

**PRODUCTION AND MARKETING OF BROILERS BY CONTRACT  
WITH APPLICATIONS TO OTHER OREGON  
AGRICULTURAL ENTERPRISES**

**by**

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PRODUCTION AND MARKETING OF BROILERS BY CONTRACT  
WITH APPLICATIONS TO OTHER OREGON  
AGRICULTURAL ENTERPRISES

INTRODUCTION

Farm production /1 has traditionally been known for its independence. The individual farmer produced those products which, in his opinion, would be most profitable, considering the resources at his command and his personal desires for work or leisure. Net returns for the product under consideration and of alternative products at the time production began determined in large measure the quantity that was produced for market. Quality of production varied with many factors such as the technical knowledge of the farmer, weather, insect pests and disease. Consumer demand for a particular product also varied with season of the year, prices of substitute products and income levels. Under these circumstances production of a specific product frequently was high when consumer demand was at a low point resulting in low prices in order to market the available supply. Fluctuations in prices and production

/1 Farm production includes marketing of the products of agriculture to the first handler. Economists define production as the creation of want satisfying power, i.e. utility. Marketing creates place, possession, and time utility. In this study, when the term farm production is used it refers to the creation of utility by the farmer in growing and selling his products. When the term production is used alone or in connection with the name of a particular farm enterprise, such as broiler production, it refers to all utility creating steps or processes from the time production is begun on the farm until the product is sold to consumers. The words, production and marketing, were both used in the title for the benefit of those not familiar with the economist's definition of production.

caused incomes to be unstable and were a source of uncertainty to farmers. These same fluctuations were a source of uncertainty to secondary industries which supplied agriculture with needed inputs or processed the products of agriculture.

To overcome the fluctuating conditions and resultant difficulties outlined above, a method of coordinating primary and secondary production with each other and with consumer demand became desirable. A contractual form of coordination has been used during the past 30 to 40 years in the production of fruits and vegetables for canning and freezing, sugar beets, and other products where assurance was needed that there would be a supply of products available to make efficient use of processing plant and equipment. In most cases, coordination has been achieved by regulating planting and harvesting schedules in line with processing plant requirements and market demand. Field service departments provided management assistance to growers and maintained quality products by advising on matters pertaining to items such as fertilization, planting, insect and disease control, irrigation, and harvesting.

In recent years, a form of coordination known as vertical integration <sup>/2</sup> has begun in other agricultural industries. The broiler industry is frequently cited as an example since it has become more integrated than most other agricultural industries. Other enterprises such as egg production, turkey production, swine production,

<sup>/2</sup> Vertical integration has been defined several ways. Most definitions, however, state that vertical integration involves the control of more than one step in the production process. Practically all firms are integrated to some degree according to such

beef fattening and lamb fattening enterprises are mentioned frequently in news releases, research and extension publications, professional agricultural journals, and group discussions as being likely to become integrated.

A number of different forms of integration have developed in a relatively short time. They range all the way from complete ownership by one firm of all resources used in production to an informal agreement between representatives of the firms involved. As a result integration is often viewed with skepticism. Farm producers fear they may lose their independence in making production decisions. Changes in relationships among firms are a source of uncertainty for which an allowance must be made when making plans and decisions.

The broiler industry has become more integrated, both by ownership and by contract, than other agricultural industries. A study of that industry should provide a basis for appraising the likelihood of contract production becoming important in other agricultural industries involving the feeding of livestock and poultry.

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definitions. Vertical integration is presumed to mean that control extends across production processes that are usually performed by two or more separate firms. It should be noted that firms with limited resources would necessarily need to have smaller operating units within the integrated organization than if the same resources were used by a specialized firm. In a new, growing industry it may be necessary for firms to be integrated. As the industry grows specialized firms develop. Contractual production arrangements are a form of integration which coordinates production of firms in different segments of an industry with the individual firms retaining their separate ownership.

## Statement of the Problem

### Developments Within and Growth of Broiler Industry Leading to Problem

Broiler production began as a by-product of the commercial egg enterprise (53, p. 511). Poultrymen fed the cockerels, obtained by purchasing straight run chicks of egg laying strains, to a marketable weight and finish. Broilers from this type of production were usually available only during the summer of each year. Breeding and feeding programs were not specialized for meat production. Processing was frequently done by the grower who also sold the broilers direct to stores or consumers. Under these circumstances quality of the product and efficiency of production were low compared to present standards.

Poultry breeding and nutrition research findings made broiler production feasible as a specialized commercial enterprise. The development of special meat strains and crosses of chicks along with rations for fast efficient growth made it possible to produce a broiler chicken of higher quality with less feed per pound of chicken. Economic factors such as increased incomes resulted in consumer purchasing more broilers. Production was encouraged through increased profits but as the number of broilers produced increased the profit margin has decreased. Broiler consumption increased rapidly during World War II and the upward trend has continued to the present time. High income levels and trends in eating habits of people have encouraged increased consumption. In some instances feed manufacturers and hatcheries actively encouraged farmers to begin growing broilers.

Improvements in production efficiency made increased profits possible in the short run. Being more familiar with new developments in breeding and nutrition research, feed manufacturers and hatcherymen no doubt recognized the profit possibilities in broiler growing sooner than most poultry growers. In some instances, these firms grew broilers in competition with farm producers.

In the beginning, some broiler growers slaughtered their birds and sold them direct to retail stores or consumers. Others sold their live broilers to processors who slaughtered other poultry in addition to broilers. Birds were frequently sold to consumers on New York dress basis /3. Later broiler growing became one area of specialization and broiler processing another. Also the supplying of manufactured feeds and chicks became areas of specialization. Specialization has resulted in the production of more uniform broilers with a shorter feeding period. Processors now sell the birds drawn and frequently they are packaged ready-to-cook /4.

Firms which have large fixed investments in plant and equipment can reduce overhead costs per unit by expanding output. A large uniform output was particularly advantageous to firms which operated on a fixed margin above costs. To help achieve this advantage, hatchery operators, feed manufacturers, and processors began to integrate various phases of broiler production.

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/3 New York dress refers to poultry that have been bled and feathers removed.

/4 Ready-to-cook refers to broilers that have been cut into individual servings ready for cooking by the housewife.

Within the broiler industry there developed two main forms of integration. One was by ownership of resources used in hatching, growing, processing and distributing broilers. The second form was one of contractual arrangements between or among firms in the industry. The latter form is much more widespread and involves a much larger proportion of the broiler industry. Integration by ownership tends to be limited to a few large scale firms. This study deals with the contractual form of integration.

Contractual arrangements have been used in broiler production for a number of years. Their use apparently coincides with the development of the industry on a commercial scale.

#### Delineation of Problem from Point of View of Producing Firms

As specialization developed, problems of equating supply and demand such that prices were relatively stable and favorable were accentuated. Increases in supply were favored in order to reduce fixed costs per unit by utilizing production capacity and adopting new cost reducing methods of production. Although an increasing supply of high-quality product encourages the development of consumption patterns and increases in demand favorable to the industry these changes occur slowly and there appears to be a tendency for supply to increase faster than demand with lower prices being the result. Contractual arrangements were begun to assure integrators of an increasing production of broilers. Purchases of chicks and feed and the demand for processing services would automatically increase as a result.

Contractual arrangements are a source of doubt, however. What their effects will be on individual firms and relationships between and/or among firms needs to be established. Individual farmers express fear that the broiler grower will become more of a caretaker than an entrepreneur. Firms in other segments of the industry are competing vigorously to maintain their present status or to obtain a larger share of the volume. The future of some of the smaller firms is uncertain considering the pressure for larger volumes at lower margins that is brought to bear by integration. These pressures may cause a departure from optimum conditions as defined by economic principles.

#### The Problem From the Point of View of Society

Changes that have been occurring also give rise to uncertainty from the point of view of society. The long run effects of changes caused by integration are of primary interest to society as consumers of food. Questions are raised relative to the long run effect on food prices and the competitive nature of agriculture. If broiler production becomes concentrated in a few controlling firms, some feel agriculture will be in danger of becoming controlled by non-farm business interests with the result being the disappearance of the family farm.

#### Objectives of the Study

The objectives of the study were as follows:

1. to ascertain differences in production and marketing of broilers when firms operate as independent units and when they coordinate production and marketing by contractual arrangements.

2. to ascertain the effects of these differences on firms in the broiler industry, relationships between firms and the consuming public.
3. to appraise the feasibility and possible effects of the use of contract production in other Oregon agricultural enterprises.

### Research Methods

Data from both primary and secondary sources were used. Primary data were obtained through personal interview surveys conducted during the summer of 1958. The first survey included forty-one commercial broiler growers in the Willamette Valley and Medford areas of Oregon. The growers interviewed were selected by drawing a random sample of growers' names from a listing of commercial broiler growers in the Willamette Valley and Medford areas of Oregon. The list was stratified by size of enterprise. A commercial enterprise was defined as one which produced 10,000 or more broilers in a 12 month period. The size strata were from 10,000 to 39,999, from 40,000 to 100,000, and more than 100,000 broilers. The sampling proportion varied from stratum to stratum. The second personal interview survey included all of the major broiler chick hatcheries, feed manufacturers using broiler growing contracts, and broiler processors.

Schedules of questions were used to guide the interview and for recording of answers. In the broiler grower survey, two schedules were used -- one to record data pertaining to general phases of the enterprise and one to record data pertaining to an individual



batch or lot 15 of broilers. Data on several batches that a given grower had sold in the recent past were obtained whenever feasible. A third schedule was prepared which was adaptable for interviewing hatcherymen, feed manufacturers and/or processors. This was necessary since in some instances one firm was engaged in all three phases of the broiler industry.

The records were edited and checked before tabulations and other statistical calculations were begun. The details of these calculations are presented in later sections of this study.

Data from broiler feeding experiments conducted by the Department of Poultry Husbandry, Oregon State College, were used to establish the input-output relationship for feed and liveweight of broilers. It was assumed that the basic input-output relationship for broilers was of the same shape in the feeding trials as in commercial broiler enterprises. A production function of the same shape was calculated using the survey data obtained from growers.

Secondary data on numbers of broilers produced and gross income were obtained from United States Department of Agriculture publications. Agricultural Experiment Station publications were the source of information on broiler production in various areas of the United States.

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15 The chicks started at one time were considered to be a batch or lot. Growers with more than one broiler building considered the broilers in a particular building as a batch or lot even though chicks may be started at the same time. Whenever this situation was encountered, separate batch records were completed for each building for use in calculating an average batch record for the grower.

## THEORETICAL CONSIDERATIONS PERTAINING TO PROBLEM

The production and marketing of agricultural products may be considered as a continuous process from the initial act of planning what to produce to the final sale of the product to the consumer. The production process includes all of the steps between these extremes. As such it can be thought of as a functional relation between inputs and output. The inputs in this case are composite inputs which consist of the usual farm inputs such as land, labor and machine time plus inputs for processing, transporting, storing, wholesaling, retailing and other required operations in producing a consumption good. The inputs may be supplied by one firm which is completely integrated or by more than one firm with each supplying part of the inputs. The typical case in modern times is where a number of specialized firms, each with a production function of its own which is part of the more inclusive function, supply specialized inputs. These specialized firms may be completely independent or they may be linked together by various contractual or other arrangements. The purpose of this section is to ascertain, in theoretical terms, what the effects are on the input-output relationship of having the inputs supplied by firms linked together by contractual arrangements as compared to having them supplied by firms operating independently. Comparisons with other situations may be used wherever clarification of the concept results.

### Situations Conducive to Coordinating Production by Contract

There are four situations which are conducive to the development of contractual arrangements (54, p. 717-721 and 68, p. 1818). First, whenever the production functions of firms operating at different phases of production are interdependent, costs can be lowered and net returns increased by coordinating production by the use of contracts between the firms. The adoption of new innovations has resulted in specialization which increases the interdependence of firms within an industry. Second, when there are possibilities of adopting new technology, adjusting to changed demand conditions, or other factors but firms are slow to change, the development of contractual production is encouraged. The third situation arises because of imperfections in the market which result in a "failure" of the market to get products produced in the right quantity at the right time. The development of the modern supermarket and new methods of retailing which require large quantities of uniformly high quality products gave rise to the fourth situation.

