Effects of Size and Business Arrangement on the Profitability of Hog Farrowing Operations in Manitoba

By

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A Thesis

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In Partial Fulfillment of the Requirements

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Abstract

The structure of the hog industry in Manitoba is changing. Small independent family farms are being replaced by modern megafarms which are often integrated with feed companies. Investment capital is needed so hog farmers can increase the size of their operations and remain competitive in the world market. Commercial banks will lend up to 60% debt on new hog production facilities. Producer groups typically have 25% of the equity capital needed for expansion, with the remaining 15% equity capital needed will be raised by attracting venture capital to invest in hog operations.

The purpose of this thesis is to identify the most attractive size, type, and business structure of hog operation to make it attractive for venture capitalists to invest the 15% equity capital needed for expansion. Representative 600 and 1200 sow farrow to wean operations, as well as 600, 1200, and 2400 sow farrow to finish operations were modeled and, hog and barley prices were varied to assess the profitability of the operations under different price scenarios.

The farrow to wean operations were profitable only when market hog prices were high. Farrow to finish farms were profitable under most market conditions. The exception being when market hog prices were low. The 2400 sow farrow to finish operations showed the best profitability in terms of ROA over the fifteen year period.

The most desirable operation for a venture capital investor would be the 2400 sow farrow to finish operation, which exhibits the highest average ROA the shortest amount of time the 15% of equity capital would need to stay in the operations. The next best alternative of the attraction of venture capital would be the 1200 sow farrow to finish operation which exhibits lower ROA and has a three year period that the venture capital would need to stay in the operation.

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CHAPTER 1 INTRODUCTION

1.0 Introduction

The hog industry in Manitoba is currently going through an expansion phase. There were approximately 3.5 million hogs marketed in 1998, this is estimated to increase to 5 million hogs by the year 2005. The makeup of Manitoba hog farming is changing also as producers are increasingly running larger hog farms, thus trending away from the small independent family farm to the modern megafarm which is often integrated with feed companies.

Investment capital is needed so hog farmers can increase the size of their operations and remain competitive in the world market. This capital can come in the form of debt capital, from commercial lending institutions or from equity capital as offered by independent investors. Commercial banks will lend up to 60% debt on new hog production facilities, which leaves 40% equity to be raised by other methods. Equity capital can be in the form of retained earnings or shares.

Prospective investors in hog facilities include long term investors who tend to be led by groups of producers, as well as short term investors or venture capitalists who are looking for high returns over a short period of time. Producer groups tend to be able to raise 25% of the equity capital needed for expansion. The remaining 15% equity capital

to be raised will be raised by attracting venture capital to invest in hog operations. The purpose of this thesis is to identify the most attractive arrangement of size, type, and business structure of hog operation to make it attractive for these venture capitalists to invest the 15% equity capital needed for expansion.

1.1 Objectives

The objective of this thesis is to identify the combination of business structure and size of different types of hog operations that will be most attractive to venture capitalists. This will be done by estimating the expected rates of return on total assets(ROA) for the various combinations of business structures and sizes of hog operations. The results from this thesis are expected to show how the different arrangements of the hypothetical model hog farms affect the total expected profitability and the range of expected profitability as measured by after tax profit per pig and expected ROA. The sensitivity in terms of profit to the various model hog farms to changes in, feed costs, pork prices, and size of operation will also be examined. The question of what combinations of sizes, types, and business organizations would be suitable for a short term investor in terms of expected returns and length of time that their capital must be committed to a particular operation will come out of this thesis also.

The purpose of this thesis is to answer these questions in order to be able to develop business plans that are directed toward attracting investment capital to hog producers in Manitoba. As well as identifying the most profitable business arrangements for the different types of hog operations.

1.2 Methodology

The basis of this thesis will come from developing model hog farms, which include farrow to finish, and farrow to wean operations. Three different size operations for the farrow to finish operations and two different size operations for the farrow to wean operations will be considered to capture the effects of efficiencies of size. The production parameters will be based on the best management practices, as are consistent with representative types of efficiently run farms in Manitoba.

Al Theede formerly of the Saskatchewan Pork Implementation Team has developed a series of computer spreadsheet templates to perform financial analysis and provide proforma financial statements for pig production units called PorkPLAN. PorkPLAN will be used to generate pro forma financial statements for the types of hog operations under different business arrangements over a 15 year period. From PorkPLAN the average and the range of ROA will be calculated for each model farm setup.

The financing arrangements will remain constant across all business organizations, each business will finance the hog operation at 60% debt and 40% equity. This will allow for the isolation of the effects of business organizations on expected profitability. A debt level of 60% is the maximum exposure that equity capital could lose since commercial banks would not finance a hog enterprise above this level.

For each different arrangement of hog operation pro forma financial statements will be generated for the 15 year planning horizon. From each base plan different price and cost scenarios will be calculated to assess the sensitivity of ROA to the major price parameters.

1.3 Thesis Outline

The first part of the thesis will deal with identifying two appropriate sizes for each model hog operation. This will include a moderate, medium, and large base operation for each of the farrow to finish, and a moderate and medium size for the farrow to wean operations. Once the appropriate sizes of operation are targeted, the capital required for each operation will be identified. Then the base production parameters for each type and size of hog operation will be identified. After this is done the alternative business arrangements, corporation or limited partnership will be included as a part of the analysis. For each of the different combinations of operation PorkPLAN will be used to generate

15 years of pro forma financial statements. The expected ROA will be calculated for each model farm, the ROA values will be used as the analytical tool when doing all the comparisons in this paper. This will give a range of hypothetical outcomes to assess the variability of profits for the various model farms.

CHAPTER 2 LITERATURE REVIEW

2.0 Introduction

This chapter is a literature review covering the current structure of the Manitoba hog industry as well as where the industry is headed in the future. The first part of the chapter includes a breakdown of hog production in the province which covers the distribution of hog operations and marketings by size and type of operation, the distribution of hog marketings by farm size, and the distribution of sows by farm size. The second part of the chapter discusses hog marketing and risk management in Manitoba. The third part of the chapter is an examination of some of the emerging changes in the hog industry such as market driven changes and emerging production systems. The fourth part of the chapter deals with advantages that Manitoba has in pork production. Production units and business organizations in Manitoba, as well as hog investment from an investors point of view are discussed in part five.

2.1 Present Structure of the Manitoba Hog Industry

The organization of the Manitoba hog-pork sector is already highly integrated with Hutterite Brethren[1] accounting for 40% of all hog production in Manitoba and feed

[1] The Hutterite Brethren are a group of people connected through religious and family ties that farm in collective groups throughout Manitoba.

companies accounting for approximately 40% of production in 1998. The remaining 20% of hog production is accounted for by smaller independently owned and operated farms (Wruck, 1998).

2.1.1 Distribution of Hog Production Units and Marketings in Manitoba by Types of Operations

The types of hog operations in Manitoba that are summarized include feeder, farrow to finish, and finishing. A feeder operation takes a young pig that has been weaned from the sow and grows that pig to 23 kilograms body weight. A finishing operation raises hogs from 23 kilograms to an approximate market weight of 110 kilograms for slaughter. A traditional farrow-finish operation is a single site facility where pigs are raised from the weanling stage of approximately 21-28 days old all the way to market weight for slaughter.

The breakdown of production by type of operation in Manitoba in 1996 illustrated that of the 1835 production units in Manitoba 35% were finishing operations and 32% were farrow-finish operations. The distribution of market pig sales by operation in Manitoba in 1996 showed that the bulk of the market pig sales were from farrow to finish operations which accounted for 64% of the 1,627,006 market pigs sold. Finishing operations accounted for 35% of the market pigs sold. The bulk of hog marketings in Manitoba are from farrow to finish operations. Feeder operations accounted for 10% of the total production units (Wruck et al, 1998).

In Manitoba total active hog production units decreased by 9.4% from 1995 to 1996. The largest decrease was in the categories of 1000 hogs marketed and under in which 190 producers were active in 1995 who were not active in 1996. It was primarily the older or inefficient production units that ceased operation. Meanwhile in the 1,001 hogs marketed and over category there was an increase of 9 active production units and in the 10,001 hogs marketed category there was an increase of 10 units (Manitoba Pork Yearbook 1996). This supports the hypothesis that a move to larger more efficient production units is taking place (Wruck et al, 1998).

2.1.2 Distribution of Hog Marketings by Farm Size

Of the 1285 production units in Manitoba that marketed finished hogs in 1996, 58% of them fall into the size range of 1-1000 hogs, while accounting for only 13% of total hogs sold. In contrast the farm size range of 7001-16000 accounted for 6% of total production units, while accounting for 38% of total marketings.

2.1.3 Distribution of Sows in Manitoba

The distribution of production units with sows in 1996 indicated that the total number of farms with sow herds was 771 and the total number of sows was 145,196. The 1-150 sow herd size farm represented 71% of total production units, while accounting for only 19% of the total number of sows. The 851-1450 sow range accounted for 2% of the production units, and 9% of the total number of sows respectively. The farms with more

than 1450 sows accounted for only 1% of the total number of production units yet represented 11% of the total number of sows (Wruck et al, 1998).

2.2 Marketing of Hogs in Manitoba

The Manitoba hog industry existed under a single desk selling system controlled by Manitoba Pork est. until July 1, 1996. Under single desk selling all producers in Manitoba received the same price for equal quality hogs and incurred the same costs for marketing, research, development and promotion. In addition to this all producers received equal access to information on technology and product development, and to the benefits from promotion. Each hog producer had a single vote in marketing agency elections, regardless of size of operation. These factors most likely played a role in allowing a large number of the small producers in Manitoba to exist along side the small number of large producers (Klein et al, 1995).

The biggest change influencing pork production in Manitoba is the province's move to the dual marketing of hogs on July 1, 1996, which ended Manitoba Pork est.'s monopoly on the marketing of hogs in Manitoba. Under the dual marketing system producers have the choice of selling their hogs through Manitoba Pork est. or marketing them directly to processors.

The most significant implication of dual marketing in Manitoba is that it paves the way for strategic alliances and contracting for processing system integration. The hog production industry in Manitoba has traditionally been coordinated through Manitoba Pork est. Hog farmers operated on a produce and then sell basis. Now that Manitoba Pork est. is no longer setting the price it is likely Manitoba will see an increase in negotiated personal contractual linkages or alliances and a decline in the use of impersonal marketing through Manitoba Pork (Schrader and Boehlje, 1996).

2.2.1 Risk and Hog Production

A common business strategy to reduce the price risks associated with hog production is to contract for supplies. It is also possible to reduce output price risk by contracting product sales. Some hog firms reduce price risks by vertically integrating the input supply or product distribution chains (Schrader and Boehlje, 1996). These are issues that will be very important to producers in Manitoba as the industry adapts to the dual marketing of hogs. In Manitoba producers are offered a variety of options to reduce both the input and output price risks associated with hog production. These options include the Hog Margin Indicator, Soymeal Price Protection Option, the Basis Contract, and the forward pricing options on the price of hogs.

Hog profits are affected by the changes in the sale price of hogs and the purchase price of weanlings and feed inputs. The margin that a producer is left with is based on the value of a market hog minus the weanling cost and the cost of feed used to produce

the hog. This profit margin is what is left for covering all other costs, and profit. A producer would benefit financially by capturing the high profit margins and minimizing the duration of, or completely eliminating the low margins. Manitoba Pork est.'s risk management services such as forward contracting hogs, locking in a Canadian/U.S. exchange rate, and the ability to lock in the price of soymeal feed requirements are part of the solution to risk management.

2.2.2 Hog Margin Indicator

The fluctuations in the price of inputs such as feed, which accounts for up to 60% of production costs, or output like the price of hogs are very important. The *"Hog Margin Indicator"* (HMI) is a new marketing information service offered by Manitoba Pork est. that is intended to improve a producers profits by reducing the risk associated with feed costs and hog prices. This service provides a producer with an indication of margins if the producer locks in hog prices and feed costs. The premise is that Manitoba Pork est. will assist producers in making better pricing decisions by providing essential market information and related pricing strategies in a timely manner (Manitoba Pork est., 1998).

Manitoba Pork est. will provide a HMI for each month, 11 months into the future according to representative industry calculations, along with the forward prices for hogs. As a result, hog producers will receive rapid information on changing pricing conditions and opportunities in the hog and feed markets that affect their prospective margins. This information will help make business decisions on fixing hog prices or feed prices to

protect desirable margins. Depending on the market outlook, high margins indicated for one or more months may encourage a producer to lock in their price, feed cost, or both to protect their specific margins (Manitoba Pork est., 1998).

The calculation for the HMI provides an industry measure to show pricing trends and opportunities affecting profit margin. A producer can make their own adjustments to customize the calculations to their own production situation. The calculation takes hog value and deducts both the feed and weanling costs.

Hog value is calculated on the basis of Manitoba Pork's forward contract price, on a 111 kilogram live weight hog dressing 80% with a 109 index, and a weight premium of $3.00 (Manitoba Pork est., 1998).

Feed is calculated on a 3:1 conversion for a 22.5 kilogram to 111 kilogram gain (585 pounds), 75% barley, 20% soymeal, and 5% premix. Feed is valued at current prices for the first 3 months, and forward contract prices, 3 months earlier, for months 4 to 11 months ahead. Futures market values for barley and soymeal are used with adjustments made for basis in Manitoba. Current premix costs are applied to the remaining 5% of the ration (Manitoba Pork est., 1998).

Weanlings are valued at 1.7 of the current market price times 22.5 kilograms for the first 3 months, and 1.7 times of the forward price times 22.5 kilograms for months 4 through 11 ahead (Manitoba Pork, 1998).

The benefits of the HMI are that it provides the producer with an indication of the profit margins that could be locked in, it allows a producer to target specific hog prices and feed inputs to improve profit margins, and it provides a producer with timely information to take advantage of favourable prices.

2.2.3 Soymeal Price Protection Options

Profits in hog production are directly affected by price swings in soymeal, which is a key source of protein in hog feed rations. For example, a rise of $50.00 per tonne results in a loss of $3.00-$4.00 per hog. Within a single year prices can vary by $50.00 per tonne or more. In the 12 months starting in April 1997 to March 1998, the price of soymeal ranged from a summer high of $460.00 to the recent March low of $260.00 per tonne (47% protein, delivered to Winnipeg) (Manitoba Pork, 1998).

The Soymeal Price Protection Option (SPPO) was developed by Manitoba Pork est. as a way of extending feed price protection to producers. For $5.00 per tonne, a producer is able to buy an option to protect against a major upturn in the soymeal market over the next 1-11 months. Monthly soymeal prices that can be protected will be calculated daily based on U.S. soymeal futures. The producer is still free to buy the actual soymeal at

lower prices at any time from anywhere else. The SPPO will provide a producer with maximum price protection for a set tonnage in the month that the producer selects. Tonnage units are 25 tonnes, or approximately one semi load (Manitoba Pork est., 1998).

The cost of the SPPO is $5.00 per tonne, or about 30 cents per hog. For a producer it is a form of insurance against losing more than this amount per hog from significant price rises in the soymeal market. This is only available to producers having Manitoba Pork hog delivery contracts or forward price contracts over the period covered by the SPPO (Manitoba Pork est., 1998).

2.2.4 Basis Contract

The Canada/U.S. exchange rate has a significant impact on the hog prices producers receive because hog prices are determined by U.S. hog prices in U.S. dollars. For every cent that the Canadian dollar drops the value of a hog increases by approximately $2.00 in Canadian currency. During the last three years, the exchange rate has ranged between 68 and 75 cents in Canadian currency (Manitoba Pork est., 1998).

Manitoba Pork is offering producers a Basis Contract, which provides producers the ability to lock in the current exchange rate on hogs to be marketed in any of the next 11 months forward. The Basis Contract allows producers to decide when they want to lock in the U.S. hog futures price. The producers decision will be based on when they believe

U.S. hog prices have reached their high based on current information (Manitoba Pork est., 1998).

The Basis Contract is shown as a ratio of Manitoba Pork est.'s forward contract price to the U.S. hog futures price. This ratio locks in the Canadian/U.S. exchange rate, along with a standard conversion used between a Canadian and U.S hog carcass. The producer can decide when to apply the ratio to the U.S. futures up to 11 months from the time the producer took the basis by calling Manitoba Pork est.. If not called in by the time the Basis Contract is up, the producer's price will be calculated using the U.S. hog futures at 12:30 p.m. that day. The basis contract can cover any number of hogs up to a producers total production for the month. The producer can deliver the hogs that are under the Basis Contract any time during the delivery month selected (Manitoba Pork est., 1998).

2.2.5 Forward Pricing Options Offered By Manitoba Pork est.

Under Manitoba Pork est.'s forward price contracting program a producer has the ability to manage the price that they receive for hogs up to eleven months in advance of delivery. By forward pricing a producer is able to reduce risk and maximize returns in a fluctuating price market. The options available to Manitoba producers include fixed pricing, guaranteed minimum pricing, window pricing, and target pricing.

Fixed pricing guarantees a producer a set price for a quantity of hogs for the month(s) in which they are contracted. Price is based on U.S. futures.

Guaranteed minimum pricing offers a producer the ability to lock in a minimum guaranteed price within a designated month or months with the added advantage of being able to benefit from price gains between the time of signing the contract and the time of delivery.

Window pricing offers a producer the flexibility of benefitting from prices that move between a set range of minimum and maximum prices. Under this option the producer receives a price no greater than the maximum and no less than the minimum, calculated on the day of delivery.

Target pricing allows a producer to choose a price at which they are prepared to forward contract their hogs to Manitoba Pork, over a set period of time. The price that the producer selects will be higher than the current forward price. If the forward price strengthens over the time period, Manitoba Pork will generate a fixed price contract for at least your target price (Manitoba Pork est., 1998).

2.3 Vertical Integration in Manitoba Hog Production

Family run hog operations in Manitoba fall into two categories, those who are integrated with feed companies, and those who are independent of feed companies. Feed companies in Manitoba have integrated with producers in the hog production business.

They combine their expertise in swine genetics, nutrition, and animal health with the farm management experience of producers to set up and run farrowing and finishing operations.

A producer can enter into a finishing agreement whereby the feed company offers construction of a modern finishing facility at a guaranteed price. An example of a typical setup is a 1,200 head hog finishing facility costing around $285,000. In exchange for the feed company's capital and services the hog producer is usually required to provide around 25% equity investment in the finishing barn, bank financing for balance of loan, land and site services, competent barn labor and supervision, and work in accordance with the company's particular protocol. Barn operating, repair and maintenance costs are the producers responsibility, along with cleaning and preparation of the facility between placements and loading/unloading of the pigs. The weighing of the pigs to ensure proper market weights and maintenance of a herd record keeping system is usually the responsibility of the producer.

The feed company supplies the swine producers with feeder pigs to be grown to slaughter weight. Functions related to the marketing of the pigs and cost of insurance coverage on the pigs may be covered by a company. The feed company may take assumption of all risk for fluctuations in the market price of pigs, and responsibility for keeping the barn full throughout all-in, all-out production.

Swine producers can enter into a feeder pig production agreement where they maintain commercial breeding stock for the feed company, produce feeder pigs and finish hogs to slaughter weight. The terms are similar to those described for the finisher operations. A feed company may provide feed, medications, and a technical service representatives to provide herd management guidance. They will usually demand the producer to implement a formulated, phased feeding program. Placement and transportation of all pigs may be part of the deal with the feed company.

Producers receive a base income that is termed a grow out fee. The grow out fee can be tied to specific production performance parameters, such as market index, days to markets, or pigs weaned per sow. There are often production performance premiums associated with feeder pig and finishing production. If the performance standards are not met, producers may be subject to penalties.

