Manitoba Producers' Willingness-to-Invest in New Generation Cooperatives

by

Tasha J. Turko

A Thesis submitted to the Faculty of Graduate Studies of

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in partial fulfilment of the requirements of the degree of

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A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirement of the degree

MASTER OF SCIENCE

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Master's Thesis/Practicum Final Report

The undersigned certify that they have read the Master's Thesis/Practicum entitled:

Manitoba Producers' Willingness-to-invest in New Generation Cooperatives

submitted by

Tasha Turko

in partial fulfillment of the requirements for the degree of

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The Thesis/Practicum Examining Committee certifies that the thesis/practicum (and oral examination if required) is:

Approved

(Approved or Not Approved)

☑ Thesis ☐ Practicum

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Abstract

The New Generation Cooperative (NGC) has been a popular form of farmer-owned enterprise widely adopted by producers in the United States, especially in North Dakota and Minnesota. The adoption rate of this organizational form has been comparatively slow in the province of Manitoba, which is geographically adjacent to these two states.

The objective of this thesis is to ascertain which factors affect Manitoba producers' willingness-to-invest and willingness-to-commit to NGCs, as well as potential monetary investment in NGCs. Finally, whether or not these decisions are affected by producer farm type is determined.

Data collected from surveying Manitoba producers are analyzed using ordered logit to examine the producers' willingness-to-invest and willingness-to-commit, and tobit to examine the producers' potential monetary investment in NGCs. Further statistical analysis is shown through producer profiles, odds ratios and marginal effects.

Positive and significant associations are found between a producer's self-assessed knowledge about NGCs, having been approached, farm size, education level and their willingness-to-invest, while there is a negative association with age. Self-assessed knowledge level and contracted commodities have positive and significant associations with willingness-to-commit. Finally, self-assessed knowledge level, having been approached, farm size, net cash income, minimum rate of return required, age, and education level have positive and significant associations with potential monetary investment, while production of commodities under contract and risk-aversion levels have negative associations with potential monetary investment.

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Chapter 1: Introduction

The New Generation Cooperative (NGC) organization has been a popular form of farmer-owned enterprise adopted by producers in the United States, especially in the northern states of North Dakota and Minnesota. The first production facility, belonging to American Crystal Sugar was constructed on the North Dakota/Minnesota border in the early 1970s (Stefanson and Fulton, 1997). These producers were interested in owning their own production facilities in order to capture the value-added by processing commodities grown on their own farms. The adoption rate of the NGC organizational form has been comparatively slow in the province of Manitoba, which is geographically adjacent to these two states. While located close to one another, they are quite far away from each other in their rate of NGC adoption. This study looks into the fundamental reason for this slow adoption rate: the producer. Cooperatives are producer-owned and run organizations and therefore are reliant on the knowledge, interest and characteristics of individual producers and the producer groups that are facilitating their development.

1.1 Purpose of Study

The goal of this thesis is to ascertain which factors affect investment in potential Manitoba NGCs. More specifically, factors that affect a Manitoba producer's willingness-to-invest and willingness-to-commit to NGCs are investigated. It is also of interest whether or not these variables have an influence on Manitoba producers' potential monetary investment in NGCs. Finally, whether or not these decisions are affected by producer farm type is investigated.

1.2 Benefits of Study

Similar studies focusing on producer-investor characteristics have been conducted in the United States; however, this is the first study to focus on Manitoba producers and the characteristics influencing their NGC investment decisions. Much of the research that has focused on NGCs in Manitoba has been concentrated on their formation. There have been studies discussing success factors, obstacles, and general start-up information for NGCs. Other research has created guides that provide organizers and researchers with specific information about NGC start-ups.

This thesis is important because the focus is on producer investment in NGCs. An advantage of the study being conducted in Manitoba is that it will also benefit groups across Canada considering NGCs as a potential organizational form. It may help to know what types of farmers typically invest and how to approach different types of producers that might not typically be interested in investing. Not only will it benefit these other producers and groups, but this study will hopefully encourage further and similar research in other provinces.

This research also has the potential to benefit rural community development organizations, as cooperatives have been shown to strengthen, stabilize and contribute to growth in communities and rural areas (Centre for the Study of Co-operatives, 2001). If these types of organizations are considering whether or not to help fund an NGC, then it will be beneficial for the authorities to have as much information as possible.

Finally, advisors consulted by producers considering an agricultural start-up may benefit from this information. It has been shown that agricultural advisors tend to know

and be involved very little in NGC start-ups in the province (Carlberg and Turko, 2008), so any information will be beneficial to those parties as well.

1.3 Outline of thesis

This thesis has been organized into seven chapters. This first chapter has provided a brief introduction to the topic, the purpose and desired outcomes of the study. This chapter also outlined the potential contributions and benefits of this study, and addressed who this research may assist.

The second chapter reviews new generation cooperatives and the types of NGC shares available in Manitoba. Also, the literature resulting from studies focusing on general producer investment decisions, new generation cooperative and off-farm investment decisions.

The third chapter details theory and resulting empirical model for the thesis. With an overview of capital budgeting theory, social capital theory, portfolio theory and human capital theory/demographics, a series of ten hypotheses are developed. These hypotheses are presented in order to serve as variables for the empirical model.

Chapter Four discusses data collection methods and describes how the survey was distributed. Survey data, charts and tables summarizing the data collected are presented and discussed briefly. The fifth chapter describes the methods used to estimate Manitoba producers' NGC investment and commitment decisions. The ordered logit model is outlined with its application to the measurement of a producer's willingness-to-invest in an NGC, followed by the logit model's application to measuring a producer's willingness-to-commit to an NGC. Next, the tobit model is used to model the amount of

money a producer would be willing to invest in an NGC. Methods used in further analysis of the models are presented at the end of Chapter Five as well: producer profiles, odds ratios and marginal effects.

In Chapter Six, the results of the empirical model analyses are presented. The parameter estimates for the NGC investment probability logit model are given, followed by the producer profiles, odds ratios and marginal effects. Following the investment probability model are the results for the NGC commitment probability logit model. Finally, the monetary investment tobit model results are presented. The seventh and final chapter gives a brief summary of the thesis, followed by conclusions comparing the hypotheses outlined in Chapter Three with the actual results of the three models. Finally, implications and applications of these results are suggested.

Chapter 2: Literature Review

This chapter begins by reviewing the new generation cooperative structure and investment implications. It then examines studies that have been conducted on topics relating to general producer investment decisions, investment decisions in new generation cooperatives, and investments decisions in off-farm ventures.

2.1 New Generation Cooperatives

A cooperative is defined as being an organization that is member-owned and controlled (Coltrain, Barton and Boland, 2000). The producers involved in a cooperative seek to achieve benefits, such as wealth and market power, for themselves and other farmers through the pooling of their resources. Through collaboration, producers may be able to access better resources than they would while attempting to undertake a project independently. The collaboration of producers also tends to alleviate the individual risk by having it spread between other members in the cooperative.

While agricultural cooperatives traditionally focus on the raw commodities produced by farmers, the farmers involved in NGCs are able to capture extra profits through the value-added processes that the cooperative carries out (Stefanson and Fulton, 1997). Such cooperatives are involved in the processing, packaging and/or distributing of commodities produced by the cooperative farmer-members. The cooperative's operations and marketing of products have been a means of helping producers stabilize income and provide financial security.

An NGC is a fairly new type of cooperative created for farmers to achieve the same goals as a traditional cooperative, but have been known to integrate characteristics

of corporations and other organizational structures. Traditional cooperatives, like NGCs, have members who take active roles in the cooperatives. These members benefit by owning part of the cooperative, having control over investment through voting rights, and sharing in profits distributed in proportion to patronage or residual earnings from market transactions the cooperative undertakes. As for control in the cooperative through the holding of voting rights, NGCs maintain the traditional cooperative democracy allocating one vote to one member. NGCs are more restrictive than traditional cooperatives (Coltrain, Barton and Boland, 2000) and generally have three basic distinctive features, as described next.

2.1.1 Delivery rights are tied to member equity share purchases.

The purchase of one equity share allows the producer/member to deliver a set amount of their commodity to the cooperative (Fulton, 2000). This implies that the greater the number of shares that are purchased by a producer, the greater amount of the associated commodity they are entitled to deliver to the cooperative. This also entitles them to a greater share of patronage-based net income. As well, the cooperative is required to accept the delivery from the farmer based on production standards outlined in the delivery contract (Stefanson and Fulton, 1997). If the person does not meet their delivery obligation, they will be required to either purchase the product from elsewhere to meet the delivery requirement, or the money needed to purchase the product will be removed from the producer's equity account. However, a potential patronage refund helps to encourage full and timely delivery of product to the cooperative.

2.1.2. Closed (or restricted) membership.

Membership in an NGC is restricted only to producers who have purchased shares from a fixed pool of available shares (Centre for the Study of Co-operatives, 2001). Closed membership is often advantageous for this type of cooperative because the producers who are able to purchase shares also have the ability to consistently deliver the specified quantity and quality of the required commodity to the cooperative (Triple R CFDC, 2001). The closed membership in structures also provides a potential for the shares to appreciate in value, and helps to eliminate the free-rider problem that would occur in traditional cooperatives.

The total number of equity shares that are available and offered for sale is based upon the optimal processing capacity of the facility. Each NGC plant constructed is built with a certain yearly production capability and this determines the number of membership shares available for purchasing by potential producer/members. The number of membership shares available for purchase has a fixed amount of commodity allocated to each membership share purchased, which, when multiplied by the shares available for purchasing, will equal the production capability of the plant. For example, if an ethanol plant is being constructed to produce 40,000,000 gallons of ethanol, it would require approximately 15,000,000 bushels of feed wheat annually in order to produce at the plant's production capability (Green Car Congress, 2005). In this scenario, one share could require the delivery of 2,500 bushels of feedwheat to the ethanol facility, which would require the NGC to sell 6,000 delivery shares to producers.

The shares sold are the means of financing the equity portion (approximately 30 to 50 percent) of the NGCs (Fulton, 2000). The cooperative then sells this pre-

determined, limited number of shares to potential producer/members. After these shares are distributed and the plant production capacity is yielded by having all of the membership shares sold, the membership to the cooperative is closed and shares can no longer be bought or sold freely. At this point, delivery is also restricted to members. Even though shares can no longer be bought or sold, they can be traded with permission from the board of directors (Triple R CFDC, 2001).

2.1.3 High levels of equity investment required by members

The producers who wish to become members and be able to deliver their commodity to the cooperative must purchase equity shares (Stefanson and Fulton, 1997). This requires up-front funding, and depending on the amount of the commodity they are willing to commit to deliver to an NGC, this can be a large amount of equity. When an NGC is successful and earnings are relized, a certain portion of the profits are reinvested in the cooperative (for maintenance, assets, expansion, etc.) while the other portion is distributed to members as patronage refunds. These patronage refunds can be given out as cash dividends or retained in the patron member's equity account. Though there is a large equity requirement, the cash patronage refunds to NGC producer-members are generally quite a bit higher (65-85%) than traditional cooperatives (20-35%), (Coltrain, Barton and Boland, 2000).

As previously noted, there is a large amount of equity required for NGC plant construction. For this reason, there are different types of equity shares that the cooperative has the option to issue: membership shares, investment (preferred stock) shares and preferred investment shares. For this reason, an NGC will often have both

types of investment shares for sale in addition to the membership shares. Preferred investment shares are shares that allow producers to deliver commodity to the NGC. These share prices are non-par and are set according to financial needs of the cooperative. Due to the fact that NGCs have closed membership, often the capital that is raised from the preferred investment shares alone is not enough. This is why Manitoba NGCs offer additional types of shares. Membership shares are par-value shares required for gaining voting rights and earning limited return on investment capital. Non-producer-members who are looking at diversification strategies while maintaining an active role in an NGC may consider this potential investment opportunity and have the opportunity to purchase membership shares. Investment (preferred stock) shareholders are the third type of share offered by NGCs in Manitoba, allowing non-producers to invest in the cooperative while not maintaining an active role. Investment (preferred stock) shareholders are guaranteed a fixed rate of return, while supporting rural economic development of their communities by creating jobs and encouraging financial gains for local farmers (Centre for the Study of Co-operatives, 2001).

2.2 Models for Cooperative, NGC and Off-farm Investment

Puaha and Tilley (2003) studied investment decisions in NGCs and value-adding processing cooperatives. Factor analysis and the tobit procedure were combined in order to determine the effects of farm and producer characteristics on the producer investment decision pertaining to value-adding NGCs. More specifically, the study was performed to determine the effects of monetary and non-monetary variables of NGC members and non-members on the cooperative investment decision. If producers were more familiar

with value-added processing cooperatives, were receiving a tax credit for their investment and are full-time farmers, they were more willing to invest in the cooperative. It was also found if producers believe the NGC will create social and non-monetary benefits, then they were more likely to invest. However, producers who live further away from where the cooperative was located, were also employed off-farm and wanted a lower-risk investment were less willing to invest.

Jensen et al. (2003) studied the willingness of producers to invest in a new generation biodiesel cooperative. A probit model was used to determine which factors affect a producer's willingness to join the biodiesel cooperative, while a tobit model was applied in order to estimate potential share purchases in the NGC. In estimating the probit model it was found that if producers had a college education and had on-farm storage for commodities produced on their farms, then they were more willing to invest in an NGC. If producers felt less positive about the potential of biodiesel markets, were over the age of 65 and not debt free, then they were less likely to invest. In estimating the tobit model it was found that producers with higher incomes were willing to purchase a greater number of shares in the cooperative. If farmers expected minimal returns from the biodiesel facility, then they were less likely to purchase shares in the cooperative. Also, if more than half of a producer's income came from an off-farm source and if the producer lived in a western (grain-producing) region in the state then they were also less likely to purchase shares in the NGC.

LaDue, Miller and Kwiatkowski (1991) studied producer investment behaviour and the potential for expansion in the farm business enterprise. Ordinal logit models were employed in order to analyze investment behaviour and the probabilities of the

producer making an investment. The study was carried out to ascertain which characteristics affect the investment behaviour of farmers. It was found that when producers had a higher gross income and were of a lower age, they were more likely to make an investment towards expanding their farm operation. It was stated that as older farmers near or reach the age of retirement, there was a tendency for those farmers to shy away from new investments.

Davis and Patrick (1998) studied influences on off-farm investment decisions. Tobit models were used in order to investigate which variables would have a significant effect on off-farm investment; one was designed to estimate the effect of specified variables on the percentage of total investment in off-farm assets, the next estimated the effect of specified variables on the level of total investment in off-farm assets. It was found that if a producer was educated, had a higher net worth (or had greater amounts of equity that they were able to invest), was already involved with off-farm ventures and was a livestock producer, then they were more likely to have a higher percentage of off-farm investment. On the other hand, if the producer was older and/or if they had higher levels of debt, then they were less likely to have a higher percentage of off-farm investment. It was found that if a producer had a higher net worth and some sort of off-farm involvement, then they were more likely to have a higher level of off-farm investment as well. Additionally, if a producer was farming a higher number of acres and was of a younger age, then they were more likely to have a higher level of investment in off-farm ventures.

Aramyan, Lansink and Verstegen (2005) studied the investments in energy-saving technologies by Dutch greenhouse farm owners. The probit model was combined with a

truncated regression model in order to estimate two different decisions: whether or not they were willing to make the decision to invest and, if the decision was to invest, what the level of investment will be. They found that numerous variables had a positive and significant effect on the probability a farmer would invest in the energy-saving systems; a larger farm, a larger family, an available farm successor, higher solvency, and the implementation of modern equipment. It was found that if the level of labor was higher and there was capital already invested in energy installations then there was an increase in the level of investments that an individual makes.

Isengildina and Hudson (2001) studied the cotton industry and the factors that affect the adoption of hedging decisions. A multinomial logit model was used in order to find the probability of adopting alternative marketing strategies; direct hedging decisions, such as futures and/or options, indirect hedging, such as pools or marketing contracts and cash markets. They found that the variables that were positive and significant on the probability of producers choosing direct hedging over other marketing strategies were risk-aversion, farm size and the purchase of crop insurance. Direct hedging selection was inversely related to the amount of income received by government payment and the agreement with the statement that the producer had the preference of alternative risk management measures as opposed to hedging. They also found that the variables directly related to the probability that farmers would choose indirect hedging (cooperative marketing pools or forward contracts) were the size of the farm and the agreement with a statement that pools netted the producers a higher price than they would receive in a cash market. Agreement with a statement that there was preference of risk management measures as an alternative to hedging was also positively related to

choosing indirect hedging practices. Isengildina and Hudson (2001) also used marginal effects to show the probability of choosing one marketing strategy instead of the others. The marginal effects used the means of the independent variables to show that the probability of choosing indirect hedging was the greatest, followed by cash sales and direct hedging.

Chapter 3: Theory & Empirical Model Development

The decision by a producer to invest in a new generation cooperative is complex. When making this decision, producers are actually faced with three component decisions: the capital budgeting decision, the social capital investment decision and the off-farm investment decision. NGC investment is characterized by requiring producers to provide a one-time outlay of capital up-front, which is the focus of capital budgeting decisions. Whether or not the capital investment fits into the producer's business plan and investment portfolio is also an issue. The characteristics of the off-farm investment and whether it possesses the desired risk and return of the producer will be factors in the investment decision. At the same time, producers are pooling their resources with others in an attempt to capture value-added benefits the cooperative creates. This relationship created by the interaction with other producers demonstrates that the investment is one for which social capital theory can be applied.