### Interdependence of Production Functions

Whenever production involves specialized phases of production and costs in one phase are dependent on the level and timing of production in other phases the production functions of producing firms are interdependent. The level of efficiency of firms at one stage of production depends partly on the output of firms at other stages of production. This situation gives rise to a need for

coordinating production in the various stages of production. The need also infers that some method of coordination will give a greater output for a given level of input use than firms operating completely independent of one and another would be able to achieve. This study is concerned with the contractual method of coordination and the influence it has on the input-output relationship.

The production functions for farms and for firms which either supply inputs or process farm products are interdependent. The production function of an input supplying firm is affected by farmers' decisions to buy or not to buy from the firm in question. The function is also affected by farmers' decisions as to when to buy. The latter situation has an important implication to the operation of the firm over time. The volume of production in relation to capacity in a given time period has a direct influence on costs per unit and net returns. The firm must keep costs per unit low to compete with other firms. The production function of firms that process farm products is affected similarly by farmers' decisions. The interdependence in the functions has been an important motivating force for contractual production arrangements between firms. In some industries, firms that supply farm production inputs or that process the products of agriculture have been in a position where they could increase or insure a given level of profits by giving contracts for farm production according to specified conditions relative to how and when the production was to be accomplished. In contracts involving inputs for farm production the method of payment was an important consideration.

The need for additional capital for farm production encouraged farmers to accept contracts. Contractors frequently supplied inputs on a credit basis and shared the risks of production with the farmer in order that the contracts would be acceptable to farmers.

The interdependence of production functions and contractual arrangements may lead to conflicts in the attainment of optimum production conditions in all firms operating at the various stages of production. For example, a particular characteristic may be beneficial from the point of view of a firm at the farm level but may result in higher processing costs. Also suppliers of inputs may find it difficult to operate at the optimum point of production unless they can induce the users of these inputs to produce such a large volume that the price of the product is reduced to a point that only a few most efficient producers earn a competitive return for their labor, capital and management.

Interdependence further complicates production since the optimum size of enterprise is not the same in all stages of production. The processing phase in most agricultural production is efficiently carried out only at a size that can handle the output of a number of farm units ranging from several to many units. Likewise many farm supply phases of production require a size of enterprise for efficient operation that will meet the requirements of many farm units.

The conflicts between the production functions and differences in optimum size of enterprise may result in the firms which have a stronger bargaining position taking advantage of their power in

forcing other firms to produce under other than optimum situations. These power positions may be reflected forward to firms nearer the consumer or backward to firms nearer the beginning of the production process.

### Economic Change

Change involves the adoption of new methods. Historically, the adoption of new technology has taken time. Assuming the technology will increase net income this makes it possible for early adopters to earn greater profits than those who have not yet made the adoption. Sometimes the advantages of a particular change may not be apparent to firms most directly involved. Farm firms may be reluctant to make adjustments in production plans in line with changes in demand or in the technology used in production. In some instances it may be impossible for farmers to acquire additional capital or other factors needed to make an indicated adjustment. Under such circumstances a non-farm firm may recognize an opportunity to increase its income through contracting with farmers for production and farmers may welcome the easing of some resource restriction such as capital as a result of the contract. The increased income from an expansion via the contractual method may be greater than would be the case by a horizontal expansion of the business making contracts with farm producers.

### Market Imperfections

Much has been written about the effects of deviations from conditions of perfect competition. The purpose of this brief section is not to give detail of economic theory but rather to state in general terms how market imperfections give rise to the need for a method of coordination to supplement market prices.

In a perfectly competitive system of markets, price coordinates production by giving guidance to the decisions made by entrepreneurs at various stages of the production process. Resources are allocated among the various stages by the profitability of firms operating at the various stages. If a particular phase of production has too many resources more output comes forth than can be sold at existing prices and as a result prices decline with a direct depressing effect on profits. Reduced profits encourages the shifting of resources to other phases of production until profits are equated in all phases of production.

Economists have recognized the fact that the real world departs from the perfect competition model. Much has been written about conditions of monopoly and imperfect competition. When conditions of perfect competition are not met, producers do not have perfect knowledge, the number of buyers and sellers may be a few instead of many and the actions of one buyer or seller may affect the transactions of other buyers and sellers.

The timing of production in relation to demand is extremely important. Decisions made by firms operating with less than perfect

knowledge results in periods when the quantity that suppliers have available can only be sold at reduced prices or periods when the quantity available is reduced to the point that marketing transactions occur at increased prices. Price does not coordinate production with market demands and fluctuations in price result. Price fluctuations are a source of uncertainty which contributes to problem of price being unable to coordinate production within production periods.

Under conditions other than perfect competition, firms find it to their advantage in terms of profits to supplement price as a method of coordination. Non-price competition becomes important. Firms attempt to avoid price competition by establishing brand-names for their products which are differentiated from competing products in the minds of consumers, by contracting for supplies of inputs or for sale at a future date, by integrating additional functions, and in other ways.

#### Development of Modern Retail Food Stores

Retailing of food products has undergone tremendous change. The development of chain stores about the beginning of the century started a trend toward larger stores in food retailing. The more recently developed supermarket and cooperative arrangements among supermarkets have accentuated the trend toward larger stores. The large retail establishments have adopted new methods of retailing which require an assured volume of quality food products. The customer in a modern foodstore shops on a self-service basis with few contacts with



sales personnel. The products must "sell" themselves. This can be done best by maintaining uniformly high quality products in the displays at prices that attract customers. To acquire the products wanted, retailers specify the quality and quantity of the various products desired and accept offers for the delivery of the products. In some cases it has been necessary to inform farm producers of these specifications via contracts to assure having the products when needed. Contracts may be made by the retailer directly or by a processing firm which sells to the retailer.

#### Relationships in Broiler Production Which Have Encouraged Production by Contract

The purpose of this section is to review what has happened in the broiler industry which has encouraged coordination of production by contract in the various segments of the industry. The four situations outlined in the previous section are considered in relation to broiler production.

#### Interdependence Among Broiler Firms

Broiler production was started by non-specialized producers who not only fed broilers, but often performed the processing and wholesaling functions as well. In many cases, production was seasonal and was one enterprise on diversified farms.

With the development of the modern broiler industry specialization occurred. The production process was divided into specialized

production phases. In some instances, several phases of production were performed by one company but the general situation has been for firms to specialize in hatching, growing, feed manufacturing, processing, or retailing.

Specialization has occurred to take advantage of more efficient methods of production. These methods involve the development of new technology in all phases of production. Specialization has brought about increasing interdependence among firms in the industry. Cost functions in a particular firm depends on production decisions made by other firms.

#### Technological Developments

The broiler industry has undergone rapid change as a result of new technology. Research of Agricultural Experiment Stations and private firms has brought forth a rather steady flow of improved strains of meat chickens, new feed formulas, and machinery for feeding and processing broilers.

Breeding and nutrition. Poultry husbandry specialists in breeding and nutrition have been able to develop new strains and crosses of chickens and feed formulas which have increased the efficiency of growth. That is, a larger bird weight is now obtained for a given level of feed consumption per bird. Individual growers who purchased the improved chicks and rations made greater profits than other growers assuming other things equal.

Mechanical innovations. Hand labor used in handling of feed was an important item of expense in the broiler industry. The feed was usually delivered to the farm in bags, unloaded by hand and the feed fed by hand. The development of bulk delivery trucks which can deliver up to 12 tons of broiler feed reduced the handling cost. The adoption of mechanical feeders by some growers has reduced labor requirements and thus labor costs.

In the processing of broilers, overhead conveyor lines and automatic equipment have increased the number of birds a given plant could process per hour reducing the labor requirement per 100 pounds of chicken processed.

Many of the mechanical developments are profitable only when used at near capacity levels. Fixed costs in machines and equipment are higher as a result of new developments.

#### Competitive Conditions in the Broiler Industry

Competitive conditions in the broiler industry range from conditions approaching perfect competition in the growing phase where the number of firms is large and the demand curve nearly perfectly elastic to imperfect competition in other segments.

Broiler growing. In the broiler growing segment, no one firm controls a large enough share of the total output of the industry or buys a large enough share of the inputs that its actions influences prices received or paid by other producers. In other words, buying and selling transactions occur at market price.

Since the size of broiler growing firms is relatively small, entry into broiler growing is easy compared to entry in other segments of the industry. Many growers adapt buildings originally constructed for other uses to the growing of broilers. Anyone having the capital necessary to gain control of broiler houses and equipment either through purchase, construction or leasing and to purchase chicks, feed, and other supplies may enter production as a broiler grower. Ability to obtain production credit either through a credit association, a commercial bank or by contracting with a feed manufacturer or broiler processor makes entry even less restrictive.

Chick hatching, feed manufacturing and broiler processing. The chick hatching, feed manufacturing and broiler processing segments of the industry have many similarities relative to degree of competition. The number of firms in each segment is small compared to the number of growing firms. Each hatchery and feed manufacturing plant using modern machines efficiently produces sufficient volume to supply multiple growing firms with chicks or feed and each processing firm can slaughter the output from a fairly large number of growing firms. This relationship between relative size of firms results from economic forces within the various segments of the industry which determine the optimum size of firm. Some of these forces originate in the technological developments in a particular phase of production.

Since the number of firms is small the policy of an individual firm has an effect on competing firms. An increase in feed or chick

sales by one firm frequently means a decrease in sales by other firms. An increase in purchases of broilers by one processor as a result of bidding a higher price would mean other processors would have to either bid competitively or limit their processing operations. Under conditions of imperfect competition, however, firms tend to restrict price competition whenever possible. Managers adopt non-price-competitive measures. Contractual arrangements are a means to avoiding price competition since a "captive" market situation is created. It should be emphasized that the length of the contract determines how long the captive market exists. Integrators must meet competition from other integrating firms at the time of renewing contracts. In order to encourage growers to agree to contractual arrangements these firms offer incentives such as guarantee of a market for winter batches of broilers, sharing of losses in the event prices decline below specified levels, and management assistance. Some instances of concealed price competition undoubtedly exist such as a grower receiving more than usual "extra" chicks or freight reductions on feed deliveries.

Entry into either broiler hatching, feed manufacturing, or broiler processing is considerably more difficult than entry into broiler growing. Established firms have attained their size through expansion as the industry developed, or through large investments at the time of entry. Few individuals have resources that will allow them to enter with a sufficient volume of business to attain economies of scale to be competitive pricewise with established firms.

Among the established firms operating in Oregon are branches of corporations engaged in other activities as well as broiler production and marketing. Under conditions of temporarily low margins in a particular area brought about by the entry of a new firm or other conditions it is possible for established firms to continue production by depleting reserve accounts or relying on earnings of other departments. Under such circumstances, the entrance of a new firm becomes difficult and unattractive. Individuals or firms with resources that would allow them to enter the broiler industry in one of these segments frequently may find a more profitable use for their resources.

Product differentiation becomes a very important part of the policy established by individual hatcheries, feed manufacturers, and broiler processors. This is evidenced by extensive advertising campaigns conducted by these firms to establish brand names for their products.

Broiler retail outlets. The retail segment of the broiler industry is different from other segments. The majority of broiler sales are through the meat departments of retail food stores. This department may in some cases be operated on a concession basis by a specialist who leases space from the store owner. For purposes of this study, the fact that broiler retailing may be done by a meat department operator who does not own the complete store is not important. The important difference between the retail segment and other segments of the industry lies in the fact that the retail function is not performed by a firm specialized in broilers to the degree firms in

other segments are specialized. Receipts from the sale of broilers comprise a small percentage of total receipts for an average retail market. This is particularly true of large supermarkets and chain stores whereas receipts from sale of broilers or inputs for broiler production tend to make up a large proportion of total receipts in other segments of the industry. Exceptions to this occur in the case of feed manufacturers who may specialize in feeds other than broiler feeds or in the case of national meat packers who are active in broiler production and marketing.