When a producer is producing feeder pigs and finishing hogs the feed company may agree to clear surpluses when feeder pigs are in a temporary long position. Likewise, when feeder pigs are in a short position the company may agree to prevent shortages in finisher hog producer barns.

2.3.1 Dynamic Pork Corp.

On January 30, 1998, Manitoba Pork est. and N.M. Paterson & Sons Ltd. announced the formation of Dynamic Pork, to develop and manage the province's first network

contract hog farming operation. Dynamic Pork provides an alternative to farmers and other investors interested in taking a position in the hog industry without taking on the large investments, risks and labour demands that are part of a conventional large-scale hog operation. Dynamic Pork will develop and manage the contract hog farming networks but each network will be independently owned and operated by its farmers and investors

A network may be defined in this case as a group of investors who own the breeding stock and progeny through to market. The network benefits from the profits and assumes the risks that are inherent in commodity markets. The network will contract with: qualified hog producers who own and operate barns, with a sow barn owner/operator to produce weanlings, and with nine finisher barn owner/operators to finish the hogs. Barn operators are paid for their labour and the use of their facilities, and because they are required to have a minimum investment in the network, they will share in the profits or losses of the company.

Dynamic Pork has based its plans on a network that produces 37,000 hogs annually, with a 1700 sow barn supplying nine 1300 hog feeder barns. Every 18 weeks, each feeder barn will receive 1,300 twenty three kilogram weanlings over a two-week period. The feeder barns will feed the hogs with grain provided at cost from feed toll mills operated by N.M. Paterson & Sons Ltd. and care for the hogs at the networks expense

until they are ready for market. The network will pay the sow and feeder barn a fixed rate for caring for the hogs.

Dynamic Pork provides services in the terms of network development and network operations. In the area of network development Dynamic Pork will be responsible for: managing all securities law-related issues with respect to raising equity financing for the network, pre-arranging financing packages for sow and feeder barns, recruiting the necessary participants which includes feeder barn and sow barn operators, assistance in obtaining government approvals for network facilities (environmental and municipal requirements), procuring breeding stock, and developing performance specifications and operation standards for the sow and feeder barns.

In terms of network operations Dynamic Pork will be responsible for; measuring network productivity and assisting with performance improvements and quality control initiatives, providing marketing services through Manitoba Pork est., identifying and sourcing equipment and supplies, negotiating contracts for technical services (veterinary, nutritionist, etc), collecting and paying accounts, arranging for management expertise, administer and enforce network contracts, provide public relations services, and manage network logistics such as feed delivery and transportation.

Each network will have its own management and will be responsible for: ownership of breeding and replacement stock, feed costs, services and supplies, marketing costs,

Dynamic Pork fees for management services, payments to the sow and feeder barn operators, transportation costs, and insurance. For its part, the network will receive all revenue from marketing the finished pigs and the proceeds from the sale of culled sows and boars.(Manitoba Pork, 1998)

2.4 Quantity/Quality Concerns in Hog Production

Another risk in hog production is related to quantity/quality concerns. With the advent of dual marketing and as the processing industry in Manitoba becomes more specialized with larger plants (such as Maple Leaf in Brandon), flow scheduling to keep plants working at full capacity becomes more important to maintain efficient operations. For example, matching hog finishing capacity to packing plant kill capacity is important to the overall cost efficiency of a plant. This coordination can be more difficult to attain in open markets. Thus it will be increasingly important to coordinate production and processing activities to keep packing plants working at peak efficiency(Boehlje et al, 1997).

Consistency, in terms of quality standards, can be more easily accomplished with a contract/ownership coordinated system. For example, specialized feed mixing and blending equipment to manufacture specific rations may not be economical on the scale of a single farm. The coordination needed to get both quality and quantity for efficient

operations can be achieved through contracts, ownership of more than one stage, joint ventures, or similar arrangements in the food production and distribution chain. Thus we can expect to see backward integration in the Manitoba hog industry, as well as increased forward integration from feed companies to producers (Schrader and Boehlje, 1996).

System coordination in terms of contract ownership can also reduce or control the risks of safety/health risks in food production by its ability to adapt and respond quickly to changes in product or environmental laws. Health and safety risks include the risk of food borne disease, and the risk of polluting water, air, and land resources. The safety concern issue is especially important for Manitoba due to the fact that more than 80% of Manitoba pork is sold to customers outside the province, and one quarter of these exports are bound for markets outside Canada (Manitoba Agriculture, 1998). It is of the utmost importance that Manitoba maintain its high health standards in the hog industry to compete in the global hog market. The competitiveness of meat production will soon be more dependant on the reliability of the safety and the quality of the meat than on quantity and price (Blaha, 1998).

Another advantage of contract/ownership is the ability to respond to increased specificity in consumer demand. Consumers expect quality control and products with specific characteristics to be available when desired. With the upward trend in the standard of living and the increase in the ethnic diversity of markets, the trend is toward greater product diversity (Boehlje et al, 1997). Consumers are demanding more

information about the safety and healthfulness of the food they eat. Consumers are also demanding greater variety, convenience and service in the food products they prefer. The hog-pork sector will need to provide increased value to the consumer across an increasing variety of characteristics and attributes, while staying cost competitive with competing pork suppliers as well as competing meats (Srivastava and Bamford, 1998).

The need for more exacting quality control and flow control is going to tax the ability of spot markets to coordinate production and processing effectively. The problem lies with the ability of a spot market to convey the full message concerning such attributes as quantity, quality, and timing of a product and characteristics of a transaction.

The key reason why contract/ownership coordination in the hog/pork complex has not advanced as rapidly as was predicted in the 1960's is the biological capacity to respond to consumer demand for specific characteristics. Recent advances in genetics, nutrition, and reproduction in the hog/pork subsector have resulted in more control and predictability, and as a result the ability to biologically engineer the kind of pork consumers want. With these advances we are going to see the increasing importance of contract/ownership in the Manitoba hog/pork industry.

2.5 Market Driven Change in the Pork Industry

Where the open market falls short in achieving the needed coordination between producers and processors, other options will emerge. A supply chain approach will increase the interdependence between the stages in the pork chain. This will encourage strategic alliances, networks, and other linkages to improve logistics, product flow, and information flow. As a result relationships between input suppliers, producers, and processors are expected to become more personal (Boehlje et al, 1997). Negotiated coordination also results in more rapid transmission of information between the various economic stages and as a result enhances the ability of the system to respond to changing consumer demands, economic conditions, or technological improvements.

2.6 Emerging Production Systems

Technologies that offer significant cost savings such as, all in-all out stocking, and segregated early weaning (SEW) are not compatible with traditional production systems. All in-all out stocking has been shown to help decrease the spread of infectious diseases, enhance feed efficiency, reduce the total number of days required to achieve market weight, lower death loss, and spread fixed costs over more units of output. Trials at Purdue University have shown that SEW has the benefits of breaking disease transmission, reducing days to market, increase feed efficiency, and reduce mortality.

Performance improvements in average daily gain of 21% in nurseries and 13% in grower-finisher pigs have been observed in SEW operations (Boehlje et al. 1997).

Consumers demand a wide diversity of products with very specific characteristics. Traditional production systems have difficulty responding to these needs. A closer coordination in the pork industry is needed from genetics through processing and retailing than has happened in the past. Improved methods of animal identification, the introduction of HACCP (Hazard Analysis Critical Control Point) systems and greater vertical coordination through contracting along the supply chain are needed to ensure the Canadian hog-pork sector's ability to meet emerging demands of product differentiation based on production practices, animal welfare, environmental sustainability, and the use of biotechnology (Srivastava et al. 1998).

2.6.1 Hog Production Growth Trends

The rapid growth of large, industrialized production firms with close ties to processors in the United States, and the growth in Canada of large farms integrating with feed companies are forcing change in the hog industry. As a result of integration traditional independent hog producers are going to have to find a way to capture the benefits that are inherent to the system efficiencies available now. Studies have shown economic advantages to coordinated efforts in the swine industry such as feed and labor efficiencies and lower death losses. Other advantages include volume purchasing which can lead to price discounts and premiums that may be paid for hogs sold on a volume

basis. The hog industry in North Carolina is an example of the success of large independent hog production companies. The development of the North Carolina hog industry has been accompanied by marked gains in productivity that have offset the advantages of lower feed costs enjoyed by the midwestern U.S. hog producers. Also the ability to provide packers with leaner, high quality hogs in volume has led to price premiums for large North Carolina hog producers (Kliebenstein and Lawrence, 1995).

2.6.2 Expansion Trend in Manitoba

In Manitoba the expansion trend is being driven by contract integration between producers and feed companies such as Elite Swine, Landmark Feeds, and the Puratone Corporation. The move to dual marketing in Manitoba which now allows the processors and large producers to develop specific delivery contracts with packers. This should stimulate to some extent increased expansion of the hog industry in Manitoba. These coordinated hog production contracts are an indication of the future expansion of the hog industry towards larger more efficient farming.

The production efficiency in terms of pigs sold per sow per year for Manitoba hog operations has been shown to exhibit a steady increase as the size of sow production units get larger (Figure 2.1). The most significant increase is a three pigs per sow increase from 16.64 pigs sold per sow per year for the 1-150 sow range farms, to 19.64 pigs sold per sow per year for the 351-550 sow operations (Wruck et al, 1998)

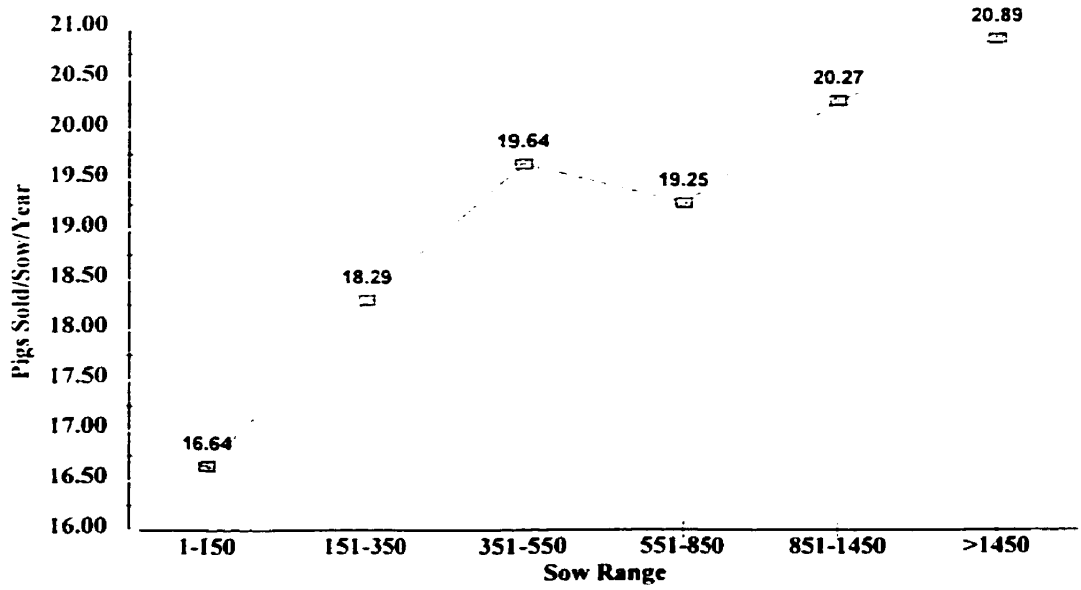


Figure 2.1: Herd Size and Production Efficiency

The advent of dual marketing and the ability to contract directly with processors will also lead to the possibility that larger farms may be able to take advantage of price premiums for large quantities of consistent quality hogs delivered directly to processors. Networking or producer cooperation is one approach that can help small and medium sized operations gain increased access to information, technology, capital, and markets. Networking can allow traditional producers to gain advantages associated with large pork production operations (Koehler et al, 1996).

2.6.3 Advantages of Manitoba in Hog Production

Feed is the greatest single variable in terms of cost of production for hogs, representing over 60% of the cost of production. Manitoba is in a position to capitalize on market expansion because of its advantage over other provinces in land and grain

costs. The elimination of the Western Grain Transportation Subsidy or Crow Benefit will encourage livestock feeding closer to the areas of feed grain production. This will make it less profitable to farm in the traditional way where grains and oilseed crops were grown and shipped out by rail for export to other countries. In the long term it should become more profitable to feed livestock in Manitoba than in other western provinces. This is because transportation and pooling charges will reduce the net price available to Manitoba feed grain producers from the Canadian Wheat Board, compared to the CWB price available to producers in other parts of western Canada. As a result Manitoba livestock producers will be able to buy locally grown feed grains for less than producers in Alberta and Saskatchewan. Manitoba also has the land base to support environmentally acceptable expansion (Landmark-Portec, 1995). Manitoba has more than 5 million hectares suitable for agricultural production. As a result of this the province has sufficient land for expansion of hog facilities and sound manure disposal (Manitoba Agriculture 1998).

2.6.4 Producer Networking: The Pipestone System

The Pipestone System in Pipestone, Minnesota is an example of a successful networking situation. The Pipestone System is a producer oriented production system comprised of independent hog producers working in close association with the Pipestone Veterinary Clinic. The clinic oversees the system, yet it remains independent from the producers and the system. It is a system of raising pigs that encompasses multipliers, sow barns, and nursery-finishers.

The producers who are part of the system retain ownership of the pigs and contract to deliver hogs to a packer. The Pipestone Veterinary Clinic serves as the communication center for the group. The clinic manages the gilt multipliers and sow farms that form the foundation of the system. The veterinarians provide consulting services and offer a variety of options for producers to take advantage of a fee for service basis. Services include coordinated group marketing, genetically tailored nutrition program, recommended building specifications, etc.

The system started in 1990 with a 700 sow gilt multiplication unit called Hiawatha Gilts Ltd. This farm produced PIC's line of Camborough gilts. Producers bought shares according to the number of gilts they wanted to receive. Producer demand led to a second gilt farm a year later called Calumer Gilts.

In late 1991, a group of gilt farmer shareholders decided to change the way they were producing finishing pigs. Rather than spend money on updating their facilities, they got the clinic to put up a new sow farm to handle breeding, gestation, and farrowing. Then gilts would move directly to the new sow farm instead of to shareholders. As a result producers would take delivery of pigs weaned from the centralized sow farm. The objective was to provide large groups of single source, high health pigs for placement in farmers nurseries and finishers.

The producer who owns shares in the sow unit, owns the right to purchase a comparable share of pigs when they are weaned. One share is worth 600 pigs every eight weeks. Each 3,200 sow farm site produces 1,200 pigs/week. Producers receive pigs at cost of production. Producers receive 16-18 day old weaned pigs which are shipped up to 200 miles for a one day fill of the producers nursery site. Producers know about 2-3 weeks in advance when to expect their pigs, and individual farms are all-in all-out by building or by site. Producers are not obligated to any feed company. Most producers do follow the clinic's recommended building plans of 600 head rooms for nurseries, and 600 or 1200 head finishing barns. Most producers in the system follow the clinic's recommended feeding program, as well most pigs are marketed on a Swift contract through Global Ventures, an entity set up by the clinic. Producers are only obligated to keep performance records on all pigs, which are filed at the clinic for analysis.

The Pipestone now has a stud farm called Pipestone Artificial Breeders (PAB), which started at 100 boars and now has grown to more than 600 boars in three separate studs. A new 500 head boar stud is now being stocked in Audobon, IA. Both gilt multiplier farms (Hiawatha and Calumet) have expanded to 1,600 sows each and changed to two site production, and as of early 1997 the Pipestone System has grown to 25,000 sows. These sows are owned by independent farmers through purchased shares, and housed in sow farms managed by the clinic (Duxbury-Berg, 1998).

2.7 Production Units and Business Organizations in Manitoba

In Manitoba most hog operations are sole proprietorships where new equity capital for expansion or upgrade of operations has been provided by retained earnings and unrealized capital gains on farm assets. Most hog farmers in Manitoba can not generate sufficient equity capital from retained earnings for needed expansion of operations. Expansion of the hog industry in Manitoba is going to rely on the ability to attract equity capital from outside investors. The best business organizations for attracting equity capital from a legal and a business perspective are the limited partnership, and the corporation.

2.7.1 Limited Partnership

A limited partnership is a business organization comprised of one or more limited partners and one or more general partners. In a limited partnership the liability of the limited partners is limited to their investment in the business. This is important to prospective investors who will want to avoid the liability of a general partnership. The burden of general and total liability in a limited partnership rests with the general partners, who are responsible for management.

Limited partners do not receive a management salary because they cannot participate in management. Limited partners share directly in the profits or losses of the business.

General partners are typically paid a certain percentage of gross receipts as a cost for management. The limited partners share in profits or losses based on their percentage of ownership.

The limited partnership is generally dissolved with the death or withdrawal of a general partner. Provisions can be made to ensure the continuity of the business that require the partnership or the surviving partners to purchase the interest of the deceased partner.

The advantage of limited partnerships is that they can attract outside equity capital form limited partners without loss of management control by the general partners. The main advantages for limited partners are that they are not responsible for management and they are not put in a position of unlimited liability.

2.7.2 Corporation

A corporation is a legally created entity. It provides a means of separating ownership from management and of protecting both parties from the liabilities associated with the corporation. The liabilities of owners are limited to their individual investment in the business. Management is only liable for what is defined as 'prudence and reasonable competence in the performance of management. Continuity of the business is not associated with the life cycle of any one person. The corporation is created by law and can only be terminated by legal action. The ultimate power within the corporate

business structure lies with the stockholders. Stockholders elect a board of directors that appoint management.

Ownership of a corporation is held as small shares or claims on the net worth and profit of the business. The different types of claims on a business include preferred stock, common stock, warrants, and convertible debentures.

Preferred stock has preference over other equity claims on the assets of a business in bankruptcy. It also has preference over other equity claims on income. Most preferred stock carries a fixed dividend obligation per share that must be paid whenever the company generates a profit. If the stock is accumulative preferred, the fixed dividend obligation accumulates form year to year when not paid out and has priority claim if or when the business shows a profit. Voting privileges are usually not attached to voting stock.

Common stock has no right or priority over any other stock for dividends or asset distribution, should the corporation be dissolved. Common stock is the residual claimant on both income and net worth. Each share of common stock entitles the holder to one vote on matters coming before the stockholders, such as electing a board of directors for the company. Income allocation is divided equally per share of common stock.

A warrant is an assigned right to purchase a specific security at an established price. Warrants are usually used by established corporations. and are allocated to existing stockholders.

A convertible debenture is a debt instrument carrying the right to be converted into an equity claim, usually common stock at a predetermined price at the option of the holder. Once issued it may dilute existing stock.

2.8 Hog Production From an Investors Point of View

When investors are deciding whether or not to include an investment in a hog operation as part of their portfolio they evaluate certain financial measures to assess the potential profitability associated with that investment. Investors' considerations will likely include the expected value and the variability of the rate of return on assets (ROA) or the expected value and the variability of the rate of return on equity (ROE). ROA is going to be used to assess financial performance because it eliminates the effects of financing decisions in the analysis..

2.8.1 Rate of Return on Assets (ROA)

Rate of Return on Total Assets (ROA) or *return on investment* relates earnings before interest and taxes (EBIT) to the hog production unit's total investment in assets. Total

assets are used in an attempt to measure total investment and the higher the value of the ROA, the greater the return on investment. The formula for calculating ROA is given in equation 1.

$$ROA = \frac{EBIT}{Total\,Assets} \qquad (2.1)$$

Long term investors would be looking for low variability in returns and a ROA comparable to what they would receive in similar long term investments. Long term investors are looking for less risk or variability and a fairly certain return on their investment. Short term investors or venture capitalists would be looking for high returns on their investment over a short period of time and thus would be more likely to accept a higher variability on the rate of return on their investment in exchange for the chance at higher profits. The more risky or variable the returns to an investment are the greater the need for potential profit to compensate investors for the risk.

