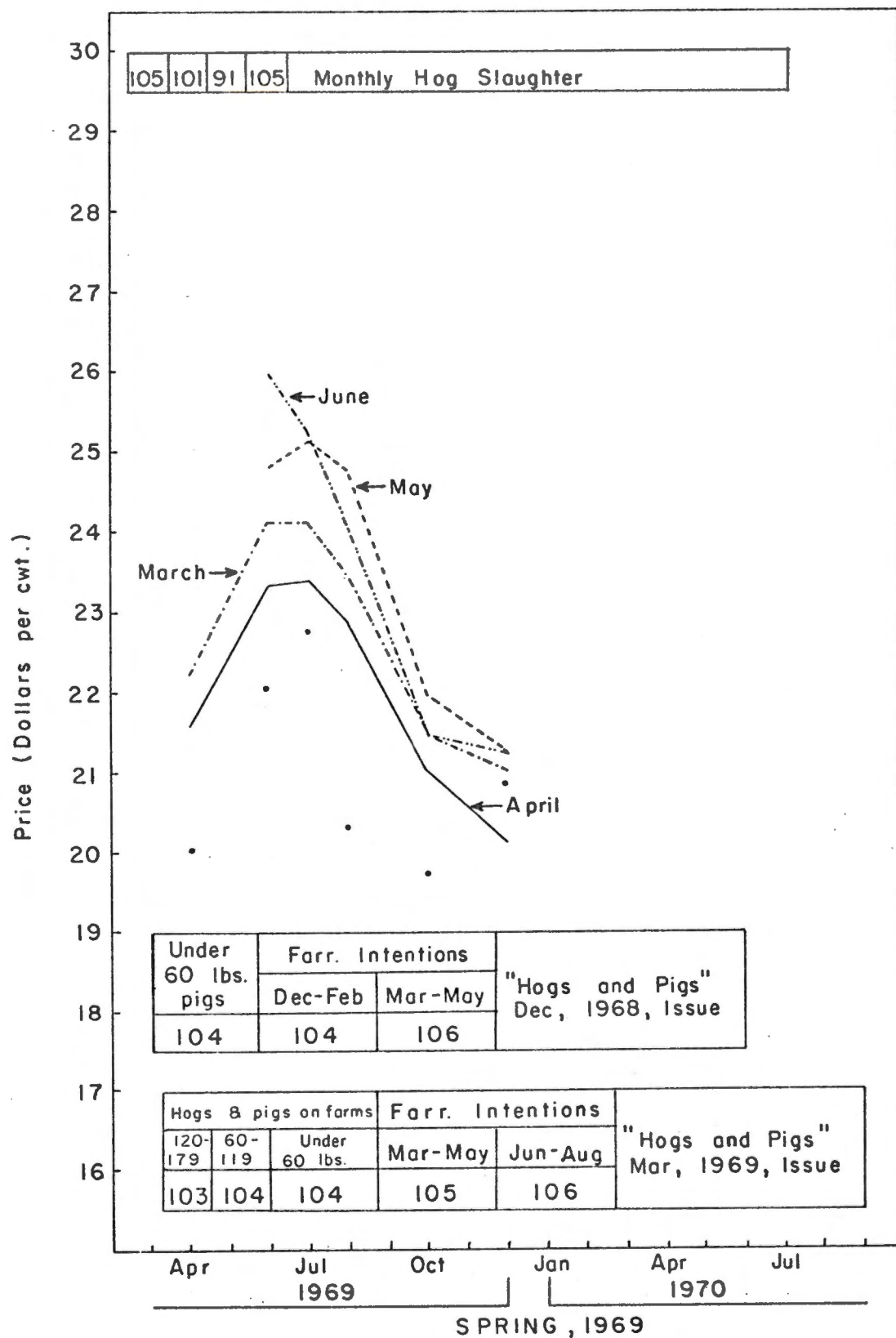


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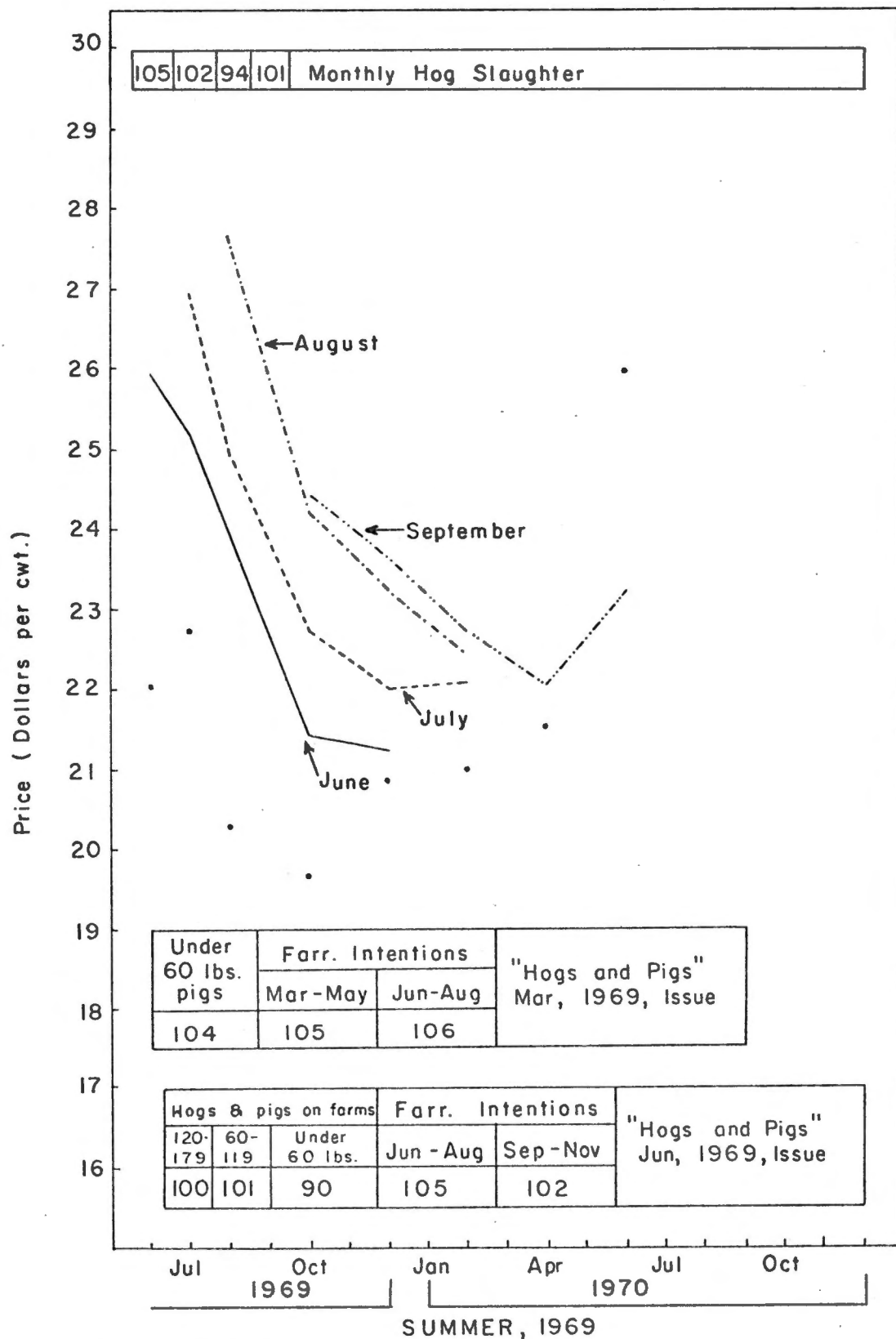