The number of firms that sell broilers at retail is relatively large when all retail grocery stores are included. Many such stores handle a very small number of broilers per year, however, compared to the large supermarkets and chain grocery stores. For purposes of this study it was the larger stores taken as a group that were considered as a segment of the broiler industry.

The number of large stores is relatively small compared to the total number of stores. The number of broilers sold per large store is probably between 10 and 15 thousand broilers per month. It is not size as measured by the volume of broilers marketed per retail store that is important but the size of investment that is required to establish a large-scale retail outlet which determines the number of firms and also the relative ease of entry.

### Changes in Retailing

The development of the large food supermarket and self-service shopping appears to be the change that triggered many other changes. Supermarkets placed emphasis on volume selling at reduced markup to attract customers from competitors. One of the ways costs per food item sold was reduced was to eliminate much of the selling labor needed by old methods by displaying the items where the buyer could select the desired items directly. In the case of broilers this change was accompanied by changes to prepackaging of the broiler and to ready-to-cook broilers for a large part of total sales. For this method of selling to be successful, the customer must be satisfied with the quality of broiler obtained each time a purchase is made. Also the product must be available when the customer wants to buy. Supermarket management insisted on uniform quality of broilers on a year around basis when buying from processors. The large number of broilers purchased by supermarkets attracted processors to supply them with the kind and quality of broilers desired and in the volume required. The availability of broilers at all seasons of the year at lower prices stimulated consumption.

Processors needed an assured supply of high quality broilers available for slaughter when needed to fill orders from retail outlets. Supermarket accounts were particularly sought after since the selling costs per broiler were lower on the large orders and repeat orders more readily obtainable when satisfactory service was given.



Processors who could reduce costs of processing could attract more business which itself meant cost reductions per unit for a given plant since overhead costs could be distributed over more units. Thus, processors were striving for cost reducing techniques which resulted in modern facilities which process large numbers of broilers at a low cost per bird.

### Effects of Contractual Arrangements on Production Decisions

Production decisions are made on the basis of present knowledge and what the manager thinks the situation will be in the future. Many factors influence the manager of a firm in the making of these decisions. Costs in relation to receipts for alternative uses of resources or for alternative ways to produce a given product undoubtedly are important. The confidence the manager has concerning his knowledge of the present and how well it represents future situations would influence his decision. In some cases, a specialized fixed investment may be an important determinant in production decisions.

Contractual production arrangements do not remove the need for production decisions but they do change the circumstances under which they are made. One important way in which the circumstances are changed relates to the uncertainty involved in trying to judge the future.

Firms operate under conditions of uncertainty and in some instances under conditions which make adjustments in production difficult if not impossible. These conditions may explain why

broiler growers or other firms may not adjust production to achieve maximum profits.

A firm's reaction to uncertainty may be demonstrated by discounting the marginal value product curve, figure 1. This discounting causes producers to use less inputs or to not expand their enterprises to optimum size since the entrepreneur equates MC (line AD) with the discounted marginal value product line. Anything such as contractual arrangements that reduced the amount of uncertainty and thereby the discounting of MVP would be expected to have an output-increasing affect. Without contractual arrangements the degree of uncertainty would be high. Broiler growers would not expand production to take full advantage of profit possibilities when new developments occurred. Broiler hatcheries, processors and/or feed manufacturers would likewise be slow to expand without assurance that the growing segment was expanding at a rate that would require their new capacity. Costs per unit would be higher under these circumstances which would tend to keep marketing margins wide. Specialization and its resultant lower costs would be hindered. With uncertainty reduced by contractual arrangements, size of firm in all segments could be increased with lower unit costs and more specialization to take advantage of new developments in breeding, nutrition, management and equipment. Depending on the degree of competition that exists, lower costs are either passed on to consumers in the form of lower prices or shared between lower prices to consumers and higher profits to producing firms.

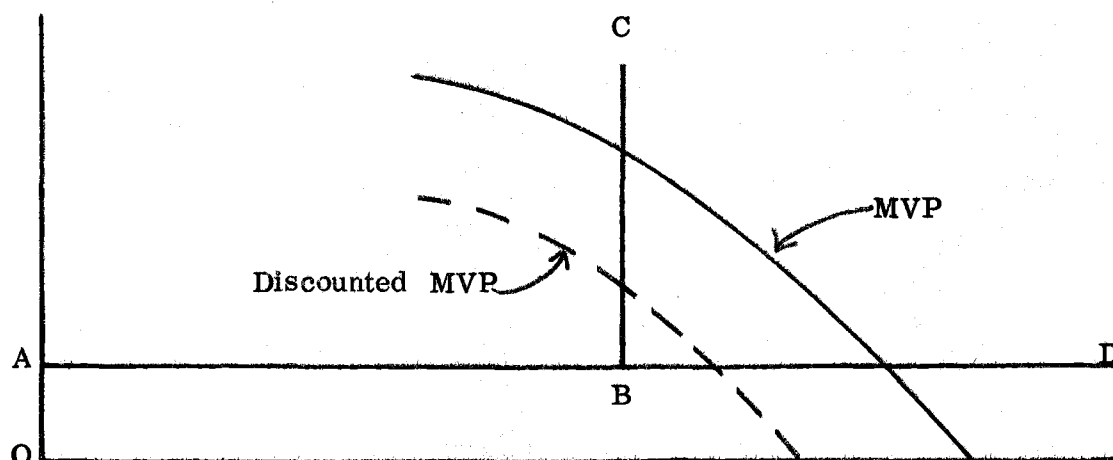


Figure 1. Discounted marginal value product and marginal cost curve with and without input rationing

The situation where the manager finds it difficult or impossible to make adjustments in production may also be illustrated by figure 1. Assume that line ABC is the marginal cost of a resource such as capital. At point B the curve becomes infinitely inelastic. This occurs when a loaning agency establishes a maximum amount they will loan a given firm. Capital is rationed to the firm and prevents the optimum combination of resources. A similar situation occurs if the entrepreneur has an aversion to risk and restricts the level of input use or size of business to avoid increased risk.

Contracting firms frequently make capital available by supplying inputs of production on a credit basis in order to attain a larger volume of sales. This would have the effect of shifting the point at which the marginal cost line becomes infinitely inelastic to the

right. Under such a situation the firm would use a larger number of units of input and total output would be increased.

Contractual arrangements which provide a guaranteed minimum price per unit of output or a similar provision would shift some of the risk from the broiler grower to the contractor. A grower who had voluntarily restricted capital use because of an aversion to risk would tend to expand his enterprise when growing broilers under a minimum price guarantee.

Most contractual arrangements involve supervision or at least visits by fieldmen representing the contracting firm. The assistance obtained in managing the growing operation may reduce the amount of variation in output in a particular enterprise. In this way risk would be reduced. The variation in output may result from new ideas gained from fieldmen or from the recognition of a disease problem early enough to initiate control methods before losses become large. Supervision may increase feed efficiency by proper adjustment and location of feeders and waterers or by insisting a grower be prepared for emergency power failures or extreme hot periods.

## ANALYSIS OF SURVEY DATA AND PRESENTATION OF RESULTS

This section presents the results of the analysis of data collected by personal interview surveys and from secondary sources. The first part presents a brief statement of the status of the broiler industry in Oregon and the United States. Next the results of testing for differences in the production surface due to degree of integration and size of enterprise are presented. The last part of this section compares present broiler production with theoretically optimum situations to ascertain any effects that may be due to contractual production arrangements.

### Status of Commercial Broiler Industry

The commercial broiler industry has experienced rapid growth during the relatively short time since its beginning. The number of broilers produced in the U.S. increased from about 34,000,000 in 1934 to 1,659,636,000 in 1958, table 1. Gross income from farm marketings and value of home consumption for broilers increased from \$19,000,000 in 1934, which is the first year broiler receipts were listed separate from other farm chicken receipts, to about one billion dollars in 1958. During the same period cash receipts from sale of other farm chickens declined.

Broiler production in Oregon increased at a faster rate than the average rate of increase in the United States. Production increased about 65 times in Oregon compared to an increase of 40-45 times in the United States. The number produced in Oregon increased from about

Table 1. Commercial broiler production and gross income from broilers in Oregon and the United States, 1934-59

Year	Oregon		United States	
	Number Produced Thousands	Gross Income Thousands dollars	Number Produced Thousands	Gross Income Thousands dollars
1934	120	53	34,030	18,861
1935	150	70	42,890	24,551
1936	200	94	53,155	31,357
1937	225	111	67,915	41,809
1938	250	115	82,420	45,509
1939	275	110	105,630	52,037
1940	421	172	142,762	71,621
1941	690	298	191,502	102,975
1942	828	497	226,187	154,650
1943	1,159	835	285,293	238,262
1944	1,043	939	274,149	235,282
1945	1,172	1,704	365,572	327,059
1946	1,549	1,735	292,627	288,603
1947	1,704	2,018	310,168	302,170
1948	2,471	3,180	370,515	405,171
1949	3,212	3,083	513,296	442,530
1950	4,336	4,162	631,458	532,652
1951	5,854	5,269	788,601	689,317
1952	5,093	4,831	860,891	756,182
1953	4,889	4,041	946,533	786,324
1954	5,525	4,177	1,047,798	746,891
1955	6,133	5,000	1,091,684	843,953
1956	8,382	6,035	1,343,660	838,450
1957	7,697	5,345	1,447,523	886,062
1958	8,340	5,231	1,659,636	1,002,186

120,000 to more than eight million while gross income increased from \$53,000 to about \$5.2 million.

The year 1934, at least for data reporting purposes, represents the beginning of the commercial broiler industry since that is when the industry achieved enough importance to justify the collecting and reporting of statistical data separate from other farm enterprises. Of course, broilers were produced prior to this date but the number produced and gross income were probably less than in 1934.

The rapid growth of the broiler industry may be attributed to several factors. New developments in breeding, nutrition and processing were very important. Another important factor which merits special attention is the development of new business arrangements between firms in the industry. Contractual production arrangements, one of the new arrangements, was the focal point of this study.

Contractual production arrangements make coordination between segments of the industry easier. Feed manufacturers or dealers have been the principal source of contracts in Oregon (56, p. 10). Contracts assure a sale outlet for feed in the case of the feed manufacturer and a source of financing for the grower.

Early broiler production was a high risk enterprise. A disease outbreak or a price decline for broilers was often financially disastrous for the individual grower. Because of the high risk, credit agencies usually were reluctant to finance broiler production unless other assets were available to secure the loan. Prospective broiler growers frequently were unable to satisfy security requirements. In order to expand sales of feed and supplies, contracting firms extended

credit for growing broilers on a more liberal basis. Credit for variable capital needs allowed established and prospective growers alike to use their own funds to finance buildings and equipment in expanding or starting a broiler growing enterprise.

No historical record was found of the first broiler production contract in Oregon. Cable of Arkansas has written that:

"In 1929 and 1930 a new method of financing broiler production was made available by several local hatcherymen and feed distributors. Baby chicks and feed could be obtained on credit; the amount due was payable when the farmer marketed his broilers." (12, p. 8)

It seems likely that contracts and financing arrangements started somewhat later in Oregon. Interviews with representatives of the principal feed manufacturing firms, hatcheries and processors that were active in 1957 indicated that contracts were started during the late 1940's and early 1950's. The number of broilers produced in Oregon began to increase at a faster rate in 1946 which marks the beginning of commercial broiler production in Oregon. Apparently, contractual production arrangements were initiated after the industry was fairly well established.

#### Description of Broiler Growing Enterprises

Personal interview survey data were obtained from a sample of broiler growers selected at random within three size strata. This section describes the enterprises and compares the three size groups.

Broiler growers interviewed in the small size group had produced broilers commercially for 3.5 years on an average, table 2.



Growers in the medium and the large size groups had 4.8 and 8.0 years of experience respectively. This relationship indicates that broiler growers may start with a small enterprise and expand as experience is acquired.