Individual component decisions cannot be made without taking into consideration the dynamics of the additional decisions. This is because the ultimate decision to invest requires a significant commitment of monetary resources. In order to develop a model of producer investment in a new generation cooperative structure, theories pertaining to each component decision must be discussed with respect to their relevance to the overall cooperative investment decision. First, capital budgeting theory will be defined, as will support for the application of the theory. Next, the description and application of social capital theory will be outlined. As well, in order to model the off-farm investment decision, portfolio theory and its application will be discussed. In the model development section, arguments for inclusion each variable to be included in the model

will be given along with the hypotheses that can be drawn. Human capital theory will also be discussed as studies have shown that personal characteristics and resources of an individual have an effect on the outcome of the investment decision (Davis and Patrick, 1998; Jensen et al., 2003; Olson, Kibbe and Goreham, 1998; Puaha and Tilley, 2003; Aramyan, Lansink and Versetegen, 2005; Isengildina and Hudson, 2001; Zeuli and King, 2004). Social capital theory and human capital are the two most common types of capital and are often discussed together as there can often be found a relationship between the two (Lin, 2001). However, their applications will be discussed separately in this chapter to see the different effects of each.

3.1 Capital Budgeting Theory

A capital asset investment is one for which a one-time outlay of capital is required for an asset that may be retained for several years (Olson, 2004). A share purchase in an NGC may fit into this classification because of this sizeable capital requirement. When faced with the decision of whether or not to invest in potential capital projects and/or assets, capital budgeting is the decision tool the financial manager or producer will employ. This procedure determines whether or not an investment fits into a producer's business plan and whether the investment is worthwhile. Generally, capital budgeting decisions are for long-term investments for which funding is required at the time of investment. When a producer is expending capital for investment in an NGC, they are purchasing shares that fund the establishment of the structure while reserving the right to deliver commodity to the NGC (Fulton, 2000). According to Bromwich (1976), investment decisions, such as the decision to invest in a plant, are the focuses of capital

budgeting. Therefore, capital budgeting theory can be reasonably applied to the NGC investment decision.

The initial step the producer takes in the capital budgeting process is the analysis and consideration of different investment opportunities. When individuals are researching prospective investment opportunities, it is of benefit to have comparable business models. King (2001) states that lessons learned in the establishment of one NGC can benefit other potential NGCs. Organizational information, along with how the structure is effectively being managed and run after formation, is important. Therefore, when an individual is deciding upon investment in an NGC, it is imperative that they have information pertaining to structures operating under NGC format. Extensive knowledge of individual NGCs and how this type of cooperative has created success is of significant importance for the researching investor (King, 2001).

If a producer is investing capital in an NGC, they need to be aware of the successful cooperatives and how these cooperatives have created this desired level of success. In order for a producer's agricultural and marketing cooperatives to succeed, they need to stay informed about success factors that have an effect on them (Goldsmith et al, 2001). As a result, if a producer knows about a greater number of successful Canadian NGCs, they will be more willing to invest in an NGC that is being constructed to process a commodity grown on their farm. This leads to the following hypothesis:

H_1: A farmer's knowledge of successful NGCs will be positively related to their willingness-to-invest in an NGC.

In the case of NGC investment, the resources the producer seeks return on are both the commodities being delivered to the NGC and the capital investment

requirement, for their share of the NGC's value-added returned from processing the commodity delivered. Up-front financial resources must be provided and/or acquired for the exchange of shares in the cooperative. Depending on the amount of the commodity a producer is willing to commit to deliver to an NGC, this can be a large sum. The traditional steps of firm-employed capital budgeting decisions involve examining alternative investment strategies and assessing economic feasibility (Olson, 2004). Producers have business plans and portfolios to take into consideration, and their business plans contain specific goals that they would like to achieve and limitations that have the potential to negatively influence an investment decision (Barry, 2000). For example, a goal might be investment in an NGC project, but a limitation might be the funds available for the financing of the project. Therefore, the producer is simultaneously faced with deciding whether or not to invest in a project, and based on their current financial position, whether or not to borrow funds to finance the project (Bromwich, 1976). Aramyan, Lansink and Verstegen (2005) assert that even if the investment appears to be profitable, the investment will not be made if the producer is not in good financial standing. It has been found that when producers have a higher net worth (or more equity capital that they have available for investment) they will be more likely to have a higher percentage of their assets invested off-farm (Davis and Patrick, 1998). As a result, it is reasonable to have a farm's net cash income included in an empirical model, and the following hypothesis can then be tested:

> *H_2: A farm's net cash income will be positively related to a producer's willingness-to-invest in an NGC.*

3.2 Social Capital Theory

When a producer is investing capital in an NGC, they are knowingly pooling their resources with other producers and individuals in order to capture value-added profits (Coltrain, Barton and Boland, 2000). This interaction with and dependence on fellow producers creates a social bond between them. Therefore, not only are the producers making a significant investment towards the capital asset but they are investing in the social relationship between themselves and others. Robison, Schmid and Siles (2002) state that social capital can be generated by combining resources or by creating relationships, between individuals, that are mutually advantageous. Social capital can so be defined as being the investment in relationships with the goal of obtaining a certain return in the marketplace (Lin, 2001). Therefore, the NGC investment decision can be viewed as a social capital investment decision.

Lin (2001) states that when a person has access to better information about social resources, then it will lead to the production of a greater amount of social capital as well. A producer's knowledge of the NGC structure would be an influence at any stage of the decision-making process. If a farmer has been educated about NGCs, it could be expected to have an impact on the outcome of the investment decision. These assets may lead to a producer being more comfortable with the investment and more confident that the investment will achieve personal goals. It has been shown that producers more familiar with cooperatives have a higher probability of investing in a cooperative venture (Puaha and Tilley, 2003). The following hypothesis arises as a result:

H_3: A producer's knowledge about NGCs will be positively related to their willingness-to-invest in an NGC.

If a producer is initially approached by someone with information about a potential NGC investment, then it will have an effect on whether or not the producer accepts the investment in question. If a producer does not have the knowledge about a potential investment opportunity, then they are not actually given the choice of whether or not to invest. If a farmer has been educated about NGCs or if they have been approached about joining an NGC, it will have an impact on the outcome of the investment decision at any stage of the decision-making process. If a producer has been approached by someone involved in starting up an NGC, then it is hypothesized that they will more likely be willing to invest or commit commodity to the potential NGC. Social capital theory suggests that this interaction among individuals tends to create social connections and these social assets may lead to producers having more positive views and attitudes toward NGCs. A positive attitude is associated with being more comfortable with the investment and more confident that the investment will achieve personal goals. Manuel, Hurley and Phillips (1978) found that a positive attitude toward cooperative entities resulted from educating producers about cooperatives through member relations programs and through positive experiences with the cooperative. Further, Puaha and Tilley (2003) found that 73% of NGC members stated that when initially investing in an NGC, they were approached by people they knew who were involved in organizing the structure, while 61% of non-members stated that they were not. This suggests that a higher percentage of producers that joined the cooperative and became members were approached by individuals about the venture.

H_4: Having been approached about joining an NGC will be positively related to a producer's willingness-to-invest in an NGC.

Lin (2001) explains that an individual invests in social capital in order to maintain or gain resources of value. There are three main resources to which the investor is looking to have greater access, or as mentioned, to obtain a specified return on. These three resources are wealth, power and reputation, and show the investor's desire to access economic assets, political assets and social assets, respectively (Lin, 2001). It is also theorized that individuals who hold higher positions in social networks tend to accumulate these resources at a higher rate than individuals who hold a lower position, and they also tend to occupy high positions when involved with other resources as well. For example, if a potential producer/investor has greater access to economic assets, then they are also likely to have greater access to social assets.

This theory is parallel to firm-employed capital budgeting theory, which reasons that an investment might be profitable, but not feasible because of a lack of financial resources (Olson, 2004). Therefore, whether an investment will be considered will be dependent on whether or not the producer has the funding to undertake such an endeavour. As mentioned, even if an investment seems to be profitable, if the producer is not in good financial standing, then the investment will not be made (Aramyan, Lansink and Verstegen, 2005). It has been found that if a producer has more money available for investment, and has a higher proficiency for paying off debt, then the farmer will be more likely to make investments (Aramyan, Lansink and Verstegen, 2005). Another study found that when producers were approached about investment in an NGC, it was the producers with higher farm incomes who were more likely to purchase a greater number of shares in the cooperative (Jensen et al, 2003). Also, if farmers were members of NGCs, they tended to have higher farm net cash incomes compared to those individuals

that were non-members (Olson, Kibbe and Goreham, 1998). Therefore, the support for H_2 (above) which includes a farm's net cash income in an empirical model can also be shown under the social capital theory application.

It is also hypothesized that if a producer is already involved in marketing commodities under contract, they will be more likely to participate in an NGC. A producer is required to supply product to the NGC based on production standards outlined in a delivery contract (Stefanson and Fulton, 1997). Forward production contracts are similar in that they outline the production standards according to requirements of the contracting firm (Olson, 2004). Producers involved in contracts may be more familiar with the type of social relationship and with the type of commitment that goes along with the contract commodity requirements. Although contract farming is risk-limiting and low capital when compared to an NGC investment which is known to be a little riskier, a positive relationship has been shown between contract farmers and their willingness-to-invest in value-adding cooperatives (Puaha and Tilley, 2003). Also, it has been found that producers are more likely to choose a cooperative or forward contract when they feel they can get a higher price as opposed to the price they could get in a cash market (Isengildina and Hudson, 2001). As a result, the following can be formulated:

> *H_5: A producer's production of a commodity under contract will be positively related to their willingness-to-invest in an NGC.*

3.3 Portfolio Theory

A portfolio is a compilation of assets owned by an investor, be it an individual or a company. Portfolio theory attempts to find the optimal combination of these

investments according to the goals of the individual producer/investor. Generally, a producer will have a minimum annual expected rate of return in mind, but also a maximum level of risk they are willing to bear when the taking an investment into consideration. The goals are set according to these desired risk and return levels, but are also based on the other types of investments the producer holds. The off-farm investment decision gives producers the opportunity to diversify their portfolios by investing in alternative assets (Davis and Patrick, 1998). An NGC gives producers the opportunity to invest in an alternative asset: the processing facility itself. Therefore, the NGC investment should be viewed in part as an off-farm investment decision.

While the investment itself is in the capital asset, the investment simultaneously gives the producer an opportunity for portfolio diversification. Generally when the producer is setting goals according to desired risk and return levels, their portfolio will specify the minimum rate of return. Individual investments in social capital are made with a personal expected return, as the combination of all returns benefits the cooperative organization (Lin, 2001). It has been found that members of NGCs believe that the rates of return, or the return on their investment, in the cooperative are similar to or slightly higher than other investments while non-members tend to believe that these rates of return are slightly lower than alternative investments (Olson, Kibbe and Goreham, 1998). In Manitoba, where it is assumed that a majority of producers are not members of NGCs, it is reasonable to theorize that a producer who requires a higher rate of return will be less likely to invest in an NGC. On the other hand, it has been found that individuals are more likely to invest in NGCs over alternative marketing methods because they believe that pools will help them receive a higher price than they would receive in the

cash market (Isengildina and Hudson, 2001). It has also been shown that producers who are investors in NGCs are optimistic about the cooperative's ability to increase income or return on the investment (Cobia, 1997). Therefore, it is reasonable to hypothesize that if producer's expected rate of return required on their monetary investment in a cooperative is higher, then a higher monetary investment will be made. This is restated below in the sixth hypothesis:

> *H_6: A producer's expected rate of return required on the investment will be negatively related to their willingness-to-invest in an NGC, but positively related to their potential monetary investment in an NGC.*

The portfolio of a producer, in addition to the desired rate of return, also includes the maximum amount of risk that the producer can bear. It has been shown that producers prefer to have an investment that is low in risk (Puaha and Tilley, 2003) and that members of NGCs, when compared to non-members, tend to believe strongly that there is a reduced amount of risk associated with cooperative membership (Cobia, 1997). Zeuli and King (2004) found that farmers' risk-aversion levels tend to be a factor in deciding whether or not to participate in an NGC. It was also found that there is a positive association between risk-aversion levels and producers' probability of being involved in indirect hedging with cooperative pools or forward contract marketing strategies rather than direct hedging methods such as futures and options (Isengildina and Hudson, 2001). However, NGCs have been shown to be more risky investments as opposed to risk-reducing strategies. Therefore, it is reasonable to hypothesize (H_7) that a producer who is less willing to invest may feel that having low risk associated with their

investment be more important than a producer who is less willing to make an NGC investment.

H_7: A producer's level of risk-aversion will be negatively related to their willingness-to-invest in an NGC.

3.4 Human Capital Theory and Demographics

Human capital is defined as personal resources that reside in and/or can be further acquired by the individual decision-maker (Robison, Schmid and Siles, 2002). These resources can be of physical nature, such as money, inherent nature, such as education or skill, or of a symbolic nature, such as a diploma. Demographics are the descriptive characteristics of populations or a portion of the population. Often demographics are attributes found in each individual in the population and can be generalized to groups of people or the entire population. Examples of demographic attributes are age, gender, and income. These attributes are also resources that reside in or can be obtained by an individual producer, so human capital and demographics will be discussed together in this section. Farmers with characteristics such as youth, education, and a greater number of assets are a new wave of farmers who are looking for alternative and more profitable marketing options as compared to traditional selling practices. They are not satisfied with current structures and are looking for new ways to add value to commodities that they are currently producing (Olson, Kibbe and Goreham, 1998).

It is stated that human capital tends to induce social capital in because when individuals are trained and educated at a higher level, they are more likely to be socially elevated (Lin, 2001). Therefore it can be hypothesized that a producer's education will

be positively associated with a producer's willingness to undertake social capital investments such as an NGC investment. Education has been shown to have a positive effect on their willingness to invest in off-farm ventures (Davis and Patrick, 1998). Further, it has been shown that farmers who have received a college education have had a higher likelihood of joining an NGC (Jensen et al, 2003).

H_8: A farmer's level of education will be positively related to a producer's willingness-to-invest in an NGC.

It is also hypothesized that age will be negatively associated with investment in an NGC. It is expected that younger farmers will be more likely make investments as they have a longer period over which they can distribute future costs and/or benefits (Aramyan, Lansink and Verstegen, 2005). Age has been shown to effect the decision to undertake alternative off-farm investments. Davis and Patrick (1998) found that older producers were less likely to have a high percentage of their total assets invested in off-farm assets. Not only has age been shown to have an effect off-farm investment in general, but it has been shown that producers over a certain age were less likely to be willing to invest in NGCs (Jensen et al, 2003). As well, members of NGCs have been found to be younger than producers who are not NGC members (Olson, Kibbe and Goreham, 1998).

H_9: A farmer's age will be negatively related to a producer's willingness-to-invest in an NGC.

It is assumed the producers with larger farms might make investment decisions differently than producers with smaller farms because larger farms have families that tend to rely more heavily on farm income than smaller farms (AAFC, 2000). It has been

shown that if producers have larger farms then they were more willing to make the decision to invest (Aramyan, Lansink and Verstegen, 2005). Another study concluded that producers that farmed a higher number of acres were more likely to have a high percentage of their total investments in off-farm assets (Davis and Patrick, 1998). Isengildina and Hudson (2001) found that as farm size increased, the probability of selecting pools or forwarding contracts increased as well. Larger producers have been found to make the majority of investment in NGCs as these producers are usually the first to purchase the limited number of shares (Zeuli and King, 2004). Therefore, it can be reasoned that producers that have larger farms (farm a greater number of acres) may be more likely to invest in a potential NGC. This hypothesis is restated below in the tenth and final hypothesis (H_{10}).

> *H_{10}: Farm size will be positively related to a producer's willingness-to-invest in an NGC.*

Chapter 4: Data Analysis

This chapter presents data collection methods and outlines the distribution method of surveys to Manitoba farmers, including incentives and survey follow-up methods. The sampling frame, sample size and population of interest are then presented. Next, the survey is outlined with reference to Appendix B. Finally, survey data and charts summarizing the data collected are presented and discussed briefly.

4.1 Data Collection

Agricultural producers in Manitoba were surveyed to determine their knowledge of NGCs, their investment interests and strategies, and their farm and various demographic characteristics. The questionnaire was delivered to each individual within the following sampling frame: the survey instrument was included in the Manitoba Co-operator, a weekly farm newspaper that is received by virtually every Manitoba farmer. An envelope upon which was printed the print "Fill out this Survey and Win" was included as an insert in the newspaper in an attempt to capture each subscription holder's attention. The questionnaire, cover letter (Appendix A), postage-paid reply envelope and entry ballot for newspaper subscription draws were contained in the package. The questionnaire shown in Appendix B was in pamphlet form and contained twenty-one questions. Both the questionnaire and cover letter assured producers that their personal information would be kept confidential. A draw for one of twenty subscriptions was promised to individuals as an incentive for responding to the survey. A reminder ad was placed in a subsequent issue of the newspaper, and later an article was written to inform

producers that they would still have time to send the questionnaire in and be eligible for the draw.

