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Swedish Dairy Farmers' Interest in using Price Risk Management Tools

- A Study of Correlating Factors

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Abstract

The dairy market will change importantly in the coming years. The quota system, which has regulated the European dairy production, will disappear in 2015 and the European dairy market will then be importantly affected by the volatility characterizing the dynamic of world prices. Besides this, the global demand of dairy products is expected to increase due to the growing world population. Farmers in countries such as the U.S. and New Zealand, when compared to Swedish farmers, show greater familiarity and experience with risk management tools. This is due to having been using for years derivatives in order to minimise price volatility. Derivatives are decreasing the risk of being affected by volatile prices and can serve as an insurance against relevant price drops.

In this study, we use a quantitative questionnaire in order to analyse the factors which may qualify the Swedish farmers' interest toward the use financial derivatives. The factors were divided into subgroups - farm characteristics such as milking system, farmer characteristics such as age and environmental factors such as the type of dairy processor they deliver to. A probit analysis is then proposed to determine if and to which extent these factors have been driving the farmer's interest in the use of derivatives.

The results in this study showed that 34 % of the farmers wanted to use derivatives, either through a dairy cooperative (13 %), a bank (2 %) or both (19 %). The probit analysis showed that farmers, who were concerned about the milk price and wanted to often be updated about milk price, did not want to use derivatives. In contrast farmers who managed a company with favourable results and did not think derivatives were difficult to learn wanted to use derivatives. Derivatives are in reality best suited for farmers not willing to bear risk and would like to reduce price volatility. These results could be due to low experience and knowledge about how derivatives work. We conclude by stressing that in order to make dairy companies financially sustainable in the long term, knowledge about the functioning and purpose of derivatives is needed.

Sammanfattning

Marknaden för mejeriprodukter står inför drastiska förändringar de kommande åren när mjölkkvoterna som tidigare regulerat den europeiska mjölkproduktionen försvinner år 2015. Eftersom den svenska marknaden tydligare kopplas till den globala mjölkmarknaden kommer det resultera i mer volatila mjölkpriser. Dessutom förutspås den globala efterfrågan på mjölkprodukter att öka på grund av en växande population. Lantbrukare i länder som till exempel USA och Nya Zeeland har sedan länge använt derivat för att minska risken av varierande priser och de har därför en större erfarenhet än svenska lantbrukare att använda riskhanteringsverktyg. Derivat minskar risken för att bli påverkad av volatila priser och kan användas som en försäkring mot plötsliga prisfall.

Målet med studien är att analysera faktorer som har en koppling till lantbrukarnas inställning till att använda derivat genom att göra en kvantitativ enkätstudie. Faktorerna är indelade i undergrupper; lantbruksspecifika faktorer som till exempel mjölkningssystem, ägarspecifika faktorer som till exempel ålder och omgivande faktorer som till exempel vilket till mejeri företaget levererar. En binär regressionsanalys, en så kallad probitfunktion, beräknar om, och i vilken omfattning faktorerna påverkar viljan att använda derivat.

Resultatet av enkäten visade att 34 % av lantbrukarna ville använda derivat, antingen genom ett mejeri (13 %), en bank (2 %) eller båda (19 %). Probitanalysen visade att lantbrukare som var oroliga för varierande mjölkpriser och ofta uppdaterade sig om aktuellt mjölkpris, var osäkra på om de ville använda derivat. Lantbrukare som drev företag som gjorde ett bra resultat och som inte trodde att derivat var svåra att lära sig ville använda derivat. Derivat är ett bra instrument att använda när en lantbrukare vill minska sin utsatthet för risk och reducera påverkan på sitt företags likviditet. Resultatet av studien berodde till stor del på att lantbrukare inte till fullo förstår hur derivaten fungerar och hur de ska användas på bästa sätt. För att ge lantbruksföretagen lönsamhet på lång sikt i den föränderliga marknaden finns det stora kunskapsbehov att möta.

Dictionary

Derivatives	Futures contract, forward contracts, options and swaps. Based on an underlying asset as commodities, weather or stocks. Can be used either to hedge against risk or for a speculative purpose.
Forward contract	A customised private agreement, outside the trading floor at an exchange, between two parties to buy or sell an asset at a specified price on a future dates. Can be customised to fit anyone who wants to trade an asset.
Futures contract	An agreement, basically done on a trading floor at a futures exchange, to buy or sell a commodity at a predetermined price in the future. The contracts are standardised in the matter of quantity and quality of the asset.
Hedging	Making an investment to reduce the risk of averse movements in an asset and therefore avoid market fluctuations.
Intervention price	Can be a price ceiling, price floor or tax subsidies that a governing body has given the market to enhance a society's welfare.
Options	Gives the owner the right, but not the obligation, to buy or sell a specified amount of an underlying asset at a specified price within a specified time.
Speculating	A trading in an asset that has a significant risk of losing, in an expectation to be able to gain. A speculator takes a calculated risk, based on assumptions of the other side of the trade and is not depending on pure chance or random outcomes.

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1 Introduction

The dairy production will change drastically due to an increasing demand of food and significally changes in the European dairy market. The major changes, which the dairy producers will face in the near future, are presented in this chapter together with problems, purpose and delimitations of the study.

In the last decade, China and India, two of the most populated countries in the world, have experienced important improvements in terms of GNP growth and welfare. When the growing population in mainly urban areas is getting wealthier they increase their milk and meat consumption (de Haan et al., 2001). The milk consumption of the world is expected to increase more than 50 % between 1997 and 2020. As seen in figure 1 the growth of milk consumption will increase significantly in parts as India, China and Asia, which can be covered by the surplus of milk in Europe and Australia. Dairy producers will be affected by the growing consumption of milk, which indicates a brighter future for dairy farmers all over the world. The increasing demand of food has affected the definition and dynamics of world prices of several crops and dairy products (ibid). This will have many impacts in the future with new challenges and opportunities that will characterise the economic activities of farmers.

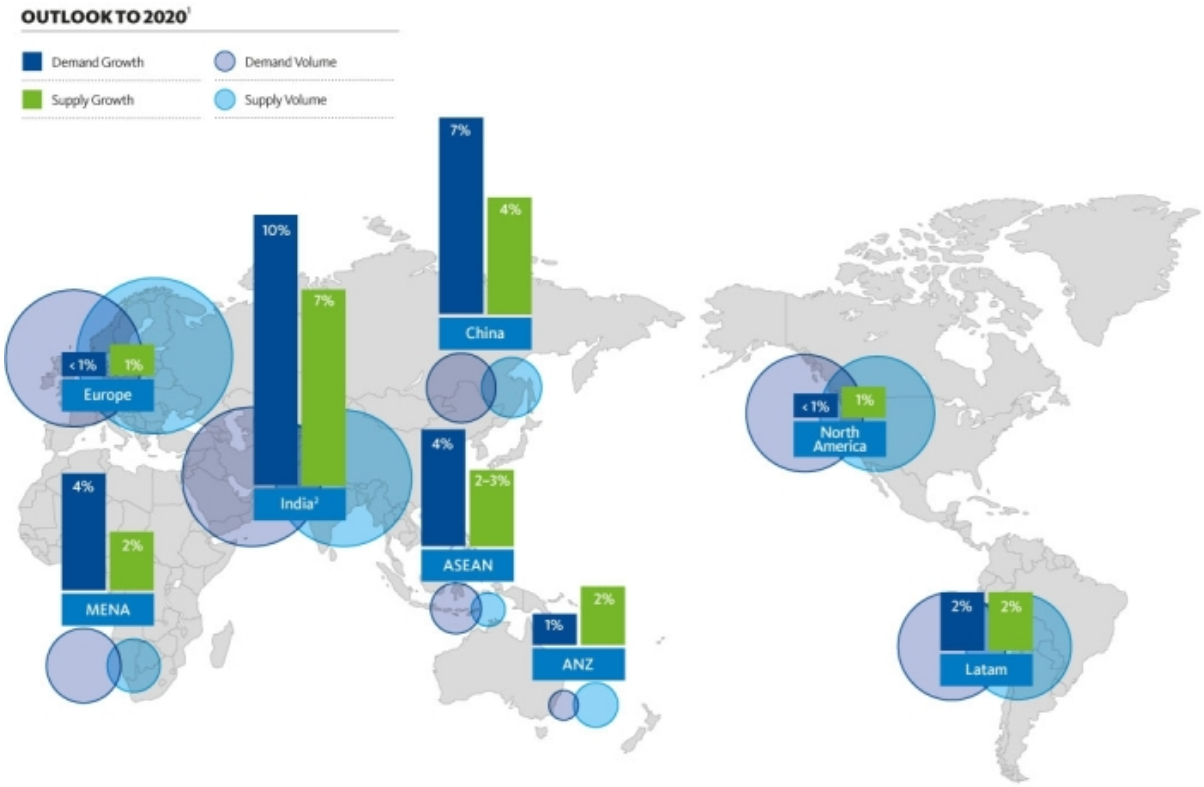

Figure 1. There is a surplus of milk production in relation to consumption in Europe and a big growth in milk consumption in India, China and Asia (www, Fonterra, 2014).

The European Union is a major actor on the world dairy market with the largest produced volume of milk (www, Dairymarkets, 2014). EU's production of 157 million tonnes of milk corresponds to 27 % of the world's total production and with India on second place with 141 million tonnes of milk. European producers are one of the biggest milk exporters in the world

and the exported volume of milk from European countries will increase due to the higher demand from emerging countries (ibid). The growing demand in the world is a market opportunity to European farmers to increase their production and thereby their export.

The European milk price is regulated by the European Union with an intervention price that has guaranteed a lowest price to the farmers (Lukkarinen & Lannhard Öberg, 2012). The intervention price has stepwise been deregulated between 2004 and 2009. Today the European milk price is more related to world market prices, as shown in figure 2, and the producers are therefore more affected by volatility in prices. The deregulation in the dairy industry makes every farmer more sensitive to changes since they have to bear risk of political changes and price volatility caused by external factors as global weather and currencies (Sckokai, 2012). The shift of responsibility concerning the price risk management from public to private actors may have positive effects on a deregulated market (Maynard et al., 2005). One way of managing the increasing price risk is to use financial tools as derivatives. The industry can be more attractive for investors and new shareholders due to new market opportunities.

The European dairy market is about to experience drastic changes when the milk quotas will be abolished in 2015 and the market will become fully liberalised (Sckokai, 2012). The aim with the quotas was to regulate the dairy production within the European Union. The annulation of the quotas will have an impact on the dairy industry in Europe since the production no longer will have any restrictions or penalties for overproduction.

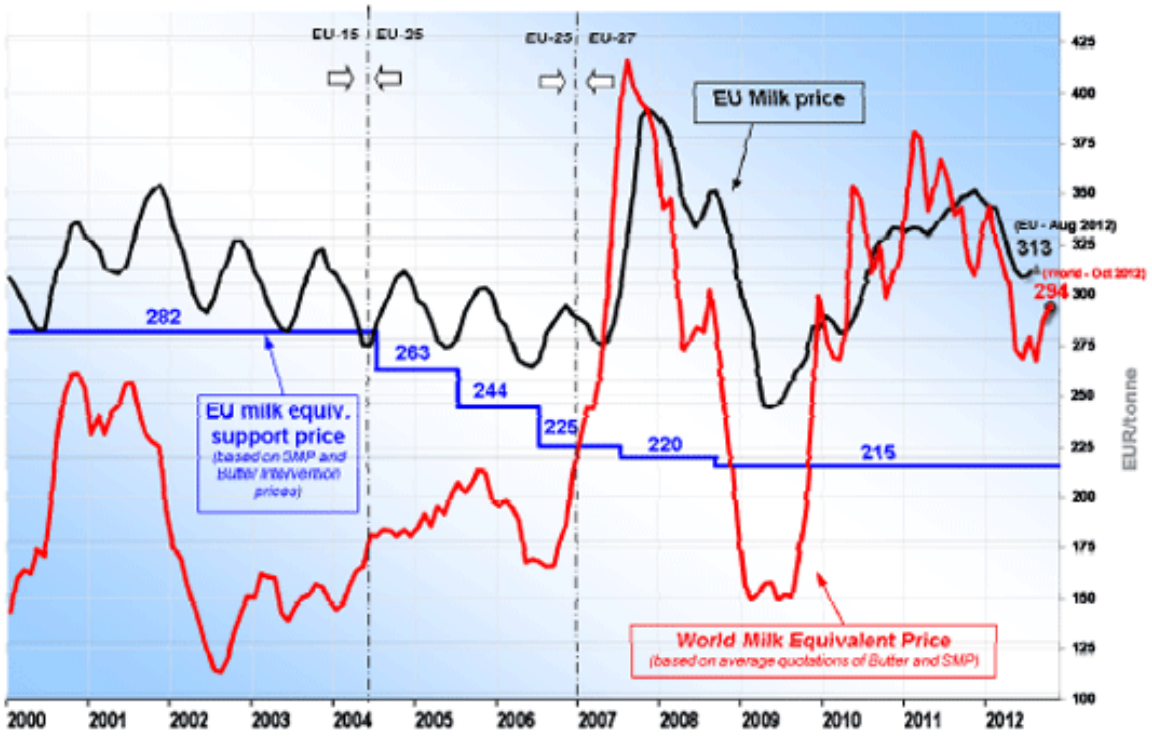

Figure 2. World milk price, European milk price and the European deregulated intervention price from 2000 to 2013. (www, The Dairy Site, 2014)

In Sweden the numbers of dairy farms steadily decrease and in 2013 there were 4742 dairy farms, which produced 2.87 million tonnes milk (www, LRF Mjölk, 1 & 2, 2014). Dairy farmers can be members of a dairy cooperative or deliver to a private dairy processing

company, in total there are 19 dairy processing companies in Sweden and most of them are managed as cooperatives. The dairy market in Sweden can be divided into regions where the different cooperatives have the possibility to exert market power at a local and regional level in an almost monopolistic scenario (Swedish Competition Authority, 2011). Arla Foods is buying approximately 70 % of the produced milk in Sweden, as shown in figure 3, and during 2013 Arla Foods was the eighth biggest dairy company in the world when comparing turn over from dairy sales (www, DairyCo, 1, 2014; www, Arla, 2014; www, LRF Mjölk, 2, 2014). The second largest dairy company in Sweden is Skånemejerier/Lactalis with approximate 14 % of the market. The third largest actor is Norrmejerier with approximately 7 %.