The length of time that an investor is required to keep their capital tied up in a project will affect the required return on investment that will be needed to attract investment in hog production facilities. Investors prefer their investments to be as liquid as possible, in other words they prefer investments (all other things being equal) where they can turn their investment into cash as quickly as possible. Because of this investors

have to be compensated in terms of a higher return on their investment the longer the time it is going to be tied up. The thing that has to be determined is how long will this venture capital have to be tied into a hog facility before the hog facility can manage on its own without the venture capital, as well as what return is going to be required to attract that venture capital.

A study was done in 1998 on the ROA of a typical well managed hog operation in Manitoba (Pieper, 1998). The study was done by combining historical pork prices and feed costs with the present value of buildings and equipment costs, as well breeding stock values and hog performance levels as documented by PigChamp data recording systems for a 500 sow farrow to finish operation within the top 25% of performance standards across the province were used. Performance levels of 2.30 litters per sow per year, 22 pigs weaned per sow per year, 167 days to market and 21 market hogs sold per sow per year were used in the analysis.

From this study Manitoba's ROA figures on a typical modern well managed hog operation averaged 14.5% over the last six years. The fact that the entire initial capital outlay for new buildings and equipment, as well as fair market value for all breeding stock, market livestock and land were included in the asset base, the ROA figures as estimated should be considered as a minimum attainable. This was confirmed by other experts in the swine industry who estimate ROA to typically be between 10-15% in well managed swine operations (Pieper 1998).

2.9 Summary

The hog industry in Manitoba is expanding and this expansion is being done for the most part by the larger hog operations. This is in evidence by the recent trend towards the increase in large production units and production of the larger farms, and the trend in smaller farms that are exiting the hog industry. The types of business organizations involved in future expansion are going to be organized in such a way as to be able to attract equity capital, which means that they are most likely going to be some form of limited partnership or corporate entity.

The future of hog production in Manitoba is moving towards the increasing integration of the hog industry. Backward integration is now possible with the advent of dual marketing and it is likely that larger producers are going to start contracting directly with processors in some form of backward integration. Feed companies are already well placed in the Manitoba hog industry and it is likely that this vertical integration will continue in the future as more hog producers link up with feed companies in different forms of production contracts.

The role of Manitoba Pork est. will still have a strong influence on the marketing of hogs in Manitoba as they provide input price and output price options to producers with

their contract options such as the Hog Margin Indicator, the Basis Contract, the Soymeal Price Protection Option, and their forward pricing options on the price of hogs.

The analysis of financial performance for the hog production units studied will be based on the financial measure of Rates of Return on Assets. This will be analyzed in terms of the expected ROA, and the variability of ROA as measured by the variance and standard deviation. PorkPLAN will be used in assessing ROA for a typical well managed hog operation.

CHAPTER 3 PORKPLAN

3.0 Introduction

PorkPLAN is a spreadsheet that uses production and financial information to project cashflow, profit and loss and balance sheet information for hog production. Finishing and farrow to finish operations can be modeled with PorkPLAN. An understanding of the spreadsheet program is needed in order to understand how asset values and earnings were derived.

This chapter includes a detailed discussion of PorkPLAN, how the specific inputs work in relation to the running of PorkPLAN, and a detailed description of the outputs. A discussion of how the output will be used in the analysis of the model hog farms will also be covered.

3.1 Input Section

The input section of PorkPLAN consists of 136 inputs which will be used to create a simulation model of the annualized production and financial situation of the model farms. Inputs include production efficiency assumptions as well as cost and financing information. The input form from PorkPLAN is presented in Appendix A.

3.1.1 Animal Section

Input number 1 is the number of farrowings per week which is based on the design of the barn and the number of farrowing crates available each week. The total number of breeding sows needed to fill these farrowing crates is affected by many factors, the most significant being the number of litters produced per sow per year (input #11).

A design factor which will be considered in the analysis is that operators farrowing more than four or five sows per week and design their facilities around all in all out farrowing rooms. This means that each week's group of sows is contained in a separate room. Total number of breeding sows is calculated by taking the integer value of the number of farrowings per week times 52 (the number of weeks in the year) divided by the litters per sow per year.

Input number 2 is the sow to boar ratio which refers to the number of sows that can be serviced by one boar. The number assumes that all or most breeding is done by natural service. The larger production units may have a higher sow to boar ratio because they are better able to carry on normal operations if they lose an individual boar. The smaller operations require a lower sow to boar ratio so that there is more choice in the type and size of boars available. When artificial insemination A.I. is used the number of natural service boars is entered here. The additional costs associated with A.I. and other

breeding costs can be included at input number 65. The number of boars required for the operation is calculated by dividing the number of breeding sows by the sow to boar ratio.

Input number 3 is the percentage of open gilts (pool of gilts available for breeding and replacement services) to the total breeding sow numbers. Farmers normally keep a pool of open gilts available for breeding and replacement purposes. The number of gilts kept in the pool works out to be a percentage of the total sow herd numbers. As gilts are taken from the pool, replacement gilts are added. The calculation of the number of gilts in the pool at any given time is done by multiplying the percentage of open gilts to the total breeding sow numbers by the total number of breeding sows.

Input number 4 is the cost of replacement, open gilts. The average cost of F1 replacement females from a breeding stock company is the suggested default value for this input. If the operation is planning to use farm raised gilts as replacements, the gross income for slaughter pigs should be entered. The input used is equal to the income that could have been received for the gilt had it been marketed for slaughter. Another option is to buy bred gilts. The cost of bred gilts is normally priced at a margin over the cost of the open gilt and includes both a breeding fee and a boarding charge.

Input number 5 is the cost of replacement boars. Normally, all boars in commercial production units are purchased as opposed to being raised on the farm. The boar supplies

half of the genetic improvement potential within a herd so it is important to purchase the best quality animal possible.

Input number 6 is the replacement/culling rate of sows, which is the percentage of breeding sows that are replaced by young gilts each year. If the replacement percentage is high for an extended period it suggests that the sows are not doing very well and are not surviving into the later parities or pregnancies. The later parities (numbers 4, 5, and 6) in a sow's lifetime are the most productive with the highest number of pigs born alive. If the replacement rate of sows is to low, eventually the average age of the sows will increase and the productivity will decline as the sows reach parity over number 6 when productivity begins to decline.

Input number 7 is the replacement/culling rate of boars. In most cases boars are kept for approximately 2 years, this works out to a turnover rate of about 50% of the animals in one year. Culling rates may be higher if the farm is seeking quicker genetic progress.

Input number 8 is the sow death rate, the percentage of sows in the breeding herd that die on an annual basis. The lower the percentage the better. If the death rate exceeds 5%, an examination of the operation should be done to correct the problem.

3.1.2 Farrowing Productivity

Input number 9, pigs born alive per litter, input number 10, preweanling death loss, and input number 11, litters per sow per year are the major inputs in calculating the number of pigs weaned and as a result sold from the production unit. The preweanling death loss input refers to the percentage of pigs born alive which die prior to weaning. This variable will depend on the management of newly farrowed sows, the building facilities and the mothering ability of the animals.

The litters per sow per year input refers to the number of litters produced by the sow on an annual basis. This value has considerable impact on overall herd productivity. This value is related to the breeding management, reproductive disease status, nutrition, etc., of the sow herd. An earlier weaning age allows for a slight increase in total litters per sow per year. By using earlier weaning times also tends to increase the litters per sow per year.

Input number 12, weaning age in days, which refers to the average age of baby piglets when they are weaned. The weaning age has traditionally been 28 days, but an increasing number of operations are moving to a 21 day weaning with good success. It is now possible to move to even lower weaning ages of 10 to 14 days.

Input number 13 is the post weaning death loss to 20 kg weight, which refers to the number of post weaning death losses in the immediate post weaning time period. The

separation of post weaning death losses in input number 13 and the grower finisher death loss at input number 14 is made to provide a calculation of the number of feeder pigs which would be available for sale. The sale weight of the post weaned pigs is approximately 20 kg. This weight is used to split the two death loss inputs(post weaning vs grower) . Usually the highest death loss happens in the immediate post weaning period, and these losses are related to the disease status, management program, and building facilities of the farm unit.

Input number 14 is the grower finisher death loss which refers to the percentage of pigs which die in the grower finisher stage of growth. Any percentage above 2% or 3% should be considered abnormal and should be investigated. The feed used by pigs which die at this stage is taken into account in the feed usage and feed cost calculation within the model.

The number of pigs weaned is calculated by multiplying the number of farrowings per week by the pigs born alive per litter by the litters per sow per year and then by one minus the preweanling death loss percentage.

The total pigs marketed is calculated by:

Pigs marketed = pigs weaned x (1 - post weaning death loss) x (1 - grower finisher death loss). (3.1)

The pigs marketed per breeding sow per year is calculated by dividing the total pigs marketed by the number of breeding sows.

3.1.3 Feeding Costs

The calculations of feeding costs in PorkPLAN are derived from two components, the cost of feed ingredients and the amount of feed used as calculated from animal weight ranges and feed conversions. The feed use of breeding stock is calculated as amount eaten per day on feed.

Input 15 is the cost per tonne of the feed used as creep or starter feed within the farrowing unit. The feed cost of this input times the kilograms of creep feed used at input 39 is added to the overall feed cost.

Input 16 refers to stage 1 starter feed, or the cost per tonne of the first stage starter feed used immediately after weaning. Weaning weight (input 40), feed conversion (input 41), and weight of switching to stage 2 starter (input 42), are used to calculate the kilograms of stage 1 starter used and this cost is applied to the overall feed costing equations.

In some operations the same feed is used throughout stage 1 and stage 2, and in that case the per tonne cost input at input number 16 should be the same value as the stage 2 starter (input 17).

Input 17 refers to the cost per tonne of stage 2 starter feed. This input is used in association with inputs number 43 and 44, stage 2 starter feed conversion and the weight input at input number 44 when a switch is made from stage 2 starter to grower 1.

3.2 Inputs for On-Farm Milling

3.2.1 Feed Ingredient Costs

Input number 18 refers to the cost of barley per tonne. This is a key ingredient for barley is a key ingredient in all rations, and the cost of barley can vary significantly. Input 19 sets the relationship between the cost of wheat and the cost of barley. Wheat has been historically 20% to 40% higher in cost in relation to barley. The value of barley price is entered as a percentage of wheat price which then calculates the wheat cost at the specified price of the barley at input number 18. Input 20 is the per tonne cost of hulless barley. If hulless barley or other feed grains are used, the proportion used can be entered in the ration formulas worksheet. Inputs number 21 and 22 allow for additional and other feed grain or energy component in the feed.

Input 23 refers to the per tonne cost of soybean meal used as a protein supplement within the ration formulations. Soybean meal is the most commonly used protein supplement but there may be situations where soybean is not used. In that case this input

could be used for the per tonne input for the other protein ingredients. Adjustments would be made in the ration formulation section for the percentage of that ingredient within the total ration.

Other protein supplement used in swine diets, such as canola meal are entered as Input 24. The default version of PorkPLAN calculates a cost of canola meal at 63% of the per tonne cost of soybean meal. This has been the historical relationship between canola meal and soybean meal prices. Input number 25 refers to the per tonne cost of either peas or the pea/canola blend that was used as an additional protein ingredient in the feed formulations. Input number 26 provides another location to place additional protein feed ingredients into PorkPLAN.

Inputs number 27 to 30 refer to the per tonne cost of various vitamin and mineral premixes or base mixes which are purchased as ingredients in the ration formulations. Input number 31 refers to the purchased cost on a per tonne basis of oil or fat used as an ingredient in the ration formulations. Oil or fat is starting to be used in swine rations for both an energy source and as a means of controlling feed dust, it is used at around a level of 1% or 2%. Input number 32 refers to the per tonne cost of purchased lysine which is used as an amino acid supplement within the ration formulations. Lysine is the limiting essential amino acid, and synthetic lysine is added to rations at low levels, in the range of 0.1% to 0.05% of weight. Inputs number 33 to 37 refer to the additional feed ingredients that can be used in the ration formula.

Input number 38 refers to the per tonne cost related to the manufacturing of feed. The cost used at this input increases the cost of the calculated rations immediately below this input by the direct amount entered. The additional costs involved in on farm feed manufacturing includes additional equipment, additional energy use, additional labour and additional management requirements for ration formulation, purchase of ingredients, inventory control, etc. These could also be included as part of other inputs, for building ad equipment, labour, management fees, etc.

3.2.2 Calculations of the Cost of Farm Mixed Feeds

The cost of farm mixed feeds is separated into the cost per tonne of grower #1 ration, grower #2 ration, finisher ration, dry sow ration, and lactation ration. Each of these calculations refer to the rations formula worksheet, where the exact percentage amounts of each ingredient (barley, feed wheat, etc) used for each of the different hog growth stages (dry sow, lactating sow, grower #1 ration, etc) are inputted and that percentage is brought to the input worksheet to be multiplied by the cost of each ingredient and summed to a total cost per tonne for each mixed feed formulation.

When feed is manufactured off farm and the complete rations are purchased at an all inclusive per tonne cost, the per tonne cost values can be entered directly into inputs number 18 through to number 37. As a result of using this direct input, the formula calculations are bypassed and the value is used in calculating the feed costs. An example of this would be if grower number 1 ration was bought at $180.00 per tonne, the value of

$180.00 would be placed in the cell that calculates the cost per tonne of grower number 1 ration. The same would go for the other rations, depending on whether all or some of the rations were purchased from off farm sources.

The goal seek tool on Microsoft Excel can also be used here. The goal seek tool in Microsoft Excel is a method of goal seeking which determines the value that is required in a single input cell to produce a result that you want in a dependant (formula) cell. For example, the desired per tonne of feed can be entered and the feed manufacturing costs, input number 38 varied to the appropriate amount. By doing this, it calculates the manufacturing margin above ingredient cost. By doing this with one ration, often the others calculate out very close to the desired amount.

3.3 Feed Conversions and Quantities

Input number 39 refers to the kilograms of creep feed used by each pig while still nursing the sow. It is to used in calculating total feed costs. This should be the amount of creep feed, the cost of which was used as input number 15.

Input number 40 is the weight of each individual pig at weaning. This weight should be adjusted in relationship to the weaning age used at input number 12. This weaning weight is used as a starting point for feed use and cost calculations using starter feed 1.

Input number 41 refers to stage 1 starter feed conversion. This feed conversion input, as well as the ones to follow, are the kilograms of feed needed to produce 1 kilogram of live weight gain. The conversion is used to calculate the quantity of feed needed to take the stage 1 starter pig from the weaning weight, input number 29, to the switching weight to stage 2 starter at input number 31. The same methodology holds for the remaining feed calculations.

Input number 42 is the weight at which the change is made to stage 2 starter feed. For those farms using only one type of starter, this weight is relatively immaterial providing it falls between the weaning at input number 29 and the switch to grower ration 1 weight at input number 33. In the case of the single starter ration, identical input prices are used at input number 16 and input number 17. Input 43 refers to the feed gain conversion ratio for the stage 2 starter ration. Input 44 is the weight at which a change is made from feed from stage 2 starter ration to grower ration 1. Input 45 refers to the conversion ratio for feed gain for the grower ration 1.

Input 46 is the weight at which a change is made from grower ration 1 to grower ration 2. In those cases where only one grower ration is used, the changeover weight can fall between the beginning of grower ration 1 (input number 33) and the switch to finisher ration (input number 37). Input number 47 refers to the conversion ratio of feed to gain for the grower ration number 2.

Input number 48 refers to the weight that a change in feed is made from grower ration number 2 to finisher ration. Input number 49 refers to the feed conversion ratio throughout the finishing period up until market weight.

Input number 50 is the amount of feed fed to dry, gestating sows on a daily basis. This input is used to calculate the annual feed requirements and hence feed cost for the gestation sows. Input number 51 refers to the amount of feed fed to a lactating sow while with her litter. This is used to calculate the feed usage and therefore the cost for lactating sows and thus the overall feed costs for the production unit.

Input number 52 refers to the amount of feed fed to an individual boar on a daily basis. This is used to calculate the annual feed requirements and therefore, feed costs, for the herd boars and the overall herd usage.

3.4 Financing and Project Costs

Financing arrangements and capital costs impact both cashflow and profitability of an operation. The assumptions made about financing and project costs carry through the pro forma analysis.

Input number 53 is the total cost calculated on a per sow place basis of building the barn, related equipment, site preparation, well, manure lagoon, etc,. The intent of this input is to calculate the overall project cost for buildings and equipment. Land is not included in this cost, but is referred to in input number 55.

The calculation for breeding stock cost on a per sow basis is done by:

((Number of breeding sows + the number of gilts in the pool) * (cost of replacement gilts) + (number of boars x cost of replacement boars)) / number of breeding sows. (3.2)

Input number 54 is the pre-commissioning cost(precomm. cost) or the operating capital required on a per sow basis. This is used when planning a new farm project to include the necessary operating capital to start up and establish the herd as part of the overall project cost. When operating capital is included in arriving at the total project cost this input is included. Operating capital or overhead is approximately $1000.00 per sow.

Based on the building and equipment cost on a per sow basis (input 53) and the operating capital per sow (input 54), a total project cost on a per sow basis is calculated. By multiplying this number by the number of breeding sows, the total project costs are derived.

Inputs number 56 to number 75 refer to mortgage or other loan costs. Up to five different mortgage or other types loans can be entered and calculated in PorkPLAN. The first input under each loan is a percentage of the total project cost. This percentage is then used to calculate the principle for the loan. Terms of the loan include inputs for the interest rate, the amortization term of each loan, and the age of the loan in terms of how many years payment has been made on the amortization period. Depending on the age of the loan in years, the interest payment in that year is calculated and added to the interest on long term debt in the income statement. This allows for an estimation of interest cost at various times as the loans are retired.

Input number 76 refers to the percentage of the total project costs which are financed through a debenture, the issuing of preferred shares or other forms of subordinated debt. It is used to calculate a principle amount which is indicated immediately below. If the principle is known it can be inputted directly, or the specific percentage at input number 76 can calculated using the goal seek tool. Interest rate or dividend rate associated with the debenture, preferred shares, or subordinated debt are entered as input 77.

Input number 78 refers to the term in years for the financing instrument, whether debenture, preferred shares or subordinated debt. This, along in combination with the calculated principle and interest rate at input number 77, are used to calculate an interest charge on long term debt within the income statement, and a principle and interest payment on the cash flow statement.

Input number 79 is the balance outstanding on the operating loan on an average operating day throughout the year. When a sufficient amount of operating capital is capitalized into the start up of the project (input 54), the amount required for overdraft should be small. Input number 80 is the interest rate charged on the operating or overdraft style loan. The interest on the operating loan is calculated from the interest rate and the balance on an average day. This amount is then entered into the income statement as interest on operating loan.

Input number 81 refers to the life of buildings and equipment for calculation of straight line depreciation.

Input number 82 refers to the amount allocated to maintenance on buildings and equipment as a percentage of book value. Maintenance rate will vary with the age of the buildings and equipment in that the older they are the higher the maintenance rate that will need to be allocated.

3.5 Salary and Labour

Input number 83 refers to the salary or income level designated for the farm owner, primary operator, or farm manager. The amount will vary with the individual

circumstance and how the business is organized. A zero entry is used here when the calculated net income and cash balance are used to indicate the family/farm income.

Input number 84 are the number of hours the owner/operator/manager is putting in to actually working with the pigs. The total labour requirement is calculated by using the hours of labour required per sow per year (input 86) multiplied by the number of breeding sows then the value of hours worked by owner/operator/manager (input 84) is subtracted and the remaining hours are charged at the salary and benefit cost per hour (input 85). The normal range will be from zero for larger units where the farm manager is not directly involved with the pigs, to 2,200 hours, which is 52 weeks at 40 hours a week.