At the time of sampling, in the fall of 2006, the newspaper had 12,600 subscribers constituting a majority of the population of farmers in Manitoba. The goal was to achieve a relative balance of grain and livestock producers, the two main types of farm categories in Manitoba. Seven hundred and seventeen usable surveys were returned. The number of individuals that filled out the survey is a low proportion of the overall number of subscribers, but this is a common characteristic of questionnaires that are sent out through the mail in general (House, Gerber and McMichael, 1977). The questionnaire was distributed through an unconventional mailing method, and this might further explain the lower number of responses. Additionally, a low number of responses might be attributed to the time of year selected for mailing as farmers might have been carrying out fall fieldwork (Pennings, Irwin and Good, 1999).

4.2 Survey

The survey instrument can be found in Appendix B. Questions on the survey were intended to be used or to have the potential to serve as variables in econometric modeling. The first part of the survey poses questions about producers' self-assessed knowledge of, experience and familiarity with NGCs. Next, producers were faced with questions about their operations. Respondents are asked about farm type and commodities found on their farms as these provide demographic statistics. Whether the producers are producing commodities under contract was asked in order to determine what types of commitment requirements that they are already required to fulfill.

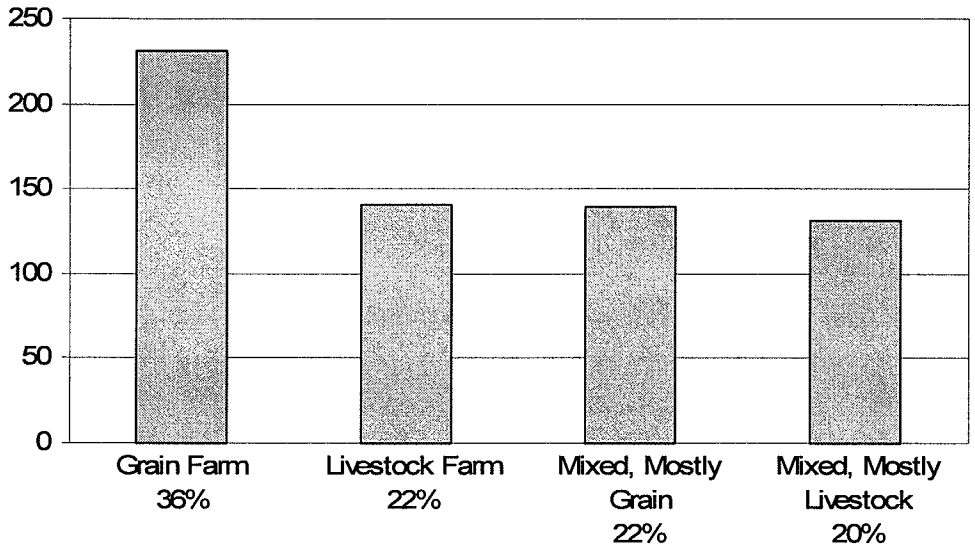
Respondents are then asked in which agricultural region in Manitoba their farm is located, followed by questions about income. They are asked what the farm's annual net cash income is as opposed to the total income for their household. The next section of the survey asks producers about their monetary assets, investments and their potential investment criteria. Questions are posed about off-farm investments, as well as factors that would influence potential investment opportunities.

The next part of the survey contains questions focused on potential NGC investment. Such a cooperative would hypothetically be constructed in order to process a commodity grown on the producer's farm. Questions on the survey were intended to be used or to have the potential to serve as dependent variables in econometric modeling. Respondents are asked to identify the probability with which they would be willing to invest in an NGC, potential share purchases for commodities grown on their farms, and requirements for potential NGC commitment. Producers are asked to specify how much they would be willing to pay for a share to be able to deliver the specified commodity to an NGC, and, at this price, how many shares they are willing to purchase. Finally, the survey closes with a series of demographic questions.

4.3 Survey Results

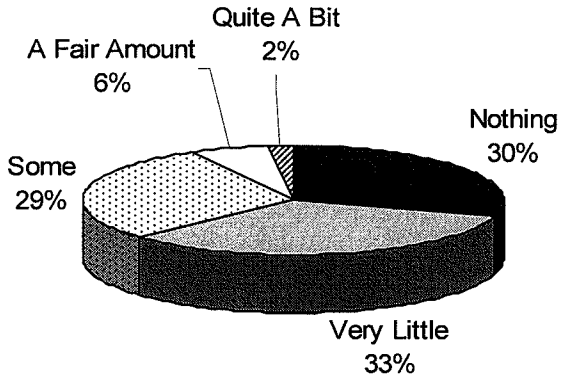
Producers were asked to select a response that best described and identified their farm. A majority (58%) of the respondents are producers that are running strictly or mostly grain farms, while 42% manage entirely livestock or mostly livestock operations. Although the majority of the respondents are producers from grain farms, the difference between the two producer groups was not large.

Figure 1. Distribution of Farm Types for Producer NGC Survey Respondents



The first question of the survey asked producers to self-assess their level of knowledge about NGCs. As Figure 1 shows, only 2% of producers admitted to knowing "Quite A Bit" about NGCs, while a mere 6% of producers know "A Fair Amount." Thirty percent of producers responded that they know "Nothing," and another 33% of producers answered that they have "Very Little" knowledge about NGCs. The remaining 29% of producers feel that they have "Some" knowledge about NGCs. It is important to note that over half of producers feel that they know quite little, one-third of producers know some and one-sixth of producers are quite knowledgeable regarding NGCs.

Figure 2. Producer Self-Assessments of NGC Knowledge: 1 = Know Nothing, 5 = Know a Great Deal



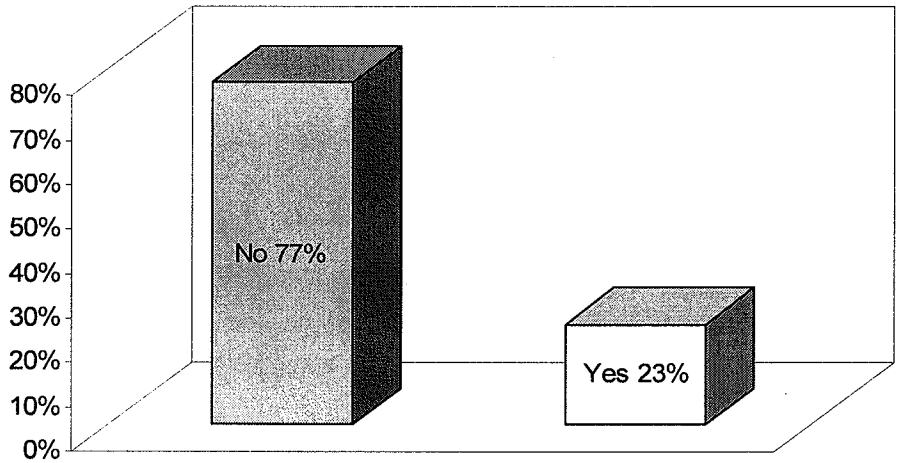
The following table displays the self-assessed knowledge of producers by farm type. It can be seen from Table 1 that an equal number of grain and livestock producers, 28%, feel that they know nothing about NGCs, while a greater percentage of livestock producers, 37%, feel they know very little about this type of structure when compared to grain producing respondents, 32%. Thirty-three percent of grain producers feel that they know something about NGCs, while only 26% of livestock producers responded in this way. This percentage of livestock producers was lower than the amount of farmers that feel that they know nothing about NGCs. A higher percentage of livestock producers, however, feel that they know a fair amount about NGCs than grain producers; 7% of livestock producers responded that they think they know a fair amount about NGCs, while 5% of grain producers did so. Additionally, an equal number of grain and livestock producers (2%) feel that they know quite a bit about NGCs. It should be noted that the largest percentage of livestock producers responded that they know very little, while the largest percentage of grain producers feel that they know more, or "some," about NGCs.

Table 1. Producer Self-Assessments of NGC Knowledge by Farm Type

	Knowledge About NGCs					
Type of Farm	Nothing	Very Little	Some	A Fair Amount	Quite A Bit	Row Totals
Grain	28%	32%	33%	5%	2%	100%
Livestock	28%	37%	26%	7%	2%	100%

Producers were asked to state whether they have been approached about joining an NGC. Figure 3 shows seventy-seven percent of producers having responded they have never been approached about joining an NGC, while 23% of producers have.

Figure 3. Proportion of Survey Respondents Approached About Joining an NGC



The following table is a break-down of each type of farm and whether they have been approached about joining an NGC. Table 2 shows that of the total grain producers that responded, 81% have not been approached about joining an NGC, while 19% of

them have. Seventy percent of all livestock producers have not been approached about joining an NGC, while 30% have. This shows that a higher percentage of livestock producers have been approached about joining an NGC when compared to grain producers.

Table 2. Proportion of Survey Respondents Approached About Joining an NGC by Farm Type.

	Approached About Joining an NGC		
Type of Farm	No	Yes	Row Totals
Grain	81%	19%	100%
Livestock	70%	30%	100%

For similar reasons, producers were also asked to demonstrate their knowledge about successful NGC establishment in Canada. Though there are currently around ten active NGCs in Canada, almost none would be considered "successful" compared to most found in the northern U.S. It should be noted that a producer's answer to this question may depend upon their definition of a successful cooperative. The "correct" answer would most likely be "1 to 3", or, if generous in the definition of success, "4 to 6." Figure 4 shows that the greatest percentage of respondents think that there are "10 or more" successful NGCs in Canada. The percentages for the responses "1 to 3" and "4 to 6" were evenly distributed, with 18% of each group. Only 8% of respondents think that there were 7 to 9 successful NGCs, while 17% of producers do not think that there are any successful NGCs in Canada.

Figure 4. Producer Responses of Number of Successful NGCs Operating in Canada

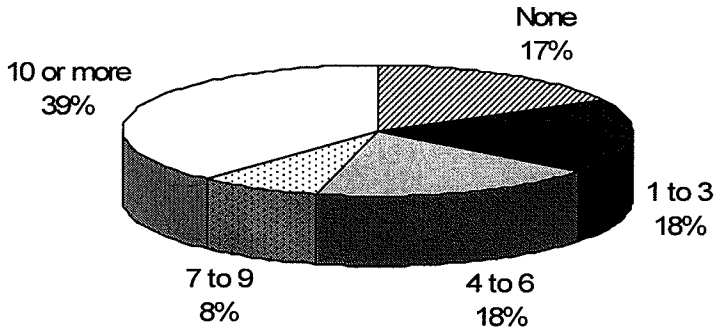


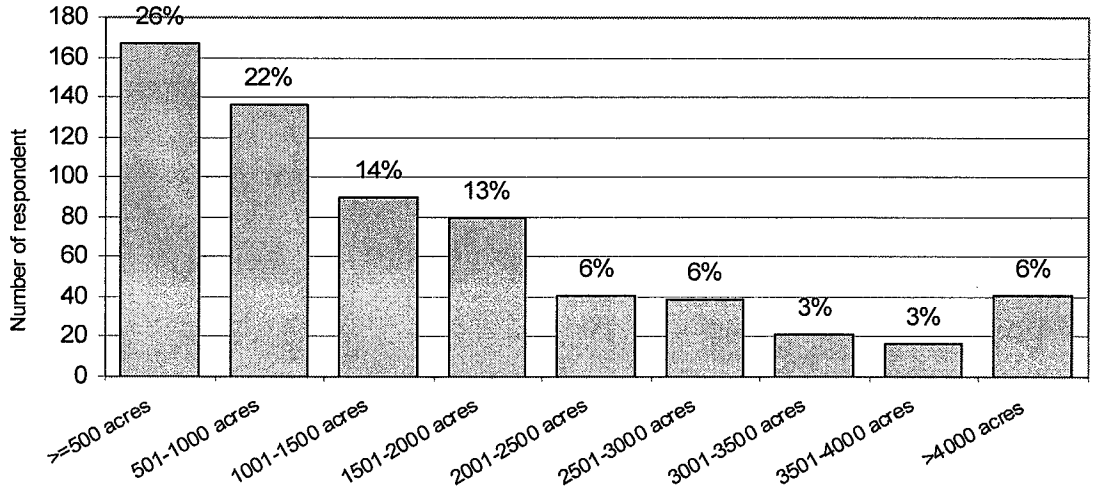
Table 3 shows the break-down of each type of farm and their estimates of how many successful NGCs there are in Canada. In both cases, whether individuals are from a grain or livestock farm, the largest percentage of individuals believe there are 10 or more NGCs in Canada. Forty percent of grain farmers believe in ten or more successful NGCs in Canada, while 37% of livestock producers hold the same assumption. Seventeen percent of grain producers and only 16% of livestock producers believe there are no successful NGCs in Canada. With the correct number falling in the range of "1 to 3" successful NGCs, a greater percentage of grain producers, 20%, think this is the correct estimate while 18% of livestock producers responded in this manner. In the close estimate of four to six successful NGCs, 20% of livestock producers believe there is this many while 18% of grain producers make this estimate. A greater percentage, 9%, of livestock operation respondents believe there are seven to nine successful NGCs in Canada, while only 6% of grain producers hold this assumption.

Table 3. Producer Responses of Number of Successful NGCs Operating in Canada by Farm Type

	Predicted Number of Successful NGCs In Canada					
Type of Farm	None	1 to 3	4 to 6	7 to 9	10 or More	Row Totals
Grain	17%	20%	18%	6%	40%	100%
Livestock	16%	18%	20%	9%	37%	100%

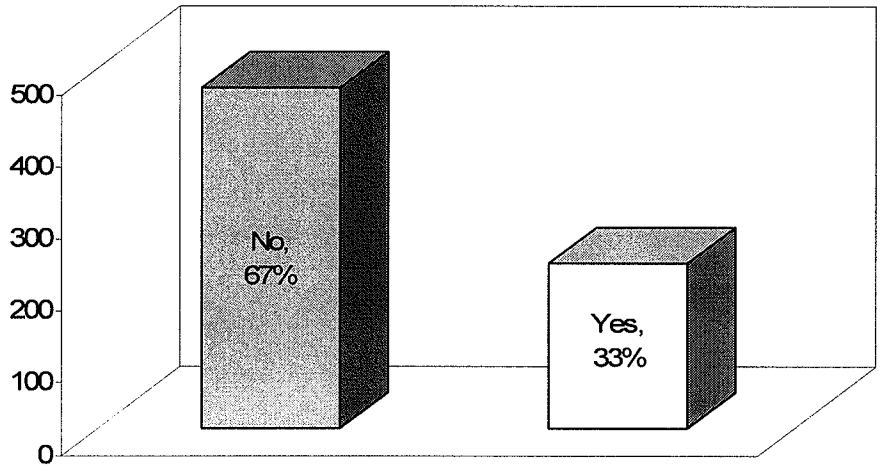
Producers were asked to state the total number of acres they farm in a typical year. It can be seen from Figure 5 that almost half of the producers normally farm 1,000 acres or less. The largest number of farmers (26%) cultivate 500 acres or less in a typical year, while the next largest group (22%) typically farm between five hundred and 1,000 acres or less. Although almost half of the producers are usually farming 1,000 acres or less, with the average farm size is found to be 1,575 acres.

Figure 5. Producer estimates for number of acres farmed in a typical year



Producers were also asked whether any of the commodities they are currently producing on their farm are contracted. In an NGC, a producer is required to supply a specified commodity as outlined in the delivery contract (Stefanson and Fulton, 1997). As shown in Figure 6, it was found that two thirds of producers do not produce commodities under contract; only one-third do so.

Figure 6. Producer Responses to Whether they Currently Produce Commodities Under Contract



The following table is a break-down of farm type by whether respondents are producing commodities under contract. Table 4 shows that of the 33% of producers currently producing commodities under contract, a considerable majority are grain farmers.

Table 4. Producer Responses to Whether they Currently Produce Commodities Under Contract by Farm Type.

	Production of Commodities Under Contract	
Type of Farm	No	Yes
Grain	45%	82%
Livestock	55%	18%
Column Totals	100%	100%

Respondents were also asked to select the category into which their farm's net cash income (after taxes) in a normal year falls. Figure 7 shows that the greatest percentage of producers represents farmers who have a net cash income falling within the median range of $10,000 to $24,999. It should be noted that 26% of farmers stated having an income lower than $9,999, while almost half of the respondents (47%) make over $25,000 in a normal year.

