NCCC-134
APPLIED COMMODITY PRICE ANALYSIS, FORECASTING AND MARKET RISK MANAGEMENT

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Suggested citation format:

Parcell, J. L., and M. R. Langemeier. 1996. "Determination of Base Payments for Feeder Pig Producers and Finishers." Proceedings of the NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. Chicago, IL. [http://www.farmdoc.uiuc.edu/nccc134].

Determination of Base Payments for Feeder Pig Producers and Finishers

Joseph L. Parcell and Michael R. Langemeier*

This study examines the level of base payments required to make feeder pig finishing and producing contracts comparable to independent production performance. Stochastic dominance with respect to a function is used in the comparisons between contract and independent production. Required payments for risk averse feeder pig finishers and producers with average production efficiency are similar to those currently offered by contractors. Producers with above average production efficiency or who were risk neutral require payments well above current contract rates, before they would prefer contracting.

Introduction

The scope of contract hog production in the United States has grown in recent years. According to survey results summarized by Rhodes (1990), contract hog production accounted for 10 percent of U.S. slaughter in 1988. By 1994, contract feeder pig finishers accounted for 17 percent of all feeder pigs marketed and feeder pig producers accounted for 24 percent of total feeder pig production (Grimes and Rhodes). Profits achieved by being a low cost producer have been a major factor in the expansion of contract production (Rhodes, 1995).

As contract production increases, more information is needed pertaining to types and terms of contracts (Sheldon). Previous research has focused on comparisons between specific contracts and independent feeder pig production. Johnson and Foster used generalized stochastic dominance to evaluate the performance of independent production and five feeder pig finishing contracts. Contracts differed by base payment and bonus payment schedules. Base payments ranged from $5 to $8 per pig marketed. These five contracts and independent production were ranked using various risk aversion levels. Independent production was the least preferred alternative for strongly risk averse producers. At risk aversion levels close to risk neutral, independent production was a more attractive alternative. Kliebenstein and Hillburn provide a framework for which feeder pig finishing and feeder pig producing contracts can be evaluated. The level of returns and risk varied widely among different contracts. Zering and Beals analyzed the income potential for a feeder pig finishing contract and a feeder pig producing contract in North Carolina. Unlike the feeder pig producing contract, they determined the feeder pig finishing contract generated sufficient income to cover

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costs. Lack of profitability from the feeder pig producing contract was used as their rationale for the predominance of feeder pig finishing contracts in the region.

Previous research has provided useful information pertaining to relative profitability of various contracts and independent production. However, it has not addressed an important question asked by potential growers: what level of base payments are needed for contract production to be comparable to independent production? The fact that most contracts can be negotiated, coupled with the wide variation in contract terms and rates, make this question extremely pertinent.

The objective of this paper is to determine the minimum level of contract payments that would leave a grower indifferent between contract and independent production.[1] Three feeder pig finishing contracts and three feeder pig producing contracts were compared to independent production and feeder pig finishing. Comparisons are made using stochastic dominance with respect to a function and alternative levels of production efficiency.

Contract Types and Characteristics

There are several reasons why contractors and growers are interested in contract relationships. Contract production is an effective way for contractors to rapidly expand production (Rhodes, 1995). By using contracts, contractors shift costs associated with facilities to growers and mitigate risk associated with owning facilities. In addition, contracting enables contractors to produce the volume and quality of pigs that attract packer premiums (Rhodes, 1995). Growers have entered contracts to reduce production and price risk, and to obtain financing for facilities (Rhodes and Grimes; Kliebenstein and Lawrence). Risks associated with changes in feed costs, breeding stock prices, feeder pig prices, and market pig prices typically remains with the contractor. Depending on the type of contract used, fixed payment or base payment plus performance, production risk can also be substantially reduced through contracts. By reducing production and price risk, contract production provides a more stable cash flow per pig.

Contract pig production involves an agreement between a contractor and a grower. The contractor owns and provides feeder pigs for finishing contracts and breeding stock for feeder pig production contracts, and bears the costs associated with feed, medication, and transportation. Growers raise pigs in their own facilities and are compensated with base payments and performance incentives. Growers' costs typically include labor, facility costs (facilities and equipment), repairs, utilities, insurance, and property taxes.

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[1] In this analysis feeder pig producers represent producers marketing feeder pigs, feeder pig finishers represent producers purchasing feeder pigs and marketing finished pigs, and growers represent both feeder pig producers and feeder pig finishers.