Input number 85 refers to the per hour cost of additional labour including any benefits charged to the operation of the production unit. For a family operation where no additional labour is paid for, zero is entered.

Input 86 refers to the number of hours of total labour required per sow per year to operate the farm. This can vary but on average it is in the range of 15 to 30 hours per sow per year, with larger production units usually on the lower range and smaller units usually closer to the upper range. This includes both paid and unpaid labour.

Input number 87 is the average number of hours worked by employees. This is the time worked on annual basis by outside employees and is used to calculate the number of employees required.

3.6 Other Production Costs

Feed, financing and labor costs make up a major portion of cash outflow and expenses in swine production. There are other costs associated with production listed separate from these major items.

Input number 88 are costs of animal health service and animal health supplies on a per pig marketed basis. Intensive and sophisticated health programs will tend to have a higher value. The calculated animal health costs are shown on the line below input 88. In the case where an exact animal health cost is known the goal seek tool can be used to work backwards to an appropriate per pig marketed input at input 88.

Input number 89 refers to the charge for all utilities on a per pig marketed basis. Only those costs directly attributable to the pig operation should be included.

Input number 90 is the cost of handling and distributing manure onto a land base, or other disposal costs. Production units that use custom applicators has resulted in the suggested value of approximately 0.0075 of a cent per gallon.

Input number 91 refers to the manure production rate measured as cubic feet per sow per day. Suggested values for this input are presented in Table 3.1.

Table 3.1: Manure Production Rates for Different Types of Production Units

Per Sow Farrow to Finish	2.2 Cubic Feet Per Sow Per Day
Per Sow Farrow to Feeder Pig Production	0-81 Cubic Feet Per Sow Per Day
Per Feeder Pig Using Wet Dry Feeders	0.2 Cubic Feet Per Feeder Pig Per Day
Per Feeder Pig Using Dry Feeders	0.25 Cubic Feet Per Feeder Pig Per Day

Input number 92 refers to the total cost for artificial insemination (AI) and other breeding costs throughout the year. Input number 93 is the total amount per year spent for office and accounting expenses. Input number 94are costs relating to renting equipment and materials throughout the year. The rental expense input is another place where unaccounted for expenses can be included. Input number 95 are all other expenses and costs.

3.7 Marketing

Number of animals sold, quality of animal, live weight, price and marketing costs are summarized in this section.

Input number 96are the number of feeder pigs sold. The line above input 96 refers to the number of feeder pigs available for sale. In the case where 100% of the pigs are sold as feeder the same value is used.

Input number 97 refers to the transportation costs in moving feeder pigs to the buyer or the point of sale. Input number 98 refers to the all additional costs related to the marketing of pigs, like sales agency fees, auction fees, etc.

Input number 99 is the live weight in kilograms of the sale of feeder pigs. The weight along with the feeder pig market price calculated below input number 73, are used to calculate the income per feeder pig.

Input number 100 refers to the feeder pig pricing factor/formula for the sale of feeder pigs. The price that is used is based on a formula which is a factor of the market price for slaughter hogs. The factor is used to calculate the gross income per feeder pig. Sensitivity analysis is improved by making a mathematical connection between the feeder pig income and the market price for slaughter/finished pigs. The goal seek tool can be used to modify the factor in order to establish a specific gross return per pig. The calculated price per kg live weight, price per pound, and gross income per feeder pig are shown on the lines below input number 100.

Input number 101 are assembly yard costs used when slaughter hogs are sold through an assembly yard system. Input number 102 refers to the cost of transportation on a per pig basis to the assembly yard location or the slaughter plant.

Input number 103 refers to the market price on a per ckg (hundred kilograms) dressed weight basis. A sensitivity table and graph is produced by PorkPLAN that shows the different levels of net income and cash balance at various market prices.

Input number 104 refers to the average grading index of slaughter animals. The grading index refers to a combination of carcass weight and lean meat yield. Animals are graded in slaughter plants by Agriculture Canada inspectors and they make a calculation of grading index. Good quality animal genetics produce an average index of 108. The market price at input 103 refers to an index of 100.

Input 105 refers to the live weight of slaughter pigs as they leave the farm. Input number 106 refers to the dressing percentage of a live weight pig once it is slaughtered. A market price index 100 (like in input 103) refers to hot, dressed carcass weight. The dressing percentage makes the conversion from live weight to carcass weight. The calculated gross return per pig is shown below input 106 and is based on the live weight of the animal, the dressing percentage, the market index, and the market price.

Input number 107 establishes a factor linking the price received for cull sows and the market price received for finished pigs. The price of sows will usually be around 60% to 70% of the market price. The calculated price is shown below this input. Input number 108 refers to the average weight of culled sows sent to slaughter. This input along with the line above a calculated sow price, is used to calculate income from culled, slaughter

sows. Input number 109 refers to the market price for culled boars going to slaughter, based on a per ckg live weight basis. Input number 110 refers tot he live weight of culled, slaughtered boars.

3.8 Miscellaneous Costs

Input number 117 refers to the municipal and local property taxes paid by the unit. Input number 118 refers to calculate the insurance premium on buildings and equipment, based on number of cents per hundred dollars of annual coverage. This premium is calculated against the book value of the buildings and equipment used for depreciation calculations which is indicated on the line above input number 81.

Input number 119 refers to the insurance premium in cents per hundred dollars of coverage on the animals. This value is based on the inventory value of the breeding stock and the growing and finishing animals. Input number 120 is the insurance premium and insurance coverage for business interruption. Input number 121 refers to the liability insurance premium necessary for 2 million dollars of liability insurance on an annual basis. If the exact overall insurance cost for the farm is known that exact amount can be entered here and a zero value for inputs number 118, 119, and 120. Input number 122 refers to the insurance coverage on a per pig marketed basis for transportation from farm to the assembly yard or slaughter plant.

Input number 123 refers to the fee charged by Agriculture Canada for grading in slaughter plants. The fee is charged directly to the animal and is deducted from the gross income per pig. Input number 124 refers to the research or other checkoff that might be part of the cost of marketing animals. Input number 125 refers to the administration costs charged by the marketing board or other sales system. Costs are based on a percentage of the value of the animals.

Input number 126 refers to the any other income that might be attributable to the pig operation and is entered as a lump sum amount. Input number 127 refers to other income sources related to the pig operation which are paid on a per pig marketed basis.

Input number 128 is the income tax rate applied to the income statement on income under $200,000. Input number 129 is the income tax rate applied to the income statement on income over $200,00.

Input number 130 refers to the annual inflation factor used throughout the 15 year time frame of the pork production model.

Inputs number 131 to 135 refer to the average daily gain for pigs eating the 5 different types of feed rations specific to this model. The inputs should represent the average grams of body weight gain during the time period the pigs are eating each type of feed.

The weight gains will be based on the feed conversions which were established at inputs numbers 40 through 49.

3.9 Accrual Income Statement

In accrual accounting revenue is recognized when the earning process is virtually complete and when an exchange transaction has occurred, and recognizing expenses as they are incurred in generating those revenues. Revenue and expenses recognized under the accrual basis of accounting are independent of the time when cash is received or cash expenditures are made. This is different than a cash based accounting statement where revenue is composed of the cash actually received during the year, irrespective of when the goods were produced or when they are sold. Similarly, operating costs are included as expenses only in the period when they are paid, irrespective of when they were incurred.

Revenues and expenses for the income statement are derived from the information provided in the input section of PorkPLAN. Production and financial information are used to generate the accrual income statement.

3.9.1 Revenue Section

The livestock income is derived by summing up the livestock revenue from the finished pigs marketed, the weanling pigs marketed, the cull sows marketed, and the cull boars marketed.

The revenue from finished pigs marketed for the first year of operation is derived by reference to the first 52 weeks cash flow statement in the first 52 weeks worksheet, which sums up the total revenue per month from finished pigs over the first 52 weeks of the life of the operation. The per month revenue is calculated by multiplication of the number of market pigs sold by the gross income per finished pig which is referenced from the summary information section of the matrix worksheet. For the second and subsequent years the revenue from finished pigs marketed is derived by references to the annual cash flow section of the Matrix worksheet.

The revenue for weanling pigs marketed in the first year of operations is derived from the first 52 weeks cash flow statement in the first 52 weeks worksheet, where the revenue from each of the first 52 weeks are summed up for the first year of operation. The weekly totals are derived by multiplication of the number of feeder pigs sold per month by the calculated gross return per weanling.

The calculation of the yearly revenue from the sale of feeder pigs is calculated by reference to the cash flow statement from the matrix worksheet. Here the number of

feeder pigs sold per year is multiplied by the sale weight of weanlings times the weanling market price per kilogram live weight.

The revenue from cull sows marketed for the first year of operation is derived from reference to the inventory section of the first 52 weeks worksheet. The monthly total revenue from the sale of cull sows is summed over 52 weeks to come up with the total revenue from the sale of cull sows for the first year of operation. The monthly total revenue from cull sow sales is derived from the inventory section of the first 52 weeks worksheet and is calculated by multiplication of the sows culled per month by the market sow price. The calculated revenue for cull sows marketed yearly is derived from the cash flow statement in the matrix worksheet. This is calculated yearly for years 1 through 15.

The calculated revenue for cull boars marketed in the first year of operations is derived from the cash flow statement in the first 52 weeks worksheet, and is calculated as the sum of the weekly value of revenue for cull boars over the first 52 weeks of simulation. The weekly calculations are derived from the multiplication of the number of boars culled, multiplied by the total of the market boar price per ckg live weight, multiplied by the cull boar weight, divided by 100. The calculated revenue for the cull boars marketed in years 2 to 15 are calculated yearly by reference to the cash flow statement of the matrix worksheet.

The other income output on the income statement is derived by taking the other farm income including interest income and adding that to the other pig income.

For the first year of operation the other income is derived by reference to the first 52 weeks worksheet in the cash flow section, where the values of the other farm income including interest and the other pig income is added up over the first 52 weeks of operation.

The value of the other pig income for each of years 2 to 15 is derived by reference to the matrix worksheet in the income statement; where the other annual pig income is added to, the other income on a per pig marketed basis, multiplied by the value of the total pigs marketed minus the number of pigs sold as weanlings.

The animal inventory adjustment for year 1 is calculated as the total sows in the herd multiplied by the cost of replacement gilts, then adding the value of the cost of replacement boars multiplied by the number of boars required, and then adding to this the sum of suckling pigs plus weaner pigs, plus grower 1 and 2 pigs, plus finisher pigs, multiplied by the value of the gross income per finished pig divided by 2.

The total revenue is the sum of the livestock income, other income, and the animal inventory adjustment.

3.9.2 Variable Costs

The variable costs are derived from reference to the first 52 weeks worksheet in the variable costs section. The formulation is done by summing the total cost over the first 52 weeks of; feed, replacement breeding stock, salaries and benefits, veterinary (drugs and supplies), utilities, maintenance (buildings and equipment, manure handling and disposal, artificial insemination and breeding costs, office and accounting expenses, rental expenses, other expenses (consulting, fees, etc), marketing and transport, and operating interest charge.

For years 2 to 15 the variable costs are derived by adding the yearly variable costs (same categories as in year 1) to the interest owed on a operating loan (if an operating loan is required).

3.9.3 Contribution Margin

The contribution margin is calculated by taking total revenue and deducting from it variable costs.

3.9.4 Fixed Costs

The fixed costs section of the income statement includes the values for the fixed costs of the operation, the depreciation, and the interest on long term debt.

Fixed costs for the first 52 weeks of operation are calculated from the first 52 weeks worksheet in the fixed costs section and are the total over 52 weeks of the weekly sum of. the salary of the owner/operator, property taxes, and insurance. Fixed costs for years 2 to 15 of the operation are derived from the matrix worksheet.

Depreciation for both the first 52 weeks and for the years 2 to 15 of the operation are calculated using the straight line method. The book/starting value of buildings and equipment for depreciation is divided by the life span of the buildings and equipment. This is a constant value throughout the 15 years of the operation.

The interest on long term debt for both the first 52 weeks and the years 2 to 15 is calculated by addition of the interest payments on mortgage loans number 1 to 5, plus the interest paid on debentures/preferred shares/subordinated debt.

The total costs are the sum of the variable costs, the fixed costs, the depreciation, and the interest on long term debt. The net income before taxes is calculated as the total revenue minus the total costs.

3.9.5 Accrual Adjustments

This section is comprised of variables that are added on to the net income of the operation before income tax is calculated. Included in this section is ending accounts payable, opening inventory, and opening accounts receivable. The ending accounts

payable, the opening inventory, and the opening accounts payable do not affect the simulation of the operation so zero values are entered for all 15 years.

The deduct section include all variable that are subtracted from the net income before taxes are calculated. This section includes ending inventory, ending accounts payable, opening accounts payable, and the prior years losses carried forward. The only variable that will affect the simulation is the prior years losses carried forward, all the rest are set to zero for the entire 15 year period.

The value for prior years losses carried forward is derived from the previous years net income before taxes, if the value for net income before taxes is negative then that value is returned here.

3.9.6 Net Income For Tax

The net income for tax output is calculated by taking the value for the net income before taxes, plus accrual adjustments.

3.9.6.1 Income Tax Payable

The income tax payable output is calculated by using a income tax rate of 21.84% on the first $200,000 of income and an income tax rate of 45.84% on income over $200,000. The net income for the limited partnership is based on the person income tax rate for a individual with earnings greater than $59,180 in Manitoba.

3.9.7 Net Income After Income Tax

The net income after income tax output for the corporate and limited partnership hog operations is calculated by taking the net income before taxes and subtracting the income tax payable, using the prevailing tax rates in Manitoba for 1998. For the corporation a standard formula is used and for the limited partnership investors are taxed based on their individual tax bracket. For the analysis it will be assumed that they qualify to be in the highest tax bracket. This is due to the fact that a person who earns more than $59,180.00 in Manitoba is in the highest tax bracket and it is unlikely that people earning less than this would be investing in one of the hog operations.

3.10 Balance Sheet

The balance sheet is a systematic listing of all the businesses assets and all its liabilities at a specific moment in time. The accounting identity underlying the balance sheet is assets equals liabilities plus net worth. Liabilities are the claims on the firm's assets by lenders and other creditors. Net worth represents the claims of owners on those assets. The total claims of creditors and owners can not exceed the total value of the assets.

3.10.1 Assets

The cash available at time zero is based on the calculated capitalization minus the capital cost of buildings and equipment minus the cost of land/site for the barn. The calculated capitalization for time zero is derived from the matrix worksheet and is calculated by multiplication of the capital for buildings/land/equipment per sow, by the number of active breeding sows. For years 1 through 15 the cash is calculated as the net cash balance minus the interest on operating loan.

The net cash balance is calculated by the adding together the surplus/deficit for the period, the interest on the operating loan for the beginning of the period, and the cash on hand at the beginning of the period. The total net cash inflow is calculated as the sum of total livestock revenue, loan proceeds, other farm income, accounts receivable, other pig income, and capital sales. Total cash outflow is calculated as the sum of the livestock expenses and general expenses. The interest on operating loan expense is calculated as the amount of net cash balance times the interest rate (if net cash balance is negative), or zero if the net cash balance is positive.

The livestock inventory output is calculated for years 2 through 15 as the total sows multiplied by the cost of replacement gilts, plus the cost of replacement boars multiplied by the number of boars, plus the sum of suckling pigs, weaners, and growers, multiplied by the gross income per pig divided by 2. The livestock inventory is calculated for year 1 and then this value is held constant throughout the rest of years 2 to 15.

The long term assets include the sum of the land, buildings and equipment, and other long term assets. Land is held at a constant value over the 15 years. Buildings and equipment are calculated as the cost of buildings and equipment per sow place multiplied by the number of active breeding sows (calculated in the third year of operation). This value is depreciated using the straight line method for years 2 through 15, based on a life span for buildings and equipment of 20 years.

3.10.2 Liabilities

The current liabilities consists of the operating loan which is set to zero throughout the 15 years of the simulation. The long term liabilities for the operation consist of the mortgage loans number 1 to 5, and the debentures.

The mortgage loan number 1 at time zero is calculated as 60% of the total capitalization needed to start the operation. The mortgage loan number 1 for years one through fifteen is calculated as the mortgage loan minus the interest payment and the payment of interest to the principle, which is calculated in the amortization and repayment section of the financial statements worksheet.

The mortgage loan payment is calculated as an annuity payment, with the principle to be paid off in fifteen years at a specified interest rate.

The mortgage loans output number 2 to 5 is calculated in the same fashion as the mortgage loan number 1, except that this keeps track of the sum of the mortgage loans number 2 to 5 instead of just one mortgage loan.

3.10.3 Equity

Equity section consists of the outputs class A common shares, preferred share capital, and retained earnings. The class A common shares are calculated as the calculated capitalization needed for the project, minus the amount of capital from all the mortgage loans, minus the capital from the debentures. The preferred share capital for the operation is set at zero for the entire fifteen years.

Retained earnings are calculated by taking the retained earnings at the beginning of the year, minus the dividends paid out, and then adding net income after income taxes.

Total equity is calculated as the sum of class A common shares, plus the preferred share capital, plus the retained earnings.

3.11 Cash Flow Statement

The cash flow statement is a projection of all the cash transactions relating to the business that occur during the accounting period. All cash on hand at the beginning of the period constitutes the sources of cash for the business. The cash outflows and the cash on hand at the end of the period make up the uses of cash, which must always equal the sources for accounting purposes.

The purpose of a cash flow statement is to provide information about the operating, financing, and investing activities on cash resources. For the purposes of financial reporting, the cash flow statement can be used as a tool to evaluate the solvency and liquidity of an enterprise. The liquid resources of a firm will be measured in terms of cash and its cash equivalents. In order to measure these types of resources, this statement is structured to reflect the cash flows involved in the operating, financing, and investing activities of the firm. These three activities of the firm include items such as cash flows resulting from discontinued operations, cash flows from extraordinary items, outlays for acquisition of assets and proceeds from the disposal of assets, the issue and repayment of both debt and share capital, and the payment of dividends. The cash flow statement enables an investor to assess the firms ability to generate cash from internal sources, to repay debt obligations, to reinvest and to make distributions to owners.

3.11.1 Cash on Hand

Cash on hand for the first 52 weeks is the cash available for operating inventory buildup. The cash available for operating inventory buildup is derived from taking the calculated capitalization needed for start up of the operation, deducting the calculated cost of buildings and equipment, and then deducting the cost of land or site for the barn.

For years 2 to 15 the cash on hand is derived as the cash balance from the previous years operations. The cash balance calculation for yearly operations are calculated as the net cash balance minus the interest on operating expense.

The net cash balance is calculated as the total cash inflow minus the total cash outflow, plus the operating loan at the beginning of the period, plus the cash on hand at the beginning of the period. The total cash inflow is calculated as the sum of total livestock revenue, loan proceeds, other farm income (including interest), accounts receivable, other pig income, and capital sales.

The total cash outflow is calculated as the sum of livestock expenses and general expenses. The livestock expense output is calculated as the sum of feed costs, breeding stock, salaries and benefits, utilities costs, veterinary and drug costs, manure handling and disposal, artificial insemination, rental expenses, other expenses, and marketing costs.

The general expense output is calculated as the sum of maintenance costs, property taxes, insurance, office and accounting expense, salary (owner/operator), income tax, mortgage loan #1 (Principle and interest), mortgage loans #2 to #5 (principle and interest), common share dividends paid, debenture interest/preferred share dividends, and debenture/preferred shares paid out.