Table 2. Experience of broiler growers by size groups, Willamette Valley and Medford Area, Oregon 1957-58

Size Group	Number of broilers pro- duced annually	Experience as commercial broiler grower	Experience with some form of integration
	Number	Years	Years
Small	10,000 - 39,999	3.5	3.0
Medium	40,000 - 99,999	4.8	2.6
Large	More than 100,000	8.0	1.8
<hr/>			
Average of all growers $\angle a$		4.3	2.8

$\angle a$  Average is weighted by the inverse of the sampling proportion in each stratum.

Growers experience with some form of integration was inversely related to size of enterprise. Experience as independent growers average one-half year for the small size group but more than six years for the large size group. One grower in the small size group and four growers in the large size group indicated that production for their enterprise had not been under contract for the period of time included in the survey. At the time the survey was made several growers who had not produced under contract previously had become members of a cooperative and had signed contracts for the batch they were then growing. Some indicated they had done so in

anticipation of low market prices for broilers during the latter part of 1958.

A majority of broiler growers in all three groups were experienced poultry producers at the time they began to grow broilers commercially. However, the number of growers in the medium size group that were experienced poultry producers represented only 53 percent of the growers. Sixty-four percent and 91 percent were experienced poultry producers in the small and large size groups respectively. Of the experienced producers, most had been egg producers. Turkey production was the second most frequent type of experience.

Broiler growing was the only commercial farm enterprise for most of the growers interviewed. Approximately one-third produced either small grains, orchard products, or pasture on a relatively small scale. Only four growers had other poultry or livestock enterprises.

Growers in the small size group were employed off-the-farm more than growers in the other two groups, table 3. This indicates that 10,000 to 40,000 broilers per year did not provide full time employment. School bus driving or truck driving was the most common type of off-the-farm employment for the small-size group. The small-size group worked about one-fourth of their working time off-the-farm. The percentage for individual enterprises ranged from four percent to nearly 100 percent. Family labor cared for the broilers when the operator was employed off-the-farm. Family labor accounted for about one-third of the labor used in producing broilers in the small size

group but less in the two larger size groups. Nearly half of the growers in the medium-sized group worked off-the-farm -- averaging about one-fifth of the working time for the group. Growers in this size group worked at a wider variety of jobs with no one type predominating. Only three growers in the large size group were employed off-the-farm. They were employed in positions closely related to broiler growing. Individual growers worked as much as 75 percent of their working time off-the-farm but the group average was about 11 percent.

Table 3. Proportion of labor supplied from various sources to grow broilers and proportion of operator's labor in off-farm employment, Willamette Valley and Medford Area, Oregon, 1957-58

Size Group	Operator's Labor		Source of Labor to Grow Broilers			
	Proportion in off-farm employment	Proportion in broiler growing	Operator	Operator's family	Hired	Total
	Percent	Percent	Percent	Percent	Per- cent	Per- cent
Small	26	40	64	34	2	100
Medium	19	63	74	22	4	100
Large	11	82	60	26	14	100
Average of all growers <sup>/a</sup>	23	49	66	30	4	100

<sup>/a</sup> Average is weighted by the inverse of the sampling proportion in each stratum.

The percentage of farm operator's time spent in producing broilers increased as the average size of enterprise increased indicating a higher degree of specialization. The percentage of labor that was hired also increased as average size increased. Hired labor was used primarily for catching and loading broilers at time of delivery in the small size group and amounted to two percent of the labor used. The medium size group hired about four percent of the labor used while in the large size group about 14 percent hired labor was used. A few enterprises in the large size group employed men full time to work with broilers.

Data were obtained which showed the change in annual capacity of the enterprises for 1956, 1957, and 1958. The percentage increase in size was fastest for the large-size group, table 4. Most expansion resulted by construction of new buildings. The fact that larger enterprises were expanding at a faster rate increases the difference in average size of the three groups over time. The future of the small-size enterprises will depend largely on their ability to produce at a cost competitive with other broiler growers and to increase their size to achieve even lower costs of production. Results of analysis presented later shows that costs per unit were higher on an average for enterprises in the small size group than costs for enterprises in other size-groups. The degree to which the grower is dependent on income from broilers may influence the rate of increase. Small enterprises tended to be more integrated which indicated they may be more dependent on feed companies or other

integrators. If policies of the companies should change such that enterprises of less than 40,000 broilers annually would not be eligible for contract renewal many of the smaller operations may disappear as operating units in their present form. A natural alternative may be for such growers to shift to a form of production where they essentially sell their labor and rent their buildings and equipment to a broiler integrator. This form of production is commonly referred to as a labor contract. Some people express fear that all broiler growers may eventually be confronted with this alternative as a long run effect of integration. This would become an actuality only if broiler integrating firms find it more profitable to hire labor and capital rather than contract with separate firms. This would occur if growers prefer to sell their labor and rent their buildings rather than accept the risk and responsibilities of production. Whether or not the buildings would be replaced or kept in good repair by growers under these circumstances would depend on the rental rate. If the buildings were not replaced then integrators would of necessity, integrate by ownership by replacing rented buildings with owned broiler buildings. If the buildings were not maintained and the rental rate remained the same the renting of buildings would become less profitable for the contractor because disease problems or other things such as fire hazards become greater in poorly kept buildings. Eventually, the integrator would find it advantageous to own new buildings in place of rented buildings.

Table 4. Number of broilers produced and percentage increase in production by size groups for the years 1956, 1957, and 1958, Willamette Valley and Medford Area, Oregon

Size Group	Number of broilers produced			Percentage increase from 1956 to 1958
	1956	1957	1958	
	Number	Number	Number	Percent
Small	16,000	18,600	23,500	47
Medium	38,700	48,500	66,300	71
Large	68,200	106,000	142,500	109
Average of all growers <sup>/a</sup>	26,900	35,400	46,800	59

<sup>/a</sup> Average is weighted by the inverse of the sampling proportion in each stratum.

#### Relative Importance of Other Firms in the Oregon Broiler Industry

Hatcheries. Four hatcheries supplied about 70 percent of the chicks to growers interviewed. Growers usually place advance orders for chicks. Delivery dates are established for a year in advance, i. e., the grower plans his production schedule on an annual basis. This also allows hatchery operators to schedule egg settings to meet the requirements of growers. Hatcherymen set up delivery schedules with growers in order to achieve lower costs per unit of production. Oral agreements and written contracts were used about equally in establishing delivery dates for growers in the small and medium size groups. Growers in the large size group usually had oral agreements.

Feed manufacturers. Three feed manufacturers supplied about three-fourths of the feed for broilers fed during 1958 according to the records. Usually the arrangements were between the feed company and the grower rather than a feed dealer and the grower. Bulk delivery of up to 12 tons of feed at one time at a low margin plus the capital requirements of financing broiler producers makes it imperative that the feed manufacturing company deal directly with growers. In some instances a contract between the feed manufacturer and the grower was signed for each batch produced. In other instances, a contract included the batches grown during a 12 month period. Written contracts were the rule since credit was usually involved. Most feed companies financed feed and supplies. In some instances the chicks were financed also by the feed company. The feed company usually took a chattel mortgage on the chickens. Growers under contract frequently received supervisory management assistance from feed company field representatives. This also was security for the loaning feed company in insuring proper management and a larger percentage of marketable broilers. Feed manufacturers received payment when the broilers were sold. The check issued by the processor was often made payable jointly to the feed manufacturer and the grower.

Broiler processors. Four processors purchased a majority of the broilers sold by growers in the Willamette Valley. A processor located in Southern Oregon purchased most of the broilers produced

in the Medford area. Processors buy direct from growers. There are no market facilities similar to terminal markets for other agricultural products. Frequently, a broiler grower agrees to sell his broilers to a particular processor even before he receives the baby chicks. Feed manufacturers usually require that the grower has a written marketing agreement before allowing credit for feed and supplies.

The price received by growers who sold to private processing firms was determined by reports from the United States Department of Agriculture market news reporting service located in Portland, Oregon. The price reported by this agency was determined by what processors reported they were paying for broilers. Since processors had contracts for specific broilers, competition for broilers was reduced and processors had less incentive for reporting higher prices. There were a few independent broiler growers who were bargaining with processors for price. The success of these growers depended in part on their ability to have broilers to sell when market needs are high. Growers who marketed through the Washington Farmers Cooperative Association received a price equal to the average wholesale price for a three month pool period less expenses of processing and selling. They received an advance at the time the broilers were delivered plus a pool settlement at the end of the pool period.

Processors usually inspected the broilers a few days before they attained market weight and finish. Condition of the birds and market demand for broilers determined when the broilers would be processed. Marketing agreements usually specified that the processor



had a choice of delivery date within a five day period. Practically all broilers were processed when between 62 and 64 days of age, table 5. There was a tendency for larger enterprises to sell younger broilers. The broilers averaged between 3.2 and 3.4 pounds live-weight for all three size groups. Efficiency of production averaged highest for growers in the large size group since they were able to sell as large a broiler as the other two groups with a shorter feeding period.

Although growers may sign three separate contracts with a hatchery, a feed company, and a processor only one of the three firms was actually an integrator. The integrating function was usually performed by a feed manufacturing firm. In some instances, all three -- hatching, feed manufacturing, and processing -- were parts of one larger firm. When this occurred, the integrating function was performed by the firm rather than one of the parts.

Broiler growers in the medium size-group had produced broilers with more integrators than growers in the other size groups. This may be explained by observations relative to the shorter length of time that growers in the small size-group had been producing broilers and the shorter length of time growers in the large size group had produced under some form of integration. Growers usually changed integrators to obtain what they considered to be better contract terms. Occasionally, an integrator discontinued the making of contracts making it necessary for growers to change integrators.

Table 5. Average age and weight of broilers delivered to processors by growers in the Willamette Valley and Medford Area, Oregon, 1957-58

Size Group	Age of broilers delivered	Weight of broilers delivered
	Average range	Average weight range
Small	62-65	3.3 - 3.4
Medium	62-64	3.3 - 3.4
Large	61	3.3 - 3.4
<hr/>		
Average of all growers <u>/a</u>	62-64	3.3 - 3.4

/a Average is weighted by the inverse of the sampling proportion for each stratum.

Growers were asked whether they preferred to produce broilers independent of any contractual arrangements. Grower replies to the question varied, table 6. The most common reason given for preferring independent production was that they preferred to make their own decisions. Of the reasons for not preferring independent production, market price fluctuations was mentioned most frequently. Some growers gave both affirmative and negative reasons in response to the question.

#### Effects of Contractual Production

This section presents the results of analyzed data obtained by interviewing broiler growers relative to differences associated with size of enterprise and degree of integration. The first step

Table 6. Reasons why broiler growers would or would not prefer to produce broilers without contractual arrangements, Willamette Valley and Medford Areas, Oregon, 1957-58

Prefer Independent Production		Prefer Contract Production	
Reason	No. of growers	Reason	No. of growers
<b>Small:</b>		<b>Small:</b>	
Would rather make own decision	3	Lack of experience	--
Afraid monopoly may develop	--	Independents have trouble marketing	--
Grower may become share cropper	--	Rigged price -- can't compete	--
Buy cheaper feed	1	Market ups and downs	--
Greater percent profit	1	Poor marketer	1
Deal separately with each company	--	Can't sell chicks without contract	1
Need financing	1	Market fluctuates too much	3
Needs to be some independence in industry	--		
Total	6	Total	5
<b>Medium:</b>		<b>Medium:</b>	
Would rather make own decision	3	Lack of experience	--
Afraid monopoly may develop	2	Independents have trouble marketing	2
Grower may become share cropper	--	Rigged price -- can't compete	--
Buy cheaper feed	1	Market ups and downs	1
Greater percent profit	1	Poor marketer	1
Deal separately with each company	1	Can't sell chicks without contract	2
Need financing	1	Market fluctuates too much	5
Needs to be some independence in industry	1		
Total	10	Total	11
<b>Large:</b>		<b>Large:</b>	
Would rather make own decision	2	Lack of experience	--
Afraid monopoly may develop	--	Independents have trouble marketing	2
Grower may become share cropper	--	Rigged price -- can't compete	1
Buy cheaper feed	1	Market ups and downs	--
Greater percent profit	1	Poor marketer	--
Deal separately with each company	--	Can't sell chicks without contract	--
Need financing	2	Market fluctuates too much	--
Needs to be some independence in industry	1		
Total	7	Total	3

in the analysis was to ascertain whether or not there were differences in the physical relationships of broiler growing when it was by contract and when it was independent. The second step was to prepare budgets which indicate the relative profitableness of the two methods of production, i.e., contractual or independent.