Types of contracts offered vary by U.S. region. In the East Coast region, 30 percent of contract growers were involved in producing feeder pigs and 46 percent finish feeder pigs (Wind-Norton and Kliebenstein). The remaining either have farrow-to-finish contracts, produce breeding stock, or have more than one type of contract. A higher percentage of growers in the East North Central and West North Central regions finish pigs. In the East North Central region 81 percent of growers finish pigs, while in the West North Central region 63 percent finish pigs (Wind-Norton and Kliebenstein). From 15 to 17 percent of the growers in these regions produce feeder pigs.

Contract payment provisions vary widely among growers (Rhodes, 1990). Grower fees range from receiving a set fee with no performance incentives to receiving most of the fee in the form of performance incentives. In a survey summarized by Rhodes (1990), 52 percent of feeder pig finishers surveyed had some type of performance incentive. Similarly, 52 percent of feeder pig producers surveyed indicated that they had performance incentives (Rhodes, 1990). Performance incentives for feeder pig finishers typically involved feed conversion or death loss. Pigs weaned per litter and average feeder pig weights were commonly used as performance incentives for feeder pig producers.

Given the variety of production contracts used to produce and finish feeder pigs, how do contractors and growers arrive at optimal contracts? Sheldon indicates that the optimal contract depends on the extent to which moral hazard is a problem and risk attitudes of the contractor and grower. Moral hazard occurs when one party in the contract has imperfect information pertaining to actions of the other party. In contract feeder pig arrangements, moral hazard is related to the effort put forth by growers. Providing growers with a fixed payment per head, per pound, or per litter does not effectively address the moral hazard problem. However, growers that have not produced feeder pigs before, or do not know what level of production performance to expect, may prefer fixed payment contracts. To address the moral hazard problem many contractors offer incentives and discounts to induce effort.

The wide variety of contract types and provisions makes it imperative that growers compare payments among contracts and evaluate the relative attractiveness of independent and contract production. The next section describes the contracts evaluated in this study.

Description of Contract and Independent Production Alternatives

Contract Types

Three contracting arrangements and independent production were evaluated for both feeder pig producing and feeder pig finishing enterprises. Research by Johnson and Foster, and Kliebenstein and Hillburn were used to develop bonus payment schedules for feeder pig finishing contracts. Research by Kliebenstein and Hillburn was used to develop bonus payment schedules for feeder pig producing contracts. Specific contracts evaluated are described below.

The following contracts were used for feeder pig production:

Contract A stipulates the feeder pig producer receive a base payment at time of marketing based on the number of feeder pigs produced (per pig payment). No bonus payments are offered for this contract.
Contract B stipulates the feeder pig producer receive a base payment at time of marketing plus bonus payments of $0.20/pig for every 0.5 increase above 18.00 pigs/female/year. Deductions occur at a rate of $0.10/pound for average weight below 42.5 pounds/pig.
Contract C stipulates the feeder pig producer receive a base payment at time of marketing plus bonus payments of $0.60/pig for every 0.5 increase above 12 pigs/female/year and 0.08/pound for average pig weights above 50 pounds. Deductions occur for pigs under 50 pounds at a rate of $0.08/pound.

The contracts used for feeder pig finishing are as follows:

Contract D stipulates the feeder pig finisher receive a base payment at the time of marketing, based on the number of finished pigs marketed (per pig payment). No bonus payments were offered for this contract.
Contract E offers the feeder pig finisher a relatively high base payment at the time of marketing and relatively low bonus payments.
Contract F offers the feeder pig finisher a relatively low base payment at the time of marketing and relatively high bonus payments.

Contracts **A**, **B**, and **C** provide a feeder pig producer a base payment per pig produced. While contact **A** has no built in mechanism for bonuses or discounts, it is beneficial for producers to achieve a high level of pigs/female/year to increase the number of feeder pigs receiving payments and optimal feed efficiency to increase premiums received. Contracts **B** and **C** provide a base payment and a mechanism for bonuses. Contract **C** offers a relatively higher bonus schedule than contract **B**.

Contracts **D**, **E**, and **F** provide a feeder pig finisher a base payment per pig finished. Contract **D** does not include performance incentives. The bonus schedule for contract **F** provides relatively high performance incentives. Contract **E** is based on a relatively higher base payment than contract **F**, but potential bonus payments were lower.

Several assumptions were made to facilitate comparisons. Feeder pig quality and genetics were assumed to be the same for each contracting alternative and for independent growers. Thus, performance incentives were based on the performance of the grower rather than differences in genetics. Facility sizes were assumed the same for independent and contract growing as to equate fixed costs. Also, management time is assumed to be similar among alternative production methods. Finally, problems associated with co-mingling of feeder pigs were assumed to be similar among alternative production methods.