The interest on operating expense is calculated from an if statement, if the net cash balance for the year is less than zero, then the interest on operating expense is that value multiplied by the interest rate on operating loan, if not less than zero, a zero value is returned.

3.12 Calculating ROA and Variability of ROA

Values for the expected ROA and variability in ROA are calculated for each different type and size of hypothetical hog operation based on a mean value for the price of market hogs/weanlings and barley, as well as for each of the situations where hog/weanling prices and barley prices are varied by two standard deviations up or down from their average values.

The calculation of ROA values is shown in the investment sheet of PorkPLAN for both the limited partnership and the corporation. ROA values are derived by dividing the earnings before income and taxes (EBIT) (taken from the income statement) by total assets (taken from the balance sheet) for both the limited partnership and the corporation for years one through fifteen.

On a separate spreadsheet the ROA values for the 15 years are compiled for each of the different combinations of types and sizes of hog operations. The average and standard deviation of the ROA values over the 15 years is calculated for each different hog operation. These values will be used to determine how the different combinations of hog operations compare against each other in terms of a risk-return tradeoff.

The trade off between risk (measured by standard deviation) and expected profits (ROA) will be represented graphically, with the risks of the different hog operations plotted against their expected profits. Higher risk will be represented by movement along the horizontal axis, while higher profits will be measured on the vertical axis. The outcome of this will be a graph with points representing each hypothetical hog operations risk and return tradeoff. The goal is to pick out the best alternatives for investors, or the investments in terms of hog operations that provide the optimal combination between risk and return.

CHAPTER 4 SIMULATION MODELS

4.0 Introduction

This chapter deals with describing the farm specifications and the business parameter values for each of the different types of hog operations. This chapter contains descriptions of major input assumptions involved in the 600, 1200, and 2400 sow farrow to finish operations, as well as the 600 and 1200 sow farrow to wean operations.

4.1 Input Assumptions in the 600, 1200, and 2400 Sow Farrow to Finish and the 600 and 1200 Sow Farrow to Wean Operations

The following production assumptions are based on the best production practices of a well managed hog farm in Manitoba. The farrow to finish models are assumed to be three site operations employing segregated early weaning (SEW) and all in all out production. The farrow to wean models are assumed to be two site operations employing segregated early weaning and all in all out production.

4.1.1 Breeding Herd Inventory

The breeding herd inventory will be the same for both the farrow to finish and farrow to wean operations. The sow to boar ratio is 16:1. The percentage of open gilts to

total sow numbers is five percent. The replacement/culling rate of sows is forty percent a year, while the replacement/culling rate of boars is fifty percent a year. The sow death rate is three percent a year.

The number of farrowings per week is 27 for the 600 sow operations and 54 for the 1200 sow operations. The number of breeding sows for the 600 sow operation is calculated out to be 624 in year one, decrease to 610 in year two, decrease to 597 for years three and four, and then stay constant at 585 for years five through fifteen. For the 1200 sow operations the number of breeding sows is calculated out to start at 1248 in year one, decrease to 1220 in year two, decrease to 1194 for years three and four, then stay constant at 1170 for years five through fifteen.

4.1.2 Farrowing Productivity

The farrowing productivity is assumed to be the same for the farrow to finish operations as the farrow to wean operations. The number of pigs born alive per litter for the operations is assumed to increase slowly over the first four years from 10 in year one, to 10.5 in year 2, to 10.9 in year 3, and then level off at 11 for years five through fifteen. The reason for the slow increase and leveling off of the pigs born alive per litter is because it is assumed to take three years from the time the barns are initially established to the time when the barns reach optimum performance.

The weaning age is eighteen days. The preweaning death loss will start out at 8% a year and then decrease and stay at 5% a year for years two through fifteen. The post weaning death loss to 20 kilograms is 1.5% per year for the fifteen years and the grower finisher death loss is 1% per year for the fifteen years.

The number of litters per sow per year will increase over the first five years; increasing from 2.25 litters per sow per year in the first year, to 2.30 litters per sow per year in year two, to 2.35 in year four, then to 2.4 litters per sow per year from year 4 through to year 15.

4.1.3 Feeding Costs

The feeding costs for the simulations of the farrow to finish and farrow to wean hog operations is based on the assumption that the feed is mixed on the farm, as opposed to being purchased as complete feed. The following are the input parameters relating to the cost of the ingredients to be purchased in order to mix the feed at home.

4.1.3.1 Feed Ingredient Costs

The prices of the feed ingredients are the same for both the farrow to finish and the farrow to wean operations. The base price of barley is derived from the average of Canadian Grains Council weekly cash prices (Cd $/Tonne) from 1992-1997, the base price of barley is calculated as $96.96/tonne. The price of barley will be varied by two standard deviations above and below the mean in order to capture the possible effects that

the fluctuations in the price of barley could have on the simulations. The standard deviation of barley price over the 1992-1997 period was calculated to be $27.35/tonne. The simulation of the models was calculated with barley set at $151.66/tonne (two standard deviations above the mean), as well as with barley set at $42.26/Tonne (two standard deviations below the mean). Statistically there is a 5% chance that the prices fall outside the upper and lower range, which is represented by two standard deviations above or below the mean. In other words there is a 95% probability that the price of barley at any given time will fall between two standard deviations of the mean price of barley. The base/average price of barley, along with the high (two standard deviations above the mean) and low (two standard deviations below the mean) prices used for barley in the simulations is represented in table 4.1.

The cost of feed wheat is calculated to be 126.1% of the price of barley. This is based on the historical relationship between barley and wheat. Based on this relationship, the cost of feed wheat used in the simulations is calculated to be $122.27/tonne. The average price of Canadian feed wheat calculated over the 1992-1997 period was calculated to be $122.14/tonne (Canadian Grain Commission numbers). The average as well as the low and the high is presented in table 4.1.

The average, low, and high prices for soybean meal (based on Manitoba markets weekly cash price (Winnipeg) from 1992-1997) and canola meal (based on Manitoba markets weekly cash price (Altona) from 1992-1997) are also presented in table 4.1.

Table 4.1 Feed Prices Used in the Simulations

Ingredient	Base Average	High	Low
Barley	$96.96	$151.66	$42.26
Feed Wheat	$122.27	$204.95	$39.34
Soybean Meal	$315.27	$189.31	$441.23
Canola Meal	$195.50	$273.49	$117.51

All prices are represented in dollars per tonne, based on 1992-1997 period

The cost of vitamin/mineral base or pre mix number 1, number 2, and number 3 are based on current market prices and are represented in table 4.2. The price of oil or fat and the price of lysine amino acid are based on current market prices and are represented in table 4.3.

Table 4.2 Current Market Price of Vitamin/Mineral Base or Premix

Ingredient	Number 1	Number 2	Number 3
Vitamin/Mineral Base or Premix	$670.00	$700.00	$882.00

Table 4.3 Current Market Price of Oil or Fat and Lysine Amino Acid

Ingredient	Current Market Price
Oil or Fat	$900.00
Lysine Amino Acid	$3,500.00

The cost of on farm feed manufacturing used in the simulations is assumed to be 10 dollars per tonne.

4.1.3.2 Cost of Farm Mixed Feeds

The cost of farm mixed feeds for grower #1 ration, grower #2 ration, finisher ration, dry sow ration, and lactation ration used in the simulations are shown in table 4.4. The farrow to wean operation only feeds the pig up to 23 kilograms and as a result utilizes only the stage 1 starter and stage 2 starter, as well as the dry sow ration and the lactation ration.

Table 4.4 Cost of Farm Mixed Feeds

Cost of Farm Mixed Feeds	
Grower #1 Ration	$181.80
Grower #2 Ration	$172.42
Finisher Ration	$165.31
Dry Sow Ration	$153.72
Lactation Ration	$180.77

4.1.3.3 Feed Conversion and Quantities

The feed conversion and quantities will be considered to be the same for both the farrow to finish operation and the farrow to wean operation. The farrow to wean operation only grows the pig up to 23.0 kilograms and thus only utilizes feed up to the grower #1 ration stage of feeding. The feed conversion and quantities are shown in table 4.5.

Table 4.5 Feed Conversion and Quantities

Feed Conversion and Quantities		
Creep/Plasma Starter	0.50 (total kgs used/pig)	6.50 (Weaning Weight (kgs))
Stage 1 Starter Conversion	1.40 (feed to gain)	
Switch to Stage 2 Starter	10.0 kgs	
Stage 2 Starter Conversion	1.60 (feed to gain)	
Switch to Grower #1 Ration at	23.00 kgs	
Grower #1 Conversion	2.50 (feed to gain)	
Switch to Grower #2 Ration at	45.00 kgs	
Grower #2 Conversion	2.90 (feed to gain)	
Switch to Finisher Ration at	70.00 kgs	
Finish Conversion to Market	3.40 (feed to gain)	
Gestation Feed for Sows	2.50 kgs/day	
Lactation Feed for Sows	6.50 kgs/day	
Boar Feed	3.00 kgs/day	

4.1.4 Financing and Project Costs

The financing and project cost for the farrow to finish operations and the farrow to wean operations are contained in table 4.6.

Table 4.6 Financing and Project Costs

Financing and Project Costs	600 Sow FF	1200 Sow FF	2400 Sow FF	600 Sow FW	1200 Sow FW
Bldg. eqpt. site dev. cost (per sow)	$7,000	$8,000	$5,500	$3,200	$4,500
Capital Cost of Land for Barn Location	$24,000	$36,000	$48,000	$24,000	$36,000
Cost of Feed Mill	$400,200	$600,000	$950,000	$400,200	$600,000
Total bldg. eqpt., & site dev. Cost	$4,179,000	$9,552,000	$13,139,500	$1,910,400	$5,373,000
Breeding stock cost on a per sow basis	$492	$492	$492	$492	$492
Precomm. cost per sow excluding breeding stock	$1,000	$1,000	$1,000	$1,000	$1,000
Total Breeding Stock Costs (Year 3)	$293,380	$587,140	$1,176,540	$293,380	$587,140
Total precomm. cost per sow excluding breeding stock	$597,000	$1,194,000	$2,389,000	$597,000	$1,194,000
Total precomm. costs	$890,380	$1,781,140	$3,565,540	$890,380	$1,781,140
Total project costs on a per sow basis	$9,202	$10,024	$7,410	$5,402	$6,524
Total project costs	$5,493,580	$11,969,140	$17,703,040	$3,224,980	$7,790,140

The capitalization for the start up of the hog barns is assumed to be 60% from mortgage and 40% from share equity, as shown in table 4.7. The 60% from the mortgage will be in the form of a 15 year loan and interest will be calculated on the principal at a interest rate of 7.50%. The remaining 40% of the required capitalization will be raised through share equity, with interest on the operating equity loan assumed to be 8%.

Table 4.7 Initial Capitalization

Initial Capitalization	600 Sow FF	1200 Sow FF	2400 Sow FF	600 Sow FW	1200 Sow FW
Mortgage (60%)	$3,296,148	$7,181,484	$10,621,824	$1,934,988	$4,674,084
Equity (40%)	$2,197,432	$4,787,656	$7,081,216	$1,289,992	$3,116,056

The book or starting value of the buildings and equipment for depreciation is calculated in the third year of operation, the life of the buildings and equipment is

assumed to be 20 years and will be subject to straight line depreciation. The maintenance rate on the buildings and equipment as a percentage of the book value, is set at 0% in year one, 1.00% in year two, and 2.00% in years two to fifteen.

4.1.5 Salary and Labour

The salaries to the owner/operator is of $35,000 a year for the 600, 1200, and 2400 sow farrow to finish operations, and $32,000 for the 600 and 1200 sow farrow to wean operations. The number of direct hours worked by the owner/operator is assumed to be 1000 hours per year for all the operations.

The labour and benefit charges for all the hog operations is assumed to be $11.44 an hour. The hours of labour required per sow per year is assumed to be 18 for the farrow to finish operations and 13 for the farrow to wean operations. The hours that an individual employee is assumed to work each year for all the operations is 2,000, equivalent to 50 weeks at 40 hours a week. Using the above numbers it is calculated that 4.87, 12.87, and 21 person years (other than the owner/operator) are required to run the 600, 1200, and 2400 sow farrow to finish operations respectively, and 3.38 and 7.26 person years (other than the owner/operator) for the 600 and 1200 sow farrow to wean operations respectively.

4.1.6 Inputs Regarding Other Production Costs

The inputs regarding other production costs for both the farrow to finish and farrow to wean operations are shown in table 4.8.

Table 4.8 Inputs Regarding Other Production Costs

Production Costs	600 Sow FF	1200 Sow FF	2400 Sow FF	600 Sow FW	1200 Sow FW
Health Services and Supplies (per pig marketed)	$2.32	$2.32	$2.32	$1.35	$1.35
Utilities	$2.79	$2.79	$2.79	$2.06	$2.06
Manure Handling/Disposal(per gallon)	$0.0075	$0.0075	$0.0075	$0.0075	$0.0075
Manure Haulage	$8,694.00	$17,388.00	$36,420.00	$6,648.00	$13,296.00
Office/Accounting expenses	$2,904.00	$2,904.00	$2,904.00	$2,904.00	$2,904.00
Rental Expenses	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00
Other Expenses (consulting, etc)	$32,835.00	$65,670.00	$131,395.00	$32,835.00	$65,670.00

4.1.7 Marketing Costs

The cost of transport to assembly yard or plant is assumed to be $2.00 per pig for the farrow to finish operations, and $1.50 per feeder for the farrow to wean operations.

The inputs that has the most significant effect on the simulations are the market price received for slaughter hogs (for the farrow to finish operations) and the market price for feeder pigs (for the farrow to wean operations). The base slaughter hog price used in the farrow to finish models is derived from the monthly average price given as dollars per ckg dressed weight that Manitoba Pork received for hogs from 1992 to 1997. The

standard deviation over the 1992 to 1997 period will be used to measure the upper and lower possible outcomes for the model. Two standard deviations is added to or subtracted from the base price to come up with the possible dispersion in outcomes for the simulation. This will capture 95% of the possible variation or outcomes that could possibly happen.

For the farrow to wean operations the price receive for feeder pigs will be based on a formula that ties the price of feeder pigs to the market price for hogs. Hog prices are summarized in Table 4.9.

Table 4.9 Price Received for Market Hogs and Feeder Pigs

Prices Received (based on 1992-1997 period)	FF (600,1200,2400)	FW (600 & 1200)
Average Market Price Per ckg. dressed weight	$153.87	
Average Feeder Price Per kg. live weight		$2.62
+ Two Standard Deviations	$198.89	$3.38
- Two Standard Deviations	$108.85	$1.85

The following inputs will be the same for the farrow to finish and the farrow to wean operations. The average grading index of the slaughter animals is assumed to be 111.0, and the live market weight is assumed to be 110.0 kilograms. The dressing percentage of the live weight pigs is assumed to be 81% and the market sow price is assumed to be 71% of the market price or $109.25. The cull sow live weight is assumed to be 200 kilograms. The market boar price is assumed to be $75.80 per ckg live weight and the cull boar live weight is assumed to be 225 kilograms.

4.1.8 Miscellaneous

The following miscellaneous inputs are the same for the farrow to finish operations as for the farrow to wean operations. The property taxes that are payed per year by the 600, 1200, and 2400 sow operations are $7,575 and $8,150, and $9,000 respectively. The insurance premium on the buildings and equipment is assumed to be $0.46 per $100 coverage for both operations. The insurance premium on the animals and the business interruption insurance are both assumed to be $0.80 per $100.00 coverage. The liability insurance for both operations is assumed to be $225 per year for every two million dollars of liability insurance coverage on an annual basis. The transportation insurance is assumed to be $0.13 per pig marketed.

The Agriculture Canada grading fee is assumed to be $0.075 per pig marketed and the research or other checkoff involved is assumed to be $0.14 per pig marketed. The marketing board administration costs are assumed to be 1% of the gross value of the pig marketed.

The income tax rate for the corporate hog operations is 21.12% on the first $200,00 and 46.12% on income more than $200,000, based on the rate that a corporation in Manitoba would be subject to. The income tax rate on the limited partnership hog operations is based on the Manitoba personal income tax rate.

4.1.9 Additional 15 Year Inputs

The inflation factor applied to inputs such as salaries and benefits, animal health supplies, utilities, rentals and other expenses, trucking, taxes, insurance, and income tax rates is assumed to be 3%.

The inputs for the average daily gain in the first 52 weeks worksheet are as follow (expressed in grams gained per day): 500 for starter #1, 620 for starter #2, 800 for grower #1, 850 for grower #2, and 930 for finisher pigs.

CHAPTER 5 - RESULTS OF SIMULATION

5.0 Introduction

This chapter contains the results of the simulations. The farrow to finish operations are presented, followed by the farrow to wean operations. In each section the baseline simulation is presented. The baseline used average market prices for hogs, barley, etc. In each section deviations from average market prices are also presented.. The average ROA and standard deviation of ROA over the 15 year period for each baseline scenario is presented. An efficient value frontier is developed from this information so a subset of preferred alternatives are identified, based on EV trade-offs. The amount of time the 15% equity that is invested by venture capitalists needs to stay in the operations and still maintain a positive cash flow is also presented as a basis for evaluating the liquidity of the investment.