The results of this analysis are important to all phases of the industry. Growers need to understand the effects of contractual production on their enterprises. They should base their decisions to expand production or to produce under contract partly on a knowledge of these relationships. Other firms in the industry are interested in the relationships since they either sell inputs to growers or buy broilers from them. They frequently advise growers in the management of broiler growing enterprises. The financial success of growing enterprises determines partially the volume of business for hatcheries, feed manufacturing firms, and processors.

#### Calculation of Production Function

This section presents the results of testing the hypothesis that size of enterprise or degree of integration causes the level of the production function to change. That is, a production function calculated to represent an average for enterprises in a particular size group or for a particular level of integration would be different than a production function calculated for another size group or level of integration.

To test the above hypothesis it was necessary to establish a norm from which to measure changes in the surface due to variables tested. For this purpose, a function was calculated using input-output data obtained from feeding trials conducted by the Department of Poultry Husbandry, Oregon State College. McCluskey reported the results of two 10 week feeding trials conducted during 1956 (49, p 2). The trials were conducted using 3200 chicks representing 14 different breeds or strains that were being used in commercial broiler production at that time. The broilers were fed a high-energy broiler mash supplemented with an antibiotic and Vitamin B<sub>12</sub>. This mash was expected to give results comparable to commercially prepared feeds. Feed consumption and liveweights were measured weekly.

Three similar feeding trials were conducted in 1958 using the same basic ration but with a slightly different vitamin content from that fed in the 1956 trials. Feed consumption and liveweight were measured when the broilers were four and eight weeks of age.

Using the feeding trial data, an average production function for feed was calculated for each year, figure 2. A second degree polynomial of the form  $Y = a + b_1F - b_2F^2$  was used. Recent research results indicated that a function of this form gave a satisfactory fit of broiler feeding data (10, p 667). The two functions were calculated to observe the change that occurred during the time period 1956 to 1958. The difference in the functions indicates changes in breeding since the ration was essentially the same for all trials.

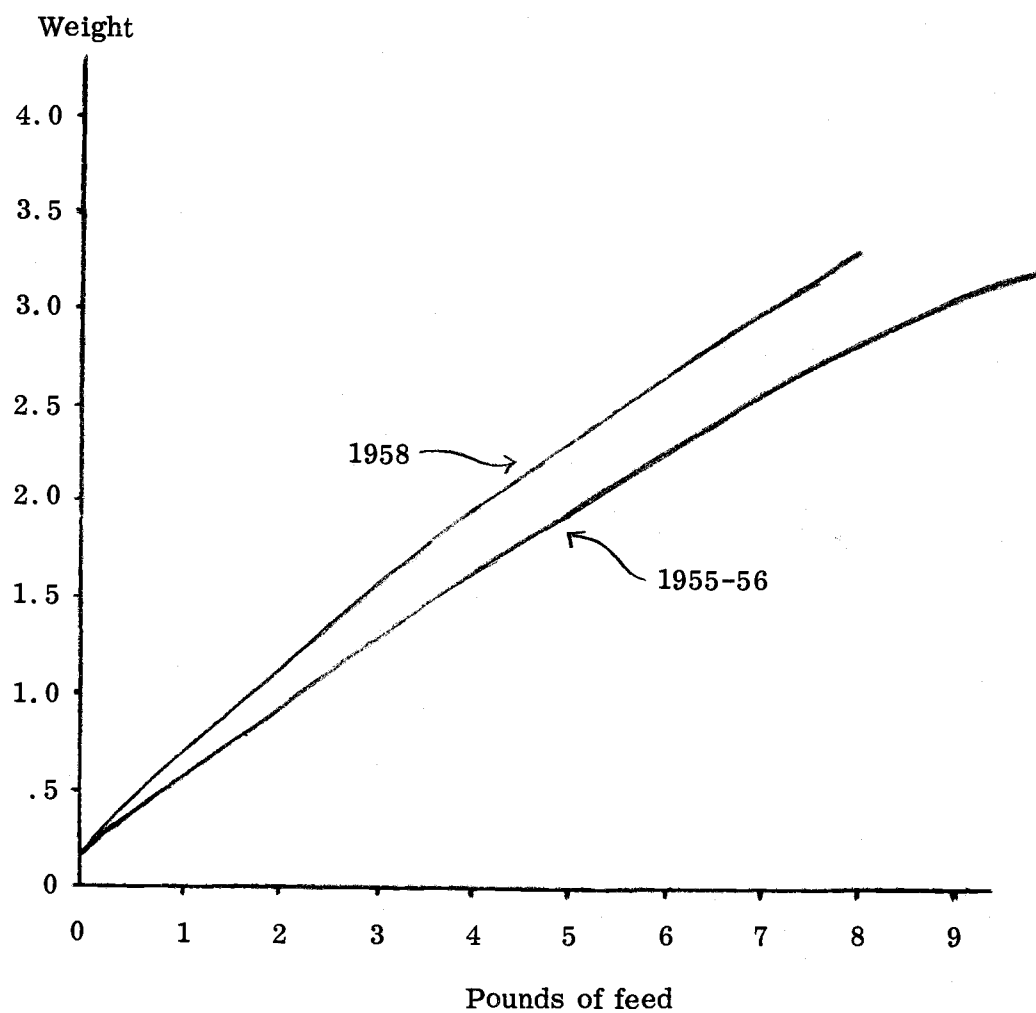


Figure 2. Input-output relationship between feed and liveweight for broiler growing, Oregon, 1955-56 and 1958

Data obtained from broiler growers during the personal interview survey were for the period 1957-58. By plotting the results of the individual batches fed by the growers interviewed it was ascertained that a major part of the batches had results which were between the two trials with a tendency toward the higher or 1958 function. On the basis of this information the decision was made that the function to be used as a norm in the tests should be somewhere between the two functions. A function was calculated using pounds of feed fed and weight at time of selling broilers from the records. The weight of a day old chick was assumed to be .08 pounds, the same as in the feeding trials. Since the function was fitted using data at the beginning and end of the feeding period it was necessary to place a restriction on the regression coefficients to insure a least squares fit of the data and at the same time a function of similar shape to the feeding trial functions. Noting that the function calculated from 1958 data tended to flatten out faster than the function based on 1956 data a choice as to which function better represented the growth relationship for broilers was necessary. The choice of which function was the better one to use in establishing the restriction, was made by determining the maximum bird weight attainable by feeding the broilers to maturity for the two feeding trial functions. The maximum weights were 4.57 pounds and 4.21 pounds for the 1956 function and 1958 function respectively. They were calculated by taking the first derivative of the two functions, equating each to zero and solving

for the Y-value. When marginal physical product is zero, total physical product is a maximum. The larger maximum weight was considered as more nearly representing the attainable weight for meat-type chickens. Thus, it was decided that the function fitted by using 1956 data was more nearly of the shape expected based on observations of chicken weights. The fact that it was based on weekly data to 10 weeks of age probably accounted for it being a more representative relationship.

The restriction was established on the basis of the relative size of the regression coefficients. It was calculated that roughly  $b_1 = -40b_2$  in the 1956 function. Day old weight of the chicks was assumed to be the same for the farm data as in the experimental data. Thus .08 pound was subtracted from the average weight of birds for each record causing the function to pass through zero. Later the .08 pound was added to raise the function to its natural position.

In order that the new function have the same shape as the 1956 function it was necessary that the  $b_1$  and  $b_2$  values have the same size relationship one to another as in the 1956 function. This was insured by writing the model in terms of  $b_2$  only as follows:

$$\text{Original Model: } Y = b_1X + b_2X^2$$

$$\text{Restriction: } b_1 = -40b_2$$

$$\text{Revised Model: } Y = -40b_2X + b_2X^2 = (X^2 - 40X)$$

The term  $(X^2 - 40X)$  represents the X value of a linear regression problem and may be designated as  $X'$ . The regression coefficient  $b_2$



is equal to  $\frac{\sum X^2 Y}{\sum X^2}$ . These terms were available from the sums of squares and cross-products as follows:

$$\sum X^2 = \sum X^4 - 80X^3 + 1600X^2$$

$$\sum X^2 Y = \sum X^2 Y - 40XY$$

Since the sample was a stratified random sample it was necessary to calculate the sums of squares and cross-products for each stratum and weight the calculated values by the inverse of the sampling proportion in each stratum.

The b values were calculated as follows:

$$b_1 = 0.47283560$$

$$b_2 = -0.01182089$$

Thus the following equation describes the average relationship between pounds of feed fed and liveweight of broilers for the batches included in the study where:

$\hat{Y}$  = the estimated Y value  
X = pounds of feed fed

$$\hat{Y} = .08 + .47283560X - .01182089X^2.$$

Using the average production function as a norm, a graphic method of regression analysis was used to ascertain the effect of size of enterprise and integration on the physical input-output relationship. These variables were selected because it appeared that the production function would change as size of enterprise and degree of integration changed. Size of enterprise was measured by the number of broilers produced during a 12-month production period. This variable was the basis of stratification in sampling. Degree of integration was established on the basis of factors discussed below.

When the study was begun, it was thought it would be a simple matter to classify the enterprises as to whether or not contract

arrangements were involved, draw a sample of integrated and a sample of non-integrated growers, collect data from each sample, make tests of significance to ascertain significant differences, and draw conclusions relative to the effects of integration. More study however, indicated that most broiler growers were operating under some form of contractual arrangement and had been for some time. This made it difficult to obtain data for growing without contract that could be used for comparative purposes. Also, most growers have had contracts with more than one integrator which makes it difficult to ascertain the effects of a particular kind of contract. Previous studies in other areas have been made that describe the types of contracts but have not attempted to show their effects on the production function of growing enterprises (11, p. 10-11). To overcome these difficulties it was necessary to establish an index of integration for each enterprise which could be used as an independent variable. The index of integration for each enterprise was calculated from data obtained during the interview. The following five items were included and subjectively weighted according to their importance:

1. The proportion of the growers' experience as a commercial broiler grower that had been under some form of integration was calculated and given the weight of two.
2. The number of contractual arrangements involved in broiler growing currently were counted. On the basis that a written contract equals  $33 \frac{1}{3}$  percent and an oral contract or agreement equals 10 percent, a figure

was calculated for each enterprise. This factor was also given the weight of two.

3. During the interviews growers were asked who made decisions for twenty-four common broiler growing problem situations. Interview experience indicated two of the decisions were not applicable. Thus they were not used in calculation of the index. A percentage figure expressing the proportion of the decisions not made by the grower was then calculated. If a particular decision was made entirely by the integrator it was counted as 4.5 percent ( $100 \div 22$ ). If a decision was made jointly by the grower and the integrator it was counted as 2.2 percent. A decision which was made by the grower on recommendation of the integrator was counted as 1.1 percent. The sum of the percentage figures was then given the weight of three.
4. The number and regularity of visits which a grower received from fieldmen employed by feed manufacturers, processors and hatcheries were included because degree of integration is related directly to the amount of supervision growers receive. Visits were counted as being either on a regular or occasional basis and a varying percentage used as follows:

<u>Regular</u>	<u>Percent</u>	<u>Occasional</u>	<u>Percent</u>
Feed supplier	60	Feed supplier	20
Processor	20	Processor	7
Hatchery	20	Hatchery	7

Since the feed supplier was the integrating firm and gave more supervision to growing operations a larger percentage figure was used for feed supplier visits. The total of the percentages for a particular record was then given a weight of two.

5. Whether or not the grower had expanded his enterprise because integration made it possible to do so was included with a "yes" reply counted as 100 percent and a "no" reply counted as zero percent. The percentage figure was given the weight of one.