Costs Per Pig for Contract and Independent Production

Information from Kansas Farm Management Enterprise Analysis Reports and Iowa State Swine Enterprise Reports for the 1986 to 1994 period were used to develop cost and production performance estimates.[2] Using Kansas Farm Management information average real variable costs incurred by contract feeder pig producers (feeder pig finishers) were $8.84/pig ($5.97/pig) and included: hired labor, repairs-tools-supplies, gas-fuel-oil, personal property tax, general farm insurance, utilities, and interest paid. Average variable costs incurred by average efficiency independent feeder pig producers (feeder pig finishers) were $40.52/pig ($63.79/pig) and included: hired labor, repairs-tools-supplies, feed purchased, farm organization fees, veterinary-medicine, livestock marketing and breeding, gas-fuel-oil, personal property tax, general farm insurance, utilities, auto expense, and interest paid. Expenses were converted to real 1994 dollars using the implicit price deflator for personal consumption expenditures (U.S. Department of Commerce).

Three alternative efficiency levels (low, average, and high) were considered. The producer's efficiency level has a two-fold effect on production and management decisions. First, the grower's efficiency level inherently affects variable costs. Using Iowa State University Swine Enterprise Analysis Reports, adjustments to costs were made to reflect low and high efficiency. Variable costs for low and high efficiency feeder pig producers (feeder pig finishers) were on average 1.20 (1.12) and 0.85 (0.87) times the costs incurred by average efficiency producers. Second, performance payments for death loss, feed efficiency, and pigs/female/year were adjusted to reflect the performance of producers with low and high efficiency. Average feed efficiency for low, average, and high efficiency feeder pig finishers were 3.8, 3.6, and 3.4 pounds feed/pound gain. Average death loss percentage for low, average, and high efficiency feeder pig finishers were 4.2%, 3.8%, and 3.0%. The average number of pigs/female/year for the low, average, and high efficiency feeder pig producers were 14.9, 16.4 and 17.9. Average selling weight of feeder pigs was 59.33 pounds.

Evaluation of profit potential for enterprise production was conducted using a real returns to grower labor, land, management, and fixed costs, or real returns over variable costs. Real returns over variable costs is revenue available to producers after subtracting variable costs from gross revenues received from contract management or through marketing as an independent producer. Market prices were based on annual average prices received by feeder pig producers and feeder pig finishers providing data to the Kansas Farm Management Association. Returns were expressed in real 1994 dollars. Independent feeder pig producers and finishers with average efficiency realized average real returns over variable costs of

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[2] Iowa Sate Swine Enterprise Analysis Reports were used to compute premiums/discounts received for feed efficiency, death loss, and pigs/female/year for alternative efficiency groups due to the lack of data for Kansas. Most data provided to the Kansas Enterprise Analysis Farm Management Data Base for feeder pig production represents information for producers in northeast Kansas. Thus, the assumption of Kansas and Iowa feeder pig producers having relative similar performance is plausible.

$18.11/pig and $9.03/pig, for the period of study. Real returns for independent producers varied substantially. Real returns over variable costs to feeder pig producers ranged from $4.58/pig to $32.27/pig and returns for feeder pig finishers ranged from ($13.62/pig) to $21.41/pig.

Procedures

Stochastic dominance with respect to a function can be used to compare net return distributions for various alternatives (King and Robison). This technique is particularly useful when making pair-wise comparisons between mutually-exclusive alternatives. Stochastic dominance with respect to a function is used to compare each contract with independent production.

To use stochastic dominance with respect to a function, information on risk attitudes is needed. Raskin and Chochran discussed the importance of adjusting risk aversion coefficients when the scale of the outcome variable used is different than that of the study for which risk attitudes were elicited. The risk attitudes reported by Holt and Brandt for feeder pig prices were used in this study. Using Raskin and Cochran, the risk attitudes from Holt and Brandt were transformed as follows:

$$w = x/c \tag{1}$$

$$r(w) = cr(x), \tag{2}$$

where w represents the returns per head for independent production, x represents the level of market hog prices used in Holt and Brandt, $r(w)$ represents the transformed risk aversion coefficients, $r(x)$ represents the risk aversion coefficients used in Holt and Brandt, and c is a constant determined in equation 1 from the level of prices in the respective studies.

Real returns over variable costs per feeder pig were used to evaluate the pair-wise dominance of three feeder pig production/feeder pig finishing contract alternatives and independent feeder pig production/feeder pig finishing for three risk aversion levels. Risk aversion levels chosen for this analysis included risk neutral (0.00 to 0.05), slightly risk averse (0.051 to 0.10), and strongly risk averse (0.101 to 0.15) preferences. Pair-wise comparisons were made for producers with low, average, and high efficiency.