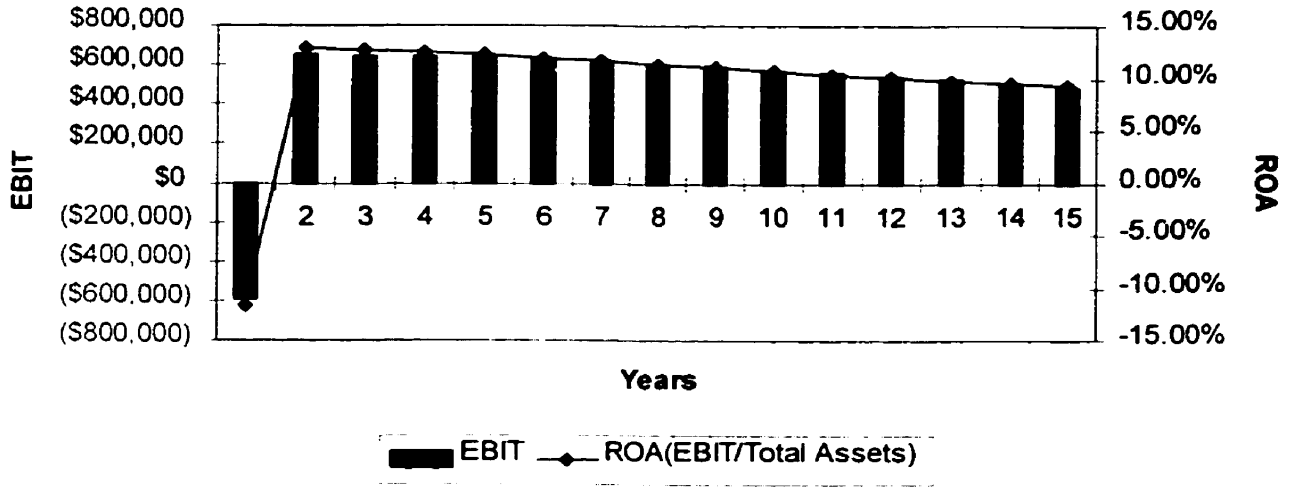
5.1 600 Sow Farrow to Finish Operations

5.1.1 Baseline simulation

When the 600 sow farrow to finish operation was simulated with the market price received for hogs and the market price for feed barley set at the 1992 to 1997 average values the rate of return on assets after tax (ROA) for both a limited partnership and a

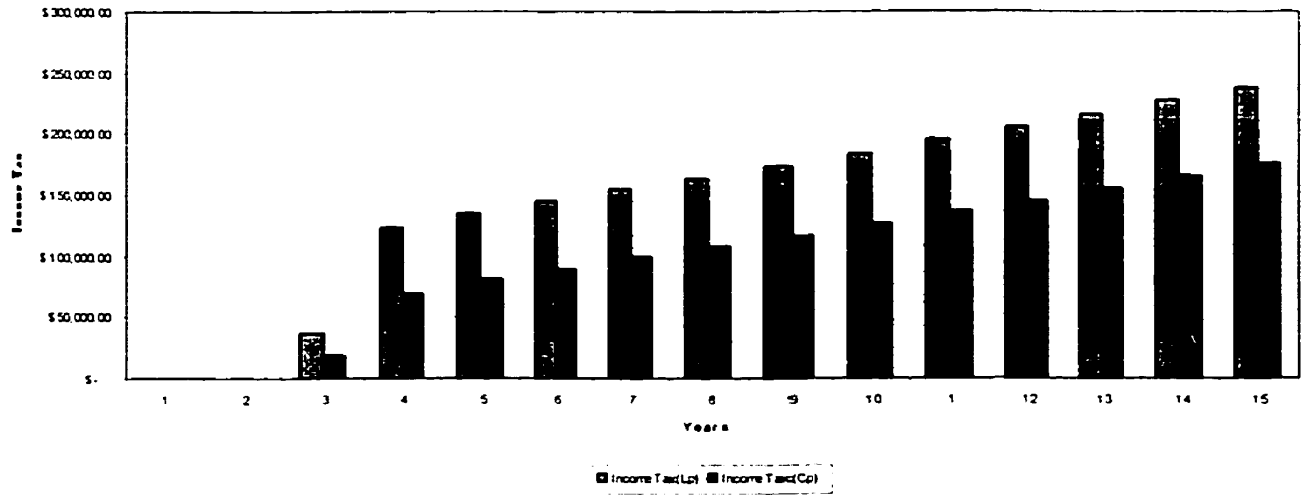
corporation over 15 years exhibit positive returns. Figure 5.1 shows the expected ROA for both the limited partnership and corporation over the 15 year planning horizon. Due to the initial start up cost involved with building the barn and establishing the breeding herd, year one of the simulation reveals a negative ROA. The ROA values then exhibit a slow decrease over the year two to year fifteen range, from 12.78% in year two to 9.26% in year 15 for both the limited partnership and corporation. The gradual decrease is due to the fact that the operations earnings before interest and taxes is declining at a faster rate than the operations total assets are declining (ROA=EBIT/Total Assets). The operations exhibit an initial loss of $588,372 in year one, then a positive but decreasing EBIT stream of values from year two to fifteen. A positive EBIT value of $650,541 is shown in year two, then the operations show a slow decrease in EBIT to $490,314 in year fifteen.

Figure 5.1 Baseline 600 Sow Farrow to Finish Operation



The corporation exhibits a higher profitability than the limited partnership in years where the hog operation is in a situation where taxes are applicable (when a profit is shown). This is due to the fact that the tax rate for the limited partnership is higher than that for the corporation. The income tax paid for the two operations are exhibited in figure 5.1.1. The operations carry forward losses for the first two years in order to reduce the tax liability. In year three the operations start to run into a net surplus and begin to pay income tax. The income tax values increase steadily from $37,304 and $19,121 in year three, to $239,059 and $176,377 in year fifteen for the limited partnership and corporation respectively.

Figure 5.1.1 Income Tax Paid For Baseline 600 Farrow to Finish Operation

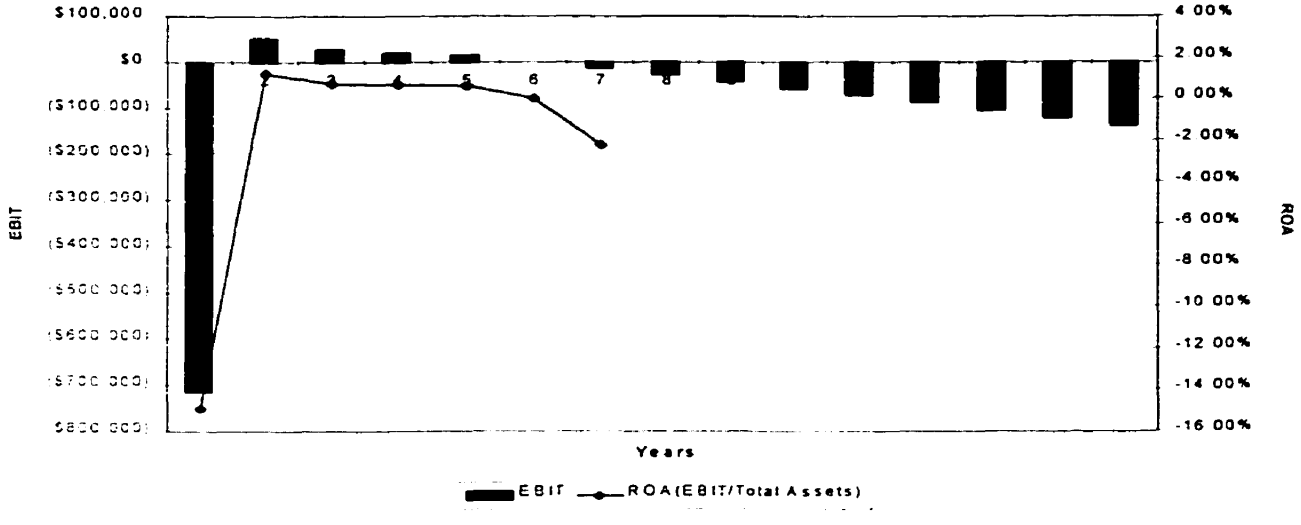


5.1.2 Sensitivity of Returns to Changes in Market Hog Prices

Figures 5.2 and 5.3 show the variability of ROA for the limited partnership and corporation over time when the market price of hogs is varied between $108.85 and $198.89, which is a range of ±2 standard deviations about the mean.

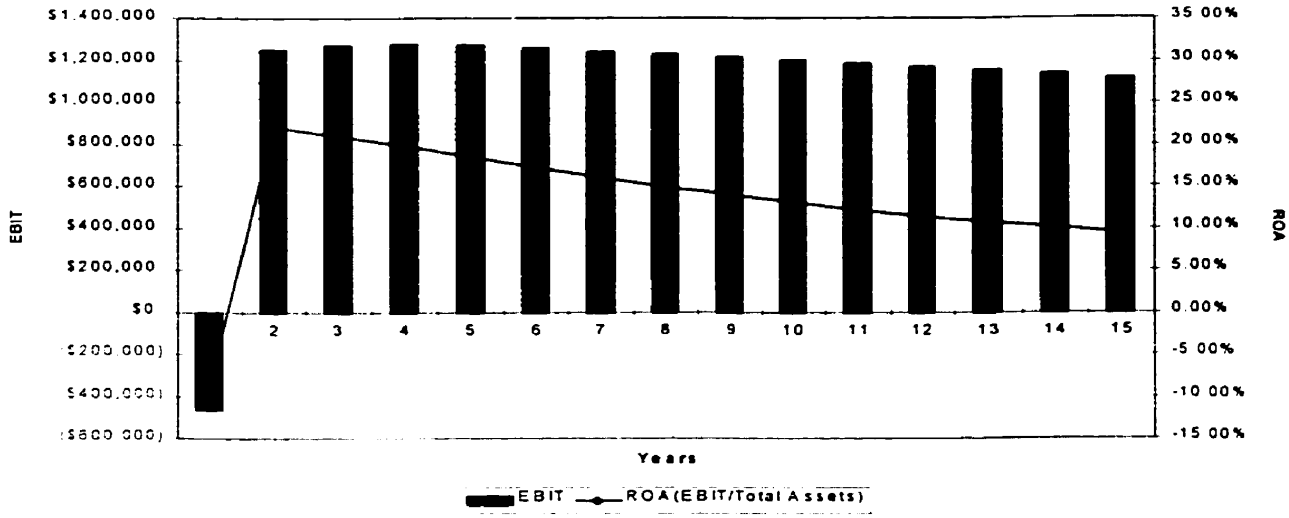
If the market price for hogs is decreased to $108.85 (Figure 5.2) and the 600 sow farrow to finish operations are simulated again the limited partnership and the corporation become unprofitable and quickly become financially unsustainable. The ROA values for years eight to fifteen are not included because of the unreasonable losses that would have been sustained, any business operation would be bankrupt after sustaining the kind of losses shown after seven years.

Figure 5.2 Sensitivity of Returns to Low Market Hog Prices For 600 Sow Farrow to Finish Operation



The 600 sow farrow to finish operations were also simulated with the price of market hogs set at $198.89 or two standard deviations above the average price (Figure 5.3). In this instance the operations are highly profitable. In year one, both the limited partnership and the corporation lose money due to the capital cost of start up. After that the operations exhibits a healthy profit as the ROA reaches 22% in year two and then slowly declines for both the limited partnership and the corporation respectively. The decline is due to a high cash flow. Cash is being accumulated from year two on with the result being that the ROA value is decreasing as cash adds to the total assets of the hog operation (ROA=EBIT/Total Assets). The EBIT values increase gradually from $1,250,794 in year two to $1,274,455 in year four, then decrease gradually from year four to $1,117,384 in year fifteen.

Figure 5.3 Sensitivity of Returns to High Market Hog Prices For 600 Sow Farrow to Finish Operation

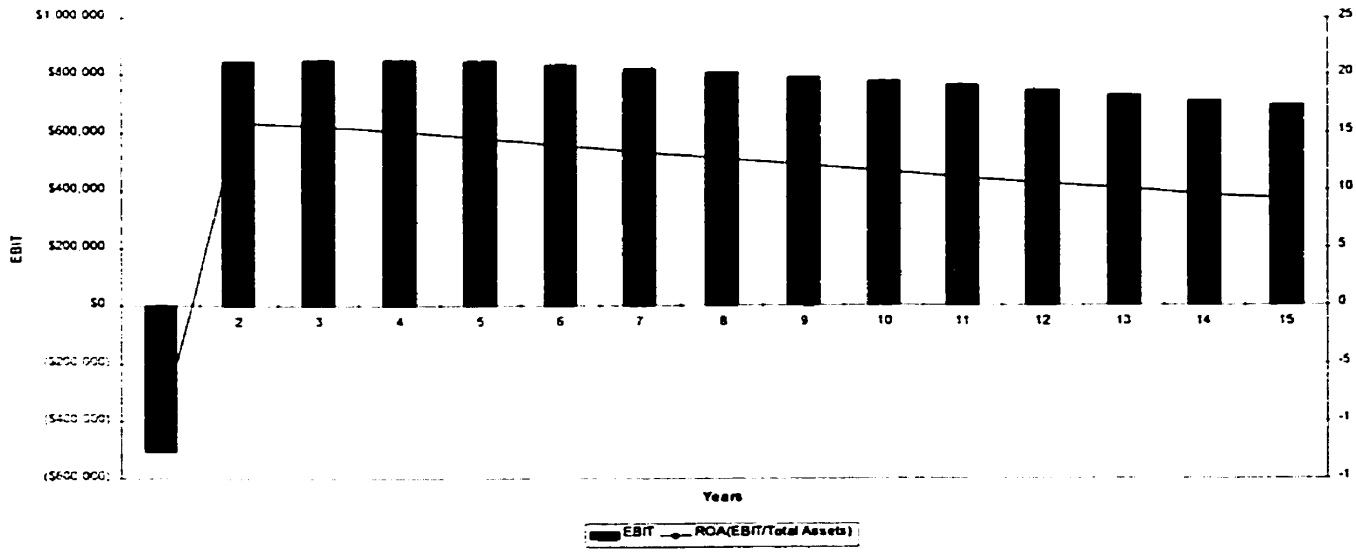


5.1.3 Sensitivity of ROA to Changes in Feed Costs

When the 600 sow farrow to finish operation is simulated with the price of barley set at $42.26, two standard deviations below the mean price (figure 5.4), the operations are very profitable for both types of business organizations.

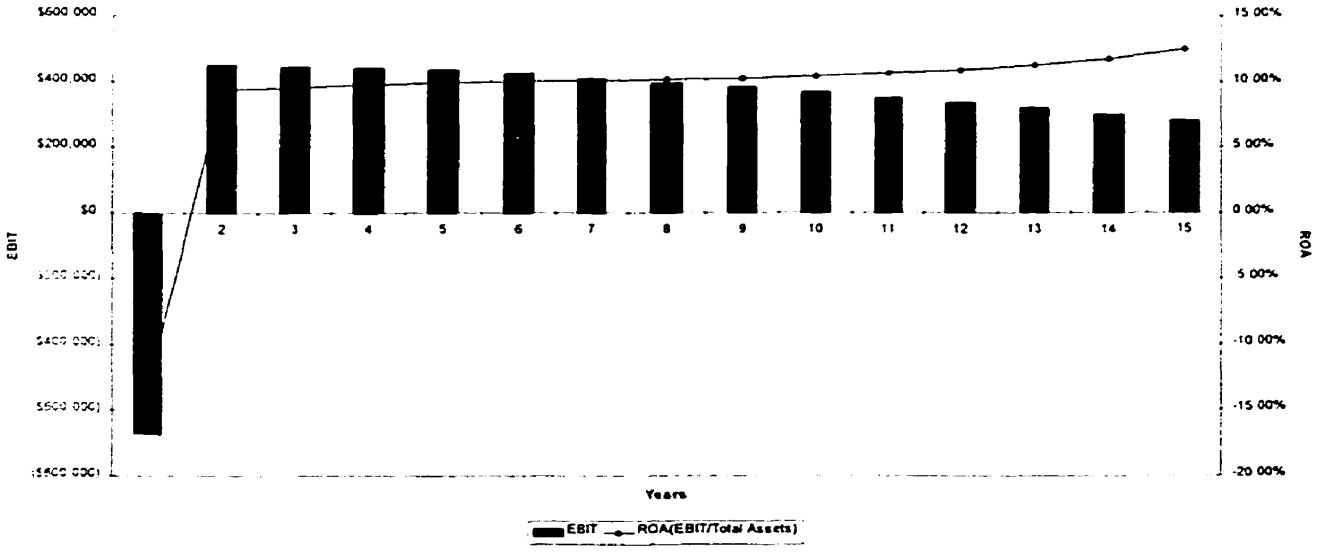
When the price of barley is set at two standard deviations below the mean price of barley the initial start up costs of the operation are overcome after year one and the two operations show a healthy profit from years two to fifteen. The operations decrease from a ROA of 15.92% in year two to 9.22% in year 15 for the limited partnership and the corporation. The ROA values exhibit a downward trend due to a high cash flow from year two on. The same as was the case for the 600 sow farrow to finish operation with the market price of hogs set two standard deviations above the mean. The EBIT values increase up to year three and then decrease gradually from a value of $854,053 in year three to $696,571 in year fifteen.

Figure 5.4 Sensitivity of Returns to Low Market Barley Prices For 600 Sow Farrow to Finish Operation



When the barley price is set at $151.66 (Figure 5.5) or two standard deviations above the mean price for barley the operations were marginally profitable over the fifteen year period, increasing from 9.40% in year two and then increasing slowly to 12.42% in year 15 for the limited partnership and corporation. The increase in ROA value is not indicative of the overall health of the operations though, since the EBIT value is declining at a slower rate than the total assets of the operations, resulting in a higher than normal ROA stream of values. The EBIT values are small and declining steadily over the fifteen year period, decreasing from $451,509 in year two to $283,877 in year fifteen.

Figure 5.5 Senisitivity of Returns to High Market Barley Prices For 600 Sow Farrow to Finish Operation



Barley is the most significant ingredient in the formulation of the various rations involved in the feeding of the pigs, as such varying the price has a direct affect on the cost of all ration formulations. The price of barley is also directly linked to the price of feed wheat which is the second most significant ingredient involved in the ration formulations. In the simulations, feed wheat is assumed to be 126% of the cost of barley.

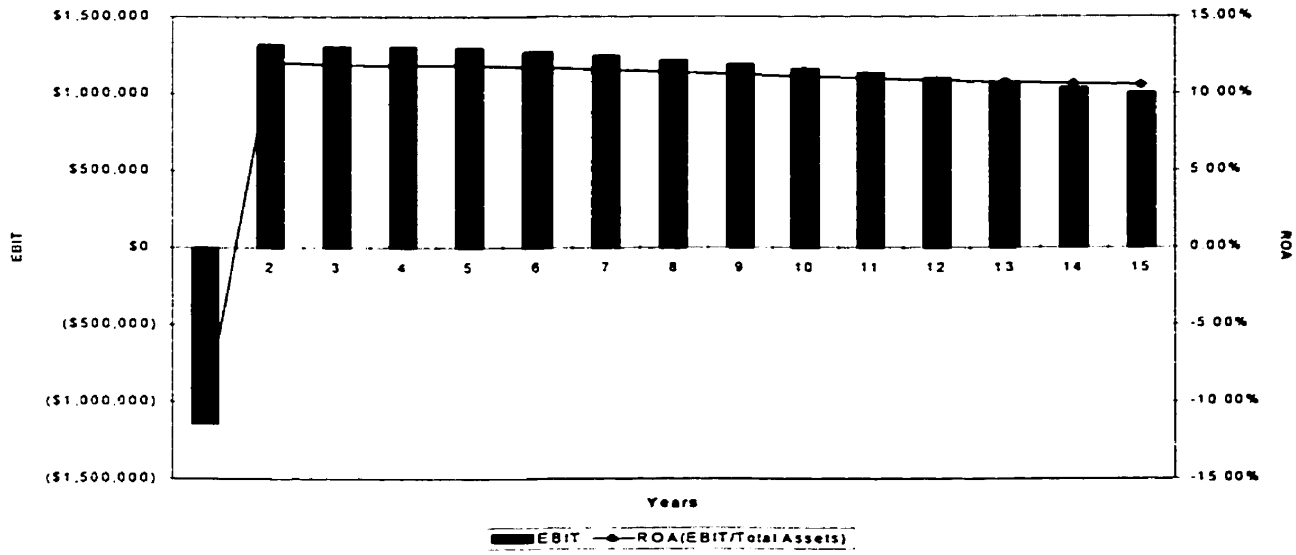
5.2 1200 Sow Farrow to Finish Operations

5.2.1 Baseline simulation

When the 1200 sow farrow to finish operation was simulated with the market prices for hogs and barley set at mean values the ROA for the limited partnership and the corporation exhibited positive returns for years two to fifteen. Figure 5.6 shows the

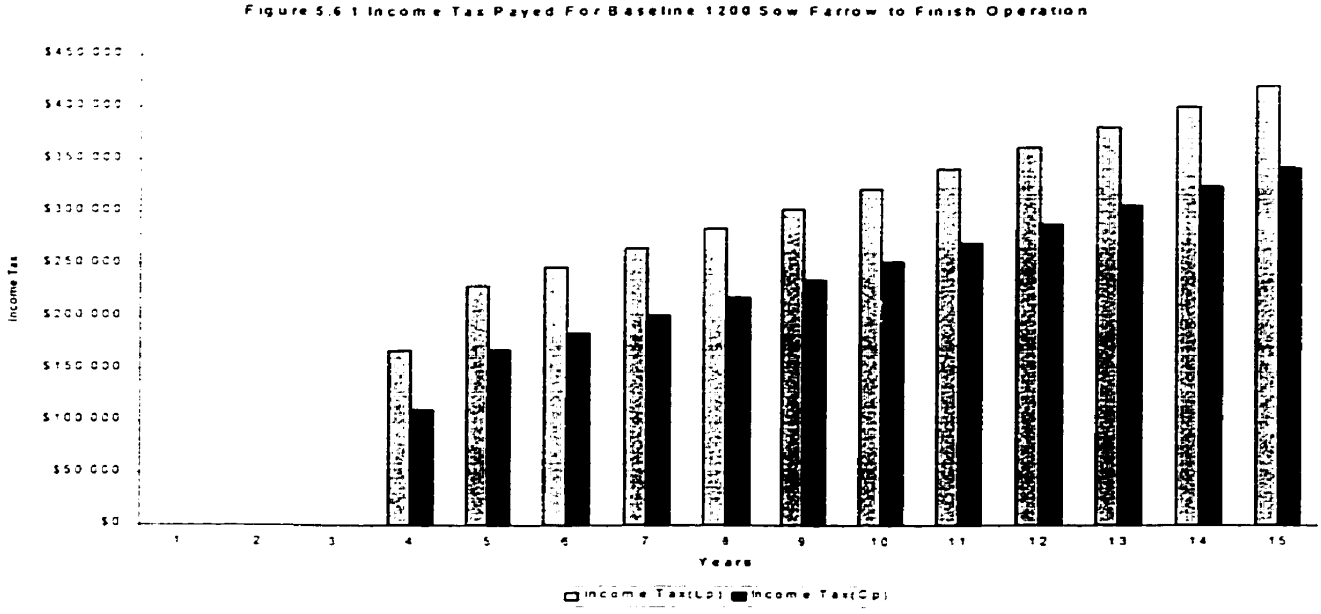
expected ROA for the limited partnership and the corporation over the fifteen year planning horizon. Due to the initial start up cost involved with building the barn and establishing the breeding herd year one of the simulation has a negative ROA of -10.45%. After the initial start up costs are overcome the ROA values for both the corporation and the limited partnership show a steady decrease in value from years two to fifteen, going from 12.05% in year two to 10.58% in year fifteen respectively. The EBIT values increase up to $1,304,925 in year three and then exhibit a gradual decrease to $1,003,138 by year fifteen.