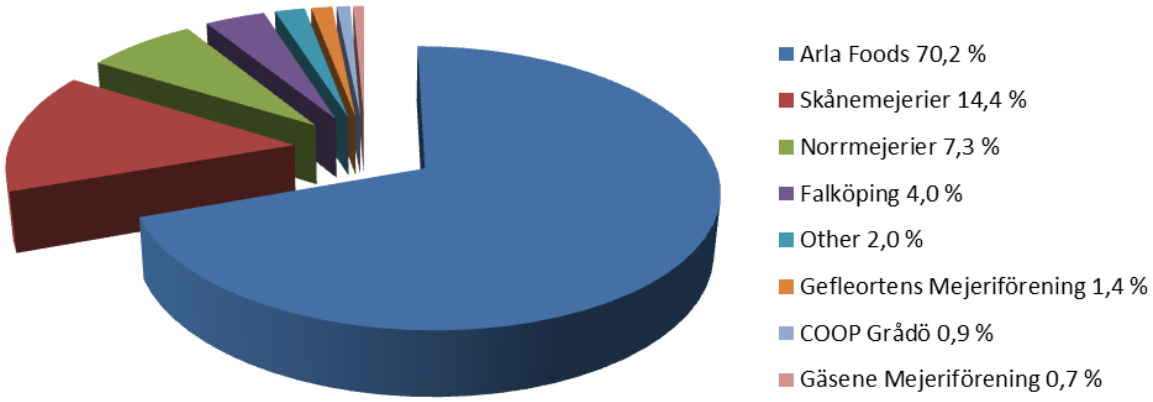

Figure 3. Market shares of dairy companies in Sweden 2013 (www, LRF Mjölk, 1, 2014).

As the milk price in the future is expected to be more volatile, the risk will increase and it will affect the dairy farm's profitability (Garner, 2010; Wolf, 2012). Most farmers are sensitive to fluctuating prices since their individual financial exposure is closely connected to their farm business (Swedish Competition Authority, 2011). The volatility of the milk price can be reduced by using several types of derivatives such as futures which are traded at different exchanges in Europe or forward contract signed with the supplier or customer (Wolf, 2012; www, DairyCo, 2, 2014). This justifies a wider interest in risk management but today almost none of the Swedish dairy farmers use derivatives to stabilise their farm income. The Swedish dairy industry still needs education and experience in different available risk management tools.

1.1 Problem Background

Risk could be categorised into either bio-systematic factors, such as weather and diseases, or socio-economic factors, such as changing currency rates or prices for inputs or outputs (Garner, 2010; Menapace et al., 2013). Many of the bio-systematic factors could be reduced by several types of risk management strategies, such as crop diversification or proactive controls of the animals. Socio-economic risk does not only mean potential damages and losses since by bearing risks one may also gain huge profits (Hardaker et al., 2004). Bearing risk is in fact a part of the business game, but by using risk management strategies risk can be reduced and the financial performance might be improved.

Dairy producers in countries like the U.S. and New Zealand are using derivatives to reduce the financial risk due to volatile milk prices (O'Connor et al., 2008). In the U.S. dairy cooperatives offer derivatives to their members and have been doing this for twenty years (Wolf, 2012; www, DairyCo, 2, 2014). Since 2010 exchanges in Europe have offered futures of for example skimmed milk powder (SMP) and butter but still is the liquidity low on the market (Wolf, 2012 & www, DairyCo, 2, 2014). In Sweden the first dairy farmer hedged his milk price in the beginning of 2014 according to an agricultural newspaper (www, Land Lantbruk, 2014). The rest of the Swedish farmers have not yet entered the derivative market of dairy products and none of the dairy processing companies offer risk minimising tools. One of the reasons to the low usage of risk minimizing tools by European dairy farmers is the intervention price, which has protected from low milk prices (O'Connor et al., 2008).

1.2 Problem

The derivative market for dairy products in Europe is young and few are familiar with dairy derivatives (Buckley, 2009; www, DairyCo, 2, 2014). The volume of dairy products traded on the exchanges today is still low and higher volumes are needed in order to establish a functional market. It is in fact essential to have a sufficiently high number of dairy producers willing to hedge against risk and a corresponding number of speculators willing to bear some of that risk. Since the knowledge of dairy derivatives is limited it is however difficult to attract traders. The derivative market has to grow stepwise to be able to attract a sufficient amount of speculators and hedgers, which is necessary for writing derivative contracts.

A functional market of derivatives in Sweden may have a wide impact and the consequences are unknown. A known advantage with a functional derivative market is that it creates awareness of milk prices (Garner, 2010). Many of today's farmers deliver milk to a dairy processor without knowing what price to expect for the milk they are selling. A price awareness makes it possible to bargain for a market price and plan for future investments. As the usage of derivatives increase by farmers in other countries also Swedish farmers could request for instance a forward contract from the cooperative to handle the milk price volatility.

A risk, which has a large impact for dairy cooperatives, is if members go bankrupt. This would lead to losses of input goods, which in turn could result in for instance higher marginal costs. If members are offered derivatives during a year of financial stress, their income could be stabilised and the risk of going bankrupt would decrease (Garner, 2010). Hence, cooperatives, which are offering derivatives to their members, also minimise their own risk of not getting enough input goods.

1.3 Purpose and Aim

To be able to establish a Swedish derivative market of dairy products a study of farmers' interest in hedging is essential. The entire dairy industry and their stakeholders have to make sure that they accommodate to the new market conditions. This study will indicate how interested and experienced Swedish dairy farmers are in risk management tools. This study can then provide useful information to be used for the future development of an actual market and for increasing the use of derivatives within the dairy industry.

The main purpose is to analyse if dairy producers have an interest in using derivatives for reducing the impact of dairy price volatility on their income. By studying farmers' interest, it is possible to clarify if they are positive, negative or unsure about adopting these instruments and identify which factors influence their opinions. In addition, this may allow to reveal how experienced the farmers are in the subject and if their interest is related to the knowledge they may have about derivatives. Dairy producers that are positive toward derivatives may be potential customers for different stakeholders within the industry. Lower risk and more stable income can provide a solid support to farmers' economic ventures and lead to a brighter future for the Swedish dairy industry.

Our aim is to reveal if there are any factors that distinguish a positive or negative interest toward the use of derivatives. Farmers with similar interest can be categorised into groups by analysing the dependency of farm and farmer characterising factors and the connection to the interest in using derivatives. This leads to our main research question, that is:

> *How are farm and farmer characterising factors connected with the interest in using derivatives?*

1.4 Delimitations

The interest of buying derivatives has until now been greater than the interest for selling derivatives. Therefore the next step is to set up a functional derivative market able to attract dairy producers. If there is a demand by the dairy producers to start use derivatives to lower their risk, speculators' role are essential for a functional derivative market because someone will have to request the surplus of risk that the dairy producer wants to reduce (Tsetsekos & Varangis, 1998). Because of the existing interest by speculators this study focuses on the hedger, which in this case is the dairy farmer.

The revenue generated by selling milk is one of the most important components of the operating income for a dairy producer and it is crucial for securing the company's financial wealth (Valvekar et al., 2010). Therefore, the focus of this study is based on the income of the dairy farm that is generated by milk production. The study is not analysing the use of derivatives for what may concern input costs. Neither is the study investigating 1) if there arespeculators who are currently willing to absorb a dairy farmer's risk nor 2) if there is an interest from dairies or banks to start trading with milk derivatives. Since it already exists several ways to hedge different input prices this is delimited in this study.

2 Theoretical Background

This chapter clarifies how the management of a company is connected to risk, risk management tools and why a farmer should be interested to use derivatives. In order to identify which factors that affects the interest in derivatives, an explanation of how the instrument work is needed.

Farm companies are exposed to risks like for example the the weather. The weather is possible to predict but it is not possible to know the actual outcome before it occur. Different types of weather are more or less favourable for the production which in turn affects the world market prices. When dairy farmers in Sweden are more exposed to world market prices of dairy products they will have to examine their attitude towards those conditions. Utility is an important concept in economics and can explain the farmers' satisfaction in using derivatives. The expected utility is described by Neumann & Morgenstern (1953) to be the sum of all possible outcomes of the associated utilities, weighted by the probability that a certain outcome will occur (Pindyck & Rubinfeld, 2005). Different individuals with the same conditions can have different perceptions of the utility of an outcome. This is due to that people have different backgrounds, personal status and different attitudes toward risk. The expected utility has a strong connection to a person's willingness to bear risk. Risk can be defined in numerous ways. A search on the Oxford Dictionary (www, Oxford Dictionary, 2014) gives a definition of risk as:

> "A situation involving exposure to danger."

People are different in their attitude toward risk. Depending on to what extent a person like risk, they are either risk averse, risk neutral or risk seeker. Risk aversion can be described as a person's unwillingness to accept a bargain with an uncertain payoff rather than a more certain bargain, but with a lower expected payoff. Risk averse people do not like to be exposed to risk compared to risk lovers who want to have a chance for a better outcome and therefore are willing to be exposed to risk (Gravelle & Rees, 2004). For example, a risk-averse person might choose to keep their money invested in a bank account which pays a low but guaranteed interest rate rather than in a stock which could have a higher expected return but entails also a higher risk of losing value. Being risk averse is a quite common feature and has lead to the establishment of insurance, portfolio choice, hedging, etc. (Eisenhauer, 2006; Menapace et al. 2013; Pindyck & Rubinfeld, 2009).

2.1 Hedging

When a farmer is exposed to a risk where the outcome might be a loss that is too big to cope with, hedging can be a solution. Hedging can be both a non-financial and a financial tool. A non financial tool minimises the risk for losses when something fatal might occur. It can, for example, be an insurance to cover losses in case of a fire on the farm. A financial tool can be a trading contract which guarantee a predetermined price of the good that is delivered at a later date.

2.1.1 Non-Financial Hedging Strategies

There exist different types of insurance contracts to cover risk of potential costs (Hardaker et al. 2004). It is possible to insure against losses due to fire or theft, life insurances in case of death or disability, cover losses of worker's injuries and of public liability and to cover losses of deceased cattle and infertility. The premium cost generated by the insurance companies' for reducing the risk makes it possible for the customers to pool the risks of losses (ibid). The insurance holder assumes a guaranteed and relatively small and known payment in exchange for a promise by the insurer to compensate the insurance holder in case of a financial or personal loss. A contract is then established, called the insurance policy, which explains the conditions and circumstances under which the insured will be fully financially compensated.

With diversification it is possible to reduce the risk if the resources are allocated to different activities that have non-related outcomes. Different variables can correlate positively and negatively depending on if they have a tendency to move in the same or opposite direction (Pindyck & Rubinfeld, 2009). Farmers could for example grow several different types of crops to reduce the risk of decreased prices for one of the crops, so called crop differentiation (Garner, 2010; Menapace et al., 2013). Farmers can also generate an off-farm income that is not connected to the volatile milk price (Shapiro & Brorsen, 1988). The income generated from another employment that not is associated with the dairy industry makes the risk of reduced income due to low milk prices smaller.

Farmers are frequently paying for consultancy and advice regarding investments decisions and for establishing loans. Decisions are often based on little or limited information, which may include risk that the decisions are wrong or would be something else if more information was available (Pindyck & Rubinfeld, 2009). Information is a valuable resource and to reduce risk people are willing to pay for it. Another way of reducing risk is by pooling with other producers. A larger volume makes it possible to take advantage of economies of scale without having a large farm, for example the transportation costs could be lower with a bigger volume. Instead of transport many small volumes of milk the pooling allows a bigger volume to be transported.