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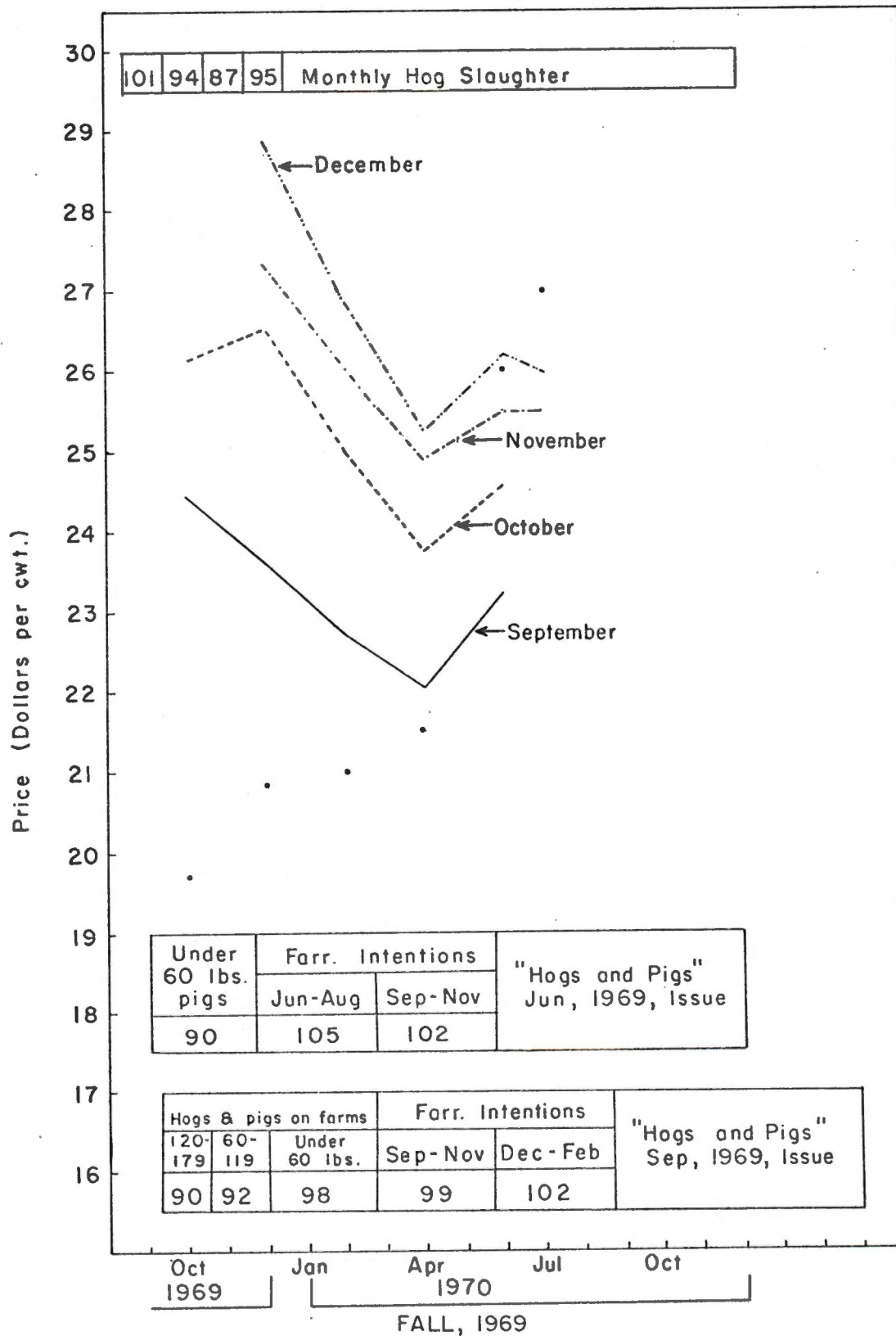