The weighted percentages were summed and divided by the sum of the weights. The resulting figure was a weighted index of integration. The calculated indices for the enterprises included in the study ranged from zero to 72 percent.

The graphical procedure, used to test the effect of size of enterprise and index of integration, was accomplished by plotting the input-output point at time of sale for each enterprise. A separate graph was made for each variable. The points were plotted with different colored pencils to reflect predetermined levels of size and integration. The plotted points in each graph clearly suggested a random distribution of colored dots indicating that no relationship existed between the independent variables and the height of the production function.

### Cost and Returns Analysis

The conclusion that size of enterprise and level of integration do not cause the height of the production function to change made it feasible to use the average functional relationship as representing the physical production possibilities for all levels of size and integration. The important economic question to be answered remained, however, i.e., which method of production and size of enterprise yields the greatest net returns per bird. With the physical relationship the same, the cost and returns phase of the problem becomes the determining part. This section presents the results of analysing selected cost, and receipts data obtained from broiler growers. The purpose of the analysis was to ascertain whether or not prices paid for production inputs and prices received for broilers changed as size and level of integration changed and to measure relative profitability for the enterprises of various combinations of size and integration.

Analysis of the data revealed that both prices paid and prices received changed slightly on an average when the records were sorted into groups on the basis of size and level of integration, tables 7 to 11. Three levels of size were used and two levels of integration. There were no small enterprises which were in the low level of integration classification. Thus, five groups were formed rather than six.

Tables 7 to 11 inclusive were calculated on the basis of the average physical input-output relationship for the enterprises.

Physical data such as pounds of feed fed, number of chicks purchased, and pounds of broilers sold or used were held constant. Average price data for the various groups were used which accounts for differences between tables.

Table 7. Selected receipts and costs per 1000 broilers sold or used for broiler enterprises in small size - high level of integration group, Willamette Valley and Medford areas, Oregon, 1958

Item	Unit	Amount	Price	Value
			Dollars	Dollars
Receipts:				
Broilers sold or used	pounds	3360	.218	732
Rebates and pool settle- ments				<u>21</u>
Total				753
Costs:				
Chicks	number	1016	.151	153
Feed incl. medication	cwt.	87.75	5.32	467
Legal fees, interest and insurance				<u>5</u>
Total				625
Receipts less costs				128

Table 8. Selected receipts and costs per 1000 broilers sold or used for broiler enterprises in medium size - low level of integration group, Willamette Valley and Medford Areas, Oregon, 1958

Item	Unit	Amount	Price	Value
			Dollars	Dollars
Receipts:				
Broilers sold or used	pounds	3360	.219	736
Rebates and pool settlements				<u>11</u>
Total				747
Costs:				
Chicks	number	1016	.142	144
Feed incl. medication	owt.	87.75	5.12	449
Legal fees, interest and insurance				<u>3</u>
Total				596
Receipts less costs				151

Differences in the average prices paid for chicks among the groups were small. For a given level of integration the price paid for chicks decreased as size of enterprise increased. Within a particular size classification, the price of chicks was higher in the high level of integration group. These differences reflect the lower costs of selling to large enterprises on the one hand and the increased costs of service in the more integrated enterprises on the other.

Table 9. Selected receipts and costs per 1000 broilers sold or used for broiler enterprises in medium size - high level of integration group, Willamette Valley and Medford Areas, Oregon, 1958

Item	Unit	Amount	Price	Value
			Dollars	Dollars
<b>Receipts:</b>				
Broilers sold or used	pounds	3360	.221	743
Rebates and pool settlements				<u>8</u>
Total				751
<b>Costs:</b>				
Chicks	number	1016	.144	146
Feed incl. medication	cwt.	87.75	4.92	432
Legal fees, interest and insurance				<u>4</u>
Total				582
Receipts less costs				169

Feed prices exhibited similar relationships as chick prices among the various groups when level of integration was not allowed to vary i.e., as size increased the price paid for feed declined. The price of feed in the large size -- high level of integration group -- was lower because of the effect of one large enterprise. This enterprise obtained a price discount by buying large quantities of feed. Transportation expense was low also for this particular enterprise because it was located close to the source of feed. It appears that the relationship would remain consistent but the rate of change may be less than indicated by the tables.



Table 10. Selected receipts and costs per 1000 broilers sold or used for broiler enterprises in large size - low level of integration group, Willamette Valley and Medford Areas, Oregon, 1958

Item	Unit	Amount	Price	Value
			Dollars	Dollars
<b>Receipts:</b>				
Broilers sold or used	pounds	3360	.214	719
Rebates and pool settlements				<u>15</u>
Total				734
<b>Costs:</b>				
Chicks	number	1016	.139	141
Feed incl. medication	cwt.	87.75	5.04	442
Legal fees, interest and insurance				<u>2</u>
Total				585
Receipts less costs				149

Prices received for broilers indicated only minor differences among the groups. The price broiler growers received were based on the market price reported at Portland. Additional receipts from rebates on feed, chicks, and processing and market pool settlement indicated no consistent pattern.

The difference between the selected costs and receipts was what the broiler grower received to pay for other inputs of production such as labor, fuel, litter, and interest on capital investment. It was not the purpose of this study to determine the rate of input use

Table 11. Selected receipts and costs per 1000 broilers sold or used for broiler enterprises in large size - high level of integration group, Willamette Valley and Medford Areas, Oregon, 1958

Item	Unit	Amount	Price	Value
			Dollars	Dollars
<b>Receipts:</b>				
Broilers sold or used	pounds	3360	.217	729
Rebates and pool settlements				<u>14</u>
Total				743
<b>Costs:</b>				
Chicks	number	1016	.142	144
Feed incl. medication	cwt.	87.75	4.71	413
Legal fees, interest and insurance				<u>1</u>
Total				558
Receipts less costs				185

and the associated expense for each of the above items. The receipts less costs figure was calculated to indicate the relative amount a broiler grower in the various groups would have to meet these expenses. Data were collected for those items expected to vary with size and level of integration. Thus the differences reflect relative profitableness for the groups of enterprises. On the basis of the range, there is about a difference of five cents per bird sold.

### Implications of Analysis of Survey Data

The analysis of physical relationships indicated no advantage for contractual methods of performing the growing phase of broiler production. Independent growers were able to grow a pound of live broiler for the same pounds of feed as producers under contract. It must be kept in mind, however, that this may be true only on an average. The efficiency with which an individual grower can produce broilers may be affected by the method of production. Since contractual production methods have been used for a number of years it may be that those growers whose efficiency of production could be increased with management assistance and other features of contract methods have accepted contracts and as a result no difference was detected. The growers whose enterprises had a lower index of integration have apparently been able to achieve efficiency as independent growers. Many of these growers undoubtedly received suggestions and advice on management from feed manufacturers and other firms without signing a contract. The individual grower must decide whether or not the efficiency with which broilers grow can be increased on his farm by producing under a contract.

Efficiency of production did not change as a result of size of enterprise. Small enterprises on an average were able to produce broilers as efficiently as large enterprises. Size of enterprise was measured on an annual production basis. Growers produce four to five batches or lots of broilers in one year. This study did not measure the efficiency of production for different sizes of lots.

The lower limit on size of enterprise was 10,000 broilers in a 12-month period or about 2,500 birds per lot. Two thousand five hundred broilers was apparently a large enough size of operation at one time for growers to achieve efficiency of production. Efficiency of broiler growing probably increases as size of lot increases but tends to level off at some size less than 2,500 broilers. Growers generally build multiple buildings rather than build an extremely large building. The capacity of mechanical feeding equipment determines the size for a particular building. As the size of a building increases, growers must accept more risk from fire and disease than if multiple buildings are used with proper spacing of buildings and sanitation measures.

Since no difference was found in production efficiency the prices of inputs becomes all important to the individual grower. His ability to bargain undoubtedly influences the prices he pays. The bargaining position of a grower is stronger before he has signed a contract. Therefore, he should analyze his alternatives on a cost basis and bargain prior to contracting to produce.

Prices were lower for large enterprises. This undoubtedly reflects lower costs for bulk handling of feed and quantity discounts afforded large enterprises. Owners of small enterprises may well consider increasing their size of enterprise in order to gain price concessions.

## APPLICATIONS TO OTHER FARM ENTERPRISES

Part of the interest in the development of contractual arrangements in broiler production has resulted from the possible expansion of contractual production arrangements to other agricultural industries. One of the objectives of this study was to ascertain the feasibility of contractual production in farm feeding enterprises other than broilers. The following enterprises were considered:

1. commercial laying flocks
2. turkey growing
3. swine fattening
4. cattle fattening
5. lamb fattening

The above enterprises were included in the study because:

- a. All are enterprises which involve the feeding of poultry or livestock to produce a marketable product or products rather than for breeding purposes.
- b. They are enterprises that are frequently mentioned as being adaptable to contractual production.

Contractual production arrangements develop in response to needs and economic pressures affecting a particular industry. It is logical to assume that differences in the needs of an industry compared with other industries account for the use of or lack of contractual production arrangements in a particular industry. If changes were to occur in the enterprises considered in this section that would make them identical to broiler production it was assumed that integration would develop in other enterprises as it has in broiler production.

### Contractual Arrangements in Selected Enterprises

The enterprises considered have all been subject to sales contracts in the past. The contracts were usually short term and were signed as marketing time drew near. Important terms of the contracts were time of delivery and price. Eggs from commercial laying flocks have been delivered to independent buyers or farmers' cooperatives frequently under some contractual arrangement wherein the grower knew what price he would receive for his eggs relative to market prices established at centers of trade. Turkeys, hogs, beef cattle, and lambs have been sold on the basis of a contract price at a specified delivery date. When the outlook has been for prices to be higher at time of delivery, buyers have been active in buying for future delivery. Conversely, when the outlook has been for a lower price at delivery time, buyers have waited to buy at lower prices.

The contracts used at present in broiler production differ from those that have been used in other feeding enterprises in that they are a contract to produce according to prescribed practices and time schedules. Frequently, the price the grower will receive is not stated in the contract. However, the grower is assured of a minimum price or amount if he achieves a specified level of production efficiency. Generally, the more important contracts do not involve the buyer but rather a feed manufacturing firm or hatchery. Whether or not the persons or firms, in the industries considered in this section, would be willing to produce under similar contractual arrangements depends on changes that may occur in the future.

Because what may happen in the future is conjectural, an accurate determination of what will happen relative to development of contractual developments in other enterprises is not possible. It is possible, however, to indicate conditions in the industries which encourage or discourage the development of contractual arrangements. Reference has been made earlier to factors which encouraged the development of contractual arrangements in broiler production. A discussion of factors which appear to have retarded the use of contractual production arrangements of the same kind in the growing phases of other industries is presented below. The factors are not discussed in order of importance so far as their influence in retarding contractual developments is concerned. The order in which new research advances occur or other changes take place will determine the relative importance of the factors. Advances which tend to make other industries more like the broiler industry will encourage the adoption of contractual production plans. Thus, research findings or other developments which offset the factors discussed below will aid the development of contractual developments in other agricultural industries.

#### Absence of Rapid Technological Advance

Rapid technological advance in all phases of broiler production was very important in the development of contractual developments in the broiler industry. New strains and crosses of meat-type chicks increased the gaining ability and the quality of the finished broiler. More uniformity of size and a larger proportion of the carcass weight

being meat were favorable to an increase in demand for broilers. Nutrition research findings provided the broiler industry with feed formulas which gave a faster rate of growth as well as a more efficient rate of growth. New feed developments coupled with breeding advances have provided a more even degree of finish in a shorter feeding time making it possible to market a younger, more efficient bird. Although, there may be a point beyond which younger birds are of lower eating quality, most people agree that quality has been increased by the younger selling age. Advancements in processing broilers have made it possible to market a ready-to-cook broiler which has resulted in greater ease of preparation at the time of cooking. Packaging of the ready-to-cook bird has made self-service retailing of broilers possible. All of the above mentioned innovations have resulted in essentially a new product. The broiler the housewife buys today is a different product than the broiler of ten years ago. The quality of the broiler has been increased while costs per unit have been reduced.