2.1.2 Financial Hedging Strategies

Financial hedging started already in the 19th century when farmers began to unite and make agreements of a sale. That was the start of the forward contract that is a private agreement between a buyer and a seller to trade an asset in the future at a certain agreed price, with a specific closing day and a given quality and quantity (Garner, 2010). Today farmers organise themselves into cooperatives to trade commodities in a larger volumes. The forward contract offered by cooperatives is a way of offering fixed prices for delivered commodities in smaller volumes to the producers within the cooperatives. It could be possible for dairy cooperatives to offer similar forward contract to their producers as the crop cooperatives are doing today. In countries such as New Zealand and U.S., those dairy forwards contracts already exist. A forward contract is missing a controlling third part, so one of the parties might default his or her side of the agreement (ibid). If the price of a commodity exceeds the contracted price, the seller has less motivation to fulfil the negotiation and will probably sell to someone else. To prevent one of the parts from defaulting, exchanges started to require a good-faith deposit to cover at least a part of the loss for the deceived part (ibid). A problem was to bring together buyers and sellers in a matter of for example quantity, time and quality of the commodity. It

was also a problem when a farmer was obliged to deliver a certain amount of crops during times of drought. Due to those elements, - the standardised future contract was born.

A future contract is a financial instrument and operates in the same way as a trade in shares, where the delivery and payment is placed in the future at the expiration day (Garner, 2010). The contract do not need to be hold until the expiration day, it can be closed by doing an opposite affair. In other words if the future contract initially was bought the affair is closed by selling back the contract. The standardised future contract is a legally binding agreement to buy or sell a commodity in the future set date with a specified quantity and quality (ibid). The future contract has opened up the market to speculators that either own or doesn't want to own the commodity.

The forward contract is more dynamic than the futures because of the possibility of hedging a smaller volume and therefore offers scale-neutral benefits (Maynard, 2003). Small farms are not favoured when it comes to using futures contracts because of a minimum volume of the traded contracts, and if the produced volume is lower than a future contract the farmer may encounter problems signing a contract. In relation to futures the forward contracts offers an administrative simplicity and makes the broker redundant. Some cooperatives offer a single price for an entire year, which eliminates the need for using futures for each month's production separately. To reduce the price risk, parts of the yearly production could be hedged over several years.

2.2 Futures for Dairy Farmers

Market prices are generally seen as following a random walk, which means that they not are predictable except from perhaps a trend (Garner, 2010). When trading commodities the farmer is exposed to risks connected to the random walk, bearing this risk can make it possible to gain more money at high prices but also make the profit low if the market prices decrease. Depending on if the farmer is a risk lover, risk neutral or a risk averse person hedging can be an interesting tool to lower the risk. Hedging contracts have two parties, the hedger and the speculator. The hedger is exposed to risk of volatile prices and wants to reduce some of it (the farmer). A speculator wants to absorb some of the producer's risk to profiting from price fluctuations and does not own any underlying commodity (Hardaker et al., 2004). The hedger receives revenue from two activities - contract trading done by exchanging risk with the speculator (financial trading) and ordinary selling the output (physical trading) (Martinez & Zering, 1992).

Dairy producers can hedge by using, for example, derivatives to minimise their exposure to the volatility in prices and instead be guaranteed a certain price in the future (Hardaker et al., 2004). Because of the random walk where prices might fall as well as rise, there is a big risk for the farmer to wish for better prices on their commodities, since the loss can be fatal. If the costs remain high, while the output prices are reaching a low level, the firm might make big losses and many years of losses might be fatal for the company's sustainable survival. A guaranteed price might be crucial for the producer to continue operating in the future.

A model by Maynard et al. (2005) shows that dairy producers, which individually are hedging milk, can decrease the price variance with 50-60% in relation to selling at a spot price to the dairy processing company. It is not necessarily optimal to hedge all of the milk on the future market because the future and spot market is not a perfect mirror of each other. If a farmer

hedge the entire milk production the risk of a lower price in the future is gone, but hedging the entire production may mean that the farmer miss a sudden rise in the price of milk. The optimal hedged volume is therefore depending on the farmer's willingness of bearing risk.

Figure 4 below illustrates the basics in using futures contract when hedging. The dairy farmer signs a futures contract at 3400 EUR/mton. If the milk price increase up to 3600 EUR/mton there will be a profit of 200 EUR/mton at the physical market, on the futures market there will be a loss of 200 EUR/mton and at a total the farmer get 3400 EUR/mton. If the price decreases to 3200 EUR/mton there will instead be a loss on the physical market and a profit on the futures market. Note that the result will be the same regardless if the price increase or decrease, derivatives reduce the risk of being affected by volatile prices.

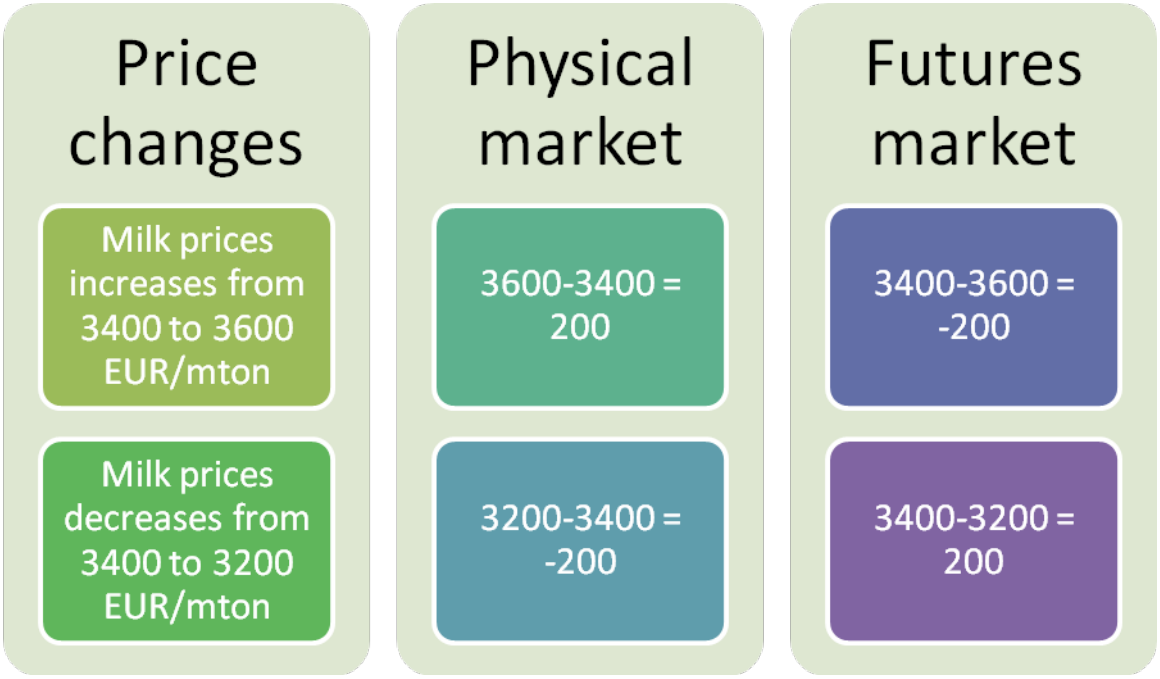

Figure 4. The fundamental structure of using futures for hedging milk, the first row shows what happens if the price rises and the second row handles if the price falls. There is no difference in the two cases for the dairy farmer; it is a fixed price of 3400 EUR/tonnes no matter what happens on the market.

If the variations between futures prices and spot prices are bigger than the variation in the spot prices alone, futures will increase the risk for the farmers (Maynard et al., 2005). Contrariwise a smaller variation in variations between spot and future prices than in the spot prices makes futures profitable for covering price risk. Depending on the willingness of carrying risk the optimal hedge ratio will be different for each person. The hedging ratio is the proportion of cash transactions covered by future contracts. To minimise the price risk of a portfolio an optimal hedging ratio can be calculated. Optimal hedging ratio is calculated by a regression between the changes in spot prices and changes in the future prices.

When a Swedish farmer wants to hedge milk on the exchange, this can be done through a merchandiser (Iwarson, 2012). A farmer can not directly trade the milk by himself on the exchange because of financial regulations. Many of the Swedish banks offer the service to trade on the exchange and for the service the farmer has to pay a transaction fee and a commission fee, which is a percentage based on the total investment (www, Eurex, 2014).

The seller of a future is then asking for a price of a specific volume and when a buyer accepts the seller's price a trade takes place. The outcome of using futures as an strategy to get a more stable income do also need some investments in terms of time and commitment. The farmer needs to know which price that would be satisfying and in the same time not takes too much commitment to get.

3 Previous Studies

There are several studies regarding factors that are shown to be associated with the use of derivatives when it comes to different primary producers. In this chapter prior studies' results are described to give an understanding of farmers' interest in using derivatives. The associated factors are then the base for questions within the questionnaire of this survey.

A section about literature review aims to illustrate which studies that previously have been made of farmers' relation to risk management tools and especially to derivatives. According to Robson (2011) it is important that the reviewed literature is of adequate relevance for the subject. To understand Swedish dairy producers situation and the possibility to adopt a new financial tool on the Swedish market studies from other countries and different orientations are used as benchmark studies.

The reviewed literature is mainly from milk producing countries characterised by a substantial experience in the use of price risk management tools. Since the market is new in Sweden studies from other countries can reveal how Swedish farmers can adopt derivatives. Farmers outside Europe are more used to global price dynamics than Swedish farmers since the market have been regulated in both Sweden and in the European Union for a long time. The derivative market for dairy products still is developing and quite new, especially on the European market (Buckley, 2009; www, Dairyco, 2, 2014). The market in EU is late in the deregulation compared to established milk producing countries as New Zealand, Australia and the U.S. (Anderson & Mapp, 1996; Martin, 1996; Maynard et al., 2005). In New Zealand and Australia the deregulation of the market started in the 1980's (Martin, 1996).

These countries differ from Sweden regarding the conditions to the daily production, weather, local regulations etc. but they have similar possibilities to trade the outcome of the production on the global market. Derivatives is a new instrument to Swedish farmers and the challenge of global price dynamics is a phenomena farmers in other countries are more used to. Studies from other countries reveal characteristics connected to farmers' use in derivatives which can be used as a benchmark study for the Swedish market. The difference is the experience and knowledge about derivatives, since it is new in Sweden the awareness might be lower.

Milk is a homogenous product it has no relevance where it is produced or what the production conditions are, it will have the same price on a spot market. The differences between the producers are the production conditions as weather and local regulations. Each farmer has different production costs which affect which price the farmer need to get. In this study it is the trade that is in focus and in the trading moment all farmers will be affected by the global market price. EU and the U.S. are the world's biggest traders of agricultural products (European Commission, 2013) and both have had many domestic regulations that affect the trading in an attempt to protect the farmers within the union (Sarris & Freebairn, 1983). These regulations affect the world market when the different unions are trying to support their domestic markets with for example intervention prices. As EU and the U.S. are deregulating their domestic markets their farmers are getting more exposed to movements on the world market and can't rely on a lowest guaranteed price from their government. U.S. farmers are more experienced in handling the price risk individually than the European farmers and they have more instruments available (Martin, 1996). As the market in EU changes, both public and private institutions will start to provide these instruments to the farmers (O'Connor et al., 2008).

The reviewed literature contains empirical studies of a variety of primary producers in different countries since there are few studies regarding the interest in derivatives of dairy producers' are made and no one in Sweden. Because of that dairy producers have a lot in common with crop producers and the differences are less than the similarities it is possible to analyse studies of risk management in crop production. Many farmers are both growing crops and having a milk production or have gone from being a milk producer to solely growing crops or the other way around. The food producers are characterised by a large volume invested assets and few employees and many primary producers affect the same stakeholders and are influenced by similar politics and external factors.

Studies with a quantitative questionnaire of farmers are reviewed which made it possible to search for factors related to the interest in using derivatives and to what extent they were important. A literature review of qualitative studies would not show relationships between different factors within the farm but would instead describe why the factors were important or not (Robson, 2011). The empirical surveys made through questionnaires of farmers by Shapiro & Brorsen (1988), Goodwin & Schroeder (1994), Harwood et al. (1999), Tauer (1986), Mishra & Goodwin (1997), Flaten et al. (2005), Hardaker et al. (2004), Patrick et al. (1985), Ford & Babb (1989) and Makus et al. (1990) are describing different factors that are relevant when analysing farmers' interest to use risk management tools. They had questionnaire surveys where they investigated the correlations of different farm and farmer characteristics with the interest in using derivatives or risk management. To find the literature for the study keywords such as *derivatives, factors, hedging, risk, risk management* and *questionnaire* were used at different search engines such as Google Scholar and Jstore.

3.1 Farmer Characteristics

Factors of personal characteristics might influence the interest in using derivatives. Previous studies regarding age, education, information and business experience have been shown to have correlations to the interest in using derivatives, which is further described in this sub-section.

Information and education are important to make decisions and farmers are willing to learn, even if they are limited by how much time they can spend to take in new information (Anderson & Mapp, 1996). In smaller firms the decision maker usually is one single person who needs to handle a lot of information, from economic management to more farm specific decisions. Farmers' situation is complex with a flood of information every minute and it is important that there are simple decision rules to work from when they are making decisions. For farmers in the U.S. commodity brokers, commercial newsletters, private firms and cooperatives are the most important information sources of commodity trading prices, when making decisions about when and how to sell commodities (Ford & Babb, 1989). The information source depends on size of the farm and if the production is towards crops or livestock. Farmers with larger farms use primarily magazines to get current market information. Commercial newsletters are 400 % more common as a source of information for large farms than small farms. Livestock farmers get their information from many different sources as newsletters from cooperatives, private firms and brokers. They also have a higher reliance to more information sources than crop producers, probably related to higher volatility in prices of their input and output commodities (ibid).