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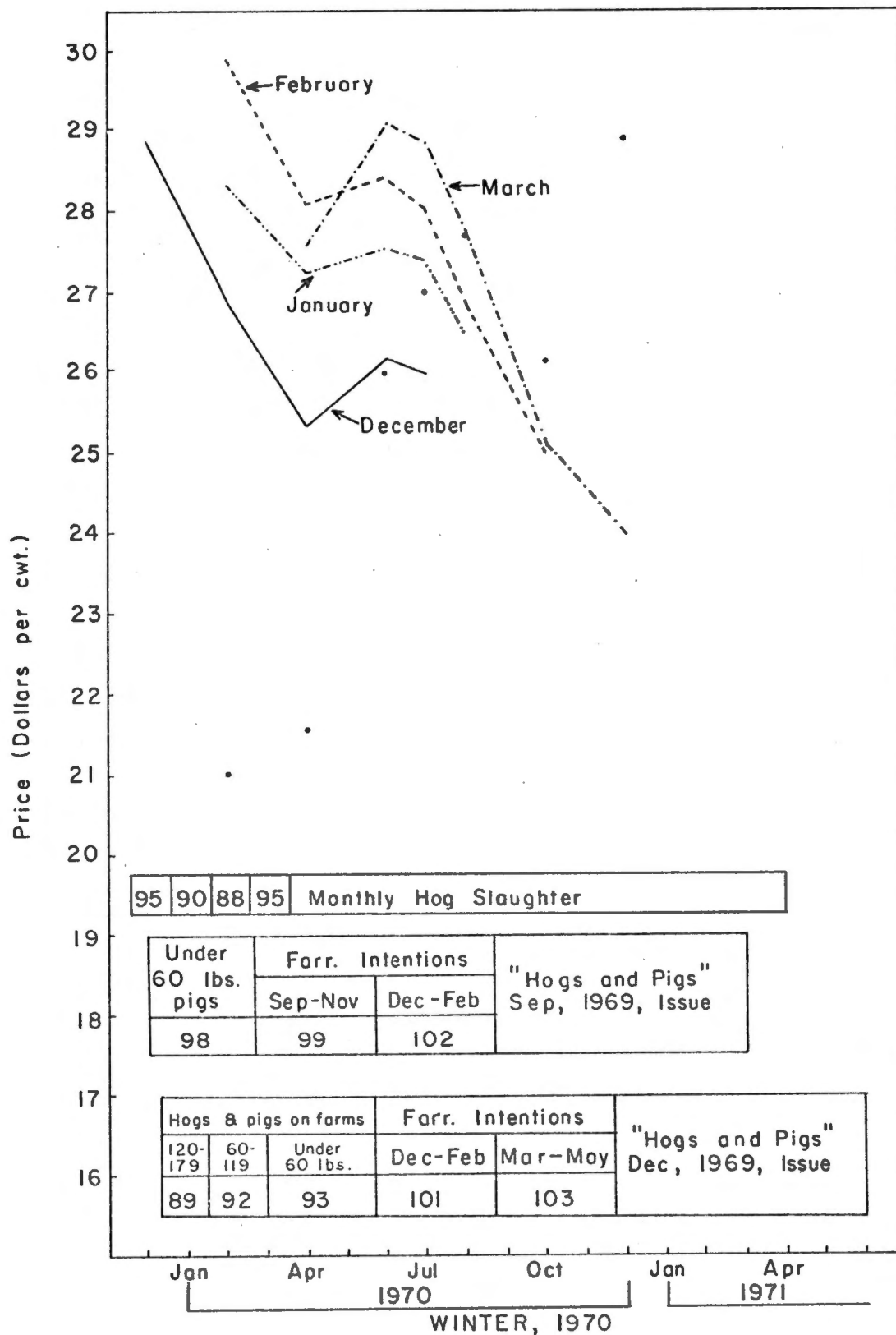