Contract base payments needed for producers to switch from independent to contract production were computed using $0.25 intervals. Premiums and discounts were added to base payments and variable costs were subtracted to make comparisons between returns from contract and independent production. Base payments, for an individual contract were increased until the contact stochastically dominated independent production at each level of risk aversion.

Empirical Results

Feeder Pig Producing Contracts

Table 1 provides a summary of base payments ($/pig) for which independent feeder pig producers would switch to contract feeder pig production. Premium payments to contracts **B** and **C** were excluded from table 1. Average premium payments attained by feeder pig production contracts for low, average, and high efficiency levels for contract **B** (**C**) were $0.67 ($2.34), $0.70 ($3.31), and $1.09 ($4.09) per pig. Premiums for alternative efficiency levels were added to derived base payments in table 1 to derive real returns over variable costs for each alternative (table 3.)

More risk averse producers require lower base payments to prefer contract production. Risk averse producers find the reduction in price and production risk associated with contracting appealing. Base payments necessary to make contract production preferred increase as production efficiency increases. Both reductions in costs and increased premium incentives were realized by the high efficiency producer. Independent producers that exhibit above average efficiency were quite profitable. Thus, it is not surprising that contract payments need to be large for this group.

Required base payments for contract **A** range in value from $17.50/pig for a strongly risk averse, low efficiency producer to $31.50/pig for a risk neutral, high efficiency producer. A slightly risk averse producer considering contract **A** would require base payments of $19.00/pig, $25.25/pig, and $29.25/pig for low, average, and high efficiency levels, respectively. Required base payments for contract **B** were $0.75/pig to $1.00/pig lower than those obtained with contract **A**. This difference represents the premiums received for contract **B**. Required base payments for contract **C** were substantially lower than those for the other two contracts. This reflects the relatively high premiums received for this contract.

Table 3 presents real returns over variable costs for alternative contracts and efficiency levels for slightly risk averse producers using base payments in table 1. For each efficiency level, returns for independent feeder pig producers were higher than required contract payments. This is due to the variability of independent feeder pig production. Returns for contract feeder pig production were relatively stable as indicated by the coefficient of variation. Independent feeder pig producers realize seven to nine times more variability in returns than do contract feeder pig producers.

Feeder pig Finishing Contracts

Table 2 provides a summary of base payments ($/pig) needed to switch from independent feeder pig finishing to contract feeder pig finishing. Table 2 does not include premium payments. Premium payments for contract **E** (**F**) for low, average, and high efficiency feeder pig finishers were $0.17 ($2.39), $039 ($2.83), and $1.17 ($3.47) per pig. Total payments received (base payments plus premiums) were similar among contracts.

Required contract payments increase for less risk averse and more efficient feeder pig finishers.

There is a tremendous difference in required base payments among efficiency levels. A slightly risk averse finisher with low efficiency requires base payments, depending on the contract, in the $4.25 to $6.50 per pig range. Slightly risk averse producers with high efficiency would require base payments in the range of $16.50 to $18.00.

Base payment levels for slightly to strongly risk averse finishers with average efficiency are similar to current payment levels being observed by contract feeder pig finishers. Lawrence indicates that contract feeder pig finishers have received annual payments of $30 and $36 per pig space or $10 to $13 per pig. The relatively low base payment values observed for strongly risk averse finishers with average to below average efficiency suggests that these finishers would prefer contract finishing over independent finishing. Risk neutral and slightly risk averse finishers with average to above average efficiency would require payments substantially higher than current payments. Thus, these finishers are unlikely to take part in contracting.

Real returns over variable costs for a slightly risk averse producer, with low, average, and high efficiency were reported in table 3. Returns for low efficiency feeder pig finishing were negative for the three contracts and relatively small for independent finishing. Finishers with low efficiency will not make enough money to pay for variable costs let alone fixed costs. These finishers, whether involved in independent or contract finishing, will not survive. Contract finishers have more stable income streams than independent finishers. Returns for independent finishers were found to be $1 to $2 per pig higher than the returns for contract finishing.

Conclusions

As contract feeder pig production and finishing becomes more prevalent, growers need information on contract types and provisions. This paper used stochastic dominance with respect to a function to determine the base payments required by independent feeder pig producers and finishers to switch from independent to contract swine production.

High efficiency producers, whether feeder pig producers or finishers, required payments substantially above current contract payments. Also, risk neutral producers with average to above average efficiency required payments in excess of current payments. Thus, these producers will produce pigs independently rather than contract. Finishers, with average performance that are slightly to strongly risk averse require payments similar to those currently being offered. Finishers that are risk averse and those with average to below average performance were likely to choose contract production over independent production.