Education is according to Shapiro & Brorsen (1988) an important factor regarding the decision of hedging or not. Years of formal education of farmers in Illinois were negatively correlated to the crop producers' usage of derivatives. It has also been shown that the educational level has a positive relation to the use of derivatives. According to Makus et al. (1990) a bachelor's degree or above affect the probability to use derivatives positively. Crop producers with low education level tended to use other risk reducing methods instead (Shapiro & Brorsen, 1988). Tauer (1986) also reveals that the more formal education the producer has, the more risk neutral or risk preferring he or she is. Goodwin & Schroeder (1994) also supports that years of education is significant correlated to the use of derivatives. In the study of Makus et al. (1990) no significant correlation between age and the use of futures and options were supported. According to a study made by Tauer (1986) the greater the age of the dairy producers is, the more likely they are to be risk lovers. In a study of crop producers in Africa, Mofokeng & Vink (2013) found that younger farmers were more willing of using derivatives. According to Hakelius study (1996) is age a factor that affects the farmers' interest in being committed to a cooperative. The older generation has a higher tendency to do business with their cooperative rather than other stakeholders, therefore could the older farmers have a higher willingness to use cooperatives than banks when hedging using derivatives. When farmers need information about farm investments or credit decisions they use banks as their primary source this could instead indicate that the farmer would choose to use banks when hedging (Ford & Babb, 1989).

A significant number of studies have focused on farmers' perceptions of risk (Harwood et al., 1999). For crop farmers, price and yield are the highest risk factors while farmers with cattle are more often concerned about legal issues (Patrick et al., 1985). Input prices and changes in the global economy and policies have been shown in studies made in New Zealand to have a greater importance for the producers than volatility in the milk price (Shadbolt & Olubode-Awosola, 2013). Some farmers accept variability and some avoid it, how depends on different factors and what objectives each individual have (Anderson & Mapp, 1996). Since people have different perception of risk there is no risk management strategy that works for everyone, for example can farmers' willingness to bear risk affect their choice of selling at future or spot prices. Risk-loving farmers would sell at spot prices since they are more willing to be exposed to higher variance in the actual price (Franken et al., 2011). Patrick et al. (1985) describes that agricultural producers strive for "safety-first" but Shadbolt & Olubode-Awosola (2013) argues that New Zealand dairy producers often think of the glass as "half full" and often see opportunities instead of threats. A study made by Tauer (1986) of New York dairy farmers revealed that they were slightly more risk preferring than a study made on swine farmers in Minnesota at the same time. Tauer argues that this statement would change because of some established policy changes would make the dairy-production in the area more risky.

Despite the fact that derivatives minimise risk caused by price fluctuations, some farmers are not interested in using derivatives. According to Rogers (2003) farmers can be divided into groups depending on their interest to adopt new products or technology. In a study made during the 1950's he developed a model where he divided farmers into innovators, early adopters, early majority, late majority and laggards. This model may explain some farmers' behaviour and predict how the usage of a new instrument such as derivatives may develop in the future. Innovators are a small part of the population and are characterised by loving high levels of risk and are highly educated with large farms (Bohlen & Beal, 1957). Early adopters are not as successful as the prior group even if they are more educated than the average farmer. They also are younger than average and more often community leaders. The early

majority are quite conservative even though they listen to new ideas and are active and social with neighbours and in communities. The group of the late majority are older and less educated than the average and also quite conservative and not very socially active. At last there are laggards that are old farmers with low education level and small farms compared to the average, and they are very conservative. Derivatives are high technical instruments which might demand, at least at a beginner's level, an individual characterised by a high orientation toward innovation. Concerning the more conservative, dairy farmers that today are unwilling to use derivatives can later change their mind when the large majority has adopted them.

A majority of producers understand that the use of derivatives may lower the income from their commodities, but in the long run the income can be equalised or even higher (Anderson & Mapp, 1996). In a previous study by Shapiro & Brorsen (1988) one of the most important factors to the usage of derivatives was if the farmer thought that the income would become slightly more stable by using derivatives. The farmers that were willing to hedge thought that the risk was slightly reduced by using derivatives. Hardaker et al. (2004) concludes that working with risk management is to find the combination of risk and return to what each firm can manage in different scenarios. Bad prior experience of hedging or lack of understanding of the instrument has according to Shapiro & Brorsen (1988) been shown to lower the usage of derivatives. Makus et al. (1990) shows that having cumulated previous experience in the adoption of forward contracts is highly correlated with the use of derivatives.

Farmers usually have a high ratio of income generated outside the farm (Shapiro & Brorsen, 1988). By having an income outside the farm the farmer are spreading the risk due to price volatility in milk. Off-farm income could therefore be used as a risk reducing tool. Risk averse farmers tend to be more willing to have complementary incomes beside the farm or do investments that give dividends and rates of return, with the purpose to balance fluctuations in income to the farm (Mishra & Goodwin, 1997). Owning forest is also a way to distribute risk. If the income generated by the milk production is low it does not imply that the income from the forest will be low. Makus et al. (1990) reveal that if a farmer is working full-time on the farm or not, is not correlated to the use of derivatives.

Swedish dairy producers can be awarded for their production (www, LRF Mjölk, 3, 2014). Some of the awards are for healthy herds while others are for volume and quality of produced milk or the cow's exterior. The proactive work made for achieving the prizes can in many cases result in a better production. A prize for a healthy cow or herd could indicate that the company have a low veterinarian cost and are therefore more cost efficient (www, Växa, 2014). An award for a high milking cow is indicating good animal health and stable incomes from their milk production. This could be a sign of a good business health and according to Harwood et al. (1999) good business health is associated with higher use of derivatives.

3.2 Farm Characteristics

This sub section covers the managerial decisions regarding the financial situation in the company, like which debt position that is acceptable and how relations to other stakeholders are.

It is crucial to be able to generate an income when the company for example has to be able to pay interests on loans. Years of uncertainty of milk prices is threatening the dairy producers long term development and by that also the firms survival (Garner, 2010). In case of

unrewarding years several companies use buffer money to cover the loss (Buckley, 2009; www, DairyCo, 2, 2014). The company's health has been shown to have a negative correlation to if the farmer felt that derivatives were needed (Shapiro & Brorsen, 1988). According to Tauer (1986) farmers with high net income are more risk preferring. Low income may imply that farmers either are risk averse since they use a safe strategy, or risk preferring to by buffering income be able to save the company in the future.

It is shown that a risk seeking farmer have higher tendency to have lower solidity within the company (Shapiro & Brorsen, 1988). Farmers who not consider low debt as important tend to have higher interest for rent payments in percentage of the revenue. Low levels of debt are also associated with an efficient performance. If the leverage is high, the farmers need to have good knowledge in managing risk in order to meet the financial responsibilities, which otherwise may cause insolvency or bankruptcy (Harwood et al., 1999). Shapiro & Brorsen (1988) revealed that the self-perceived debt position was essential to determine the thoughts about derivatives. If the farmer had a favourable self-perceived debt position, the usage of derivatives decreased. A farmer with a low level of leverage has little risk of bankruptcy and a high levered farmer has a higher tendency of using derivatives (Shapiro & Brorsen, 1988). Flaten et al. (2005) found that dairy farmers in Norway valued financial tools that can reduce risk higher if the leverage was high. High uncertainty makes it hard to do investments to create new competitive advantages or to keep the dairy production updated with new technology in order to stay competitive in the future (Garner, 2010). Interest rates are volatile and unpredictable and therefore have to be carefully handled to achieve a stable financial situation for the firm. The governmental regulations as inflation and farm policies have been shown by Patrick et al. (1985) to be equally important as the risk management actions made by the farmer.

In Sweden the most common legal form is the private firm with sole proprietorship with 93 % and the second most used legal form is the limited company with 4 % (www, SCB, 2014). According to a German study of crop producing companies, companies with unlimited liability tend to have more access to loans by credit institutes due to a better ability of paying debts (Wu et al., 2014). Shapiro and Brorsen (1988) describes that farmers with a poor debt position tend to use derivatives more frequently than companies with a better debt position. Farmers with an unlimited company and the ability to easier establish new loans might also have a bigger risk for getting in a poorer debt position and could be more willing to use derivatives. A company with many owners has better credit position (Wu et al., 2014). If one of the owners is going bankrupt the other owner could still manage the company.

The size of the farm measured in hectares has shown to have a positive correlation to the usage of derivatives in prior studies of crop producers (Shapiro & Brorsen, 1988). This could be caused due to economies of size or the difficulties for smaller farms to use derivatives because of the lumpiness of future contracts. Goodwin & Schroeder (1994) show in their study that cropland and total farm acreage is significant correlated to the use of forward contracts. By leasing acreage the farmer is able to get a bigger size of the farm without increasing the debt position when buying (Wu et al., 2014). Leasing acreage can also sometimes be the only option when surrounding landowners are unwilling to sell. A German study indicates that farmers, which lease land, also have a lower leverage (ibid). This is described as a result due to the fact that owning land reduces the credit risk that lenders are facing. A low leverage level means a lower risk for bankruptcy and also a lower tendency to use derivatives to hedge against risk according to Shapiro & Brorsen (1988). They also concluded that farmers debt position influence the usage of derivatives. Flaten et al. (2005)

revealed that farmers with bigger herds found insurance more important, but farmers with more experience took less notice about that and valued financial management higher. The geographic location has been shown to be an important factor for the use of derivatives (Patrick et al, 1985; Shapiro & Brorsen, 1988). Producers are often comparing their actions in relation to what others are doing. In a region where many producers are familiar with derivatives the likeliness of using derivatives is higher than in regions with few users (ibid). Sweden is an elongated country with long distances between dairies and farmers.

How risk is managed depends on how the financial position and firm structure looks like (Andersson, 2012). Different strategies of risk management are practicable on different farming companies. The different legal forms exist due to variations in the limitations of liabilities, number of owners but also the focus of the activities made in the business (Hemström & Geirtz, 2013). Studies made in New Zealand showed that dairy producers are more often considering managing debt to have a growing importance as a risk management strategy (Shadbolt & Olubode-Awosola, 2013). Risk management and income enhancing may affect the leverage or the liquidity, which increase the financial risk taking (Collins, 1985; Gabriel & Baker, 1980). A high equity level is a common solution for producers to manage the risk, either increasing it in risky situations or keeping it on a high level (Anderson & Mapp, 1996). With a high level of equity the risk of a loss is not solved, but the risk exposure has decreased because the farmer can cover a loss with the own equity. The focus in many farm businesses is to improve the efficiency in the production, increase returns and equity and also reduce costs (ibid). Most producers see losses caused by price and yield volatility as a part of the business on a farm, as long as the losses not threaten the financial security, but they are though not using any price risk reducing strategies (ibid). According to Makus et al. (1990) the gross revenue has a positive impact on the probability of using derivatives. Firms with a high income tend more likely to use risk management tools and vice versa firms with a low income were less given to use derivatives (Harwood et al., 1999).

A study in Norway between organic and conventional dairy farmers revealed that both groups found it difficult to predict coming policies, taxes and government support payments and because of that they ranked it as a top source of risk in the farm management (Flaten et al., 2005). In their study they also found a difference in the attitudes to risk and important inputs in the company, which could be attributable to the production system that is chosen. The organic farmer had a higher education and often with a focus on agriculture than the conventional farmers. Organic farmers are often facing more risk due to a lower yield and sometimes higher costs because they are not allowed to use for instance fertilizers and have to do mechanical weed control instead. Due to the fact that they may face more types of risks in relation to the conventional farmer, they should be interested in hedging against the milk price. Makus et al. (1990) revealed that educational level had a positive impact on the use of derivatives; therefore organic farmers may have a higher tendency to be interested in using derivatives. A study made by Rosati & Aumaitre (2004) revealed that most farmers started to produce organic milk in an attempt to get higher long term profit to be able to keep farming and avoid liquidation.

A study by Wade et al. (2004) between dairy farmers in Belgium, Denmark, Germany and the Netherlands who had installed automatic milking system (AMS) showed that it was not economically efficient due to higher fixed costs despite the lower labour cost. Installing an AMS is a costly capital investment and, in order to undertake it, many farmers may have to borrow money from a bank. If the farmer is encountering financial difficulties due to for instance high exposure in terms of loans and low earnings, bankruptcy becomes an issue.

Hence, it is important to secure a solid and stable payment flow. Both the debt position and the size of the farm is connected to the usage of derivatives (Shapiro & Brorsen, 1988).

4 Method

Surveys could suffer of deficiencies and the validity could be threatened by misunderstandings and imperfections of the method used for collecting the data. This chapter describes how actions were made to strengthen the reliability and validity in the results of this survey.