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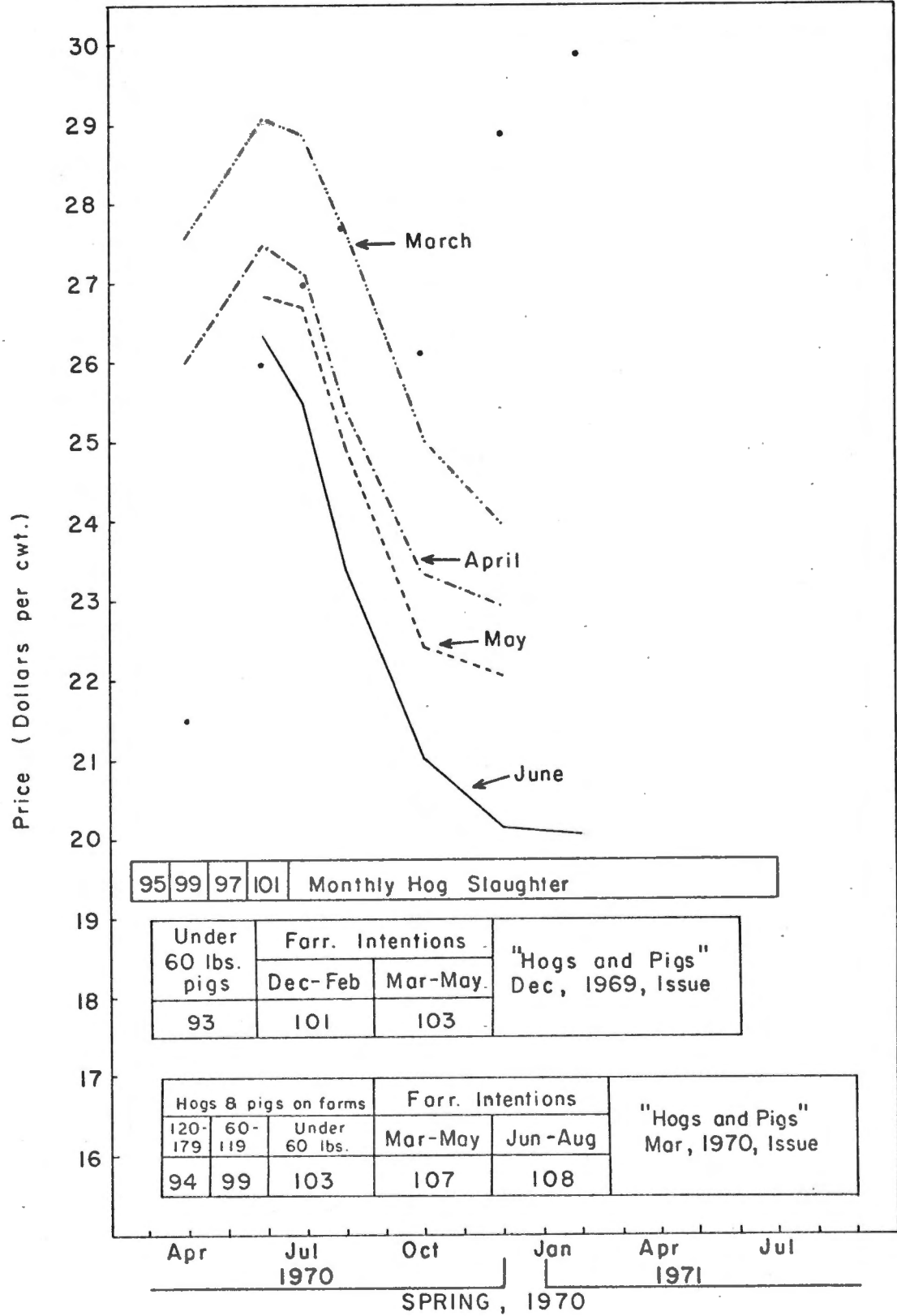


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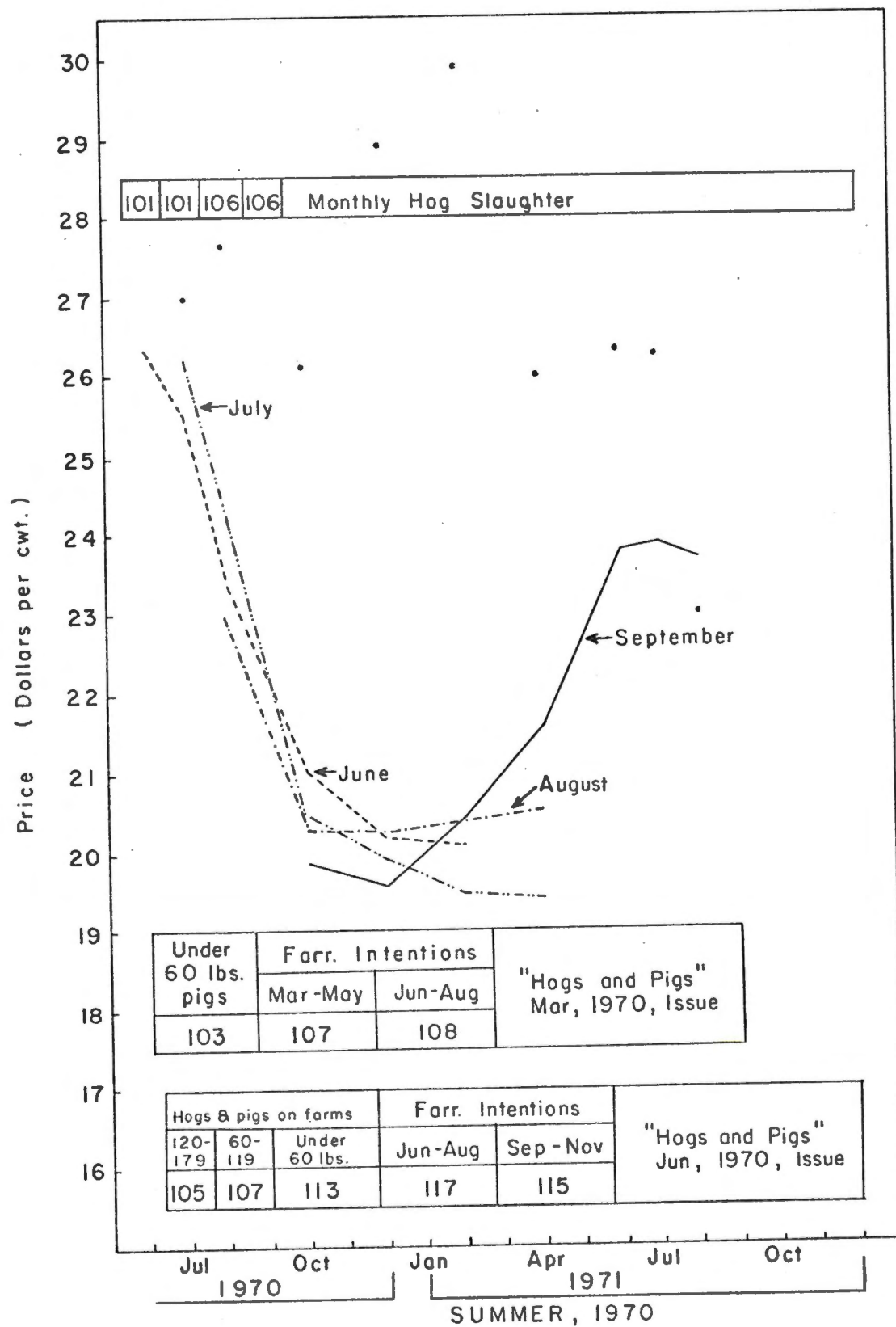