Figure 7. Producer's Farm Net Cash Income After Taxes

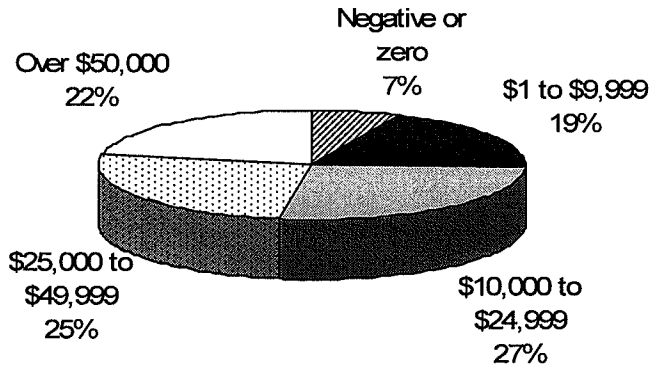


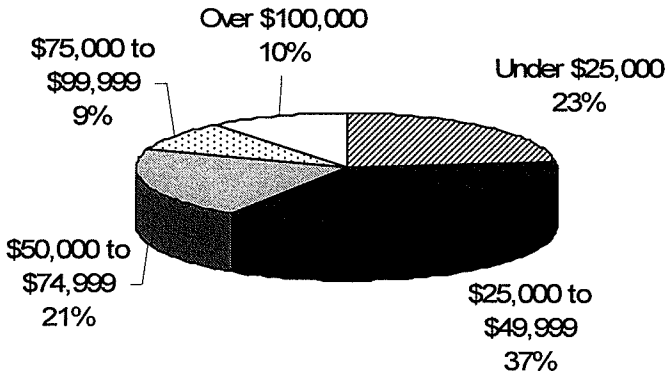
Table 5 shows the percentage of each farm's net cash income category by producer group. Interestingly, seventy-four percent of the 7% of producers who responded to having a negative or zero net cash income are livestock producers, while 70% of the producers that are making over $50,000 in a normal year are grain producers. The large percentage of livestock producers having negative or zero net cash income might be attributed to the introduction of Bovine Spongiform Encephalopathy (BSE) in 2005 still maintaining a negative affect on cattle prices.

Table 5. Producer's Farm Net Cash Income After Taxes by Farm Type

	Farm Net Cash Income				
Type of Farm	Negative or Zero	$1 to $9,999	$10,000 to $24,999	$25,000 to $49,999	Over $50,000
Grain	26%	44%	55%	62%	70%
Livestock	74%	56%	45%	38%	30%
Column Totals	100%	100%	100%	100%	100%

In addition to a producer's farm's net cash income, respondents were also asked what their total household income (after taxes) is in a normal year. Figure 8 below shows the responses to this question. A majority (60%) of the respondents make less than $49,999, while the smallest percentages of producers fall into the income categories above $75,000 a year.

Figure 8. Producer's Total Annual Household Income After Taxes



Producers were next asked about the non-farm investments they currently hold. Respondents were asked if they have stocks, bonds/GICs, mutual funds and/or non-farm real estate. Figure 9 shows the percentage of respondents who have investments in stocks. It can be seen that only 28% of producers have money invested in stocks.

Figure 9. Survey question: "Do you have stocks as a type of non-farm investment?"

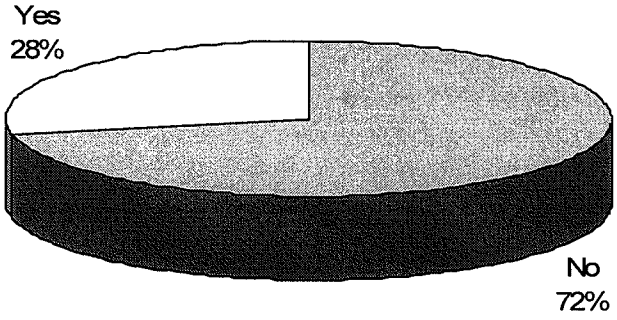
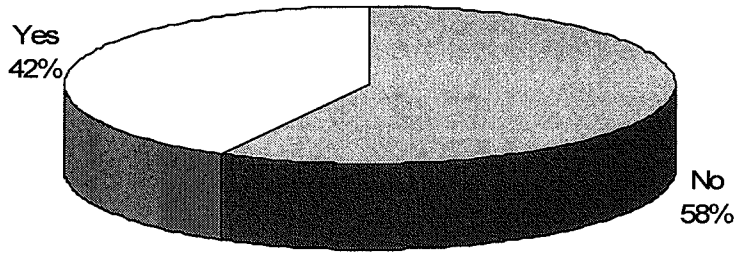


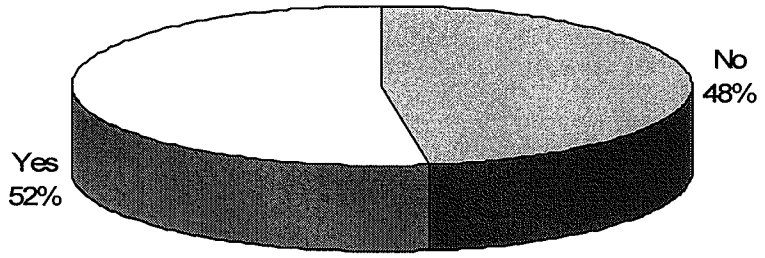
Figure 10 shows the percentage of respondents that currently have money invested in bonds/GICs. Twenty-eight percent of producers have non-farm investment in bonds/GICs, while 72% of producers do not have this type of investment.

Figure 10. Survey question: "Do you have bonds/GICs as a type of non-farm investment?"



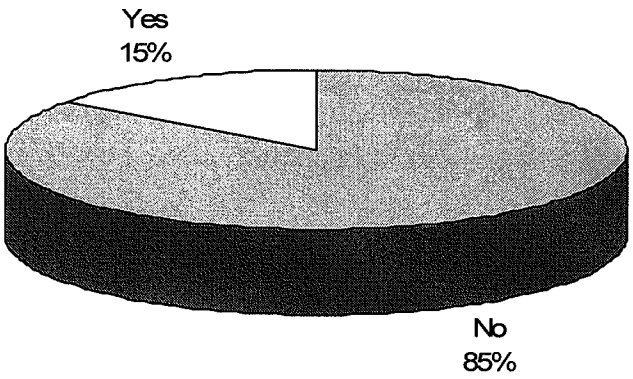
Producers were next asked to state whether they have mutual fund investments. The results are displayed below in Figure 11, which shows that the largest percentage of producers (52%) hold this type of non-farm investment.

Figure 11. Survey question: "Do you have mutual funds as a type of non-farm investment?"



Producers were also asked whether they have investment in non-farm real estate. The lowest percentage of producers, 14%, holds non-farm real estate as an off-farm investment. The results of this survey question are seen below in Figure 12.

Figure 12. Survey question: "Do you have non-farm real estate as a type of non-farm investment?"



The following question was asked in order to determine whether producers in Manitoba would be interested in investing in an NGC. The point of interest was whether

producers, if given the opportunity, would invest in an NGC for a commodity that was being grown on their farm if they found the business plan to be acceptable. The producer responses to the question are found in Figure 13. The greatest percentage (42%) of producers responded to being were "unsure" about the investment, while the next highest percentage (33%) showed a "somewhat high" interest of investing. The lowest percentage of producers (7%) responded that there would be a "very low" chance they would invest.

Figure 13. Producers' Willingness-to-Invest in an NGC

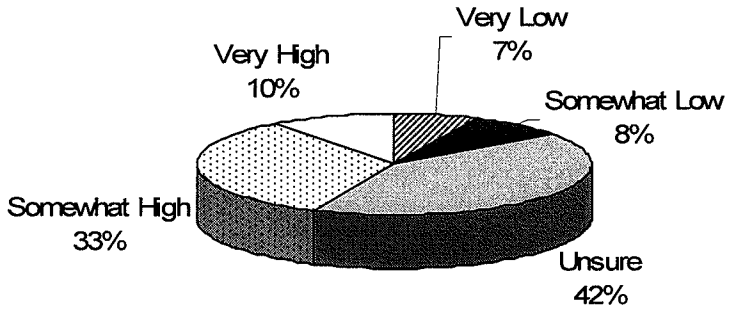


Table 6 shows 6% of grain producers responded in having a very low chance of investment, while the largest percentage of grain producers (40%) responded they are unsure of whether they would invest or not. However, the second highest percentage (36%) of grain producers responded that there is a somewhat high chance that they would invest in an NGC. For livestock producers as well, 6% responded there is a very low chance that they would invest, while the largest percentage (42%) responded they are unsure of whether they would invest or not. As with the grain producers, the second

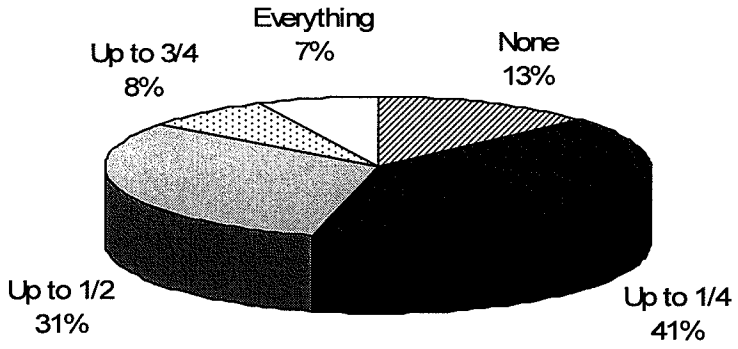
highest percentage (32%) of livestock producer responses falls in the "somewhat high" chance option of investment in an NGC. If the responses are grouped in terms of the grain producer having a "relatively low" chance of investing (grouping the very low, somewhat low and unsure responses) and compared to the grain producer having a "relatively high" chance of investing (grouping the somewhat high and very high responses), it can be seen that there is a 54% to 46% split. If the livestock respondents are grouped according to the same terms, there is a 57% to 43% split.

Table 6. Producers' Willingness-to-Invest in an NGC by Farm Type

	Chance of Investment					
Type of Farm	Very Low	Somewhat Low	Unsure	Somewhat High	Very High	Row Totals
Grain	6%	8%	40%	36%	10%	100%
Livestock	6%	9%	42%	32%	11%	100%
Overall	7%	8%	42%	33%	10%	100%

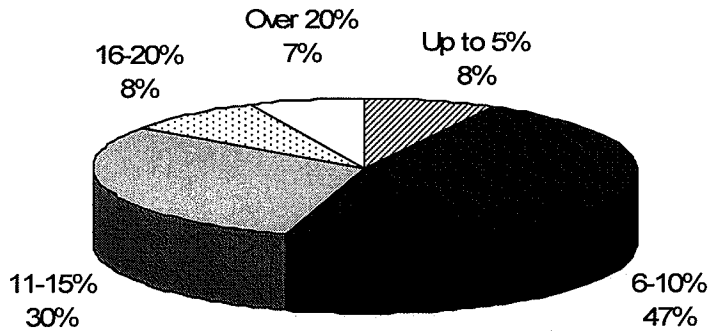
Producers were next asked what proportion of a commodity grown on their farm that they would be willing to commit to an NGC in order to help determine the level of interest in a potential Manitoba NGC. As seen in Figure 14 (13%) of producers stated they would commit nothing to the cooperative while the largest percentage, 41%, responded they would be willing to commit up to 1/4 of the commodity grown on their farm. Only 7% of producers, on the other hand, responded they would be willing to commit everything to the NGC.

Figure 14. Producer Responses for Proportion of Commodity Willingness-to-Commit to an NGC



As shown in Figure 15, almost half of the respondents (47%) believe a rate of return of 6-10% would be acceptable, while 30% feel that an 11-15% rate of return would be acceptable for them to make an investment. The lowest percentage of respondents, 7%, would require the NGC investment to yield over a 20% rate of return in order for the producer to invest.

Figure 15. Producers' Required Yearly Rate of Return on NGC Investment



4.4 Summary

This chapter began by presenting data collection methods and outlining the distribution method of the survey to farmers in Manitoba. The sampling frame was given, as well as the population of interest. Next, the survey was outlined with reference to Appendix B. Finally, survey data and charts summarizing these data were presented and interpreted.

Chapter 5: Methodology

This chapter describes the methods used to estimate Manitoba producers' NGC investment and commitment decisions. The ordered logit model is outlined with its application in the measurement of a producer's willingness-to-invest in an NGC. A second ordered logit model is used to model the potential proportion of commodity that a producer is willing to commit to an NGC. Then, the tobit model is used to model the amount of money that a producer would be willing to invest in an NGC. This dollar value is calculated from the stated willingness-to-pay for shares and the number of shares the producer would be willing to purchase in the potential NGC. NGC investment probability and commitment probability logit models were estimated using the LOGISTIC procedure in SAS, while NGC monetary investment tobit models were estimated using the QLIM procedure in SAS. The SAS syntax (code) is given in Appendix C. After these individual models are estimated, the data are separated and estimated according to operation type; grain operations and livestock operations. This process will determine whether there is a difference between the decision-making processes of producers within each type of operation group.

5.1 Definition of Variables

The following table shows the variables for the model. These were derived from the survey questions to which producers responded and the variables discussed in Chapter 3.

Table 7. Definition of Variables

Variable	Definition
INVEST	Likelihood of investment in an NGC 0=Very Low, 1=Somewhat Low, 2=Unsure, 3=Somewhat High, 4=Very High
COMMIT	Proportion of potential commodity commitment for an NGC 0=None, 1=Up to 1/4, 2=Up to 1/2, 3=Up to 3/4, 4=Everything
DOLLARS	Amount of money producers are willing to invest in an NGC
KNOW	Level of knowledge about NGCs 0=Nothing, 1=Very Little, 2=Some, 3=A Fair Amount, 4=Quite A Bit
APPROACH	1 if producer has been approached about joining an NGC; 0 otherwise
SUCCESS	Number of successful NGCs that the producer has knowledge of 0=None, 1=1 to 3, 2=4 to 6, 3=7 to 9, 4=10 or more
ACRES	Total acres farmed 0=0 to 999, 1=1000 to 1999, 2=2000 to 2999, 3=3000 to 3999, 4=4000+
CONTRACT	1 if producer produces commodities under contract; 0 otherwise
INCOME	Farm's net cash income 0=Negative or zero, 1=$1-$9,999, 2=$10,000-$24,999, 3=$25,000-$49,999, 4=$50,000+
RISK	Importance of having a low risk associated with investment 1=Very unimportant, 2=Somewhat unimportant, 3=No opinion, 4=Somewhat important, 5=Very important
RATEORET	Minimum yearly rate of return required for producer investment 0=Up to 5%, 1=6-10%, 2=11-15%, 3=16-20%, 4=Over 20%
AGE	1 if producer is over the age of 65; 0 otherwise
EDUC	Highest level of schooling completed by producer 0=Less than high school, 1=Finished high school, 2=Diploma/Techical college, 3=Finished university degree, 4=Master's degree or higher

5.2 Statistical Analysis: Ordered Logit

Logit models are discrete dependent variable models that describe the probability of an event's occurrence. When the probability that an event will occur is generated, the logit model estimates the probabilities using an interval of 0-1 without having them actually take on values of zero or one (Kennedy, 1998). The logit model is able to detect

causal or associative relationships between dependent and independent variables. The general model is an extension of the binary logit model and is built around, a latent regression model

$$y^* = \sum_{k=1}^{K} \beta_k x_k + \varepsilon, \tag{1}$$

where y is an unobservable or latent variable, β represents the vector of parameter estimates, x represents observations upon explanatory variables, and ε represents the error term which follows a symmetric distribution. The model's expectation is a linear combination of K (the subscript k runs from 1 to K), (Liao, 1994). In these models, the decision-maker is forced to make a choice between mutually exclusive alternatives, selecting one that is expected to yield the maximum utility. In the case of ordered logit, the response categories take on a natural ordering of low to high (Liao, 1994). In this study, the logit model is used to model the producer's choice to invest and choice of commitment level in a potential new generation cooperative in Manitoba. In both cases, the producers have the choice between five responses and therefore what is observed and takes the following term:

$$\begin{aligned} &y = 1 \text{ if } y^* \leq \mu_1 \ (=0) \\ &y = 2 \text{ if } \mu_1 < y^* \leq \mu_2 \\ &y = 3 \text{ if } \mu_2 < y^* \leq \mu_3 \\ &y = 4 \text{ if } \mu_3 < y^* \leq \mu_4 \\ &y = 5 \text{ if } \mu_4 < y^*, \end{aligned} \tag{2}$$

where y is observed in five ordered categories and the μs are unknown threshold parameters that are present to separate adjacent categories to be estimated by βs, the parameter estimates from equation (1).

The general logit model is illustrated below in equation (3), which shows the probability that the observed y falls into category j, while the μs and βs are to be estimated with the ordered logit model (Liao, 1994).

$$\text{Prob}\,(y=j) = F\left[\,\mu_j - \sum_{k=1}^{K}\beta_k x_k\,\right] - F\left[\,\mu_{j-1} - \sum_{k=1}^{K}\beta_k x_k\,\right] \qquad (3)$$

where the model utilizes the general cumulative distribution model, F, and the model's expectation is a linear combination of K (the subscript k runs from 1 to K).

A goal of this research is to discover what factors will increase or decrease the probability that a producer will invest in an NGC. In order to model this decision, individuals were asked to answer the following question to serve as a dependent variable: **Suppose you were approached about investing in an NGC that would process a commodity grown on your farm. If the business plan met your criteria, what are the chances that you would invest?**

The ordered logit model used to estimate this investment decision is:

$$\text{Prob}\,(\textit{INVEST} = \textit{Very Low}) = \text{logit}(\beta X) + \varepsilon, \qquad (4)$$

where X represents observations upon explanatory (or independent) variables, β represents the vector of parameter estimates and ε is the error term.