4.1 Data Collection

A study can be both qualitative and quantitative. In the qualitative approach the aim is to formulate well grounded, rich descriptions and explanations of processes in different contexts (Robson, 2011). The quantitative approach aims to measure and generalise the observed object and is therefore more suitable for measuring factors. A qualitative approach typically explain questions like "*why*" and "*why not*" while the quantitative approach answer "*how much*" or "*to what extent*". Both a quantitative and a qualitative approach were used during this research. The main survey, the questionnaire, was quantitative while the pilot study included interviews that were developed taking a qualitative approach.

Data from questionnaires is affected by the characteristics of the persons it contains for example their former experience, personality or knowledge (Robson, 2011). According to Robson (2011) a questionnaire is suitable when investigating people's interest. The aim with the questionnaire was to describe which factors are connected to the interest in using derivatives and to what extent they may actually relate. Therefore the questionnaire in itself is a quantitative approach. Using a qualitative approach would not allow to address the main aim of this study since it will not identify which factors that are influencing and to what extent they affect farmers interest in using derivatives. Questionnaires can be posted or telephoned or made as formalised interviews. There are differences between these methods. Mainly, telephoned and personal meetings are more time demanding and there is always the risk to give different information to different respondents. A posted questionnaire was chosen to this study because the data can be trusted since all respondents have got the same information and with a well planned design and formulated questions one may potentially address a large sample size. A high response rate is important when analysing the data since it will affect the significance of the results.

Posted questionnaires have disadvantages and the most risky is the response rate, not everyone will complete the questionnaire (Ejlertsson, 2005). To receive a high response rate three main topics were considered when designing the questionnaire; reduce perceived costs, increase perceived rewards and improving trust for the respondent. By reducing perceived costs Dillman (1991) means that the questionnaire should be short and easy to complete in order to get a high response rate, too many questions could make it too time consuming for the respondent (Ejlertsson, 2005). Well prepared and formulated questionnaires have a bigger possibility of a high response rate (ibid). The questionnaire should also in itself be interesting to complete and therefore have a feeling of perceived reward for the respondent (Robson, 2011; Dillman, 1991). With posted questionnaires the anonymity for the respondents can be high since they are in their home area and can fill in the form when they feel they have enough time.

Factors that could affect the response rate are values and preconceptions. If the respondents not think of the study as important, he or she might skip filling out the questionnaire (Ejlertsson, 2005). Another disadvantage with questionnaires is that the respondents have no

possibility to ask attendant questions if there is anything that is difficult to understand or if an answer needs comments to be useful (Robson, 2011). There is a problem when choosing the questions to know which alternatives and questions that suit all respondents, which can be solved by testing the questions in a pilot study.

With a pilot study it is possible to get a deeper understanding of how the dairy farmers answer the questionnaire and their perception of the questions. A meeting in person makes it possible to see gestures that would not be seen in a telephone conversation (Robson, 2011). During a personal meeting even unspoken faults could be seen. It could for example be uncomfortable for someone to say that he or she do not understand the questions, this could instead be shown in body language. The interviews with the farmers explained how and why the respondents perceived the questions as they did.

4.1.1 Cover Letter and Example

Trust is according to Dillman (1991) important to increase the response rate. To promote the topic and increase the interest to complete the questionnaire a cover letter was written. The cover letter was opening with a description of how the dairy market had changed and how the dairy producers might feel about the changing environment. A short example of how derivatives works was also attached to the questionnaire. The example was supposed to explain the idea of derivatives for those who were not familiar with the tool so they could easier answer questions about their thoughts and opinions of derivatives.The cover letter, questionnaire and example is shown in appendix 1. In the letter the intentions with the study were explained, as well as how the selection was made and how the results and each answer would be handled. The authors and companies that were behind the study were named and the logos of Federation of Swedish Farmers and Swedish University of Agricultural Sciences were attached on the cover letter to get recognition and legitimacy. The authors wrote their signatures in the end of letter to make the letter and study more personal to each farmer. Contact information was attached with an invitation to make contact if there were any questions. Both the first questionnaire and the reminder were posted to the respondents containing a prepaid envelope so it only would demand around 10 minutes and no costs for the farmers to complete the questionnaire, which also was explained in the letter.

4.1.2 Questionnaire

The questionnaire was posted to avoid getting biased from farmers that frequently uses technology as computers or smartphones and therefore might have a bigger chance of being attracted to use new technology as derivatives. It might be easier to get farmers to answer a posted survey instead of visit a web page, especially if they lack computer skills. Posted questionnaires can on the contrary be an outdated way for some farmers and it is sometimes harder to get the filled form to the mailbox and the envelope is left on the bench at home and then forgotten. This issue was solved with reminders to those who had not answered the first questionnaire. Anonymity could make the response rate higher because the respondents are treated confidential and could therefore answer the questionnaire more accurate (Robson, 2011). The respondent was given a unique code to conceal the identities, but still be able to send reminders to those who did not complete the questionnaire.

To have a satisfying number of respondents within the questionnaire a response rate of 60 % was desirable (Robson, 2011). To reach a satisfying statistical result a confidence level of 95 % and allowance of 10 % in the margin of error was desirable. The total population of all

dairy farmers in Sweden was 4635 in November 2013 (www, LRF Mjölk, 1, 2013). Therefore 90 answers was needed out of the total number of dairy farmers. With in response rate of 60 %, the questionnaire needed to be sent to 150 farmers. If the response rate would be lower than 60 % the margin of error will in turn become larger, which could compromise the statistical relevance of the results in this study.

The dairy department within the Federation of Swedish Farmers provided the contact information to the respondents since all participants were members of the organisation. The dairy producers were categorized by delivered milk per year in groups of small, medium, and large companies. Small companies had less than 250 tonnes of delivered milk, medium companies had 250-750 tonnes delivered milk and the large companies had a yearly milk production of 750 or more tonnes. The large group also contains the 10 largest dairy farms in Sweden. An equally amount of farmers in each groups makes it possible to analyse differences between and similarities within the different groups.

The questionnaire was made public on Monday the 17th of Mars 2014 and closed four weeks later on Friday the 11th of April 2014. After two weeks a reminder was posted which consisted of a copy of the questionnaire. The aim was to improve the response rate to get a significant answer rate of approximately 60 %. A response rate of nearly 45 % by the 11th of April led to the choice of also reminding the farmers by telephone. Farmers that was willing to answer could either choose to do it by themselves by filling out the earlier posted questionnaire or have the questionnaire sent by e-mail, or answering it orally over telephone. The choice of using different collection strategies was due to the low response ratio. A high response rate is important to get useful and significant results (Robson, 2011). The different methods also have several disadvantages. One of the most significant disadvantage is of the risk of affecting the respondents answers with an orally questionnaire different than with a posted questionnaire. To avoid any bias on the final results, the questioner was not allowed:

i) To comment the results
ii) Provide more information than what was given within the originally questionnaire.

The respondents were getting phone calls between 8 a.m. and 10 p.m. on weekdays and had the possibility to skip questions as they had with the posted questionnaire.

4.1.2 Questionnaire Design

The questionnaire was structured to both have a layout that was easy to follow and questions divided into three sections; derivatives, about the farmer and the company and about the farm, with the aim to keep the interest of the respondent throughout the questionnaire. The most important factors in previous studies were used in this study and even though many other factors could be associated with the interest in using derivatives they were excluded in this study to not lower the response rate. All questions in the questionnaire are summed in table 1 below.

Table 1. Questions in the study divided by theme.

Question	Theme
Q1-Q3	Previous use and knowledge of derivatives
Q5-Q7	Interest in using derivatives
Q8, Q10, Q12, Q13	Personal factors
Q9, Q11, Q14-Q22, Q24-Q31, Q33	Factors inside the farming company
Q4, Q23, Q32	Factors outside the farming company

To be able to measure a person's interest toward using derivatives it is important to not only ask about what they think because at the very end their actual action may be not consistent. According to the theory of planned behavior by Ajzen (1991) a behavior is based on three parts: behavioral beliefs, normative beliefs and control beliefs. Behavioral beliefs is grounded on the consequences of an action, normative beliefs is the surrounding persons thoughts and acceptance of the subject. Last are the control beliefs that can affect the performance either to the better or the worse. All these three parts affects a person's attitude towards a subject and therefore it is important to investigate this subject through all three aspects.

The starting questions, Q1-Q3, were supposed answer the knowledge and previous usage of derivatives. The following questions, Q5-Q7, were covering the interest in using derivatives or other financial instruments. Questions Q5a) - Q5d) was referring to the respondents normative beliefs of derivatives, questions Q5e) - Q5h) was referring to the control beliefs associated with derivatives and questions Q5i)-Q7 refers to the respondents behavioural beliefs according to the interest in using derivatives.

The following questions, Q8-Q34, were covering different factors that could be associated with the interest in using derivatives. These questions could be divided into three different sections: inside the farming company, outside the farming company and personal factors. Question Q8, Q10, Q12 and Q13 were about personal characteristics of the farmer. Question Q9, Q11, Q14-Q22, Q24-Q31 and Q33 covers factors that are decided inside the company, while question Q4, Q23 and Q32 is factors outside the company.

As seen in the table the order of the themes are shuffled and there is a variation of short and easy questions and questions that require a bigger process of thinking. This layout was chosen to help the respondent to fulfil the questionnaire without feeling that it could have been too demanding. The design of each question was carefully chosen to ensure that the study measure the right thing which in this case is interest in using derivatives. When formulating the questions it was important that the respondent should be able to answer the questions without having additional information, like for example accountancy information, nearby. Every question had answering alternatives or space to fill in numbers of for example hectares, number of cows, etc. The questions about interest were assigned a Likert scale with five options to choose from.The questions were read and revised several times to reach wordings that would not be misunderstood.

4.1.3 Pilot Study

A pilot study of the questionnaire was made to detect weaknesses and unforeseen deficiencies. To improve the reliability, three dairy producers within the authors' vicinity were chosen and willing to give their view of the questionnaire. The producers were contacted by telephone and asked to voluntarily participate in a pilot study. They were all informed about the intentions and aim for the study and what they were supposed to help with if they

were willing to participate. The important part was that they were able to discuss with the authors if they understood the questions, if the questions had the correct expression and their reflections of the questionnaire overall. Those who were willing to participate were sent an e-mail a few days before the meeting where the questionnaire, cover letter and a repetition of the aim for the pilot study was included. The meeting was held at the dairy producer's home where they could feel comfortable to answer, and it wouldn't be too time consuming to the participants.

During the interview two of the authors were present to detect as many misunderstandings and body language expressions as possible. The aim was to ask open questions and not lead or explain the questions. The understanding of the questions is important to make sure that the right object is measured (Robson, 2011). If the respondents did not understand the questions, it was usually because of deficient formulations. Obvious misunderstandings can lead to misleading answers which is hard to detect in the results. The pilot study revealed weaknesses like too few answer options and imprecise formulations in some questions. Another thing was that one participant had hedged both currencies of European fundings and crops, but without knowing it was called forwards and then answered that he never had used derivatives. The question about earlier experience was then further developed to ask specific for previous use of hedging fodder, currencies or crops. With well formulated and clear questions this weakness can be minimised or eliminated. Several of the comments were similar and when last participant in the pilot study did not result in any new weaknesses the pilot study had reached the optimal number of participants. The questionnaire was then revised regarding design and formulations. One last follow-up control was made with help from researchers at the Department of Economics at SLU to make sure the changes were improvements.

4.2 Probit Regression Analysis

To describe which factors that influence an interest in using derivatives a probit regression were chosen. A probit is an effective tool when illustrating factors correlation to an interest because it addresses the research question in a simple, solid and straightforward way. To be able to answer the aim of this study a probit regression analysis over the data generated by the answers in the questionnaire was made. A probit regression function makes it possible to calculate an expected outcome over a number of observations (Damodar & Dawn, 2009). It creates the best fitted curve as a normal distributed function for a dependent variable. The dependent variable in a probit function is a binary choice function, which means it can only take two values such as "yes" or "no".

The dependent binary variables in this study is Q2, which is formulated as "*Are you interested in hedging your milk price?*" and indicates farmers' willingness of using derivatives for hedging against volatile milk prices. Because a probit regression is based on a binary choice, each answer of Q2 will represent its own question in the analysis. The dependent variable is therefore divided into the following five yes or no questions, which all five are analysed in its own probit function:

i) Would you like to hedge using a bank?
ii) Would you like to hedge using a cooperative?
iii) Would you like to hedge using either bank or cooperative?
iv) Do you not want to hedge?
v) Are you unsure of your willingness to use derivatives?

To determine to what extent a variable influences the farmers' interest in using derivatives a describing function was created. The result of the probit regression is a combination of independent variables that are expected to have a relation to the investigated Q2, which in this case are the factors (Damodar & Dawn, 2009). These are represented as coefficients in the function for each of the factors. The function is described as follows:

$$P\,[(yi|xi1, xi2,...,xin) = 1] = \Phi(\beta 1 + \beta 2xi1 + \beta 3xi2 + ...+\beta 3xin)$$

Where Φ is the cumulative normal probability distribution and the argument inside Φ is a linear function of n numbers of questions in the questionnaire (Damodar & Dawn, 2009). A probit function calculates an expected outcome of y = 1, i.e. an answer equal to yes, as a function of the independent variables. The closer y is to 1, the better the optimisation. The factors could either be a dummy variable, which means it is binary and can take the value 1 or 0, or be rated with a Likert scale from one to five, take a percentage number or a real number. The betas in the function are represented by each factor's coefficient and describe how the expected outcome is dependent of each factor. Each beta is calculated to give a value as high as possible for the expected value in the probit function.