Figure 5.6 Baseline 1200 Sow Farrow to Finish Operation



As in the case of the 600 sow operation the corporation exhibits a higher profitability in years where taxes are applicable due to a more favorable tax rate. The income tax paid for the two operations are exhibited in figure 5.6.1. The operations carry forward losses for the first three years in order to reduce the tax liability, in year four the

operations start to run into a net surplus and begin to pay income tax. The income tax values increase steadily from $167,367 and $110,773 in year four, to $422,240 and $344,002 in year fifteen for the limited partnership and corporation respectively.



5.2.2 Sensitivity of Returns to Changes in Market Hog Prices

Figure 5.7 and figure 5.8 show the variability of ROA for the corporation and the limited partnership over time when the market price of hogs is varied between $108.85 and $198.89, a range of 2 standard deviation about the mean.

When the 1200 sow farrow to finish operations is simulated with the market price of hogs set at $108.85 or two standard deviations below the mean price (Figure 5.7) the hog operations are unprofitable and quickly become financially unsustainable. The ROA values for years eight to fifteen are not included because the operation would be forced into bankruptcy after sustaining such losses over seven years.

The 1200 sow farrow to finish operations were also simulated with the price of hogs set at $198.89 or two standard deviations above the average price (Figure 5.8). In this instance the operations were profitable over the fifteen years. In year one an ROA of -7.84% is returned for the limited partnership and the corporation, this reflects the high capital cost of starting up the hog operation. After year one the operations begins to exhibit a healthy profit as the ROA values range from 20.79% in year two and then gradually decline to 10.02% in year 15. The decline in ROA is due to the large amount of cash that is being accumulated which adds to the total assets of the corporation (the same as was the case for the 600 sow farrow to finish operation with the market price of hogs set at two standard deviation above the mean). The EBIT values for the operations increase slowly in value over the first four years of operation, then exhibit a slow decline in value from a high of $2,557,160 in year four to $2,257,321 in year fifteen.

Figure 5.7 Sensitivity of Returns to Low Market Hog Prices For 1200 Sow Farrow to Finish Operation

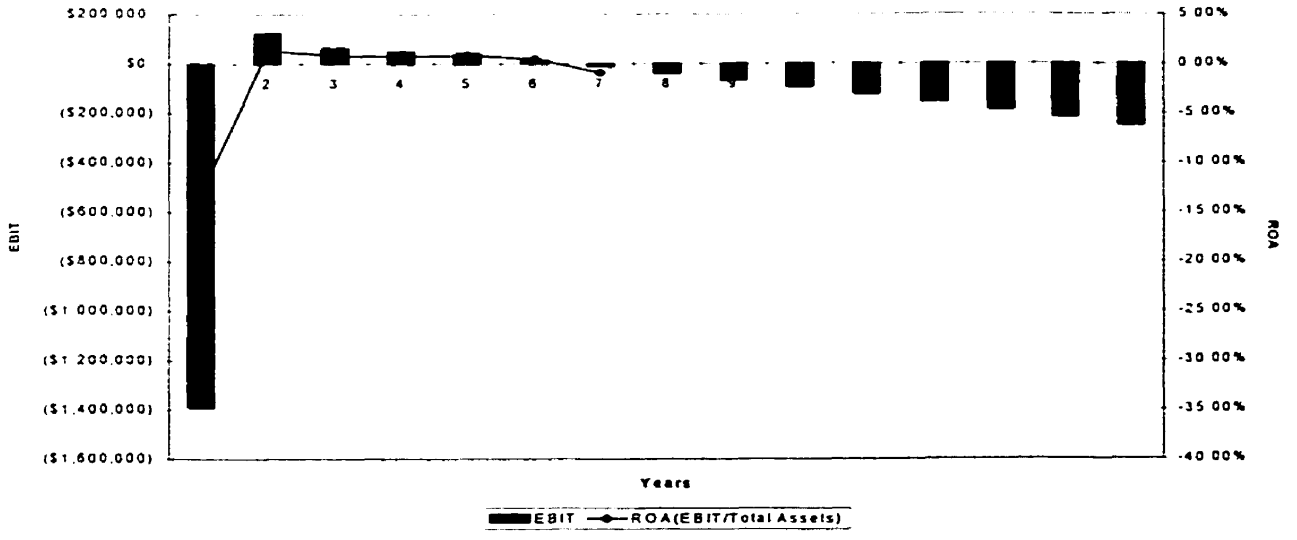
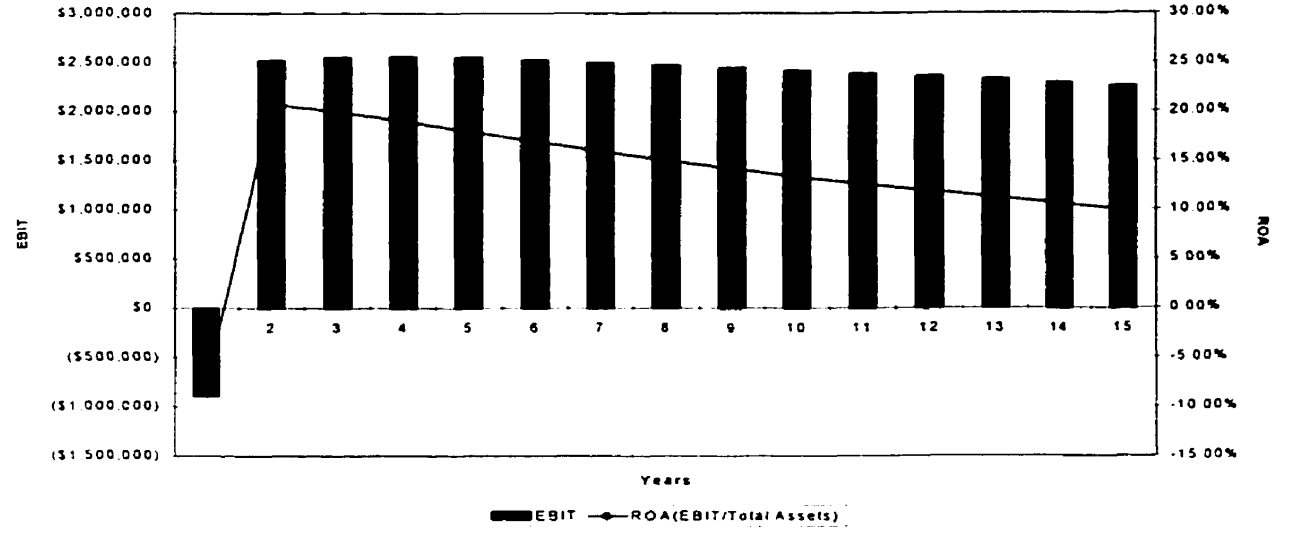


Figure 5.8 Sensitivity of Returns to High Market Hog Prices For 1200 Sow Farrow to Finish Operation



5.2.3 Sensitivity of ROA to Changes in Feed Costs

When the 1200 sow farrow to finish operation is simulated with the price of barley set at $42.26 or two standard deviations below the mean price (Figure 5.9) the operations are profitable over the fifteen year period. The initial start up costs are overcome after year one, then the ROA values range from a high of 14.96% in year two to 10.16% in year 15 for the limited partnership and the corporation. The ROA values exhibit a downward trend due to a high cash balance being built from year two on (the same as was the case for the 600 sow farrow to finish operation with the market price of hogs set two standard deviations above the mean). The EBIT for the operations exhibit a gradual decrease in value from a high of $1,721,391 in year two to $1,416,075 in year fifteen.

Figure 5.9 Sensitivity of Returns to Low Market Barley Prices For 1200 Sow Farrow to Finish Operation

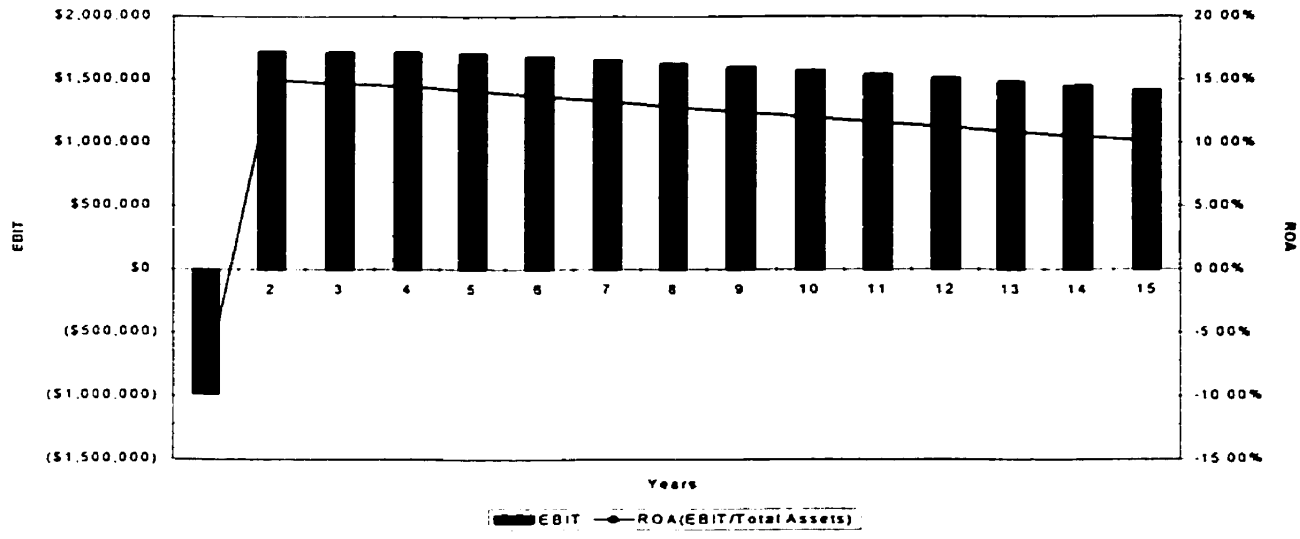
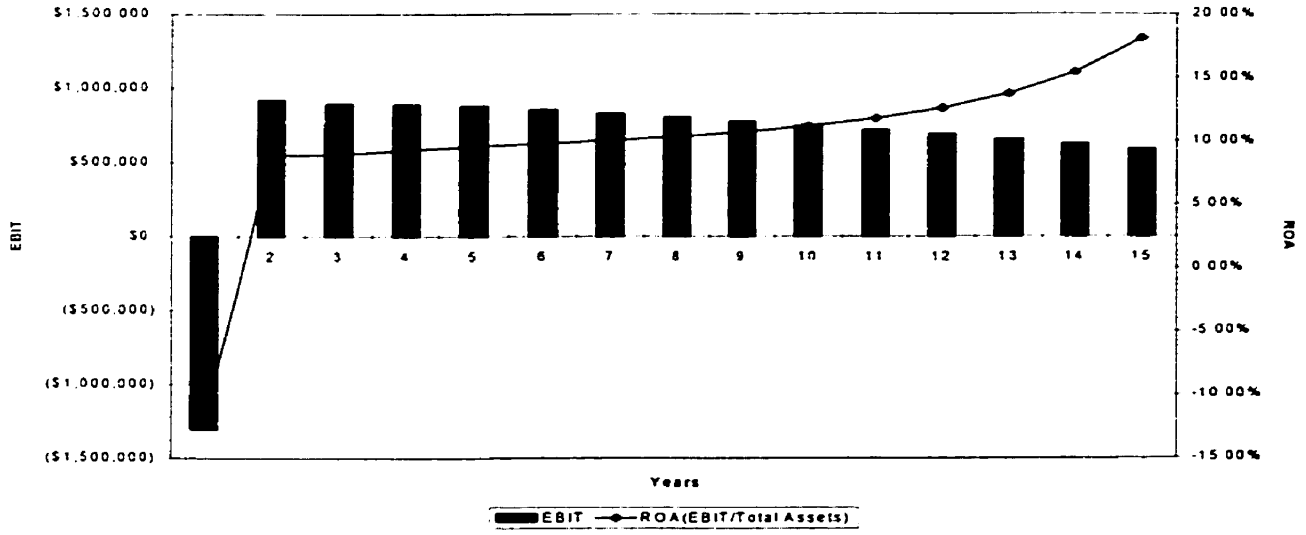


Figure 5.10 Sensitivity of Returns to High Market Barley Prices For 1200 Sow Farrow to Finish Operation



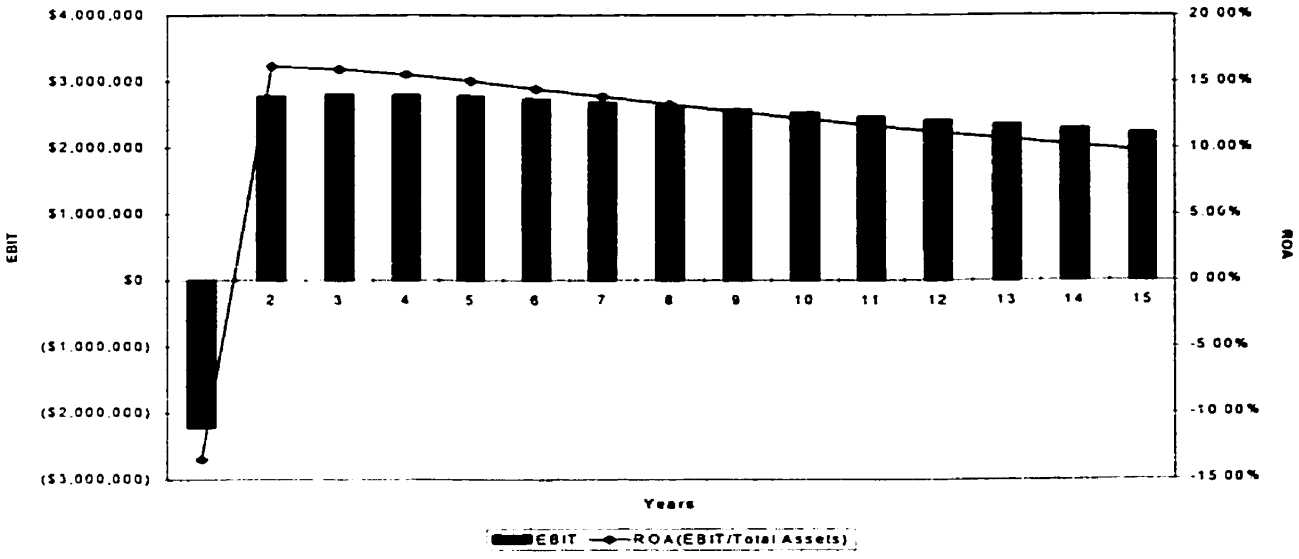
When the barley price is set at $151.66 or two standard deviations above the mean price for barley (Figure 5.10) the operations are profitable over the fifteen year period. They exhibit both positive EBIT and ROA. The increasing ROA is due to the fact asset values are declining faster than EBIT. The decline is asset value is due to the poor cash flow when feed prices are high. Net cash flow is negative for each year, resulting in declining cash balances and hence, declining total asset values.

5.3 2400 Sow Farrow to Finish Operation

5.2.1 Baseline simulation

When the 2400 sow farrow to finish operation was simulated with the market price received for hogs and the market price for barley set at mean values the ROA for the operations exhibited positive returns for years two to fifteen. Figure 5.11 shows the expected ROA for the limited partnership and the corporation over the fifteen year planning horizon. Due to the initial start up cost involved with building the barn and establishing the breeding herd year one of the simulation has a negative ROA of -13.50%. After the initial start up costs are overcome the ROA values for both the corporation and the limited partnership show a steady decrease in value from years two to fifteen, going from 16.13% in year two to 9.77% in year fifteen respectively. The EBIT values increase up to $2,798,096 in year three and then exhibit a gradual decrease to $2,221,189 by year fifteen.

Figure 5.11 Baseline 2400 Sow Farrow to Finish Operation

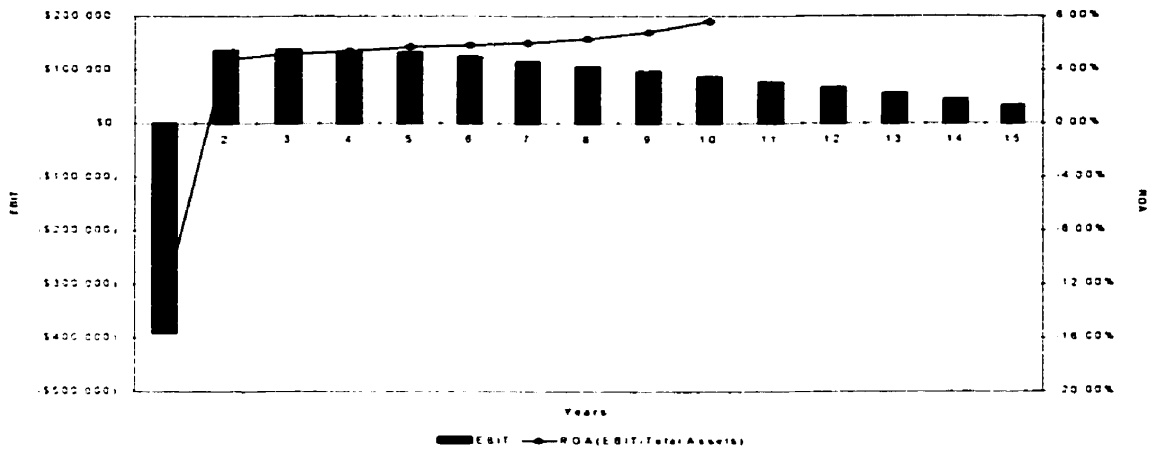


5.4 600 Sow Farrow to Wean Operations

5.4.1 Baseline Simulation

When the 600 sow farrow to wean operation was simulated with the market price received for hogs and the market price for barley set at mean values the ROA for the limited partnership and the corporation exhibited positive returns for years two to fifteen. Figure 5.12 shows that the ROA values exhibit a steady increase over the ten years going from a value of 4.81% in year two to 7.61% in year ten. This is not indicative of the overall health of the operation though as the increase is due to a steady decline in the total assets of the operation over the period, declining from $3,224,980 in year one to $1,134,204 in year ten, then becoming negative in year fourteen at -$270,364. The EBIT numbers show the declining profitability of the operation, as the operation shows marginal and declining EBIT over the entire fifteen year period, going from a high of $137,403 in year three, to a EBIT of $33,281 in year fifteen.