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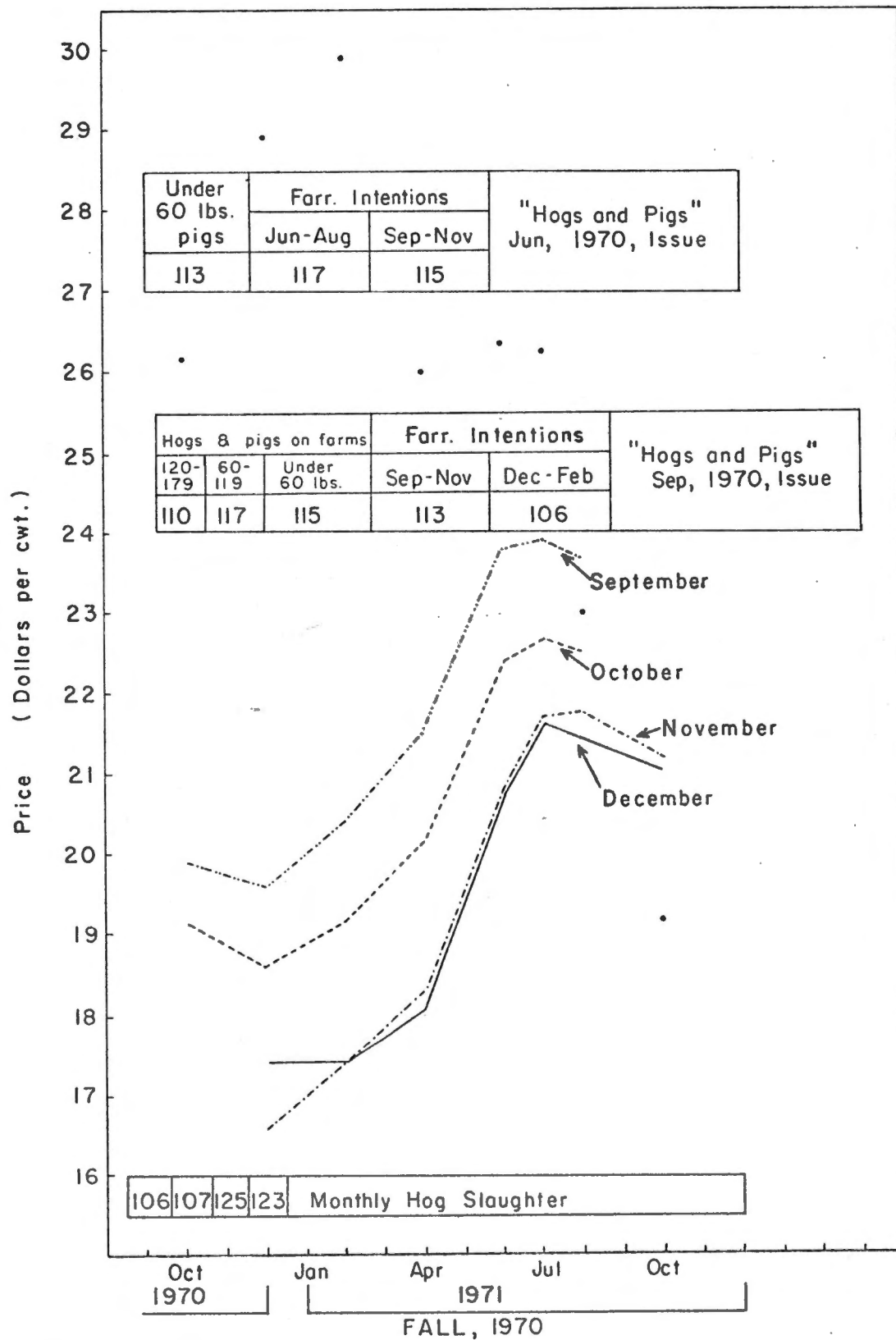