The application of contractual arrangements to other industries will depend to a large extent on technological developments applicable to those industries. The rate or degree of technological advance and the rate of adoption by established firms will influence the development of contractual arrangements. A technological advance of a minor nature may not cause a change in the relations between growing firms and the other firms of an industry. Minor adjustments may be made by the industry but the likelihood of a shift to contractual methods is



small. On the other hand, a major advance which is being adopted with caution by growers may cause integrating firms to offer contracts which encourage adoption of the new technology.

Technological advance in egg production, turkey feeding, swine fattening, cattle feeding, and lamb feeding has not been as rapid as in broiler production. The amount of feed required to produce a given output has decreased faster for broilers than for other enterprises, table 12. Processing methods have changed less and quality improvements have not been as pronounced as in the broiler industry. A major technological advance in either breeding, nutrition, or processing would encourage adoption of contractual production arrangements.

Table 12. Index of change in feed units required to produce a given output of specific commodities, United States, 1940-56

Year	Broilers	Turkeys	Eggs	Hogs	Sheep & Lambs /a	Cattle
--INDEX (AVERAGE 1940-44 = 100)--						
1940	104	105	97	98	100	96
1941	99	105	100	96	103	100
1942	103	97	103	103	98	100
1943	99	97	102	101	97	101
1944	95	95	98	102	102	100
1945	97	92	105	110	97	98
1946	95	92	95	101	99	95
1947	92	91	97	92	97	92
1948	87	88	95	97	99	98
1949	81	86	102	98	98	93
1950	80	82	95	97	97	94
1951	78	81	95	99	94	97
1952	76	80	94	89	93	91
1953	75	79	92	100	90	87
1954	71	79	87	92	94	88
1955	67	82	87	96	88	88
1956	66	83	92	100	99	95

/a Includes other sheep and lamb feeding in addition to lamb fattening.

The manner in which contractual arrangements would be encouraged would depend on the nature of the advance. An advance which was not readily accepted by firms may make it profitable for other firms to encourage the use of new technology through issuing contracts which require the adoption of specified practices. An advance that affected the most economic size of firm in processing may encourage contractual arrangements since this may be the only way the processor may get the increased production when he wants it.

#### Perishability of the Product

One of the factors influencing price variability and therefore supply variability is perishability of product. Perishable products must be sold when ready for market assuming other things constant. Increased quantities frequently must be sold at reduced prices. Low prices usually mean low profits. Low profits in one time period causes supply to decrease which in time will result in higher prices and profits since costs of production change less rapidly. High profits encourage established growers to expand their enterprises and new growers to enter the industry. Prices decline as production increases and the fluctuations begin again assuming no change in other factors. Perishability adds to the fluctuation since storage of part of the supply during periods of increased supply for sale at a time when prices are favorable is not possible.

Of the products considered in this study broilers offer the least possibility for storage. Consumer acceptance of fresh frozen

broilers has been low. Frozen birds have sold at a discount compared with freshly processed broilers. The discount plus added costs of freezing and storage make it imperative that broilers be sold fresh within a very short time after they are processed.

Processors operate on a relatively fixed margin. Any reduction in price at retail tends to be shifted directly to the grower. The price the grower receives tends to increase when retail prices increase.

Under the circumstances outlined above the broiler grower is faced with greater price uncertainty than growers of non-perishable products. Prices for products that are storable fluctuate in response to changes in supply but the fluctuations will be of smaller magnitude depending on costs of storage.

Although all the other products considered are more perishable than farm products such as grain they are less perishable than broilers in that some storage is possible at least during processing. In some instances the fattening process may be slowed down in order to market when it appears prices will be higher. Eggs if kept under refrigeration and proper conditions of humidity lose quality slowly. Several processes have been developed to extend the storable period for eggs. Turkeys stored in a frozen state are readily accepted by consumers. Turkeys are usually marketed by growers during late summer and autumn. Storage aids in preventing the market from becoming glutted and prices falling to disastrously low levels. Turkeys formerly were considered a "holiday meat" to be consumed during the

Thanksgiving, Christmas, and New Year holiday seasons. With modern storage methods, however, turkeys are now available to consumers throughout the entire year. Usually beef and lamb are sold fresh within two to three weeks after slaughter. Some flexibility is achieved, however, by the longer time period between slaughter and selling to retail stores. This longer time period allows the meat to be transported to more distant markets under refrigeration without loss of quality. In the case of beef, in particular, the longer time period improves the eating quality. Beef and lamb may be frozen without suffering heavy price discounts. Recent developments indicate that consumers may purchase considerably more frozen cuts that have been prepared for cooking prior to freezing provided costs can be reduced. Price support programs for meat by the United States Department of Agriculture have been carried out in some instances through the purchase of frozen rather than fresh meat. A large proportion of the pork consumed in the United States has been cured and is therefore a storable commodity. Meat packers cure large volumes of pork cuts during periods of temporarily depressed prices when the outlook is for higher prices. These cured products can then be stored until supplies arriving at markets are reduced and prices strengthen.

#### Seasonality and Length of Production Period

Contractual arrangements as they have developed in the broiler industry require year around production schedules. Each segment of the industry is coordinated with other segments by means of contracts.

Hatcheries set eggs to supply growers with chicks which when grown will meet the requirements of the contract between the grower and processor. The processor has ascertained that he will be able to sell the volume of broilers contracted to retail outlets when they are delivered. Since broilers require only about 65 days to grow to 3.25 pounds live-weight the grower can grow between four and five batches in a 12 month period. By staggering the starting date for the growers selling broilers to a particular processing plant the plant can have a steady number available for processing. This procedure also establishes a more constant need for chicks and feed.

The availability of chicks at any time during the year and the length of the production period makes the broiler industry different than the other enterprises considered in this study. The constant production possibility with a short time span between the beginning and end of production makes broilers more suited to contractual production.

Egg production requires a longer production period than broilers. Chicks may be ordered for delivery at any season of the year but about a six months growing period is required to bring the flock into egg production. Generally, it is profitable to retain the laying flock for at least one year after the hens start to lay. This longer production period would require that the integrator obligate his capital for a longer time period. The amount of capital per hen would be considerably more than for a broiler so each grower would have to be advanced a larger sum. This increases the amount of capital

required by the integrator and repayment would be complicated by the fact that income is received over the period of about one year, part of which could be paid to the integrator.

The feeding of turkeys, swine, beef cattle and lambs has differed from broiler growing in another way. The poults or feeder animals have not been available on a year round schedule. Rather they have been available seasonally. Turkey feeding has been a spring to autumn enterprise since poults were available in the spring and the turkeys were grown in open pens rather than buildings. Many times the pens were fields which were a source of feed. Comparatively little shelter has been required for turkeys on such fields. Cattle and lamb feeding have been winter enterprises since feeder cattle and lambs have been available at the close of the summer grazing period. In addition, feed supplies are more plentiful at this time for beginning feeding. Swine may be produced in any month of the year but the general practice has been to have sows farrow in the spring and fall with market hogs available five to six months later.

These seasonal production patterns have developed largely because costs are lowest when they are followed and any deviation has tended to result in increased costs. For example, feeder cattle can be sold for a lower price in September after grazing during the summer on low cost forage than at any other time of the year. The cost of feeder animals is a major input in cattle feeding and it is important in determining over-all profitability of the enterprise.

Changes in the industries which would make feeder animals available at low cost on a year round basis would make contractual production more feasible. The development of large year round feeding operations in some states indicates a trend in this direction.

### Market Organization

New developments tend to be accepted at a faster rate when they do not replace an established method. Broiler production developed on a commercial scale without terminal market facilities such as now exist in the case of hogs, cattle, sheep, and eggs. Direct methods of marketing were adopted in the case of broilers as specialized processors established processing plants and started purchasing live broilers.

Marketing methods for other commodities studied have been established for many years. Established marketing firms and agencies are frequently by-passed when contractual arrangements are used. Market outlets that may be omitted if contracts develop attempt to maintain their volume of business by making their services more attractive to farmers. They may do this by reducing market charges to the level where not all fixed costs are covered for short time periods to discourage the development of contractual production plans.

The number of market outlets available to a cattle, lamb or swine feeder is greater than for poultry producers. Transportation systems are also well developed making it possible to ship livestock to the market where it seems possible to obtain the highest net price. This shifting of supplies among markets equalizes prices in the

markets after allowing for transportation and shrinkage cost differences. Livestock feeders may be slow to give up their alternative market outlets for a contract which specifies when and where their livestock are to be delivered without quoting a particular price in advance unless something was received in return which increased their net returns. A major nutritional advance may make this possible. For example, feed manufacturing firms may be able to offer increased returns to growers using their feeds in the form of a guarantee similar to that used in broiler production contracts.

#### Established Production Areas

Closely related to the idea of established market organizations is the situation that new methods of production are more difficult to implement in an established production area. This undoubtedly was partially the cause of broiler growing areas developing in the Southern States. Established poultry producers had their ideas about how production should be carried out and were not as receptive to suggestions from field service personnel as a new broiler grower who was looking for management help as well as a source of operating capital or inputs on a credit basis.

The acceptance of contracts in other industries will depend partially on how receptive producers are to new ideas or whether new producers can be encouraged to enter production. Shifts in production areas may result from pressures which favor production by contract.



### Financing in Relation to Security

The broiler growing phase of the broiler industry is unique in that the day old chick does not represent an adequate security base for the obtaining of operating capital through regular credit channels. The fact that many broiler growers buy all feed that is used adds to the problem. As a result many broiler growers turned to contracts whereby firms in other phases of the industry supplied the inputs on a credit basis until the broilers were sold. Some of the larger growers who were able to finance their operations from other sources resisted contracting or produced under contract only when the market outlook was unfavorable. Sometimes contracting firms refused to issue contracts for broilers produced during the winter unless the grower would agree to produce during the rest of the year on a similar contract.

Established credit agencies will usually extend production credit for enterprises such as cattle, lamb and hog feeding where either the feed or the feeder animal is owned and can be pledged for security. Feed manufacturing firms are willing to extend feed on credit. This will make feedlot operators less dependent on input supplying firms. They will, as a result be interested in remaining as independent producers. Undoubtedly, many producers prefer to make the management decisions relative to their enterprise.

Laying enterprises are somewhat like the animal fattening enterprises since the laying hen can be used for security purposes. When egg production begins, income from the sale of eggs remains quite

constant. Egg producers can pay for feed and other inputs within a short time of their use. They can also use part of their present receipts to finance the raising of replacement pullets.

The turkey growing enterprise is more like the broiler growing enterprise than others considered. Integration by contract will probably develop faster in turkey growing than in red meat animal feeding because of a need for capital and lack of an adequate security base.

#### Degree of Specialization and Source of Feed

Broiler growing has become a highly specialized enterprise. Most growers have little, if any, crop land. Many growers have only the land occupied by the broiler buildings and the farmstead. Some growers, whose enterprises are too small to provide full employment for the operator, have an off-farm job.

One of the factors encouraging specialization is the requirement that practically all feed be specially compounded and prepared to obtain high feeding efficiency. This requirement has fostered the development of specialized broiler rations, based on nutritional research, by feed manufacturing firms.

Concentrate feeds comprise a large proportion of broiler rations. Wheat or corn and soybean or cottonseed meal are the basic ingredients used. The concentrated ration fed encourages the production of broilers near the production areas of the main ingredients but concentrate feeds may be transported with relative ease and low cost. As a result, location of broiler growing may shift more to areas of low

labor costs, favorable climate or other cost reducing factors providing the saving is greater than the additional cost of transporting feed. Lower labor costs along with reduced housing requirements may account for the increase of broiler production in the Southern States. Lack of more attractive alternatives may also have been a factor. Contractual arrangements made available the variable capital that was necessary for a grower to begin production if he had broiler buildings. In some instances, buildings were constructed by an integrator and a caretaker employed on a per bird basis to grow broilers.