Producers were given the opportunity to respond to the investment question on the following ordered scale: very low, somewhat low, unsure, somewhat high or very high. The responses for the dependent variable follow a natural ordering of low to high. The

higher values in the responses correspond to a greater interest in NGC investment and a higher likelihood of investing. The probability that a producer will choose one of the alternative responses above another is determined by whether they believe they will derive greater utility from that alternative than they would from choosing otherwise (Kennedy, 1998). Therefore, if a producer thinks there is a very high chance they will obtain maximum utility by investing in an NGC, they will likely respond that their chances of investing in an NGC are very high as well.

The ordered logit investment model, when including the independent variables outlined in Table 9 is:

$$INVEST_i = \beta_1 + \beta_2 KNOW_i + \beta_3 APPROACH_i + \beta_4 SUCCESS_i + \beta_5 ACRES_i + \beta_6 CONTRACT_i + \beta_7 INCOME_i + \beta_8 RISK_i + \beta_9 RATEORET_i + \beta_{10} AGE_i + \beta_{11} EDUC_i + \varepsilon_i,$$

where $i = 1,\ldots,N$. (5)

For further analysis, the investment responses were filtered according to farm producer type in order to determine whether or not the type of farm effects the producer's investment decision and their probability of investing. Therefore, the independent variables *GINVEST* (grain producers) and *LINVEST* (livestock producers) were substituted for the independent variable, *INVEST*.

A second dependent variable was selected to represent the producer's commitment level. Individuals were asked to answer the following question:

What proportion of a commodity grown on your farm would you consider committing to an NGC?

The ordered logit model that is used to estimate this decision is:

$$\text{Prob}\,(COMMIT = None) = \text{logit}(\alpha X) + \varepsilon, \quad (6)$$

where X represents the explanatory (or independent) variables, μ represents the vector of parameter estimates and ε is the error term.

Producers were given the opportunity to respond to the commitment question on the following ordered scale: none, up to 1/4, up to 1/2, up to 3/4 or everything. The alternative responses for this dependent variable follow a natural ordering of low to high as well with the higher values corresponding to higher interest in NGC commitment and a higher likelihood of the producer committing to an NGC. Likewise, if a producer believes there is a high chance they will obtain maximum utility by committing a larger amount of their commodity to an NGC, then the producer will likely respond that their potential commitment to an NGC is higher.

The commitment responses were also filtered according to farm producer type in order to determine whether the type of farm affects the producer's commitment decision and their probability of committing to an NGC. Therefore, the independent variables *GCOMMIT* (grain producers) and *LCOMMIT* (livestock producers) were substituted for the independent variable, *COMMIT*.

The ordered logit commitment models, when including the independent variables outlined in Table 9, are:

$$\text{COMMIT}_i = \alpha_1 + \alpha_2\text{KNOW}_i + \alpha_3\text{APPROACH}_i + \alpha_4\text{SUCCESS}_i + \alpha_5\text{ACRES}_i + \alpha_6\text{CONTRACT}_i + \alpha_7\text{INCOME}_i + \alpha_8\text{RISK}_i + \alpha_9\text{RATEORET}_i + \alpha_{10}\text{AGE}_i + \alpha_{11}\text{EDUC}_i + \varepsilon_i,$$

where $i = 1,\ldots,N$. (7)

where variables are as described in Table 9.

5.3 Statistical Analysis: Tobit

The tobit model was designed to describe the relationship between a latent, non-negative dependent variable y_i and an independent variable (or a set of independent variables) x_i. As with the logit model, the tobit model requires a latent (unobservable) variable y_i which is linearly dependent on the independent variable x_i and parameter estimate(s) β (Tobin, 1958). As a result, these parameter estimates describe the relationship between y_i and x_i. The requirement of non-negativity (equation 8) on y_i states that y_i must be equal to the latent, dependent variable whenever it is greater than zero and will take the value of zero otherwise. This is written as

$$y_i = y_i^* \text{ for } y_i^* > 0$$

$$y_i = 0 \quad \text{for } y_i^* \leq 0, \qquad \text{where } i = 1,\ldots,N. \tag{8}$$

A tobit model is used to model the producer's potential monetary investment decision in this study. The tobit model should be used when the dependent variable is limited, a continuous dependent variable is present, or where a censored or truncated dependent variable occurs. In the case of a truncated sample, the values of the dependent variable cannot be seen when it takes on an unobservable (or negative) value (Kennedy, 1998). For example, in this study the tobit model is used to determine how much money a Manitoba producer would be willing to invest in an NGC. A negative dollar value representing a producer's willingness-to-invest is not permitted in the potential investment decision and therefore the model is truncated. Kennedy (1998) states that ignoring the observations where the dependent variable is censored or truncated would be wasting useful information. The tobit model uses these observations by expressing the function as a probability of getting each observation, in order to estimate probability and

potential dollar investment in an NGC. To model the producer's investment decision, individuals were asked to answer the following questions for the dependent variable:

What would you be willing to pay for each share?

How many shares would you likely purchase at the price you specified?

The tobit model used to estimate the producer's dollar-value investment decision is:

$$E(DOLLARS > 0) = \Phi((\gamma X)/\sigma) + \varepsilon, \quad (9)$$

where X represents the explanatory (or independent) variables, γ represents the vector of parameter estimates, σ is the standard deviation, and ε is the error term, which is assumed to be normally distributed (Φ).

The tobit model will look similar to the ordered logit models that were presented, but will have the following:

$$DOLLARS_i = DOLLARS_i^* \quad \text{for } DOLLARS_i^* > 0$$

$$DOLLARS_i = 0 \quad \text{for } DOLLARS_i^* \leq 0, \quad \text{where } i = 1,\ldots,N. \quad (10)$$

In equation 10, $DOLLARS_i^*$ represents the dollar amount that a producer would be willing to invest for the right to deliver a stated amount of a commodity ever year, while the $DOLLARS_i$ will be set equal to zero for those producers who did not show interest in investing. The tobit models, when including the independent variables outlined in Table 9, are:

$$DOLLARS_i = \gamma_1 + \gamma_2 KNOW_i + \gamma_3 APPROACH_i + \gamma_4 SUCCESS_i + \gamma_5 ACRES_i + \gamma_6 CONTRACT_i + \gamma_7 INCOME_i + \gamma_8 RISK_i + \gamma_9 ROR_i + \gamma_{10} AGE_i + \gamma_{11} EDUC_i + \varepsilon_i ,$$

$$\text{where } i = 1,\ldots,N. \quad (11)$$

where variables are as described in Table 9.

5.4 Statistical Analysis: Producer Profiles

Producer profiles were calculated in order to examine the effects on probabilities of each producer's willingness-to-invest in and willingness-to-commit to an NGC. These predicted probability percentages were calculated using the following formula:

$$P = \exp\{\beta_k x_k\} / 1 + \exp\{\beta_k x_k\}, \quad (12)$$

where the parameter estimates, β, from each model are input into the logit formulas along with corresponding independent variable x_i values. For example, in the general investment model the estimate for the self-assessed knowledge level of a producer is 0.408. The positive sign on the self-assessed knowledge level variable implies that if a producer thinks he/she knows a relatively greater amount about NGCs, then they are relatively more likely to be willing-to-invest. Therefore in an ideal situation, the producer that has a "very high" willingness-to-invest will know "quite a bit" about NGCs. The number that corresponds to the higher level of knowledge is then multiplied by the parameter estimate for the producer's willingness-to-invest and is then entered into the expression. This process is employed for each variable to yield a predicted probability percentage of the producer's willingness-to-invest and willingness-to-commit while presenting an "ideal" investor for NGCs. It should be noted that if the models will have different signs on the model variables, then they will have a different producer profiles or different "ideal" investors for NGCs.

Similar profiles were also created for producers' monetary investment decisions. These profiles were created for general, grain and livestock producers as well; however,

were calculated by using the parameter estimates in Table 22 in conjunction with Equation 9.

5.5 Statistical Analysis: Odds Ratios

Parameter estimates calculated by discrete choice models can be somewhat difficult to interpret (Isengildina and Hudson, 2001). Odds ratios are one of the most useful ways of interpreting a logit model (Liao, 1994). Odds ratios show the strength of the association between the dependent variable and each independent variable in a model while all other variables are held constant. The range of the odds ratio is from zero to infinity. An odds ratio of one indicates that there is no association between the dependent and independent variables or that the condition is just as likely in both groups (Declerq, 2001). In the general investment model, an odds ratio of one would indicate that the probability of a producer being willing to invest in an NGC would be the same for producers in both groups being compared. For example, an odds ratio of 0.998 (close to one) for the independent variable representing net cash income indicates that the ratio of the probability of a producer being willing to invest being very high to the probability of a producer being willing to invest being very low is very similar for producers with higher income and producers with a lower income. However, an odds ratio that is close to zero or infinity means that there is a large difference in likelihood. An odds ratio of greater than one means that there is a greater likelihood of the event occurring (Liao, 1994). Therefore, in the general investment model, an odds ratio of greater than one indicates that the odds of the probability of investment increases if there is a higher odds ratio and decreases if there is a lower odds ratio. For example, an odds ratio for the

producer's self-assessed level of knowledge compares the producers who have a higher level of self-assessed knowledge about NGCs with the producers that have a lower level while all other variables are held constant. So, an odds ratio of 1.506 for self-assessed knowledge level means for a one-unit increase in a producer's self-assessed knowledge, the odds of a producer having a higher probability of investment is 1.506 times greater than those individuals with a lower level of self-assessed knowledge about NGCs. On the other hand, if there is an odds ratio of less than one, there is a lower likelihood of the event occurring (Liao, 1994). In the investment model, the odds ratio for the age of an individual compares producers who are over the age of 65 with producers with those that are under the age of 65 while all other variables are held constant. An odds ratio of 0.576 for the age variable means that if a producer is over the age of 65 then the odds of the producer having a higher probability of investment is 0.576 times higher than the producers that are under the age of 65. It is imperative to state that while the odds ratio is meaningful, the confidence interval in which that odds ratio lays is of equal importance.

5.6 Statistical Analysis: Marginal Effects

Another way to interpret parameter estimates is by way of the model's marginal effects. Anderson and Newell (2003) state that the parameter estimates must be transformed in order to effectively determine the marginal effects of the independent variables. Marginal effects show the effect of a change in the independent variable on the probability of choice in the dependent variable. The marginal effects are calculated at the means of the independent variables, each marginal effect being the partial derivative of the probability of an event occurring, with respect to an individual independent variable

x_k (Liao, 1994). The marginal effects are partial derivatives and cannot be obtained directly from the parameter estimates, but are reached by differentiating the original logit equation.

$$\delta j = \frac{\partial P_j}{\partial x_i} = P_j [\beta_j - \sum_{k=0}^{j} P_k \beta_k] = P_j [\beta_j - \overline{\beta}] \quad (13)$$

The change between estimates are not large in magnitude, however, a comparison can be made in observing the changes between significant and insignificant variables. In the general investment model, the marginal effect is calculated as -0.017 at the point for self-assessed knowledge and where the probability for investment is very low. This means that with a one-unit increase in self-assessed knowledge of the producer, the probability of having a very low willingness-to-invest will decrease by 0.017. A decrease in the probability that a producer will have a very low willingness-to-invest is positive for potential investment. The marginal effect is calculated as 0.039 at the point where the probability for investment is very high. This means that with a one-unit increase in self-assessed knowledge of the producer, the probability of having a very high willingness-to-invest will increase by 0.039. These statistics show that with an increased knowledge about NGCs, there will be a positive effect on a producer's level of willingness-to-invest.

Chapter 6: Results

This chapter presents the results from models constructed in Chapter 5 to estimate Manitoba producers' NGC investment and commitment probability decisions, as well as their monetary investment decision. First, results from the ordered logit model used to ascertain a producer's willingness-to-invest in an NGC are presented. The results of the second ordered logit model used to model the potential proportion of commodity that a producer is willing to commit to an NGC are next. Finally, the results of the tobit model detailed in Chapter 5 are put forward, and explain the factors affecting the amount of money that a producer would be willing to invest in an NGC. For individual models, the results from the data analysis according to operation type are presented. These results include the parameter estimates, producer profiles, odds ratios and marginal effects.

6.1 Results: NGC Investment Probability Model

The results of the first ordered logit model that models a producer's willingness-to-invest are presented in Table 8. The log likelihood ratio (LLR) test shows that the model was statistically significant at the 1% level with a Chi-squared critical value of 72.5. This implies that the model fits the data significantly better than if the model were to only contain the intercept. Table 8 also shows that the percent concordant, or the percentage of observations that the model correctly classified, was an acceptable 66.6%. The percentages of observations that the models correctly classify are interpreted as being acceptable when the value is among the highest percent concordant values, and is a value relatively close to 100 (the maximum). The data used for the investment model was then filtered by producer operation type. These data were run in the same manner as the

original investment model in order to determine whether or not the decision-making processes of grain and livestock producers are similar. The results of the estimated grain and livestock producer models for investment are also presented in Table 8. The log likelihood ratio (LLR) tests show that the both models were statistically significant. The grain producer investment model was significant at the 1% level with a Chi-squared critical value of 53.2, while the livestock investment model was significant at the 5% level with a Chi-squared critical value of 22.4. The tables also show that the percent concordant values for both grain and livestock producer models is acceptable. For the grain producer model was 68.9%, while the livestock model had 64.8% of the observations correctly classified.

The parameter estimates presented in Table 8 show the effect of a one-unit change in the independent variable on the logit of the probabilities (respective coefficients), holding all other variables in the model constant. The results in Table 8 thus show the effect of changing the independent variables on the probability of each type of producer being willing to invest in an NGC. Interestingly, the probability of a general producer and the probability of a grain producer were affected by the same variables. A producer's self-assessed level of knowledge about NGCs was found have a positive and significant effect on the probability of the general and grain producers being willing to invest. A producer's self-assessed level of knowledge about NGCs was the only significant variable to have an effect on the livestock producer's willingness-to-invest.

Table 8. Logit Model Parameter Estimates, NGC Investment Probability Model

Variable	Investment Probability Model Estimates	Grain Producer Investment Probability Model Estimates	Livestock Producer Investment Probability Model Estimates
Intercept (Standard Error)	2.057*** (0.509)	2.220*** (0.777)	2.286*** (0.785)
Knowledge Level	0.408*** (0.118)	0.279* (0.167)	0.355* (0.197)
Approached About Joining an NGC?	0.450** (0.229)	0.692** (0.340)	0.235 (0.379)
Believed Number of Successful NGCs	0.005 (0.062)	-0.011 (0.087)	0.008 (0.100)
Farm Size (in Acres)	0.185** (0.081)	0.288** (0.112)	0.121 (0.138)
Produce Commodities Under Contract?	0.156 (0.199)	0.316 (0.275)	-0.265 (0.397)
Net Cash Income	-0.002 (0.080)	0.063 (0.125)	-0.081 (0.118)
Importance of Low Risk	0.108 (0.082)	0.080 (0.120)	0.147 (0.128)
Minimum Rate of Return Required	-0.123 (0.091)	-0.127 (0.127)	-0.219 (0.149)
Age	-0.553** (0.266)	-0.697** (0.335)	-0.446 (0.476)
Education Level	0.163* (0.092)	0.128 (0.131)	0.197 (0.147)
LLR Test (χ^2)	72.492***	53.165***	22.408**
Percent Concordant	66.6	68.9	64.8

Note: Single, double and triple asterisks denote statistical significance at the 10%, 5% and 1% levels, respectively

The positive and significant relationship between a producer's self-assessed knowledge about NGCs and the probability of the general producer's investment means a one-unit increase (holding all other values constant) in the knowledge level that the general producer believes he/she possesses about NGCs will cause a 0.41-unit or a 41% increase in the probability that the producer will invest in an NGC. Whether or not a producer has been approached about joining an NGC and the total acres farmed by the producer also had positive, significant effects on the probability that the general producer, as well as the grain producer, would be willing to invest in an NGC. The education level was found to have a positive and significant affect on the general producer model alone, however, whether or not general or grain producers are over the age of 65, was found to have a negative and significant effect on the probability that these producers would be willing to invest. This means that if a producer is over the age of 65, the probability that the producer will invest in an NGC will decrease by 0.553 units or 55%.

The parameter estimates shown were used with Equation 10 in order to create two producer profiles for each model. This process, as mentioned, is employed to yield a predicted probability percentage of the producer's willingness-to-invest and presents an "ideal" investor for NGCs. The first profiles were constructed to model the probability of a general producer's willingness-to-invest, while the second and third were carried out for the grain and livestock producers' willingness-to-invest. These profiles and their resulting predicted probability percentages of investment are shown in Table 9.