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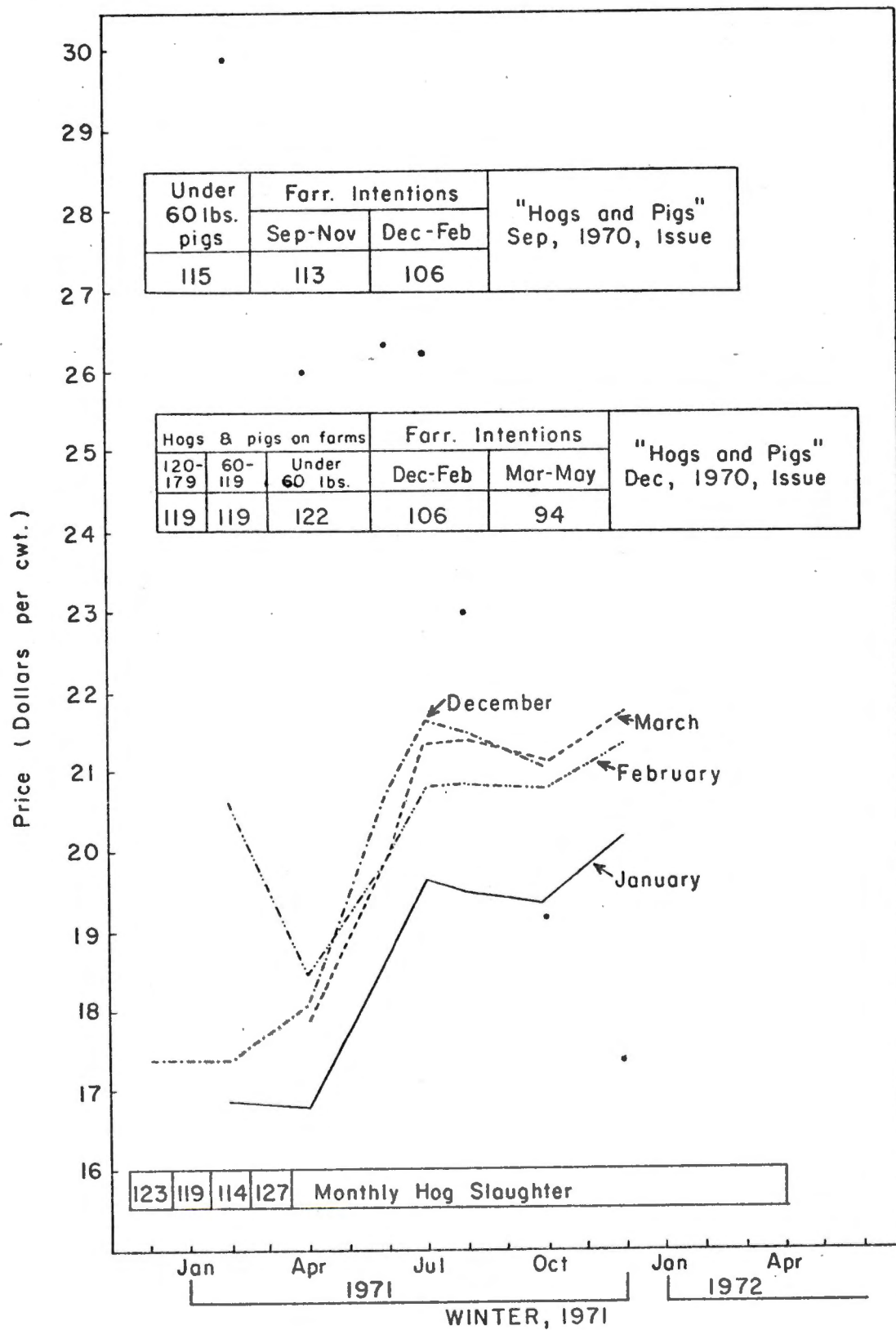