The factors are given a value of the probability, a p-value. A p-value determines the probability of correctly describing the outcome of the probit function (Damodar & Dawn, 2009). If the p-value is higher than 95 %, the factor will correctly describe the outcome in more than 95 % of the cases. A value of less than 95 % is considered to have a low significance. Significance describes the probability of an effect that is not only due to chance alone. To get the best fitted regression, factors with low significance were eliminated until all remaining factors had significance in the regression. The remaining factors with high p-value were then interpreted due to the likelihood of being significant. For example if only a handful farmers have answered yes to one of the dependent variables and have the same answers on a specific factor, it will result in a high p-value but without statistical relevance.

4.3 Reliability

Reliability describes if the result from the measured object is consistent and the results would be the same if the survey would be re-made (Robson, 2011). There are different threats to the reliability of a study. One threat is if the answers are influenced by the state of mind of the participant (Saunders et al., 2009). The questionnaires were sent during a hectic period for the farmers which could have made them less interested to answer sincerely. Another threat is if the respondents answer as they think someone would like them to, instead of their own thoughts. The farmers could also be affected by stakeholders in the dairy industry that transmit their opinion of derivatives the farmers. The results could also be affected by the change of method, because it is difficult to always phrase the questions exactly alike to every phone called farmer. The perception could be different for the participant when reading the questions instead of getting them read out via telephone. The participant's understanding of the questions could affect the results. Therefore it is important to strictly organise the questionnaire with boxes to check and not too long questions.

4.4 Validity

When constructing a questionnaire the validity of the questionnaire needs to be taken into account. This ensures that the questionnaire will measure the right thing. Validity can be divided into different types of validity: internal, content, construct and predictive.
Internal validity is if each question measures the right thing and if they reflect how the reality looks like (Saunders et al. 2009). The questionnaire had questions about the farmer and farm characteristics which makes it possible to compare the results with national statistics and reveal if the sample were representative with the reality. The questionnaires content validity refers to if the questions cover the subject that is to be measured and if the factors are essential to the study. Construct validity is about how well the test actually is measuring the interest and if there can be some generalising statements from it. To be able to tell if the result of this study is predictive it is important to look at the analysis and the findings as the response rate and p-value is satisfying.

The questionnaire was based on the literature review where earlier studies of farmers' interest in hedging have been presented. It is important to recognise that different parts of the world have various politics, financial status, cultures, and religions that could influence their measurement. To get a well underpinned study it is important that both reliability and validity are high.

It must be said that the validity of this study could be compromised by the fact that only few of the respondents knew how derivatives work. Having more farmers showing sound familiarity with the derivatives could have potentially lead to different results. In particular, factors which have been shown to not be correlated with our result could have reasonably been showing a significant correlation if more farmers were informed about the mechanisms at the basis of the derivative's adoption.

4.5 Ethical Considerations

Several ethical aspects have been considered within this study. The main consideration was how derivatives are addressed to both the reader of this study but also to the dairy producers when answering the questionnaire. It was important not to induce anyone to think of derivatives as only good or to persuade someone to use derivatives even if he or she not had intentions to do it before (Grinyer, 2002).

To be ethical during surveys it was important to inform the respondents about the intentions with the results and describe how each answer was to be handled during the study and how it is stored in the future (Grinyer, 2002). It was also important to describe the persons behind the research and how each respondent were selected. The cover letter to the questionnaire described this and informed the respondents that their answers are important for the survey but still voluntary. Incentives for answering were chosen to be excluded to not force someone to participate in the study even though the frequency could have become higher as a result of using incentives.

Two of the questions address the company's health (Q25 and Q33) which for many farmers could be sensitive to reveal without feeling too private. Because of that reason some of the respondents could have left those questions unanswered in the questionnaire. Since it has been showed in previous studies that leverage is an important factor when describing farmers'

thoughts of risk and derivatives, it was still an important question to retain in the questionnaire.

Since speculating in commodities could be seen as an ethical dilemma, it might be a reason of a negative attitude towards the use of derivatives in the results. Neurath (2012) argues that speculating in commodities may increase the prices of food and thereby affects both consumers and producers. The refutation is that hedging makes commodity prices less volatile for the user. Since a market with many actors becomes more functional, primary producers can also increase their production if the risk is reduced. Some banks in Sweden have chosen to not participate in the derivative market of commodities. While some other banks has a different strategy when advising their customers (ibid).

5 Empirics

A description of the farmer's answers gives a good picture of the participants, their dairy farm and their opinions in the subject. This chapter presents the collected and compiled results of the questionnaires.

Of the 150 farmers, 67 completed the questionnare by sending back the posted version, which corresponds to a response rate of 44.7 %. This is low in relation to other posted questionnaires and implicates that the margin of error will increase in relation to what was desired (Robson, 2011). This means that if the study was made again the answer could differ with more than 10 %. Results with a high correlation are still accurate but correlations that could be affected if the results change 10 % will not be accurate. The results of calling the respondents increased the response rate above the threshold of 60 % (63.3 %), which gave a total number of 94 respondents.

To distinguish if the answers were different between the two methods, the results of the questionnaire are described separately. One group consists answers received by post while the other group consists of answers from both posted and questionnaires filled up at the phone, which from now on is called the summarised group. Both groups are illustrated separately in the tables in this chapter, where the white columns represent the posted group and the grey columns represent the entire number of responses. Where there was a significantly difference between the posted group and the summarised group, both of the answers are described, and if not, only the summarised group is presented in the text because that group has a higher statistical relevance.

Table 2 shows the response rate according to the size related subgroups. Farmers who own small companies responded to a wider extent within the questionnaire received by the telephone calls. The posted questionnaire had a slightly higher percentage of response rates from farmers with middle and large sized farms than the summarised group.

Table 2. Response ratio divided by delivered tonnes of milk per year.

Size	Posted group	Summarised group
Less than 250 tonnes per year	28.8 %	35.8 %
250-750 tonnes per year	28.8 %	25.5 %
750 and more tonnes per year	42.4 %	38.3 %

As suspected from the beginning and as the pilot study reinforced Q25 about the solidity of the firm was a sensitive question that many of the farmers did not answer. Because of a low response rate Q25 was excluded in the analysis.

5.1 Summary - Results of Questionnaires

As seen in table 3, only 6 % knew how derivatives work and 14 % did not know what it was. 38 % of the farmers had some understanding of what derivatives are. 24 % of the posted respondents and 18 % of all respondents wanted to use derivatives regardless of who offers

the service and 39 % in both groups were not sure if they wanted to use derivatives. 56 % of the farmers had previous experience of hedging by using derivatives either by hedging fodder (21 %), crops (12 %), or the currency in the European funding (21 %).

Table 3. Dairy producers' knowledge and experience of using derivatives, where the white column represents the posted group and the grey column represent the summarised group.

Q1. Knowledge of derivatives			**Q2. Interest in using derivatives**		
I know how it works	8%	6%	**Yes, if a dairy offers the service**	12%	13%
I know roughly how it works	39%	38%	**Yes, if a bank offers the service**	2%	3%
I have heard of it	42%	42%	**Yes, regardless of who offers the service**	24%	18%
I don't know what it is	11%	14%	**No, I'm not interested**	23%	27%
			Not sure/don't know	39%	39%
Q3. Prior experience of using derivatives					
Hedging fodder through a merchandiser?	21%	21%	**Hedging crops through a crop-buyer**	11%	12%
Hedging currencies in European funds?	23%	21%	**Hedging crops through a bank**	3%	2%
			What is the hedged proportion of crops (%)?	6%	5%

Figure 6 shows the average of perceived concerns regarding different frequently changing factors ranked from the highest concern (1) to the lowest concern (7). As seen in the figure, milk price was the bigger concern followed by political changes and input prices.

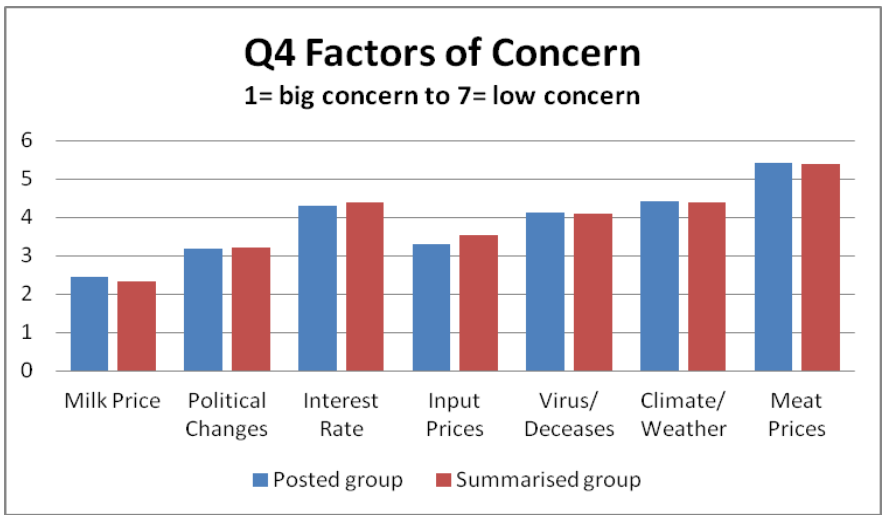

Figure 6. Q4, Factors causing concerns graded from big concern (1) to low concern (7).

As described in table 4, 53 % of the farmers in the posted group and 49 % of all respondents did not know or were unsure, if derivatives minimise the risk of volatility. 3 % of the farmers in the posted group and 11 % of all respondent fully agreed with the statement that derivatives are hard to learn. 9 % of the farmers in the posted group and 13 % of all respondent fully agreed with the statement that they are afraid of being fooled. 26 % of the farmers in the posted group and 34 % of all farmers in the questionnaire fully agreed with the statement that it is important to have a low debt ratio and 21 % of the posted group and 27 % of all respondents fully agreed that it is important to know about other dairies milk prices.

Table 4. Dairy producers' thoughts about derivatives, where the white columns represent the posted answers and the grey column represent summerised answers in the study.

Q5 & Q7	Fully agrees		Broadly agrees		Don't know/ not sure		Agrees partly		Do not agree	
Q5a. Derivatives are minimizing the risk of volatility in price	8%	13%	35%	32%	53%	49%	3%	3%	2%	3%
Q5b. If I use derivatives my income generated by the milk will decrease	2%	1%	6%	10%	69%	62%	12%	12%	11%	15%
Q5c. I think derivatives are difficult to learn and understand	3%	11%	21%	20%	48%	40%	23%	20%	5%	9%
Q5d. I think derivatives are time demanding	5%	12%	13%	14%	56%	46%	23%	22%	3%	6%
Q5e. Future volatility in milk prices are a source of concern	30%	32%	36%	35%	17%	13%	12%	14%	5%	6%
Q5f. I'm worried about being fooled when using derivatives	9%	13%	18%	14%	38%	29%	21%	21%	14%	21%
Q5g. I'm worried about doing wrong when using derivatives	14%	21%	27%	24%	35%	28%	18%	16%	6%	11%
Q5h. I'm worried about being committed during a longer time	12%	19%	29%	28%	38%	33%	17%	13%	4%	7%
Q5i. It's important for me to be low in debt ratio	26%	34%	26%	23%	15%	12%	30%	27%	3%	4%
Q5j. It's important for me to be aware of other dairies' prices	21%	27%	29%	29%	18%	13%	24%	22%	8%	9%
Q7. I fix the interest on my loans	0%	0%	3%	6%	14%	10%	80%	79%	3%	5%

Most of the farmers updated themself of the milk price on a daily basis, which is shown in table 5 below.

Table 5. How often dairy producers check the milk price, the white columns represent the posted answers and the grey columns represent all answers in the study.

Q6.	Several times a day		Daily		Every other day		Some times		Never/ don't care	
How often do you check the milk price?	3%	6%	45%	44%	8%	6%	30%	27%	14%	17%

As seen in table 6 the average farmer of this study was 54 years and 96 % of the farmers in the survey were male. 27 % of the farmers had an income outside the farm and 93 % were leasing land. The average farm supplied a number of 5 fulltime workers. The average farm had an average size of 229 hectares, had 156 hectares of forest and was growing 84 hectares of crops. The average farm also had 147 milking cows with 1630 tonnes in the posted group and 1450 tonnes delivered milk per year for all respondents. 83 % of the farms were conventional and 49 % of the farmers were awarded for their production.

Table 6. Characteristics of the farmers and their farms, where the white column represent the posted answers and the grey column represent summarised answers in the study.