Table 9. Producer Profiles for "Ideal" Investor, NGC Investment Probability Model

Variable	Investment Probability Model	Grain Producer Investment Probability Model	Livestock Producer Investment Probability Model
Knowledge Level	Quite a Bit	Quite a Bit	Quite a Bit
Approached About Joining an NGC?	Yes	Yes	Yes
Believed Number of Successful NGCs	10 or more	10 or more	10 or more
Farm Size (in Acres)	≥ 4,000	≥ 4,000	≥ 4,000
Produce Commodities Under Contract?	Yes	Yes	No
Net Cash Income	Negative or zero	≥ $50,000	Negative or zero
Importance of Low Risk	Very important	Very important	Very important
Minimum Rate of Return Required	Up to 5%	Up to 5%	Up to 5%
Age	< 65 years	< 65 years	< 65 years
Education Level	M.Sc. or higher	M.Sc. or higher	M.Sc. or higher
Chance of Investment	98.5%	98.3%	97.6%

Table 10 shows the investment probability percentages for the "non-ideal" investor for NGCs. Again, the first profiles were constructed to model the probability of

a general producer's willingness-to-invest, while the second and third were carried out for the grain and livestock producers' willingness-to-invest.

Table 10. Producer Profiles for "Non-Ideal" Investor, NGC Investment Probability Model

Variable	Investment Probability Model	Grain Producer Investment Probability Model	Livestock Producer Investment Probability Model
Knowledge Level	Nothing	Nothing	Nothing
Approached About Joining an NGC?	No	No	No
Believed Number of Successful NGCs	None	None	None
Farm Size (in Acres)	< 999	< 999	< 999
Produce Commodities Under Contract?	No	No	Yes
Net Cash Income	≥ $50,000	Negative or zero	≥ $50,000
Importance of Low Risk	Very unimportant	Very unimportant	Very unimportant
Minimum Rate of Return Required	Over 20%	Over 20%	Over 20%
Age	≥ 65 years	≥ 65 years	≥ 65 years
Education Level	Less than. High School	Less than High School	Less than High School
Chance of Investment	27.96%	30.8%	14.6%

Table 11 shows the odds ratios for the general producer's investment probability model, or the associative ratio of the probability of a producer being willing to invest being very high to the probability of a producer being willing to invest being very low. As previously noted, if there is an odds ratio of one, no association exists between the independent and dependent variables. Therefore, when considering a variable such as the believed number of successful NGCs with an odds ratio of 1.005, this indicates that the ratio of the probability of a producer being willing to invest being very high to the probability of a producer being willing to invest being very low is very similar for producers with who believe that there is a higher number of successful NGCs in Canada and producers who believe that there is a lower number of successful NGCs in Canada. The odds ratio for the independent variable "Approached About Joining an NGC?" compares the producers that have been approached about joining an NGC with the producers that have not been approached while all other variables are held constant. So, an odds ratio of 1.568 for this variable implies if a producer has been approached about joining an NGC, the odds of a producer having a higher probability of investment is 1.568 times greater than those individuals who have not been approached about joining an NGC. Likewise, an odds ratio of 1.177 for the producer's level of education means if there is a one-unit increase in the education level of an individual, the odds of a producer having a higher probability of investment is 1.177 times greater than for those individuals who have a lower education level.

As with the general producer investment model, the odds ratios for the grain and livestock producer investment models must be taken into consideration. Table 12 shows the odds ratios for the grain and livestock producer investment probability models.

Table 11. Odds Ratios, NGC Investment Probability Model

	Investment Probability Model Odds Ratios		
Variable	Point Estimate	95% Wald Confidence Limits	
Knowledge Level	1.506	1.200	1.890
Approached About Joining an NGC?	1.568	0.998	2.463
Believed Number of Successful NGCs	1.005	0.892	1.132
Farm Size (in Acres)	1.203	1.033	1.402
Produce Commodities Under Contract?	1.169	0.791	1.728
Net Cash Income	0.998	0.854	1.166
Importance of Low Risk	1.115	0.949	1.309
Minimum Rate of Return Required	0.884	0.740	1.055
Age	0.576	0.344	0.964
Education Level	1.177	0.989	1.401

For the grain producer model, the odds ratio for the independent variable representing whether or not a producer has been approached about joining an NGC is the closest to infinity at 1.998. This means those producers who have been approached about joining an NGC are more likely to have a higher probability of investment. On the other hand, an odds ratio of 0.498 for the independent variable representing age means if a

producer is over the age of 65, the odds of the producer having a higher probability of investment is 0.498 times the probability producers over the age of 65 would be willing to invest. So, the lower odds ratio means there is a lower probability that producers would be willing to invest.

Table 12. Odds Ratios, Grain and Livestock Producers' NGC Investment Probability Models

	Grain Producer Investment Probability Model Odds Ratios			Livestock Producer Investment Probability Model Odds Ratios		
Variable	Point Estimate	95% Wald Confidence Limits		Point Estimate	95% Wald Confidence Limits	
Knowledge Level	1.322	0.956	1.829	1.426	0.979	2.078
Approached About Joining an NGC?	1.998	1.024	3.899	1.265	0.603	2.654
Believed Number of Successful NGCs	0.989	0.837	1.168	1.008	0.835	1.216
Farm Size (in Acres)	1.334	1.080	1.648	1.128	0.867	1.468
Produce Commodities Under Contract?	1.372	0.799	2.356	0.767	0.350	1.683
Net Cash Income	1.065	0.840	1.350	0.923	0.731	1.165
Importance of Low Risk	1.083	0.861	1.364	1.159	0.900	1.491
Minimum Rate of Return Required	0.881	0.692	1.121	0.803	0.601	1.074
Age	0.498	0.252	0.985	0.640	0.251	1.635
Education Level	1.137	0.887	1.457	1.218	0.924	1.606

Table 13 shows the marginal effects of the investment model, evaluated at the means of the independent variables. Though the marginal effects are not huge, a comparison can be made between significant and insignificant variables. Table 13 shows that with a one-unit increase in producer's self-assessed knowledge level, the probability of a producer having a very low willingness-to-invest will decrease by 0.017 while the probability of a producer having a very high willingness-to-invest will increase by 0.039. This means that if a producer believes that he/she knows quite a bit about NGCs, then the probability that their willingness-to-invest will be very low is less likely while their willingness-to-invest being very high will be more likely. In comparison, a producer who has a very low willingness-to-invest and believes there is a higher number of successful NGCs was found to have a marginal effect of 0.000. It was also found that a producer who has a very high willingness-to-invest and believes there is a lower number of successful NGCs has a marginal effect of 0.000. This means a producer's believed number of successful NGCs has no effect on a producer's willingness-to-invest. Interestingly, with a one-unit increase in farm size, the probability of a producer having a very low willingness-to-invest will decrease by only 0.008 while the probability of a producer having a very high willingness-to-invest will increase by 0.018. These statistics suggest that although the variable was found to be significant, it might not have as large of an effect on investment as self-assessed knowledge or having been approached about joining an NGC.

Table 13. Marginal Effects, NGC Investment Probability Model

Variable	Prob(*INVEST* = Very Low)	Prob(*INVEST* = Somewhat Low)	Prob(*INVEST* = Unsure)	Prob(*INVEST* = Somewhat High)	Prob(*INVEST* = Very High)
Knowledge Level	-0.017	-0.022	-0.052	0.051	0.039
Approached About Joining an NGC?	-0.018	-0.024	-0.057	0.056	0.043
Believed Number of Successful NGCs	0.000	0.000	-0.001	0.001	0.000
Farm Size (in Acres)	-0.008	-0.010	-0.024	0.023	0.018
Produce Commodities Under Contract?	-0.006	-0.008	-0.020	0.020	0.015
Net Cash Income	0.000	0.000	0.000	0.000	0.000
Importance of Low Risk	-0.004	-0.006	-0.014	0.014	0.010
Minimum Rate of Return Required	0.005	0.006	0.016	-0.015	-0.012
Age	0.022	0.029	0.070	-0.069	-0.053
Education Level	-0.007	-0.009	-0.021	0.020	0.016

The results in Table 14 show the effect of changing the independent variables on the probability of a grain producer being willing to invest in a new generation cooperative. These results indicate the probability of an individual increasing their willingness-to-invest in an NGC is directly related to a producer's level of knowledge about NGCs. It can be seen that with a one-unit increase in self-assessed knowledge, the probability of a grain producer having a very low willingness-to-invest will decrease by

0.010 while the probability of a grain producer having a very high willingness-to-invest will increase by 0.026. As in the general investment model, this means if a producer believes he/she knows quite a bit about NGCs, then the probability their willingness-to-invest will be very low is less likely while their willingness-to-invest being very high will be more likely. On the other hand, in comparing producers having a very low willingness-to-invest and believing there is a higher number of successful NGCs with producers who have a very high willingness-to-invest and believe there is a higher number of successful NGCs were found to have marginal effects of 0.000 and -0.001, respectively. This means whether a producer believes that there is a higher number of successful NGCs has little to no effect on their willingness-to-invest if their willingness-to-invest is very high or very low. Finally, if a farmer currently produces commodities under contract, the probability of a grain producer having a very low willingness-to-invest will decrease by 0.011 while the probability of a grain producer having a very high willingness-to-invest will increase by 0.030. Although this variable is not significant, the marginal effect suggests a grain farmer who produces commodities under contract will be more likely to have a very high willingness-to-invest and that this variable is noteworthy.

Table 14. Marginal Effects, Grain Producers' NGC Investment Probability Model

Variable	Prob (*GINVEST* = Very Low)	Prob (*GINVEST* = Somewhat Low)	Prob (*GINVEST* = Unsure)	Prob (*GINVEST* = Somewhat High)	Prob (*GINVEST* = Very High)
Knowledge Level	-0.010	-0.016	-0.033	0.033	0.026
Approached About Joining an NGC?	-0.025	-0.040	-0.082	0.081	0.065
Believed Number of Successful NGCs	0.000	0.001	0.001	-0.001	-0.001
Farm Size (in Acres)	-0.010	-0.016	-0.034	0.034	0.027
Produce Commodities Under Contract?	-0.011	-0.018	-0.037	0.037	0.030
Net Cash Income	-0.002	-0.004	-0.007	0.007	0.006
Importance of Low Risk	-0.003	-0.005	-0.009	0.009	0.008
Minimum Rate of Return Required	0.005	0.007	0.015	-0.015	-0.012
Age	0.025	0.040	0.082	-0.081	-0.066
Education Level	-0.005	-0.007	-0.015	0.015	0.012

The marginal effects, the effects of a one-unit change in each of the independent variables on the probability of a livestock producer being willing to invest, are shown in Table 15. For a one-unit increase in the only significant variable in the model, self-assessed knowledge, the probability of a livestock producer having a very low willingness-to-invest will decrease by 0.016 while the probability of a grain producer

having a very high willingness-to-invest will increase by 0.033. It should be noted that although the variable is the only significant variable in the model, its marginal effects are not the greatest in the model, and there are other marginal effects which should be taken into account. For example, if a producer is over the age of 65, the probability of that individual having a very low willingness-to-invest will increase by 0.020, while the probability of that producer having a very high willingness-to-invest will decrease by 0.041. This means that if a producer is over the age of 65 then the probability that their willingness-to-invest will be very low is more likely. This appears to be the case with a producer that requires a higher rate minimum rate of return on investment as well. It is also important that if a livestock producer has been approached about NGCs the probability that their willingness-to-invest will be very low is less likely, while if a livestock farmer is producing commodities under contract the probability that their willingness-to-invest being very low will be more likely.

Table 15. Marginal Effects, Livestock Producers' NGC Investment Probability Model

Variable	Prob (*LINVEST* = Very Low)	Prob (*LINVEST* = Somewhat Low)	Prob (*LINVEST* = Unsure)	Prob (*LINVEST* = Somewhat High)	Prob (*LINVEST* = Very High)
Knowledge Level	-0.016	-0.018	-0.047	0.048	0.033
Approached About Joining an NGC?	-0.011	-0.012	-0.031	0.031	0.022
Believed Number of Successful NGCs	0.000	0.000	-0.001	0.001	0.001
Farm Size (in Acres)	-0.005	-0.006	-0.016	0.016	0.011
Produce Commodities Under Contract?	0.012	0.013	0.035	-0.035	-0.024
Net Cash Income	0.004	0.004	0.011	-0.011	-0.007
Importance of Low Risk	-0.007	-0.007	-0.019	0.020	0.014
Minimum Rate of Return Required	0.010	0.011	0.029	-0.029	-0.020
Age	0.020	0.022	0.059	-0.060	-0.041
Education Level	-0.009	-0.010	-0.026	0.026	0.018

6.2 Results: NGC Commitment Probability Model

The results of the estimated NGC commitment probability model are presented in Table 16. The log likelihood ratio (LLR) test shows the model was statistically significant at the 1% level with a Chi-squared critical value of 23.87. Table 16 also

shows the percent concordant, or the percentage of observations that the model correctly classified, was 59.7%. As with the investment model, the data used for the commitment model were filtered according to grain and livestock operations. These data were run in the same manner as the original commitment model in order to examine the decision-making processes of grain and livestock producers. The results of these two commitment models are also presented in Table 16. The log likelihood ratio (LLR) test shows the grain producer commitment probability model was statistically significant. The grain producer commitment model was significant at the 5% level with a Chi-squared critical value of 19.86, while the livestock commitment model was insignificant with a Chi-squared critical value of 9.51. The insignificant log likelihood ratio Chi-square critical value for the livestock model might indicate that the model does not fit the data significantly better than the model with the intercept only (Liao, 1994). On the other hand, the significance of the grain model figures imply the grain model fits the data significantly better than an intercept-only model. The tables also show the percent concordant for the grain producer model was acceptable at 61.2%, while the livestock model also had an acceptable 60.0% of the observations correctly classified.

The parameter estimates presented in Table 16 show the effect of a one-unit change in the independent variable on the logit of the probabilities (respective coefficients), holding all other variables in the model constant. The results in Table 16 thus show the effect of changing the independent variables on the probability of each type of producer being willing to commit to a new generation cooperative.

Table 16. Logit Model Parameter Estimates, NGC Commitment Probability Model

Variable	Commitment Probability Model Estimates	Grain Producer Commitment Probability Model Estimates	Livestock Producer Commitment Probability Model Estimates
Intercept	1.895***	2.312***	1.299
(Standard Error)	(0.504)	(0.740)	(0.797)
Knowledge Level	0.252**	0.229	0.270
	(0.117)	(0.162)	(0.202)
Approached About Joining an NGC?	0.098	-0.142	0.330
	(0.226)	(0.321)	(0.393)
Believed Number of Successful NGCs	0.092	0.161*	-0.014
	(0.063)	(0.086)	(0.104)
Farm Size (in Acres)	-0.122	-0.215**	-0.022
	(0.079)	(0.106)	(0.142)
Produce Commodities Under Contract?	0.344*	0.401	0.276
	(0.199)	(0.271)	(0.403)
Net Cash Income	-0.065	-0.064	0.019
	(0.080)	(0.120)	(0.127)
Importance of Low Risk	0.012	-0.062	0.102
	(0.085)	(0.118)	(0.137)
Minimum Rate of Return Required	-0.024	-0.018	0.066
	(0.095)	(0.129)	(0.157)
Age	-0.238	-0.578	0.015
	(0.276)	(0.356)	(0.542)
Education Level	0.069	0.022	0.183
	(0.089)	(0.125)	(0.143)
LLR Test (χ^2)	23.87***	19.86**	9.51
Percent Concordant	59.7	61.2	60.0

Note: Single, double and triple asterisks denote statistical significance at the 10%, 5% and 1% levels, respectively

Interestingly, variables that were found to be significant in the general model were dissimilar to statistically significant variables in the other models. While a producer's self-assessed knowledge about NGCs was found to have a positive and significant effect on the probability of a general producer being willing to commit to an NGC, this variable was not found to be significant in the grain and livestock commitment models. The statistical analysis shows that a one-unit increase in the knowledge level that the general producer believes he/she possesses about NGCs will cause a 0.25 or 25% increase in the probability that the producer will invest in an NGC. Whether a producer is currently producing commodities under contract also has a positive and significant effect on the producer's commitment probability. On the other hand, the grain producer's probability of commitment is directly related to the number of successful NGCs that the producer believes exist in Canada and is inversely related to the total number of acres farmed by the producer. As previously mentioned, none of the variables are shown be statistically significant in the livestock producer's commitment decision model.

The parameter estimates shown were again used with Equation 10 in order to create two producer profiles for each model. This process, as mentioned, is employed to yield a predicted probability percentage of the producer's willingness-to-invest and presents an "ideal" committer to NGCs. The first profiles were constructed to model the probability of a general producer's willingness-to-commit, while the second and third were carried out for the grain and livestock producers' willingness-to-commit. These

profiles and their resulting predicted probability percentages of investment are shown in Table 17.