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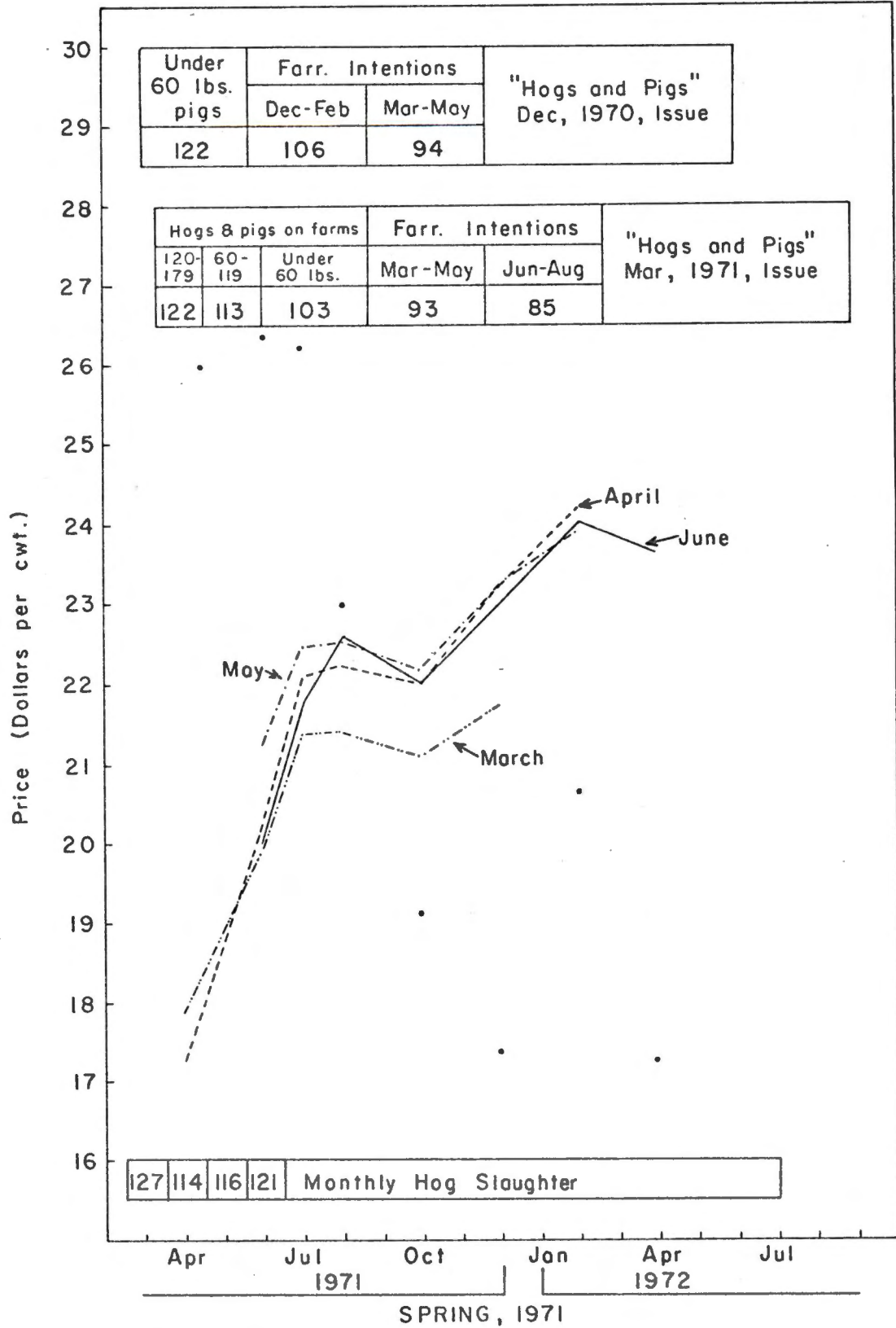


Figure 20. (continued)