Turkeys and commercial laying flocks also require a high proportion of manufactured feeds. Swine fattening rations consist largely of concentrate feeds but the use of grains produced on the farm where the hogs are fed has been much greater than in poultry enterprises.

Cattle and lamb fattening rations require relatively large amounts of farm produced roughage. Also many by-products of the processing of agricultural products are utilized. Roughages and some by-product feeds are bulky relative to their value making it more profitable to locate feeding enterprises near their source rather than transporting them to a distant area for feeding. In the Western United States, feeding areas have been concentrated in irrigated farming valleys where low cost feeds have been available. Frequently, by-products of sugar beet refineries or canning crop processing plants have been available which encourages the adoption of fattening enterprises. Adjacent to these valleys are range lands which are used as the primary feed source for breeding herds in the production of feeder animals.

Two kinds of cattle and sheep fattening enterprises are found in the Western States. One is the farmer-feeder type of fattening operation. This type of operation is found throughout the area. Owners of farmer-feedlots are not specialized in livestock feeding. They produce a major part of the feed fed. Frequently, their fattening enterprises are active only during the period of the year when crop production does not require their labor and management. The second type of feeding operation is specialized in livestock feeding, purchases a large proportion of the feed fed, and is a year-around enterprise. These enterprises have, in the past, generally been located in California. There has been some development in central and eastern Oregon. The specialized enterprises are much larger than are enterprises of the farmer-feeder type. Generally, specialized feedlots have a feed manufacturing plant and some of the larger enterprises employ people trained in nutrition, veterinary medicine, and/or marketing.

The lack of specialization for the farmer-feeder discourages an integrating firm from offering contractual production plans, that would be attractive to the livestock feeder, since management ability tends to be lower for a non-specialist. Another discouraging factor from the feed manufacturers' viewpoint is that field service personnel tend to be "extra help" during the slack feeding season.

Two additional factors appear to restrict the development of contractual arrangements similar to broiler production contracts. First is the high investment in land and/or equipment for the production of feed. This factor will limit entry to those farmers who

have the ability to obtain land either through ownership or leasing. The second factor is that feed supplies have generally been adequate security for obtaining a loan to purchase feeder cattle and lambs thus reducing the need for financial help from an integrating firm.

The specialized type of feedlot has its own feed manufacturing plant. Thus it is illogical to assume that feed manufacturers will make contracts of the type used in broiler production with this type of feedlot. Also, since the required investment for establishing a feeding operation is so high only those individuals who have adequate financial resources or credit may enter production. They are not likely to contract to produce fat cattle or lambs on a similar basis as broilers are produced.

#### Feeding on a Margin

An enterprise which buys feeder animals whose price is related to the price for fat animals may earn profits on the difference between the cost per pound of gain and the selling price of the finished animal plus the difference between the price for feeder and fat animals. On the other hand for an enterprise which feeds animals or poultry whose price is relatively fixed and not related to the price of the finished product the only source of profit is through low cost production. In the first type of enterprise the feedlot operator forces the producer of the feeder animal to absorb a large proportion of the price risk associated with the enterprise. Thus the amount of risk confronting the operator is less resulting in less interest in contracts.

### Heterogeneity of Breeding Livestock

One of the factors that encourages contract production is the demand for a uniform, high-quality product to be sold through self service supermarkets and chain grocery stores. They want uniformity for two reasons. First, their costs of buying can be reduced because buying by description is feasible and most of the actual purchasing can be done by telephone and in advance of the delivery date. Second, management of large retail grocery outlets want a uniform, high-quality product which establishes a favorable reputation in the minds of consumers. A favorable reputation leads to increased volume which is of utmost importance in modern retail stores.

Two factors that affect uniformity are breeding, and feeding. Both factors are more easily controlled in the broiler industry than the other industries considered. Poultry breeding has become a specialized business itself and the faster rate of reproduction makes it possible to produce homogeneous offspring in much less time than for swine, cattle, or sheep. Feeding of manufactured feeds assures greater uniformity also.

Production of feeder cattle, lambs, or hogs has not become specialized. Ownership of breeding herds is widely dispersed. The genetic background of breeding animals is varied. Thus, feeder animals that appear to be similar may perform differently in the feedlot. This factor discourages production by contract.

Somewhat offsetting the heterogeneity factor, however, is the larger number of cuts of meat available from a large animal carcass

and the uses made of the various cuts. This, is not a factor that encourages contractual production arrangements, however, because meat packers have been able to buy animals at public markets or direct from feedlots in the volume necessary to fill orders from retailers. The tendency has been for meat packers to integrate by ownership of feedlots rather than by contact with feedlot operators. Fear of becoming involved in anti-trust proceedings have tended to restrict feeding activities of national meat packers.

The above discussion has pointed out some differences between broiler production and other industries which have tended to retard the adoption of the type of contractual arrangements used in the broiler industry. The intent of this discussion has been to show why contracts have not been used rather than to show why they will not be used. To say that contractual production will not be applied to other industries would be foolish in-as-much as it is an observable trend. Whether or not the trend continues and the speed with which contractual arrangements develop will depend on changes that occur in the industries. It is not anticipated that these changes will occur in all industries at the same time. In fact, it may be competitive pressure from an integrated industry that will lead to research and methods conducive to contracts. The increase in low cost broiler production and consumption has created increased interest in new methods in beef, hog, and lamb feeding.

## CONCLUSIONS

The manner in which production is organized in an industry results from economic forces. In broiler production, there has been an environment which fosters production by contract. Specialization of various phases of production as a result of new technological developments has led to an interdependence of production functions. Production decisions by firms in one phase of the industry have a direct impact on other firms. Lack of coordination between production phases results in a lowering of profits for the firms. Contractual production has had the effect of scheduling production among firms.

No systematic increase or decrease in average production efficiency was ascertained in the growing phase of broiler production due to size of enterprise or level of integration. Individual growing enterprises may experience gains or losses in production efficiency due to contracts. Apparently the lower limit placed on size of enterprise in this study was high enough that broiler growers could use efficient methods of production. The ability of the broiler grower to recognize an improved method of production either by himself or with the help of fieldmen, extension personnel or others makes a greater difference in production efficiency than the actual signing of a contract.

Prices of inputs used in broiler growing decrease as size of enterprise increases. Quantity discounts as a result of larger quantities purchased at one time and savings by bulk handling feed



result in lower prices for larger enterprises. Size of enterprise was more important than level of integration in determining prices paid. Small enterprises are confronted with increasing degrees of competition from larger enterprises which are expanding at a faster rate than small enterprises.

Broiler firms produce under contract to shift some of the risks of production to other firms in the industry. When the outlook is for low prices growers sign contracts more readily. Some firms that have produced on an independent basis shift to contractual production at such times. A tendency for continued low prices for broilers has resulted in most growing enterprises shifting to some form of contractual production.

Individual growers must decide which method of production to use. This in itself is an important management decision. Some growers undoubtedly need the "security" of a contract which brings with it a ready market, and management help provided by fieldmen.

Production by contract in other livestock and poultry enterprises will increase but unless technological changes occur faster than at present it will increase at a much slower rate than has been the case for broiler production. Modern broiler production started as a new industry recently and has experienced rapid growth and change as a result of many factors. Institutional factors have not deterred its growth and rate of change as much as will probably be the case for other better established industries. There is a lack of technological advance in other industries of the magnitude there has

been in the broiler industry. Advances as a result of research have occurred in all phases of the broiler industry at a rapid pace (partly as a result of contractual production) whereas in other industries production methods have remained about the same over time. Production in other industries requires a longer period of time and storage may be performed to reduce price variability. Specialization of farm phases of production has not been as great in other industries as it has been in the broiler industry. Thus some of the factors that have encouraged broiler production by contract have not been present in other industries. For example, credit has been more readily available from regular loaning agencies since feed supplies from crop enterprises or other assets could be used as security for obtaining production credit.

Production by contract will remain as an important method of coordinating production only if it solves or alleviates some of the problems for people engaged in production. Changes in conditions of production may alter the problems and in this way change the importance of production by contract.

## SUMMARY

Vertical integration in agriculture is not a new development but it has been the center of interest in many recent discussions and publications largely because of what has occurred in the broiler industry. Vertical integration involves the linking together of firms in different phases of production to achieve a more coordinated production process. Early forms of integration in agriculture were by ownership. More recently integration by a firm agreeing to produce according to terms of a contract has become important. Contractual forms of production have been in use for 30 to 40 years in crops such as sugar beets and fruits and vegetables for canning and freezing. Contractual production arrangements have come to be widely used in broiler production and there are indications that their use may expand to other livestock and poultry enterprises. There are many variations in the contracts ranging all the way from informal agreements to near complete control of the farmer's enterprise by the contractor. Integration in this form is often viewed with skepticism. Farm producers fear they may lose their independence and be reduced to employees of the contractor.

The broiler industry was studied to ascertain why it has become so completely integrated and the effects of contractual production on relationships within the industry. The situations which are conducive to the adoption of contractual production arrangements were then considered as to how they may or are influencing other livestock and poultry feeding enterprises.

Data were obtained from both primary and secondary sources. Personal interview surveys were used to obtain data from management of firms in the broiler industry in Oregon. A sample of broiler growers were interviewed. They were selected by drawing names at random from a list of commercial broiler growers stratified by size of enterprise. A commercial enterprise was defined as one which produced 10,000 or more broilers in a 12 month period. A second survey included all of the major broiler chick hatcheries, feed manufacturers making broiler contracts and broiler processors. Feeding experiments conducted by the Department of Poultry Husbandry, Oregon State College were also a source of primary data. Various bulletins and other publications from many sources were the sources of secondary data used in the study.

Four situations that are conducive to the development of contractual production were listed as follows:

- a. The interdependence of production functions that exists when specialized firms produce products that are used in production by other firms in the industry.
- b. When there has been development of new technology which has not been adopted.
- c. Imperfections in markets which prevent price from coordinating production satisfactorily.
- d. The development of new methods of retailing which require large quantities of uniform high quality products.

Each of the above were applicable to the broiler industry which is a relatively young industry that has experienced rapid change.

Broiler production in Oregon has increased at a faster rate than the average rate of increase in the United States. Annual gross income received by farmers from broiler sales exceeds five million dollars.

Contractual production of broilers in Oregon has been primarily between the feed manufacturer and the grower. Processors frequently have marketing agreements with growers but little production supervision occurs. Growers also make agreements with hatcheries for a year in advance to start chicks on specific dates.

Size of enterprise was associated in a positive manner with the number of years experience growers had in broiler production but negatively with the number of years experience with some form of integration. Growers whose size of enterprise was in the small group were employed in non-farm employment more frequently than growers whose enterprises were larger. The larger enterprises indicated a faster rate of expansion which accentuates the differences due to size.

The number of firms in the broiler industry in Oregon other than growing enterprises is relatively small. Four hatcheries supplied about 70 percent of the chicks to growers interviewed and four processors purchased a majority of the broilers. Three feed manufacturing firms supplied about 75 percent of the feed for broilers during 1958.

A functional relationship between feed consumption and liveweight of broiler was established on the basis of feeding experiments. This relationship was used to establish an average feed-growth relationship for the growing enterprises studied. It was ascertained on the basis of the average relationship and input-output points for the individual enterprises that size of enterprise and level of integration were not associated with efficiency of production.

Prices paid for production inputs and prices received for broilers changed slightly on an average when the records were sorted into groups on the basis of size of enterprise and level of integration. Price differences may be the result of factors such as location of a particular enterprise in relation to the feed supplier or processor, volume of purchases in the case of inputs, and bargaining ability. Larger enterprises had lower costs for chicks and feed on a per unit basis. Prices received for broilers were not associated with size of enterprise.

Five kinds of livestock and poultry feeding enterprises other than broilers were considered in relation to factors which encourage the development of contractual production. Factors such as technological advance, perishability of the product, market, financing and source of feed were considered and compared to broiler production. The adoption of contractual methods as well as the rate with which contracts will become important will depend on the rate with which other enterprises become more nearly like the broiler enterprise for some of the factors considered. Other factors indicate why

contracts may not be as essential to some enterprises as they have been in broiler production.

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