About the farms and farmers							
Q8	**Average age (years)**	53	54	**Q20**	**Mean percentage of land used as fodder**	87%	87%
Q9	**Number of owners**	2	2	**Q21**	**Number of milking cows**	161	147
Q10a	**Male**	98%	96%	**Q22**	**Average requiting percentage**	32%	32%
Q10b	**Female**	2%	4%	**Q24a**	**Organic production**	15%	17%
Q11	**Number of fulltime workers**	5	5	**Q24b**	**Conventional production**	85%	83%
Q12	**Income outside the farm**	27%	27%	**Q26**	**Average awarded farmer**	47%	49%
Q16	**Leasing land**	91%	90%	**Q27**	**Average delivered milk (tonnes)**	1630	1450
Q17	**Average size of forest (hectares)**	200	156	**Q28a**	**Breed SLB**	74%	71%
Q18	**Average size (hectares)**	265	229	**Q28b**	**Breed SRB**	65%	65%
Q19	**Average size of grown crops (hectares)**	108	84	**Q28c**	**Other breed**	3%	2%

Figure 7 and 8 shows that the most common level of education was finished secondary school. None of the respondents had a post graduate degree. The figures also show that the posted group's second most common level was a university degree, while in the group with the summarised answers the second most common was primary school.

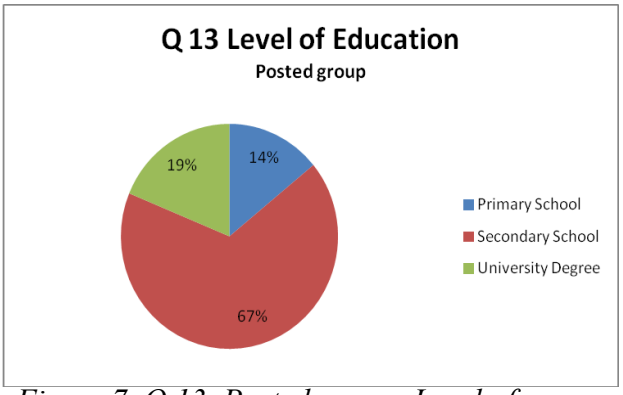

Figure 7. Q 13, Posted group: Level of education.

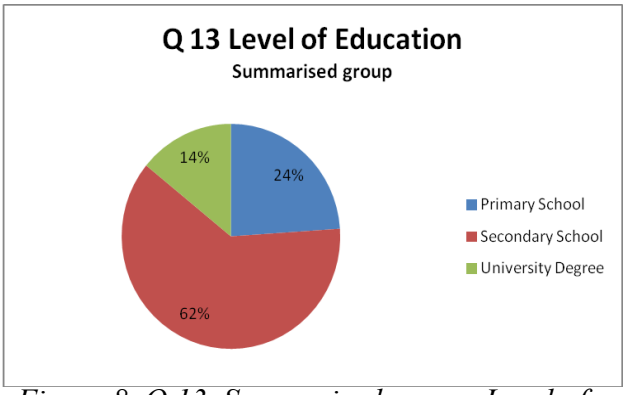

Figure 8. Q 13, Summarised group: Level of education.

Figure 9 and 10 illustrates the distribution of the legal forms adopted by the dairy companies of the study. Sole proprietor companies were most commonly used with about 63 % in the posted group, while limited liability companies come second with 23 %. In the total group sole proprietor companies had a share of 73 % and the limited companies represented 16 %. Some of the companies had a combination of more than one type of legal form to manage the farm, but they were few in both groups, so were also general partnerships and other legal forms.

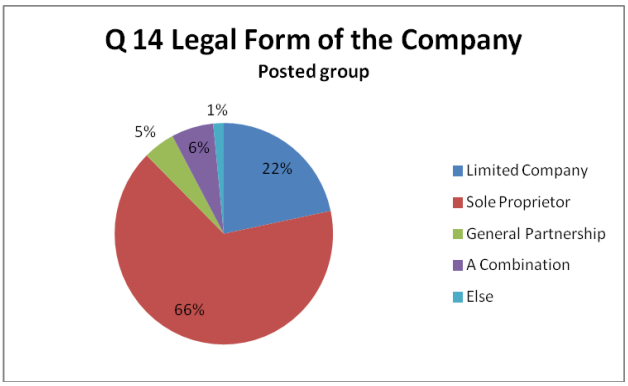

Figure 9. Q 14, Posted group: Legal form of company.

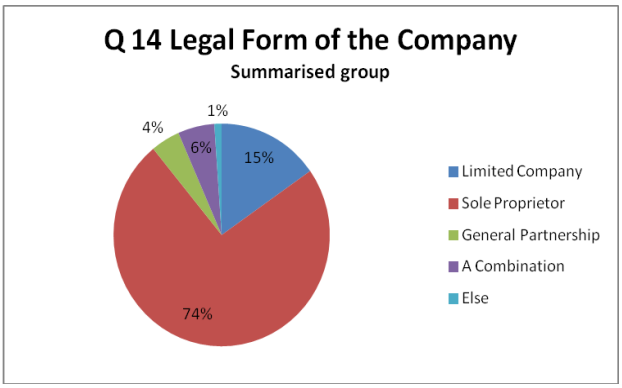

Figure 10. Q 14, Summarised group: Legal form of company.

Figure 11 and 12 shows that most of the farmers were located in the southern part (Götaland), with almost 64 %. 19 % of the farmers were located in the middle part of Sweden (Svealand) and 17 % were located in the northern part (Norrland). The differences between the posted group and the summarised group are not significant as seen in both figure 11 and 12.

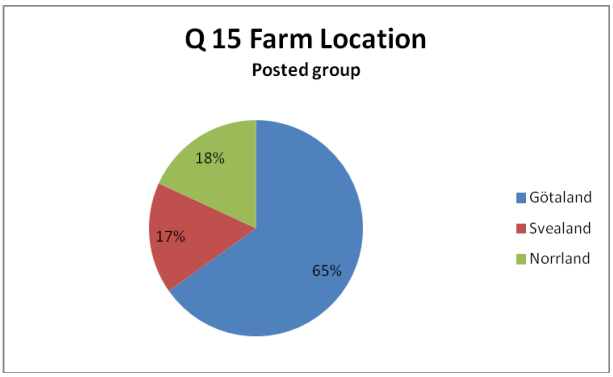

Figure 11. Q 15, Posted group: Dairy farms location in Sweden.

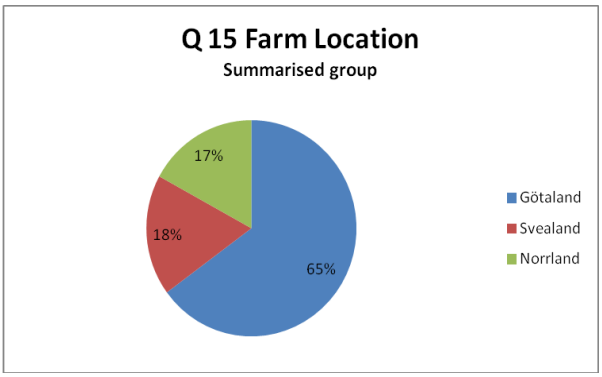

Figure 12. Q 15, Summarised group: Dairy farms location in Sweden.

Figure 13 and 14 shows what farmers thought of the future development of their dairy farm company. Of the farmers 26 % in the posted group and 21 % in the summarised group planned to expand in the future. While most of the farmers (66 % in the posted group and 64 % in the summarised group) hoped to keep an equal production as they had. 8 % of the posted group and 15 % of the summarised group planed to quit their dairy production.

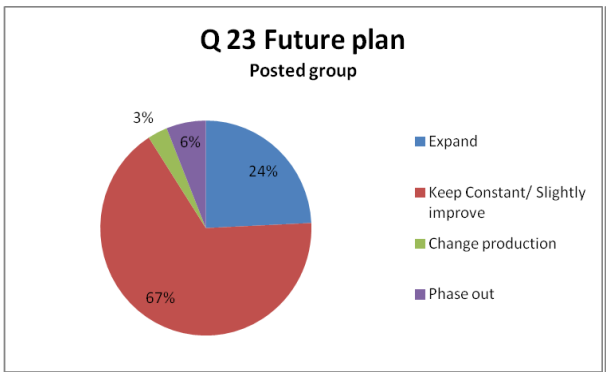

Figure 13. Q 23, Posted group: Farmers' plan for the future.

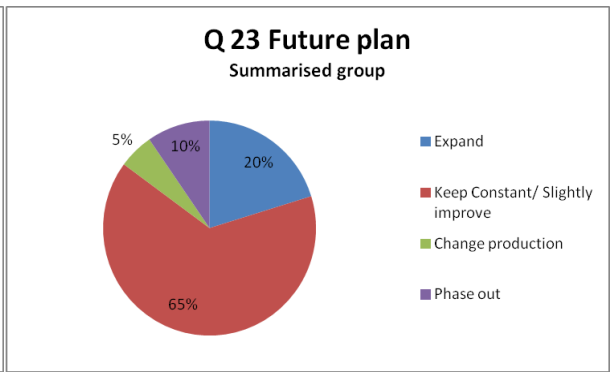

Figure 14. Q 23 Summarised group: Farmers' plan for the future.

Most of the farmers had a stanchion milking system. The posted group with 44 % and the summarised group with 50 %, which is shown in figure 15 and 16. The second most commonly used system in the posted group was the automatic system with about 20 % and the third is tandem system with 18 %, while in the summarised group the tandem system was second most commonly used with 18 % and automatic system on the third place have 17 %.

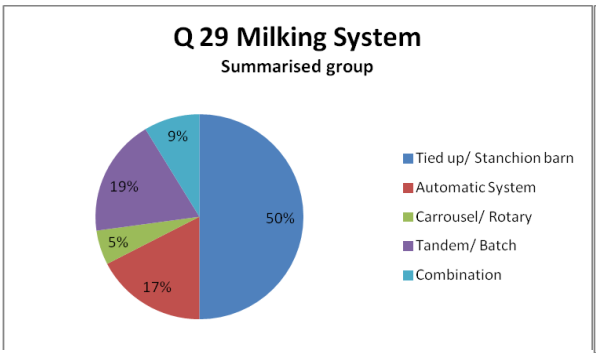

Figure 15. Q 29, Posted group: Type of milking systems.

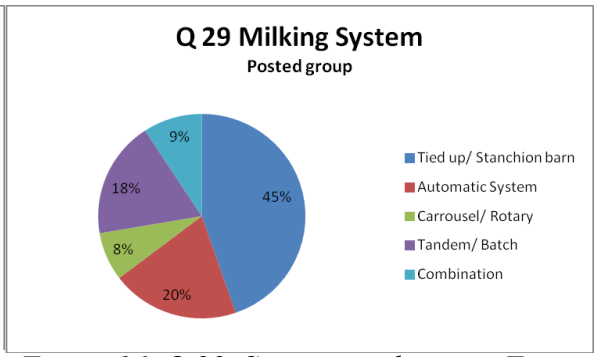

Figure 16. Q 29, Summarised group: Type of milking systems.

Most of the farmers in this study were delivering milk to Arla, about 69 % as shown in figure 17 and 18. Other usual dairy cooperatives were Skånemejerier with 16 %, Norrmejerier 9 %, Falköping 3 % and Gefleortens 2 %. The results of the posted group do not significantly differ from the summarised group.

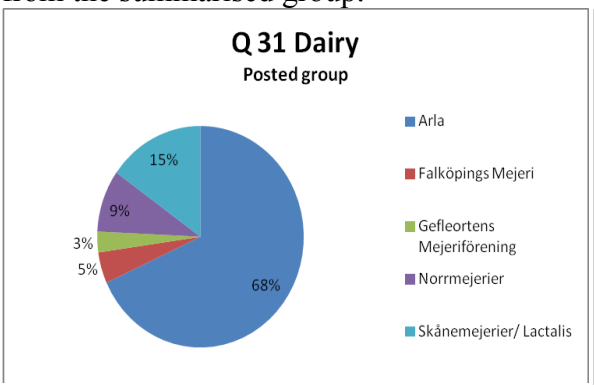

Figure 17. Q 31, Posted group: Processing companies.

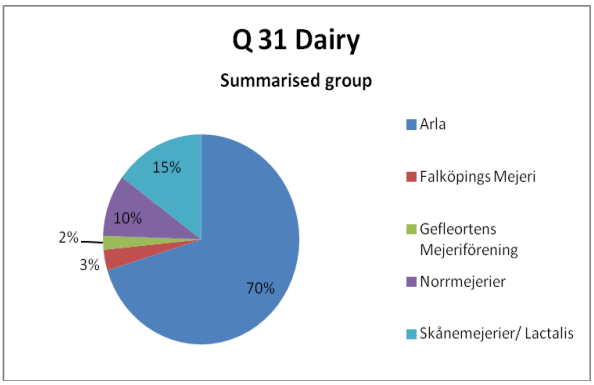

Figure 18. Q 31, Summarised group: Processing companies.

Most of the farmers received their information about the dairy market by newsletters from dairies and agricultural newspapers, which is illustrated in figure 19 below. Sites on internet and newspapers were also common information sources.