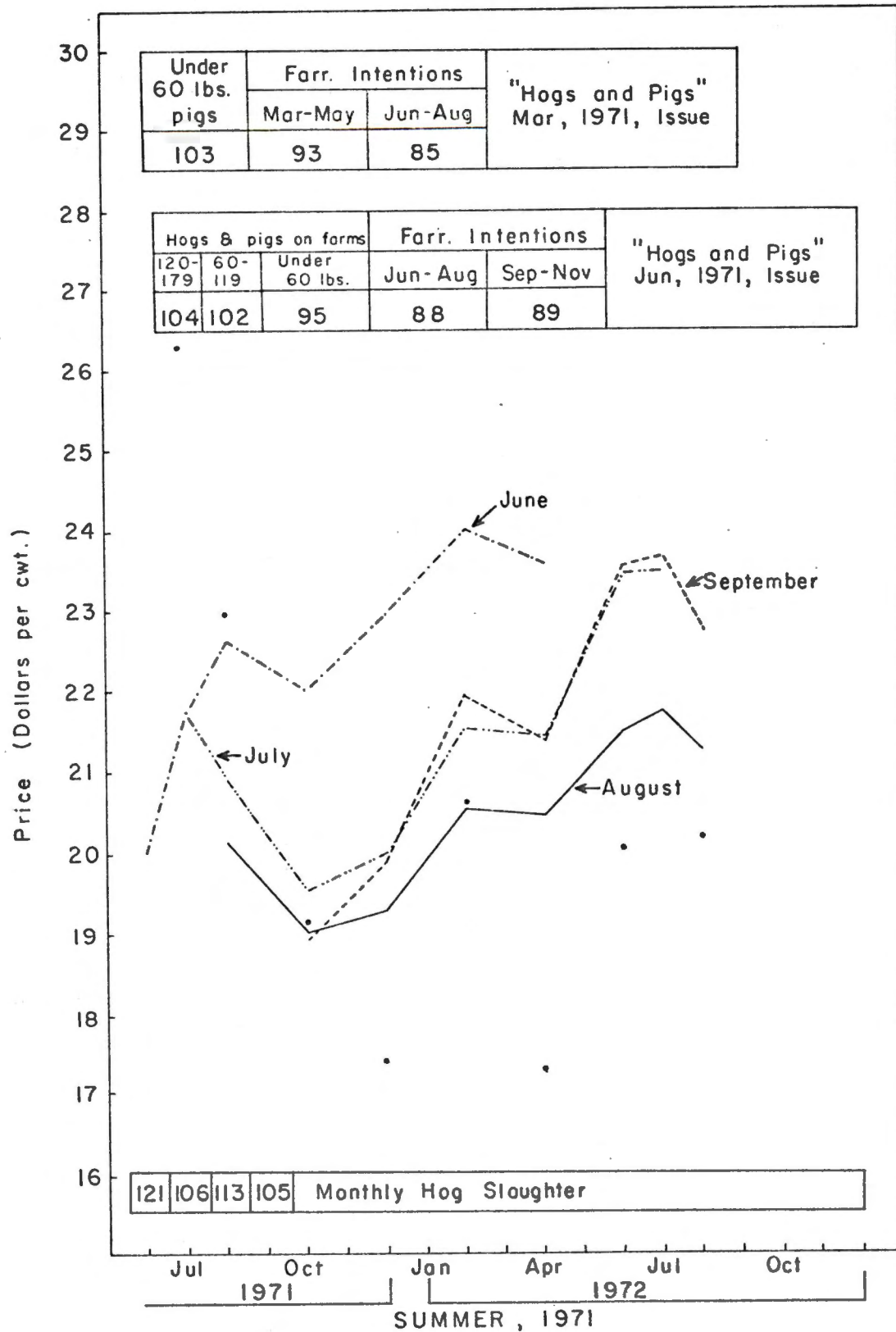


Figure 20. (continued)

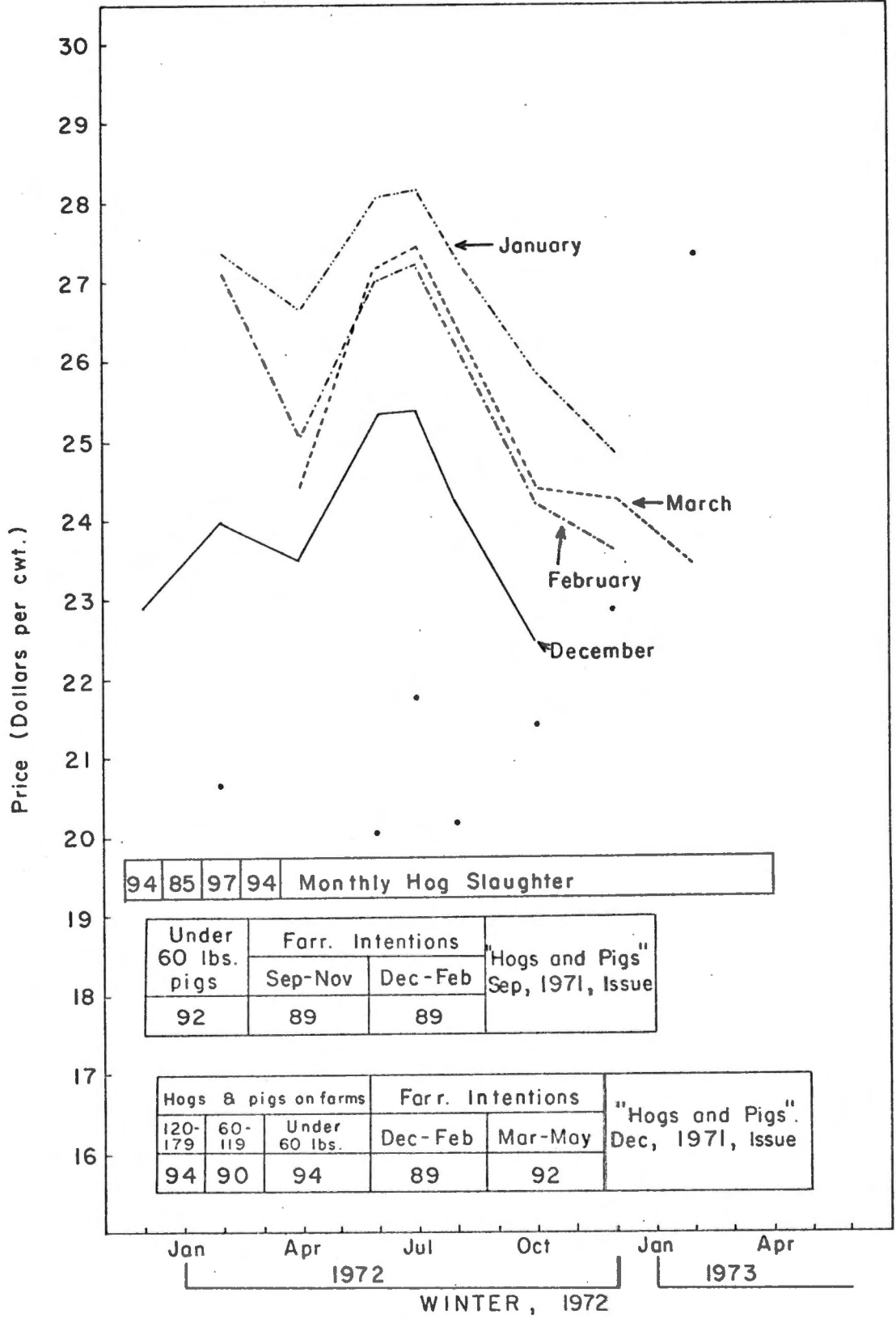


Figure 20. (continued)

VITA

René Gouin graduated in 1963 from the Institut National Agromique, Paris. He worked in an agricultural development project in Upper Volta before he and his wife, Ellen, enrolled at the University of Tennessee as students in Agricultural Economics.