Contract hog production did not financially benefit the above average efficiency grower at current contract specifications. This result suggests high efficiency growers are better off

independently growing pigs. However, if recent trends in efficiency continue, these growers will need to continue to make changes in their operation to maintain their competitive position.

Further research is needed to investigate some of the risks not included in this study. Independent producers may face additional risk in the future associated with contract control of genetics and a further reduction in marketing outlets. Another issue relates to the diversification benefits associated with producing swine and crops on the same farm. Independent hog production has been an integral part of some farms' diversification strategies. Additional research is need to determine whether this strategy remains viable.

Additional risks to the grower unaccounted for in this analysis include the voiding of the contract prior to the specified ending date and the impact of inflation on contract payments. Also, many contractors offer contracts that have a duration that is considerably shorter than the life of facilities. The relative importance of this contract risk remains an issue for further research.

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Table 1. Minimum base payment levels ($/pig) for which feeder pig producers will be indifferent between independent and contract production.

Contract	Risk neutral[a]	Slightly risk averse[a]	Strongly risk averse[a]
Low efficiency producer			
Contract **A**	20.75	19.00	17.50
Contract **B**	19.75	18.50	17.00
Contract **C**	15.75	14.00	12.50
Average efficiency producer			
Contract **A**	27.00	25.25	23.75
Contract **B**	26.25	24.50	23.00
Contract **C**	21.00	19.25	17.75
High efficiency producer			
Contract **A**	31.50	29.25	27.25
Contract **B**	30.75	28.50	26.25
Contract **C**	25.00	22.75	20.75

[a] If the base payment is higher than the level indicated, a producer would prefer contract production over independent production. If the base payment is lower than the level indicated a producer would prefer independent production over contract production.

Table 2. Minimum base payments levels ($/pig) for which feeder pig finishers will be indifferent between independent and contract finishing.

Contract	Risk neutral[a]	Slightly risk averse[a]	Strongly risk averse[a]
Low efficiency producer			
Contract **D**	10.50	6.50	2.25
Contract **E**	10.50	6.00	2.00
Contract **F**	8.25	4.25	0.00
Average efficiency producer			
Contract **D**	17.00	13.25	9.00
Contract **E**	16.75	12.75	8.75
Contract **F**	14.50	10.25	6.25
High efficiency producer			
Contract **D**	22.50	19.00	14.75
Contract **E**	22.25	18.50	14.50
Contract **F**	20.75	16.50	12.25

[a] If the base payment is higher than the level indicated, a producer would prefer contract production over independent production. If the base payment is lower than the level indicated a producer would prefer independent production over contract production.

Table 3. Returns over variable costs for slightly risk averse producers with low, average, and high efficiency.

Contract	Average	Minimum	Maximum	CV[a]
Feeder Pig Producing ($/pig)				
Low efficiency producer				
Contract **A**	8.44	7.10	10.62	0.12
Contract **B**	8.61	7.32	10.80	0.12
Contract **C**	6.53	4.47	8.27	0.18
Independent	10.09	(2.23)	22.77	-
Average efficiency producer				
Contract **A**	16.41	15.34	18.15	0.06
Contract **B**	16.37	15.16	18.04	0.06
Contract **C**	14.47	13.03	15.91	0.07
Independent	18.11	4.58	32.27	0.47
High efficiency producer				
Contract **A**	21.71	20.62	23.06	0.05
Contract **B**	22.05	20.52	24.25	0.05
Contract **C**	20.04	18.91	22.03	0.05
Independent	24.11	5.96	37.60	0.47
Feeder Pig Finishing ($/pig)				
Low efficiency producer				
Contract **D**	(0.18)	(1.41)	1.27	-
Contract **E**	(0.51)	(1.91)	1.23	-
Contract **F**	(0.04)	(1.87)	1.90	-
Independent	2.47	(20.79)	16.12	-
Average efficiency producer				
Contract **D**	7.27	6.13	8.54	0.09
Contract **E**	7.16	5.63	9.04	0.15
Contract **F**	7.09	5.21	8.84	0.14
Independent	9.03	(13.62)	21.41	-
High efficiency producer				
Contract **D**	12.75	11.66	13.77	0.05
Contract **E**	14.72	12.16	16.11	0.08
Contract **F**	14.42	12.86	16.17	0.07
Independent	15.86	(5.85)	27.67	-

[a] Coefficient of variation is defined to be mean divided by standard deviation