Figure 5.12 Baseline 600 Sow Farrow to Wean Operation

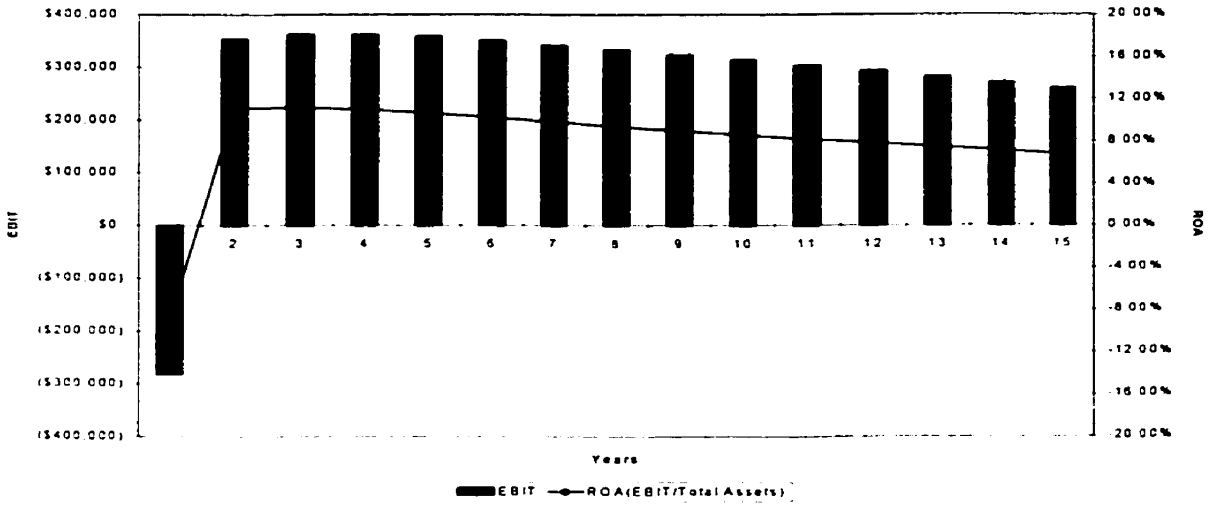


5.4.2 Sensitivity of Returns to Changes in Market Hog Prices

When the 600 sow farrow to wean operation is simulated with the price of market hogs set at two standard deviations below the average price the hog operations are not profitable and quickly become financially unstable.

The 600 sow farrow to wean operation when simulated with the market price of hogs set at two standard deviations above the mean price (Figure 5.13) is profitable over the fifteen year period. The ROA values increase from a negative ROA of -9.83% in year one, to a ROA of 10.33% in year three, then steadily decrease down to 6.33% in year fifteen. The EBIT values increase from -$306,487 in year one, to $325,762 in year three, then slowly decline down to $208,377 in year fifteen.

Figure 5.13 Sensitivity of Returns to High Market Hog Prices For 600 Sow Farrow to Wean Operation



5.4.3 Sensitivity of Returns to Changes in Feed Costs

The 600 sow farrow to wean operations were not profitable when simulated with the price of barley set at ± 2 standard deviations of the average price of barley.

5.5 1200 Sow Farrow to Wean Operation

5.5.1 Baseline Simulation

When the 1200 sow farrow to wean operation was simulated with the market price received for hogs and the market price for barley set at mean values the ROA for the limited partnership and the corporation exhibited positive returns for years two to fifteen. Figure 5.14 shows that the ROA values exhibit a steady increase over the ten years going from a value of 4.24% in year two to 8.41% in year nine. This is not indicative of the overall health of the operation though as the increase is due to a steady decline in the total assets of the operation over the period, declining from $7,166,839 in year one to $3,074,138 in year eight, then becoming negative in year twelve at -$379,394. The EBIT numbers show the declining profitability of the operation, as the operation shows marginal and declining EBIT over the entire fifteen year period, going from a high of $283,473 in year one, to a EBIT of $74,888 in year fifteen.

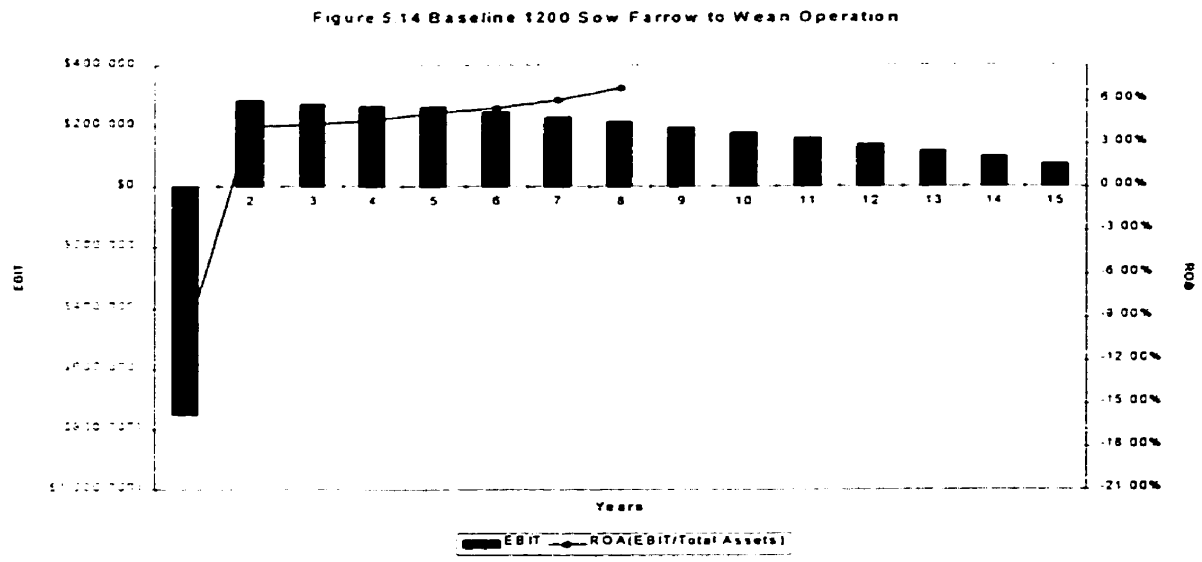


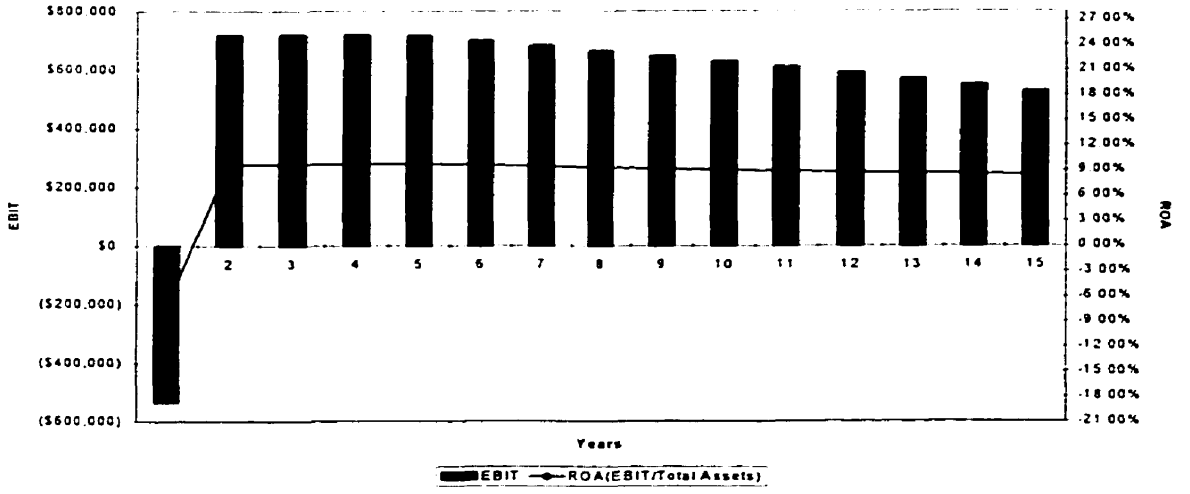
Figure 5.14 Baseline 1200 Sow Farrow to Wean Operation

5.5.2 Sensitivity of Returns to Changes in Market Hog Prices

The 1200 sow farrow to wean operations were not profitable when simulated with the market price of hogs set at two standard deviations below the mean.

The 1200 sow farrow to wean operation when simulated with the market price of hogs set at two standard deviations above the mean price is profitable over the fifteen year period(Figure 5.15). The ROA values increase to a high of 9.09% in year five, then decrease steadily down to a ROA of 8.16% in year fifteen. The EBIT values increase to a high of $646,774 in year three, then decrease slowly down to an EBIT of $425,111 in year fifteen.

Figure 5.15 Sensitivity of ReturnsTo High Market Hog Prices For 1200 Sow Farrow to Wean Operation



5.5.3 Sensitivity of Returns to Changes in Feed Costs

The 1200 sow farrow to wean operations are not profitable when simulated with the price of barley set at ± 2 standard deviations of the average price of barley.

5.6 Liquidity of Investor Cash

The amount of time that the 15% of equity capital controlled by the venture capital investors needs to stay in the each of the 600, 1200, and 2400 sow farrow to finish baseline operations and the 600 and 1200 farrow to wean baseline operations before a positive cash balance can be maintained is illustrated in Table 5.1.

Table 5.1 Liquidity of Investor Cash

	Corporation	Limited Partnership
600 Sow Farrow to Finish	3 Years	3 Years
1200 Sow Farrow to Finish	3 Years	3 Years
2400 Sow Farrow to Finish	2 Years	2 Years
600 Sow Farrow to Wean	Unprofitable operation	Unprofitable operation
1200 Sow Farrow to Wean	Unprofitable operation	Unprofitable operation

For the 600 sow farrow to finish baseline operation under a both a corporate and limited partnership business structure the 15% of equity capital controlled by the venture capital investors must stay in the hog operation for at least three years. For the first two years the cash balance of the 600 and 1200 sow baseline simulations exhibit a negative cash balance without the 15% of equity capital, while in year three both of the operations exhibits a small positive cash balance. In year four the cash balance minus the 15% equity capital exhibits a healthy positive cash balance for the corporation and the limited partnership, $587,0177 and $505,751 respectively. From year four on the corporate and limited partnership operations exhibit an increasingly positive cash balance which enable the operation to continue on without the 15% equity capital.

For the 1200 sow farrow to finish baseline operation under both a corporate and limited partnership business structure the 15% of equity capital that is controlled by the venture capital investors must stay in the hog operation at least three years. The operations would be running a negative cash balance if the venture capital was removed in the first two years, while in year three the cash balance minus the venture capital is

positive, but too small a surplus to confidently ensure continuation of the operations. In year four the cash balance minus the venture capital exhibits a healthy cash balance for the corporation and limited partnership, $1,003,857 and $984,682 respectively. From year four on the corporate and limited partnership operations exhibit an increasingly positive cash balance which enable the operation to continue on without the 15% of equity capital from the venture capital investors.

For the 2400 sow farrow to finish baseline operation under both a corporate and limited partnership business structure the 15% of equity capital that is controlled by the venture capital investors must stay in the hog operation at least two years. The operations would run a negative cash balance in the first year of operation if the 15% of equity capital was removed, while in year two the operations run a small positive cash balance, but too small a surplus to confidently ensure continuation of the operation. In year three the cash balance minus the venture capital exhibits a healthy cash balance for the corporation and limited partnership, $2,176,168 and $2,004,697 respectively. From year three on the corporate and limited partnership operations exhibit an increasingly positive cash balance which enable the operation to continue on without the 15% of equity capital from the venture capital investors.

For the 600 sow farrow to wean baseline operations the 15% of equity capital will not be able to be removed. A positive but decreasing cash balance is maintained for the

first four years of operation if the 15% of equity capital is removed. after that the cash balance becomes increasingly negative for the remainder of the fifteen years.

For the 1200 sow baseline farrow to wean operations the 15% of equity capital will not be able to be removed at any time. A positive cash balance without the 15% equity capital is only maintained for year one of the operation, in years two to fifteen the cash balance steadily becomes more negative.

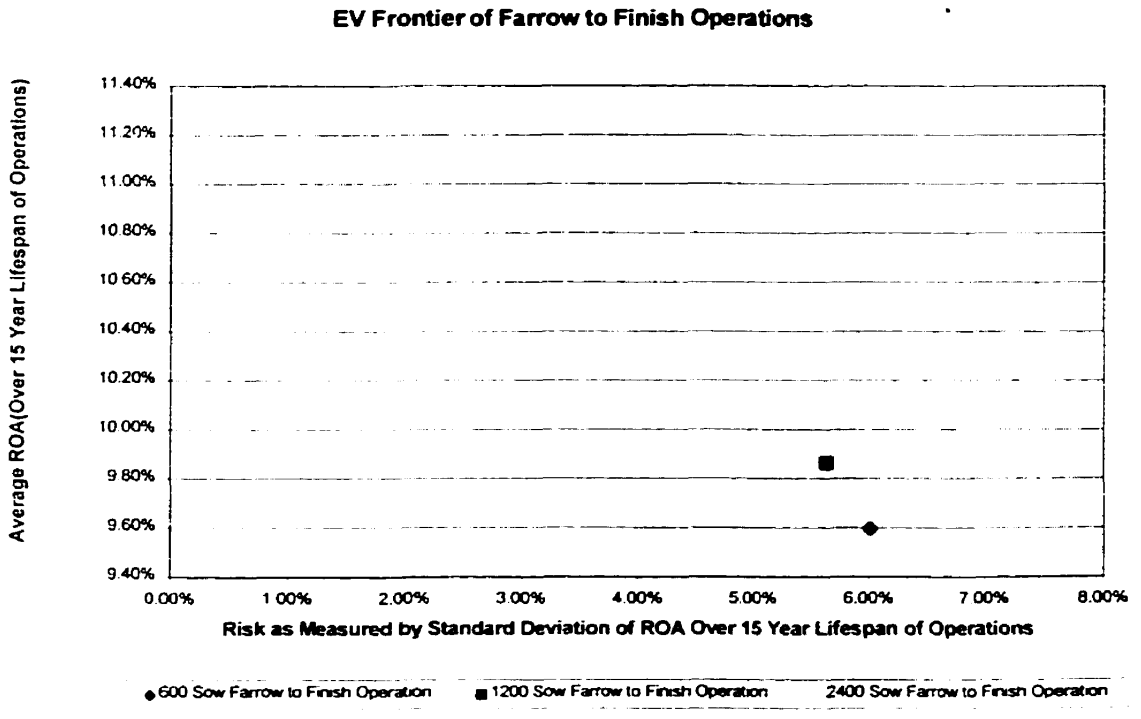
5.7 Expected Value Frontier for the Farrow to Finish Operations

Figure 5.16 illustrates the expected value frontier which illustrates the risk return trade off as measured by the average expected ROA over the fifteen year period plotted on the Y axis against the expected standard deviation of ROA over the fifteen year period on the X axis for each of the baseline farrow to finish operations. The farrow to wean operations are not included as they were not money making ventures.

The 2400 sow farrow to finish operation is the preferred operation as it exhibits the highest average ROA of 11.26% over the fifteen year period, with a standard deviation of ROA over the fifteen year period of 7.16%. The next best alternative is the 1200 sow farrow to finish operation with a average ROA of 9.86% and a standard deviation of 5.64% over the same fifteen year . The 600 sow farrow to finish operation is the least desirable operation as it exhibits the lowest ROA at 9.60% and has a standard

deviation of 6.01% over the fifteen year period. The 600 and 1200 sow operations are very similar in ROA and standard deviation, with the 1200 sow operation exhibiting a lower standard deviation and a higher ROA it would be certainly preferred to the 600 sow farrow to finish operation. The 1200 sow farrow to finish operation is the most desirable operation for venture capitalists as it exhibits the highest ROA and also the highest standard deviation of all the operations and thus has the most potential for profit of the three operations.

Figure 5.16



Chapter 6 Conclusions

6.0 Introduction

The first part of this chapter entails a summary of conclusions that were drawn from the simulations of the farrow to finish and farrow to wean operations, the second part of the chapter deals with suggestions for further research.

6.1 Conclusions

After doing the simulations of the farrow to finish and farrow to wean models the results showed that the farrow to wean operations were not profitable under any of the simulated scenarios except for when the market hog price was set at two standard deviations above the mean. As a result the farrow to wean operations are not a candidate for attracting venture capital.

The farrow to finish models were profitable over the fifteen years of the simulations when simulated under the baseline conditions, as well as when simulated with the price of barley set at two standard deviations above the mean price of barley. The only case where the farrow to finish operations did not make a profit was when they were simulated with the price of hogs set at two standard deviations below the mean. The 2400 sow farrow to finish operations showed the best profitability in terms of ROA over the fifteen year period. Over the fifteen year period examined the 2400 sow farrow to finish operations were the most profitable when comparing the baseline scenario cases of

all the operations, exhibiting the highest average ROA of 11.26%. The 1200 sow farrow to finish operations were the next most profitable exhibiting an average ROA of 9.86% over the fifteen year period. The 600 sow farrow to finish operations were the least profitable on average over the fifteen year period exhibiting ROA values of 9.60%.

In terms of the variability of returns the 2400 sow farrow to finish operations exhibited the greatest variability under the baseline conditions with a standard deviation in ROA of 7.16% over the fifteen year period. The 600 sow farrow to finish operations exhibited the next highest standard deviation of returns over the fifteen year period of 6.01%. The 1200 sow farrow to finish operation exhibited the least variability in returns over the fifteen year period at a standard deviation of 5.64%

The 2400 sow farrow to finish operation would need the 15% of equity capital controlled by venture capital investors to stay in the operation for two years before it would be sustainable without it. In terms of the amount of time that the 600 and 1200 sow farrow to finish operations would need the 15% of equity capital controlled by the venture capital investors under the baseline scenarios to stay in the operations before they would be sustainable without it works out to two years for each operation.

Taking all these factors into account the most desirable operation for a venture capital investor would be the 2400 sow farrow to finish operation, which exhibits the highest average ROA over the fifteen year scenario and the highest average ROA over the

two years that the 15% of equity capital would need to stay in the operations. The fact that the venture capital would only need to be locked into the operation for two years makes it more desirable for venture capital investors in the sense that venture capital seeks out investments that are liquid. The next best alternative of the attraction of venture capital would be the 1200 sow farrow to finish operation which exhibits lower ROA values over the fifteen year period as well as the initial three year period that the venture capital would need to stay in the operation. The least desirable operation for attracting venture capital would be the 600 sow farrow to finish operation which exhibits the lowest average ROA over the fifteen year period, as well as the lowest ROA over the three years that the venture capital would have to stay in the operation.

6.2 Suggestions for Further Research

The work in this paper could be furthered by investigating the profitability of different sizes and business setups of finishing operations and comparing them to the farrow to finish and farrow to wean operations simulated in this thesis. The research could also be extended to include the effect of incorporating and using the risk management tools offered by Manitoba Pork on the profitability of the farrow to wean and farrow to finish operations. Another area that could be extended is by manipulating the data by econometric means in order to measure the way that barley and hog prices move, and using that to come up with hog and barley prices that are linked together, then using these numbers in the simulations to measure profitability.

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