Table 17. Producer Profiles for "Ideal" Investor, NGC Commitment Probability Model

Variable	Commitment Probability Model	Grain Producer Commitment Probability Model	Livestock Producer Commitment Probability Model
Knowledge Level	Quite a Bit	Quite a Bit	Quite a Bit
Approached About Joining an NGC?	Yes	No	Yes
Believed Number of Successful NGCs	10 or more	10 or more	10 or more
Farm Size (in Acres)	< 999	< 999	< 999
Produce Commodities Under Contract?	Yes	Yes	Yes
Net Cash Income	Negative or zero	Negative or zero	Negative or zero
Importance of Low Risk	Very important	Very unimportant	Very important
Minimum Rate of Return Required	Up to 5%	Up to 5%	Up to 5%
Age	< 65 years	< 65 years	< 65 years
Education Level	M.Sc. or higher	M.Sc. or higher	M.Sc. or higher
Chance of Investment (Commitment)	89.6%	87.9%	96.4%

Table 18 shows the investment probability percentages for the "non-ideal" investor for NGCs. Again, the first profiles were constructed to model the probability of a general producer's willingness-to-commit, while the second and third were carried out for the grain and livestock producers' willingness-to-commit. Interestingly, the non-ideal livestock producer/investor in the commitment probability model still has quite a high chance of having a willingness-to-commit; almost 50%. Although the livestock producer/investor's chance of commitment is lower, their willingness-to-commit is higher and might be more open to NGC investment than a non-ideal grain producer/investor who only has a 9.8% chance of commitment.

Table 19 presents the odds ratios for the general producer's commitment probability model, or the association strength between the model's dependent and independent variables. To restate, if there is an odds ratio of one, there is no association between the independent and dependent variables. For example, when considering a significant variable, such as the minimum rate of return required on investment, with an odds ratio of 0.977 (close to one), the odds ratio indicates the ratio of the probability of a producer being willing to commit a greater proportion of their commodity to an NGC to a producer being willing to commit a smaller proportion of their commodity to an NGC would be very similar for producers requiring a high rate of return on investment as it would be for producers requiring a lower rate of return. The odds ratio of 1.286 for the knowledge level variable means if a producer believes he/she has a higher level of knowledge about NGCs, then the odds of a producer having a higher probability of commitment is 1.286 times greater than those individuals who believe they have a lower level of knowledge.

Table 18. Producer Profiles for "Non-Ideal" Investor, NGC Commitment Probability Model

Variable	Commitment Probability Model	Grain Producer Commitment Probability Model	Livestock Producer Commitment Probability Model
Knowledge Level	Nothing	Nothing	Nothing
Approached About Joining an NGC?	No	Yes	No
Believed Number of Successful NGCs	None	None	None
Farm Size (in Acres)	≥ 4,000	≥ 4,000	≥ 4,000
Produce Commodities Under Contract?	No	No	No
Net Cash Income	≥ $50,000	≥ $50,000	≥ $50,000
Importance of Low Risk	Very unimportant	Very important	Very unimportant
Minimum Rate of Return Required	Over 20%	Over 20%	Over 20%
Age	≥ 65 years	≥ 65 years	≥ 65 years
Education Level	Less than. High School	Less than High School	Less than High School
Chance of Investment (Commitment)	25.6%	9.8%	48.9%

Table 19. Odds Ratios, NGC Commitment Probability Model

	Commitment Probability Model Odds Ratios		
Variable	Point Estimate	95% Wald Confidence Limits	
Knowledge Level	1.286	1.025	1.613
Approached About Joining an NGC?	1.103	0.703	1.731
Believed Number of Successful NGCs	1.097	0.972	1.237
Farm Size (in Acres)	0.885	0.759	1.033
Produce Commodities Under Contract?	1.411	0.952	2.092
Net Cash Income	0.937	0.801	1.097
Importance of Low Risk	1.012	0.858	1.194
Minimum Rate of Return Required	0.977	0.819	1.165
Age	0.788	0.467	1.331
Education Level	1.072	0.902	1.274

As with the general producer commitment model, the odds ratios for the grain and livestock producer investment models are presented. Table 20 shows the odds ratios for the additional commitment probability models. In analyzing the odds ratios for grain producers' commitment probability in Table 20, it is imperative to look at the confidence interval as well.

Table 20. Odds Ratios, Grain and Livestock Producers' NGC Commitment Probability Models

Variable	Grain Producer Commitment Probability Model Odds Ratios			Livestock Producer Commitment Probability Model Odds Ratios		
	Point Estimate	95% Wald Confidence Limits		Point Estimate	95% Wald Confidence Limits	
Knowledge Level	1.257	0.913	1.730	1.309	0.888	1.931
Approached About Joining an NGC?	0.868	0.452	1.666	1.392	0.647	2.993
Believed Number of Successful NGCs	1.175	0.994	1.388	0.986	0.812	1.197
Farm Size (in Acres)	0.807	0.654	0.996	0.978	0.751	1.275
Produce Commodities Under Contract?	1.493	0.873	2.554	1.318	0.592	2.933
Net Cash Income	0.938	0.739	1.190	1.019	0.801	1.297
Importance of Low Risk	0.940	0.749	1.179	1.107	0.845	1.449
Minimum Rate of Return Required	0.982	0.773	1.247	1.068	0.798	1.429
Age	0.561	0.283	1.111	1.015	0.377	2.735
Education Level	1.022	0.799	1.308	1.200	0.910	1.584

The confidence intervals in Table 20 in which the odds ratios lie are of equal importance to the odds ratio point estimates themselves. For instance, although at first it appears that with higher odds ratios, variables such as knowledge level and production of a commodity under contract will have a higher impact on the probability of commitment

and that these variables will increase the odds of the probability of commitment. However, their confidence intervals are among the widest in the model, which means these estimates may not be as reliable as the ones for the significant variables. In analyzing the odds ratios for livestock producers' commitment probability, it can be seen the majority of the estimates are close to one. This means there is a very weak association between the probability of commitment and these independent variables. When analyzing the variables having values closer to zero or infinity, it can be seen that their confidence intervals are among the widest in the model.

The marginal effects are provided for the general producer commitment probability model, as well as the grain and livestock producer commitment probability models. Once again, marginal effects show the effect of a one-unit change in the independent variable on the probability of choice in the dependent variable. Table 21 shows the marginal effects of the commitment model, which are evaluated at the means of the independent variables.

Table 21. Marginal Effects, NGC Commitment Probability Model

Variable	Prob (*COMMIT* = None)	Prob (*COMMIT* = Up to 1/4)	Prob (*COMMIT* = Up to 1/2)	Prob (*COMMIT* = Up to 3/4)	Prob (*COMMIT* = Everything)
Knowledge Level	-0.021	-0.039	0.026	0.017	0.017
Approached About Joining an NGC?	-0.008	-0.015	0.010	0.007	0.006
Believed Number of Successful NGCs	-0.008	-0.014	0.010	0.006	0.006
Farm Size (in Acres)	0.010	0.019	-0.013	-0.008	-0.008
Produce Commodities Under Contract?	-0.028	-0.054	0.036	0.024	0.023
Net Cash Income	0.005	0.010	-0.007	-0.004	-0.004
Importance of Low Risk	-0.001	-0.002	0.001	0.001	0.001
Minimum Rate of Return Required	0.002	0.004	-0.002	-0.002	-0.002
Age	0.020	0.037	-0.025	-0.016	-0.016
Education Level	-0.006	-0.011	0.007	0.005	0.005

Table 21 shows that with a one-unit increase in self-assessed knowledge of the producer, the probability of having a very low willingness-to-commit will decrease by 0.021. This means if a producer has more knowledge about an NGC, then the probability they will have a very low willingness-to-commit will be less likely. On the other hand, if there is a one-unit increase in self-assessed knowledge, then the probability of the producer having a very high willingness-to-commit will increase by 0.017. This means if

a producer has less knowledge about an NGC, then the probability they will have a very high willingness-to-commit will be more likely. A lower likelihood or decreases in the probability in a producer having a very low willingness-to-commit and a higher likelihood or increases in the probability of a producer having a very high willingness-to-commit are positive for potential investment as both indicate greater interest in commitment. With a one-unit increase in the other significant variable representing current production of a commodity under contract, shows that if a producer currently produces commodities under contract, then the probability of a producer having a very low willingness-to-commit will decrease by 0.028 while the probability of a producer having a very high willingness-to-commit will increase by 0.023. Again, the decrease in a producer being not willing-to-commit and an increase in a producer being willing-to-commit are both positive for NGC commitment. These estimates demonstrate that commitment likelihood is significantly affected by whether a producer has knowledge about NGCs and whether they are currently producing commodities under contract.

The marginal effects for the grain producer commitment probability models are shown below in Table 22. With a one-unit increase in the number of successful cooperatives a grain producer believes that there are in Canada, the probability of being willing to commit nothing to an NGC will decrease by 0.014. This means if a producer believes there are a higher number of successful NGCs in Canada, then the probability they will commit nothing to an NGC will be less likely. On the other hand, if there is a one-unit increase in the number of successful cooperatives a grain producer believes there are in Canada, then the probability of being willing to commit everything to an NGC will increase by 0.012. If a grain producer currently produces commodities under contract, if

they are over the age of 65 and if there is a one-unit increase in self-assessed knowledge will also have profound marginal effects, even though the variables are not significant. If a grain producer commits commodities under contract, the probability they will commit nothing to an NGC will decrease by 0.034, while if they currently produce commodities under contract then the probability they will commit everything will increase by 0.029. If there is a one-unit increase in the self-assessed level of knowledge about NGCs then the probability that they will commit nothing to an NGC will decrease by 0.019, while if the one-unit increase will increase the probability a grain producer will be willing to commit everything to an NGC by 0.016. Alternatively, a one-unit increase in acre categorization will increase the probability a grain producer will be willing to commit nothing to an NGC by 0.018, while this increase will actually decrease the probability a grain producer is willing to commit everything to an NGC by 0.015. Also, the marginal effect is calculated as 0.049 at the point where there is a probability that the producer will commit nothing and they are over the age of 65. This means if a producer is currently over the age of 65, their willingness-to-commit nothing to an NGC will increase by 0.049. On the other hand, if they are over the age of 65, then their willingness-to-commit everything to an NGC will decrease by 0.042. The variables that are not significant but have a large marginal effect are important, because they suggest these variables have noteworthy effects on the dependent variable as well. The marginal effects of this model suggest if a producer believes there is a higher number of successful NGCs in Canada, believes they have greater knowledge about an NGC, currently produce commodities under contract, farm a lower number of acres, and if they are under the age of 65, then the probability they will be willing to commit everything to a cooperative will be more likely. A lower

likelihood or decreases in the probability a producer will have a very low willingness-to-commit and a higher likelihood or increases in the probability of a producer having a very high willingness-to-commit are positive for potential investment.

Table 22. Marginal Effects, Grain Producers' NGC Commitment Probability Model

Variable	Prob (*GCOMMIT* = None)	Prob (*GCOMMIT* = Up to 1/4)	Prob (*GCOMMIT* = Up to 1/2)	Prob (*GCOMMIT* = Up to 3/4)	Prob (*GCOMMIT* = Everything)
Knowledge Level	-0.019	-0.034	0.021	0.016	0.016
Approached About Joining an NGC?	0.012	0.021	-0.013	-0.010	-0.010
Believed Number of Successful NGCs	-0.014	-0.024	0.015	0.011	0.012
Farm Size (in Acres)	0.018	0.032	-0.020	-0.015	-0.015
Produce Commodities Under Contract?	-0.034	-0.060	0.037	0.028	0.029
Net Cash Income	0.005	0.010	-0.006	-0.004	-0.005
Importance of Low Risk	0.005	0.009	-0.006	-0.004	-0.004
Minimum Rate of Return Required	0.002	0.003	-0.002	-0.001	-0.001
Age	0.049	0.087	-0.054	-0.040	-0.042
Education Level	-0.002	-0.003	0.002	0.002	0.002

The marginal effects for the livestock producer commitment probability models are shown below in Table 23. Although none of the variables were shown to be

significant in the model, the marginal effects suggest changes in some of the independent variables might affect the dependent variable. For example, if a livestock producer commits commodities under contract, the probability they will commit nothing to an NGC will decrease by 0.020, while if they currently produce commodities under contract then the probability they will commit everything will increase by 0.018. If there is a one-unit increase in the self-assessed level of knowledge about NGCs then the probability they will commit nothing to an NGC will decrease by 0.019, while if the one-unit increase will increase the probability a grain producer will be willing to commit everything to an NGC by 0.016. Alternatively, a one-unit increase in acre categorization will increase the probability a grain producer will be willing to commit nothing to an NGC by 0.018, while this increase will actually decrease the probability a grain producer is willing to commit everything to an NGC by 0.015. Also, the marginal effect is calculated as 0.049 at the point where there is a probability the producer will commit nothing and they are over the age of 65. This means if a producer is currently over the age of 65, their willingness-to-commit nothing to an NGC will increase by 0.049. On the other hand, if they are over the age of 65, then their willingness-to-commit everything to an NGC will decrease by 0.042. The variables are not significant but have a large marginal effect are important, because they suggest these variables have noteworthy effects on the dependent variable as well. The marginal effects of this model suggest if a producer believes there is a higher number of successful NGCs in Canada, believes they have greater knowledge about an NGC, currently produce commodities under contract, farm a lower number of acres, and if they are under the age of 65, then the probability they will be willing to commit everything to a cooperative will be higher. A lower

likelihood or decreases in the probability a producer will have a very low willingness-to-commit and a higher likelihood or increases in the probability of a producer having a very high willingness-to-commit are positive for potential investment.

Table 23. Marginal Effects, Livestock Producers' NGC Commitment Probability Model

Variable	Prob (*LCOMMIT* = None)	Prob (*LCOMMIT* = Up to 1/4)	Prob (*LCOMMIT* = Up to 1/2)	Prob (*LCOMMIT* = Up to 3/4)	Prob (*LCOMMIT* = Everything)
Knowledge Level	-0.020	-0.045	0.032	0.015	0.017
Approached About Joining an NGC?	-0.024	-0.055	0.039	0.019	0.021
Believed Number of Successful NGCs	0.001	0.002	-0.002	-0.001	-0.001
Farm Size (in Acres)	0.002	0.004	-0.003	-0.001	-0.001
Produce Commodities Under Contract?	-0.020	-0.046	0.033	0.016	0.018
Net Cash Income	-0.001	-0.003	0.002	0.001	0.001
Importance of Low Risk	-0.007	-0.017	0.012	0.006	0.006
Minimum Rate of Return Required	-0.005	-0.011	0.008	0.004	0.004
Age	-0.001	-0.003	0.002	0.001	0.001
Education Level	-0.013	-0.030	0.022	0.010	0.012

6.3 Results: NGC Monetary Investment Model

The results of the estimated NGC monetary investment model estimated by the tobit procedure are presented in Table 24. The parameter estimates for the general monetary investment model are presented in the first column. The monetary investment model, as mentioned in Chapter 5, measures the potential dollar-value investment of producers. As with the investment and commitment models, the data used for the monetary investment model were then filtered according to grain and livestock producers. These data were run in the same manner as the original investment model in order to determine whether or not the decision-making processes of grain and livestock producers are similar. The results of the estimated grain and livestock producer models for monetary investment are also presented in Table 24.

The parameter estimates presented in Table 24 show the effect of a one-unit change in the independent variable on their respective coefficients, holding all other variables in the model constant. The results in Table 24 thus show the effect of changing the independent variables on the monetary investment of each type of producer being willing to invest in a new generation cooperative. Interestingly, the monetary investment of general producers and grain producers are affected by the same variables, as they were in the NGC investment probability model. The independent variables in the model that were found to have a positive and significant effect on these producers' monetary investment decisions were a producer's self-assessed knowledge, whether he/she has been approached about joining an NGC, the total number of acres farmed by the producer, the farm's net cash income, the expected rate of return on the investment, whether the producer is over the age of 65 and the education level of the producer. For

example, a one-unit increase in the knowledge level the general producer believes he/she possesses about NGCs will cause a $915.12 increase in the amount the producer is willing to invest in an NGC, while this increase will cause a $1440.96 increase in the amount of money a grain producer is willing to invest. The independent variables in the model found to have a negative and significant effect on these producers' monetary investment decision were whether they currently produce commodities under contract and the level of risk the producer is willing to bear. If a farmer is currently producing commodities under contract, the amount the general producer is willing to invest will decrease by $1583.10 and the amount a grain producer is willing to invest will decrease by $457.11. The number of successful NGCs the producers believe exist in Canada is shown to have no effect on the amount these producers are willing to invest.

The parameter estimates for the livestock producer model are similar to the general and grain producer model; however, all of the independent variables in this model were found to significantly affect the monetary investment decision of livestock producers. Also note the level of knowledge the livestock producer believes he/she has about NGCs has a significant negative effect on their willingness-to-invest in an NGC and a one-unit increase in their knowledge will actually decrease their monetary investment by $1020.25.

Table 24. Tobit Model Parameter Estimates (in Dollars), NGC Monetary Investment Model

Variable	Monetary Investment Model Estimates	Grain Producer Monetary Investment Model Estimates	Livestock Producer Monetary Investment Model Estimates
Intercept	-5580.79***	-5869.08***	-8147.54***
(Standard Error)	(52.47)	(51.40)	(62.62)
Knowledge Level	915.12***	1440.96***	-1020.25***
	(198.95)	(168.11)	(84.37)
Approached About Joining an NGC?	4895.13***	3345.81***	9780.61***
	(61.91)	(91.65)	(22.51)
Believed Number of Successful NGCs	85.56	-72.93	810.80***
	(621.80)	(609.68)	(158.04)
Farm Size (in Acres)	2695.63***	2660.52***	3471.55***
	(525.76)	(538.34)	(50.74)
Produce Commodities Under Contract	-1583.10***	-457.11***	-6276.09***
	(80.65)	(87.89)	(8.80)
Net Cash Income	1727.13***	2681.74***	811.88***
	(471.15)	(363.17)	(135.22)
Importance of Low Risk	-1158.85***	-1501.83***	-732.58***
	(447.83)	(407.27)	(261.50)
Minimum Rate of Return Required	2252.32***	2229.17***	2502.58***
	(184.82)	(412.04)	(92.307)
Age	1424.48***	90.27***	5462.22***
	(4.79)	(34.83)	(3.75)
Education Level	2192.20***	1474.78*	3121.81***
	(131.91)	(811.42)	(85.21)
Sigma(σ)	19411.00***	12463.00***	26197.00***
	(761.20)	(679.79)	(1.78)

Note: Single, double and triple asterisks denote statistical significance at the 10%, 5% and 1% levels, respectively

The parameter estimates shown were again used to create two producer profiles for each model. These were simply formulated by suing the parameter estimates for each model. The first profiles were constructed to model the probability of a general producer's willingness-to-commit, while the second and third were carried out for the grain and livestock producers' willingness-to-commit. These profiles and their resulting predicted probability percentages of investment are shown in Table 25.

Table 25. Producer Profiles for "Ideal" Investor, NGC Monetary Investment Model

Variable	Monetary Investment Model	Grain Producer Monetary Investment Model	Livestock Producer Monetary Investment Model
Knowledge Level	Quite a Bit	Quite a Bit	Nothing
Approached About Joining an NGC?	Yes	Yes	Yes
Believed Number of Successful NGCs	10 or more	10 or more	10 or more
Farm Size (in Acres)	≥ 4,000	≥ 4,000	≥ 4,000
Produce Commodities Under Contract?	No	No	No
Net Cash Income	≥ $50,000	≥ $50,000	≥ $50,000
Importance of Low Risk	Very unimportant	Very unimportant	Very unimportant
Minimum Rate of Return Required	Over 20%	Over 20%	Over 20%
Age	≥ 65 years	≥ 65 years	≥ 65 years
Education Level	M.Sc. or higher	M.Sc. or higher	M.Sc. or higher
Estimated Investment	$47,337	$47,679	$52,659

Table 26 shows the estimated monetary investment for the "non-ideal" investor for NGCs. Again, the first profiles were constructed to model the probability of a general producer's potential monetary investment, while the second and third were carried out for the grain and livestock producers' estimated monetary investment.

Table 26. Producer Profiles for "Non-Ideal" Investor, NGC Monetary Investment Model

Variable	Monetary Investment Model	Grain Producer Monetary Investment Model	Livestock Producer Monetary Investment Model
Knowledge Level	Nothing	Nothing	Quite a Bit
Approached About Joining an NGC?	No	No	No
Believed Number of Successful NGCs	None	None	None
Farm Size (in Acres)	< 999	< 999	< 999
Produce Commodities Under Contract?	Yes	Yes	Yes
Net Cash Income	Negative or zero	Negative or zero	Negative or zero
Importance of Low Risk	Very important	Very important	Very important
Minimum Rate of Return Required	Up to 5%	Up to 5%	Up to 5%
Age	< 65 years	< 65 years	< 65 years
Education Level	Less than. High School	Less than High School	Less than High School
Estimated Investment	$3,229	$15	$2,773

Marginal effects are shown in Table 27 to expand the context of the tobit model results. The results show the effect of a one-unit change in each of the independent variables on the probability of the general, grain and livestock producers' potential

amount of money they are willing to invest in an NGC. For example, with a one-unit increase in whether or not the producer has been approached about joining an NGC, the marginal effects are 2995.560 for a general producer, 2296.380 for a grain producer and 5534.140 for a livestock producer. These figures mean if a general, grain or livestock producer have been approached about joining an NGC, then their monetary investment they will be willing to invest in an NGC will increase by $2995.56, $2996.38 and $5534.14, respectively. On the other hand, a one-unit increase in whether or not a farmer is currently producing commodities under contract produces marginal effects of -968.773, -313.732 and -3551.180 for general, grain and livestock producers, respectively. Therefore, if a general producer is currently producing commodities under contract, the monetary amount they would be willing to invest would decrease by $968.77. If grain producers are currently producing commodities under contract, the amount they would be willing to invest would decrease by $313.73, while if livestock producers are currently producing commodities under contract, the dollars they would be willing to invest would decrease by $3551.18. For each of the independent variables found to be insignificant, there is either a change by a negligible amount or these changes are lower than the changes of the significant variables. Interestingly, with a one-unit increase in the age variable, the grain producer's monetary investment will increase by only 61.958 or $61.96. This statistics suggests although the variable was found to be significant, it might not have as large of an effect on investment as other variables, such as having been approached about joining an NGC.

Table 27. Marginal Effects, NGC Monetary Investment Model

Variable	Monetary Investment Marginal Effects	Grain Producer Monetary Investment Marginal Effects	Livestock Producer Monetary Investment Marginal Effects
Knowledge Level	560.004	988.995	-577.286
Approached About Joining an NGC?	2995.560	2296.380	5534.140
Believed Number of Successful NGCs	52.360	-50.052	458.772
Farm Size (in Acres)	1649.580	1826.030	1964.300
Produce Commodities Under Contract?	-968.773	-313.732	-3551.180
Net Cash Income	1056.910	1840.600	459.387
Importance of Low Risk	-709.152	-1030.770	-414.513
Minimum Rate of Return Required	1378.300	1529.980	1416.030
Age	871.706	61.958	3090.670
Education Level	1341.510	1012.210	1766.410

Chapter 7: Summary and Conclusions

7.1 Summary

This thesis was created in order to ascertain which factors are most likely to affect investment in potential Manitoba NGCs. More specifically, identification of the factors affecting Manitoba producers' willingness-to-invest and willingness-to-commit to NGCs were of foremost interest. It is also of interest whether similar or different factors have an influence on Manitoba producers' potential monetary investment in NGCs. Also, as upon producers' monetary investment, whether or not these decisions are affected by farm type is of interest.

7.2 Conclusions

The first model analyzed was the NGC investment probability model. Table 28 shows the hypotheses as stated in Chapter 3 versus the results of the NGC investment probability logit model. As hypothesized, it can be seen that each of the investment probability model analyses yielded a positive association between a producer's knowledge about NGCs and their willingness-to-invest. There were also positive associations between having been approached about joining an NGC, farm size, education level and their willingness-to-invest in an NGC. Also, there was a positive association between the general and livestock producers' believed number of successful NGCs in Canada and their willingness-to-invest. However, there was a negative association between the grain producers' willingness-to-invest and their believed number of successful NGCs in Canada. This negative association may have resulted from only

two of the fifteen NGCs operating in Canada are out-of-province grain processing cooperatives. Also, there were positive associations between each type of producers' willingness-to-invest and their risk-aversion levels. This suggests that while producers might feel that low risk associated with investment is important, they may still be willing to invest in an NGC. This may also suggest producers who are willing to invest believe that there is low risk associated with investment in an NGC. Again as hypothesized, there was a positive association between the general and grain producers' production of a commodity under contract and their willingness-to-invest in an NGC. There was a negative association between the livestock producers' production of a commodity under contract and their willingness-to-invest in an NGC. This negative association may result from having 79% of respondent livestock producers from beef farms, while only 14% being hog producers. While a majority of hog produces are contracting their commodities, the majority of beef producers still sell their cattle through auction marts. There was a negative association between the general and livestock producers' net cash income and their willingness-to-invest in an NGC, while there was a positive association (as hypothesized) between grain producers' net cash income and their willingness-to-invest. These associations may suggest that grain producers have greater financial resources or more money available for NGC investment. Finally, it can be seen that each of the investment probability model analyses, as hypothesized, yielded negative associations between a producer's age and their willingness-to-invest in an NGC. There was also a negative association, consistent with the stated hypothesis, found between a producer's minimum rate of return on investment and their willingness-to-invest in an NGC.

Table 28. Stated Hypotheses versus Results of the NGC Investment Probability Logit Model.

Variable	Expected Sign	General NGC Investment Probability Model Sign	Grain NGC Investment Probability Model Sign	Livestock NGC Investment Probability Model Sign
Knowledge Level	+	+	+	+
Approached About Joining an NGC?	+	+	+	+
Believed Number of Successful NGCs	+	+	–	+
Farm Size (in Acres)	+	+	+	+
Produce Commodities Under Contract?	+	+	+	–
Net Cash Income	+	–	+	–
Importance of Low Risk	–	+	+	+
Minimum Rate of Return Required	–	–	–	–
Age	–	–	–	–
Education Level	+	+	+	+

The second model analyzed was the NGC commitment probability model. Table 29 shows the hypotheses stated in Chapter 3 versus the results of the NGC commitment probability logit model. As hypothesized, it can be seen that each of the commitment probability model analyses yielded positive associations between a producer's knowledge about NGCs and their willingness-to-commit, between the production of a commodity

under contract and a producer's willingness-to-commit, and also between education level and willingness-to-commit to an NGC. As hypothesized, there was a positive association between whether the general and livestock producers' had been approached about joining an NGC and their willingness-to-commit. However, there was a negative association between the grain producers' willingness-to-commit and whether they had been approached about joining an NGC. This negative association may be the result of a proposed Manitoba beef NGC targeting livestock producers, as opposed to grain producers, in 2003 through 2005. These actions may have resulted in grain producers not being approached, but maintaining interest in committing and/or investing in a potential NGC. There was a positive association between the general and grain producers' believed number of successful NGCs in Canada and their willingness-to-commit, though there was a negative association between the livestock producers' willingness-to-commit and believed number of successful NGCs in Canada. This negative association may result from having five of fifteen livestock NGCs operating in Canada being out-of-province. Though it was hypothesized that a producer's farm size would be positively related to willingness-to-commit, each of the commitment probability models produced negative associations between these variables. This suggests Manitoba producers who are willing to commit commodity to an NGC are not necessarily the producers running larger farms, as with the producers that are willing to invest in an NGC. As hypothesized, there was a positive association between the livestock producers' net cash income and their willingness-to-commit. However, there was a negative association between the general and grain producer's willingness-to-commit and net cash income. These associations may suggest livestock producers who are willing to commit

commodity to a potential NGC may have greater financial resources or more money available such investment. However, opposite of hypotheses, there was a positive association between the general and livestock producers' risk-aversion levels and their willingness-to-commit and a negative association between the grain producers' willingness-to-commit and their risk-aversion levels. These associations are mirrored with whether producers have been approached about joining an NGC, which suggests that a more risk-averse producer who has been approached about joining an NGC will be more willing to commit. Finally, the commitment probability model analyses yielded a negative association between the general and grain producers' age and their willingness-to-commit to an NGC, while there was a positive association between a livestock producer's age and their willingness-to-commit. The negative associations between general and grain producers' required rates of return and their willingness-to-commit, along with the positive associations between a livestock producer's required rate of return and their willingness-to-commit, are mirrored with the age variable's statistical associations. It is important to note here that these variables were not found to be statistically significant, and therefore the findings might have been too small to measure accurately.

Table 29. Stated Hypotheses versus Results of the NGC Commitment Probability Logit Model.

Variable	Expected Sign	General NGC Commitment Probability Model Sign	Grain NGC Commitment Probability Model Sign	Livestock NGC Commitment Probability Model Sign
Knowledge Level	+	+	+	+
Approached About Joining an NGC?	+	+	–	+
Believed Number of Successful NGCs	+	+	+	–
Farm Size (in Acres)	+	–	–	–
Produce Commodities Under Contract?	+	+	+	+
Net Cash Income	+	–	–	+
Importance of Low Risk	–	+	–	+
Minimum Rate of Return Required	–	–	–	+
Age	–	–	–	+
Education Level	+	+	+	+

The final model was the monetary investment model. Table 30 shows the hypotheses as stated in Chapter 3 versus the results of the monetary investment tobit model. As hypothesized, it can be seen that each of the investment probability model analyses yielded positive associations between whether a producer has been approached

about joining an NGC and their potential monetary investment. There were also positive associations between farm size, net cash income, minimum rate of return required on investment, education level and the producers' monetary investment in an NGC. There were negative associations between producers' risk-aversion levels and their potential monetary investments, which were also concurrent with the stated hypothesis. Though it was hypothesized that a producer's knowledge about NGCs would be positively related with monetary investment in an NGC, there was a negative association between knowledge level and the livestock producers' monetary investment. This suggests that although livestock producers may be knowledgeable about NGCs, they may not be willing to make a monetary investment or it may suggest that there is more knowledge required by these investors. Also, there was a positive association between the general and livestock producers' believed number of successful NGCs in Canada and their willingness-to-invest. However, there was a negative association between the grain producers' willingness-to-invest and believed number of successful NGCs in Canada. As in the investment probability logit model, this negative association may result from having two of the fifteen NGCs operating in Canada out-of-province. Opposite of the stated hypothesis, there was a negative association between all producer groups' production of a commodity under contract and their potential monetary investment in an NGC. Though there are positive associations between general and grain producers' willingness-to-invest and all producers' willingness-to-commit to NGCs, the level of monetary investment is negatively associated with the production of a commodity under contract. The negative associations suggest that producers who are not currently producing a commodity under contract are more likely to make a monetary investment.

Finally, each of the monetary investment model analyses, opposite of stated hypotheses, yielded positive associations between a producer's age and their monetary investment in an NGC. This suggests younger producers may be less likely to actually make a monetary investment in a potential NGC.

Table 30. Stated Hypotheses versus Results of the NGC Monetary Investment Tobit Model.

Variable	Expected Sign	General NGC Monetary Investment Model Sign	Grain NGC Monetary Investment Model Sign	Livestock NGC Monetary Investment Model Sign
Knowledge Level	+	+	+	–
Approached About Joining an NGC?	+	+	+	+
Believed Number of Successful NGCs	+	+	–	+
Farm Size (in Acres)	+	+	+	+
Produce Commodities Under Contract?	+	–	–	–
Net Cash Income	+	+	+	+
Importance of Low Risk	–	–	–	–
Minimum Rate of Return Required	+	+	+	+
Age	–	+	+	+
Education Level	+	+	+	+

7.3 Implications of Findings

As mentioned in Chapter 1, this thesis is important because the focus is on producer investment in NGCs. First, though the study was carried out in Manitoba, the results can be used in order benefit groups across Canada looking at NGCs as a potential organizational form. In this case, if the proposed NGC were to be an NGC in which both grain and livestock producers would be required for start-up, the organizers would now know the factors potentially affecting investment decision. For example, if coordinators were in the process of recruiting investors, it would be beneficial to know approaching younger producers with information about NGCs and successful NGCs would increase probability of investment. Though such things as the production of commodities under contract are positively associated, there will be alternative methods to approaching the individuals who are currently not producing commodities under contract and increasing the probability of investment despite the negative relationship. For example, familiarizing the producer with the quality standards and general implications of the contract will give the producer more knowledge about the contract and essentially might facilitate investment.

Similarly, the research results may be used for individuals or groups across Canada in the process of setting up an NGC. If these parties are having difficulty with NGC set-up or are approaching a particular hurdle, they can refer to the results in order to answer their question. If they are able to identify the particular area in which they are having difficulty or where they think they might have difficulty, they can now refer to any specific table or set of results in the thesis. For example, if they believe they will potentially have problems raising monetary investment in the potential NGC, it will

benefit facilitators to know that older producers who have been approached about joining an NGC, farm a higher number of acres, have a higher net cash income, require a higher minimum rate of return on investment, and have a higher level of education will potentially make higher levels of monetary investment in an NGC.

Additionally, although the study is potentially beneficial to groups across Canada in the process of or looking to start NGCs, a suggestion for future research is to repeat the study. The study has the potential to be repeated in different provinces or for specific NGC start-ups. Though producers were allowed to choose the type of agricultural start-up in which they would potentially invest, the survey could be modified for a specific project under current development or for a commodity-specific NGC. For example, in the survey found in Appendix B, the following question was posed:

Suppose the purchase of one share in an NGC when it is formed (you only pay one time) allows you to deliver one unit of your commodity every year (which could be a bushel of grain, a fed or cull animal, a finished hog, or another commodity).

What would you be willing to pay for each share?

$_____ per _____ (bushel/head/etc.)

of which commodity? _____

How many shares would you likely purchase at the price you specified above?_____

A suggestion for simplification is to narrow the question to a specific commodity, which would be more beneficial to potential NGCs and/or NGCs currently experiencing start-up problems.

This research also has the potential to benefit rural community development organizations, as cooperatives have been shown to strengthen, stabilize and contribute to growth in communities and rural areas (Centre for the Study of Co-operatives, 2001). If

these types of organizations are considering whether or not to help fund an NGC, then it will be beneficial for the authorities to have as much information as possible.

Finally, advisors that are consulted in the event of an agricultural start-up could benefit from this information. It has been shown that agricultural advisors tend to know and be involved very little in NGC start-ups in the province (Carlberg and Turko, 2008), so any information will be beneficial to those parties as well. Information pertaining to the NGC structure would benefit advisors as a means for educating those individuals about the organizational form, and the thesis itself could be distributed as a tool for clients of agricultural advisors currently researching alternative business types.

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