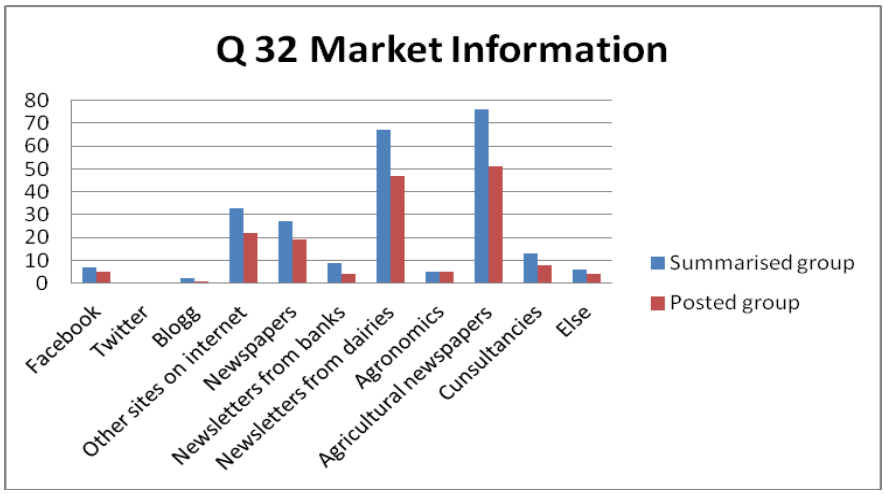

Figure 19. Q 32, Information channels for dairy prices in absolute numbers.

The farming companies had on average an estimated positive result during the last four years, which is shown in figure 20 and 21.

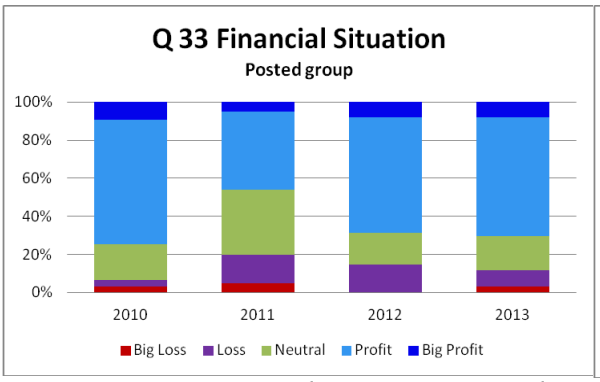

Figure 20. Q 33, Posted group: Perceived result during the recent four years.

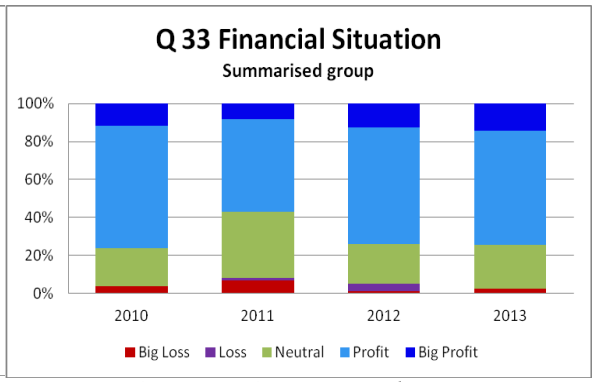

Figure 21. Q 33, Summarised group: Perceived result during the recent four years.

5.2 Summary - Interested

In this section the main difference between respondents interested in using derivatives and all respondents is highlighted. This group is represented by farmers, who are interested in hedging using a bank, a dairy cooperative, or either of them. 34 % of all respondents were interested in the use of derivatives. The positive respondents had a wider experience of using derivatives, 31.3 % compared to 22 % had hedged fodder and 37.5 % in relation to 22 % had secured their currencies in the European funds before. The interested farmers did not think derivatives were as timeconsuming as the average total group (2.5 in relation to 3.0, where 1 corresponds to “fully agree” and 5 corresponds to “do not agree”). The positive group was also less worried of doing wrong when hedging (2.7 in relation to 3.3). The group was less afraid of being tied up for a long time when hedging (2.7 in relation to 3.3).

The average farmer was two years younger and the farm was supporting 6.8 full time workers in relation to 4.5 full time workers. 7 % more of the farmers had income outside the farm and 8.5 % more had general partnership as the legal form. Owned land increased with 30 hectares

to 185 and the average herd size increased with 112 lactating cows. Less of them had a stanchion milking system, 10 % more had an AMS and 7 % had a tandem/batch system. 10 % more wanted to expand in relation to all respondent and 6 % less wanted to chase out.

5.3 Summary – Not interested

This section describes the main difference between farmers, who are not interested in using derivatives and the total number of respondents. 27 % of the farmers did not want to use derivatives when hedging their milk price. They had less prior experience of hedging, 16 % in relation to all respondents (21 %) had hedged fodder previously and 13 % in relation to 22 % had secured their currencies in the European funding. The average age of the farmer was one year older and the farm supported less full-time workers, 3.28 in relation to 4.49. 11 % more of the farms had a sole proprietor as legal form 85 %.

The owned land decreased with 36 hectares and average herd size decreased with 59 lactating cows. The milking system were more traditional were 10 % more had a stanchion milking system. Less of them wanted to expand the company in the future and 3 % more of them wanted the phase out.

6 Analysis

The aim of the study is to reveal if there are any similarities or differences of farmers' interest in using derivatives and to find out if the farmers have enough knowledge of the instrument or not. In this chapter five different probit regressions are presented based on the different answer options of the dependent question about the interest in using derivatives.

The dependent variable in this study is regarding the farmer's interest in using derivatives. Since the dependent variable is binary, each of the five answer alternatives in Q2 becomes a question of its own with a "yes" or "no" as answer. The five models have been divided by the farmers' willingness of using derivatives by interested, not interested or unsure. The models of interested respondents are then divided by whom the farmer want use derivatives through, a cooperative, a bank or both. Each and one of the questions represent the following five probit models:

Model I: *I would like to hedge using a bank*
Model II: *I would like to hedge using a cooperative*
Model III: *I would like to hedge using either bank or cooperative*
Model IV: *I am not willing to use derivatives*
Model V: *I am unsure if I want to use derivatives*

In all models the column at the right shows the significance as a number of asterisks, as seen in the p-value columns three stars have a higher p-value than one asterisk. A factor with one asterisk has a p-value between 90 % and 95 %, A factor with two asterisks has a p-value between 95 % and 99 %, while a factor with three asterisks has a p-value of more than 99 %. The column with coefficient shows if the factors have a negative or positive correlation to the dependent variable. A negative value corresponds to the opposite of the statement described in the left column and a positive value corresponds directly to the statement.

There is a risk that individual independent variables are describing the same dependent variable because of a correlation between them. Multicollinearity describes how well each individual independent variable explains the dependent variable (O'Brien, 2007). To eliminate the risk of multicollinearity between variables a variation inflation factor (VIF) test over the independent variables was made. If the VIF has the minimum value of 1.0 the variable in question is orthogonal to the other independent variables. A value greater than 4 is sometimes taken as an indicator for collinearity. In the following five models the VIF was never over 2.0, see appendix 2 for each model's VIF. This indicates no or low risk of multicollinearity between the variables.

6.1 Model I: Interested - Using Cooperative

Model I, in table 7, shows that 12.8 % (0.127660) of the respondents answered yes to this dependent variable. 84 of 94 observations were correctly predicted in the model, which corresponds to 89.4 % rightly predicted observations. Farmers which had a partnership as legal form of the company, described as a dummy variable, were more likely to use a cooperative when hedging and they were not worried about doing wrong when using derivatives. As described by Wu et al. (2014), a company with many owners has a better credit position and should have a better financial health, which indicates that the company is

not in the same need for derivatives as a company with poor financial health. Farmers, who are willing to try new things and not are worried of doing wrong despite lack of knowledge in an imperfect market, could be considered risk loving. A risk-loving farmer should be more interested in selling at spot price and not in futures according to Franken et al. (2012). Their behaviour could instead be explained by the fact that they are innovators and early adopters and therefore interested in learning new technologies (Rogers, 2003).

Table 7. Model I shows the probit analysis of the dependent variable "Yes I am interested to hedge my milk if a dairy processing company provides it"

12 of 94 respondents agreed with this statement	**Coefficient**	**Std. Error**	**z**	**p-value**	
Constant	-0.42534	0.441282	-0.9639	0.33511	
My legal form of my company is a partnership.	1.89717	0.670627	2.8290	0.00467	***
I am worried about doing wrong when using derivatives.	-0.287402	0.141268	-2.0345	0.04191	**

Mean dependent var	0.127660	S.D. dependent var	0.335500
McFadden R-squared	0.182917	Adjusted R-squared	0.099351

Probit, using observations 1-94
Number of cases 'correctly predicted' = 84 (89.4%)

6.2 Model II: Interested - Using Bank

As seen in model II 3.2 % (0.031915) of the respondents answered yes to this dependent variable. 91 of 94 observations were rightly predicted using model II, which in turn corresponds to 96.8 %. As model II shows, in table 8, the farmers with an income outside the company were likely to hedge milk prices using a bank and they did not think derivatives is hard to learn. This study shows that farmers with an income outside the farm in relation to farmers, who not had an income outside the farm, are not exposed to the same level of risk. This is according to Mishra & Goodwin (1997) because these farmers are more risk averse and thereby more willing to spread the risk of being affected of price volatility by having several sources of income. A risk averse farmer is more likely to use derivatives, which implies that a farmer with an income outside the farm should, as the analysis describes, be positive toward using derivatives. According to Shapiro & Brorsen (1988) a lack of understanding will lower the usage of derivatives and as the analysis shows, the farmers did not think derivatives is hard to learn and should therefore also be willing to use them.

Table 8. Model II shows the probit analysis of the dependent variable "Yes I am interested to hedge my milk if a bank provides it"

3 of 94 respondents agreed with this statement	Coefficient	Std. Error	z	p-value	
Constant	0.167591	0.959383	0.1747	0.86133	
I think derivatives is hard to learn	-1.21084	0.579772	-2.0885	0.03676	**
Do you have off-farm incomes	0.998173	0.749037	1.3326	0.18266	

Mean dependent var	0.031915	S.D. dependent var	0.176716
McFadden R-squared	0.431831	Adjusted R-squared	0.206024

Probit, using observations 1-94
Number of cases 'correctly predicted' = 91 (96.8%)

6.3 Model III: Interested - Using Both Bank and Cooperative

18.1 % (0.180851) of the respondents answered yes to this dependent variable as seen in table 9. In 85 cases out of 94 observations the model predicted the correct result, which corresponds to 90.4 %. Farmers, who were not afraid of being tied up during a period of time and thought milk price together with political changes were an important source of concern were interested in using derivatives irrespective of the institution which was willing to offer the product. The two sources of concern should imply that they are to some extent risk averse and should, according to Mishra & Goodwin (1997) and Patrick et al. (1985), be willing to use derivatives. As seen in the model there is a difference in interest in using derivatives between the posted and phone called group. This difference could be due to the fact that the posted group has a larger average size. Shapiro & Brorsen (1988) and Goodwin & Schroeder (1994) describes that larger farms are more likely to use derivatives. A correlation with Internet usage and interest in using derivatives with whoever that offers the service is significant in this study and cannot be neglected.

Table 9. Model III shows the probit analysis of the dependent variable "Yes I am interested to hedge my milk by whoever that provides it"

17 of 94 respondents agreed with this statement	Coefficient	Std. Error	z	p-value	
Constant	1.8418	1.36324	1.3510	0.17668	
I find information about milk price on Internet	1.79074	0.542246	3.3025	0.00096	***
I deliver my milk to Falköpings Mejeri	2.13975	1.21114	1.7667	0.07727	*
Milk price is not a source of concern	-0.803835	0.373824	-2.1503	0.03153	**
Political changes is not a source of concern	-0.331902	0.156877	-2.1157	0.03437	**
I am afraid of being tied up for a period of time	-0.837357	0.27082	-3.0919	0.00199	***
Posted farmers	1.56801	0.73711	2.1272	0.03340	**

Mean dependent var	0.180851	S.D. dependent var	0.386959
McFadden R-squared	0.546856	Adjusted R-squared	0.389312

Probit, using observations 1-94
Number of cases 'correctly predicted' = 85 (90.4%)

6.4 Model IV: Not Interested

As seen in model IV, in table 10, 26.6 % (0.265957) of the respondents answered yes to this dependent variable. 84 of 94 observations were correctly predicted in the model, which in turn corresponds to 89.4 % correct observations. In contrast with what Makus et al. (1990) describes, a farmer who have a company with high income are more likely to use derivatives. This study shows that farmers not are interested in using derivatives if the financial result was good during 2012.

Farmers that think derivatives are time demanding and did not think they minimised risk, shows a lack of understanding. This should in turn, according to Shapiro & Brorsen (1988), lower the usage. The model's result is therefore according to these factors in line with what the previous studies showed. Prior experience has been shown, according to Makus et al. (1990), to positively influence the use of derivatives. As the farmers in model IV did not have any prior experience they did not want to use derivatives. The farmers often checked the milk price but were not worried about price changes, which could be explained because they think price volatility is a part of the business and therefore are not interested in using derivatives (Anderson & Mapp, 1996).

A correlation with virus and diseases as a source of concern and the interest in using derivatives with whoever that offers the service has not been seen in previous studies. In this study the correlation has seen to be significant and cannot be ignored.

Table 10. Model IV shows the probit analysis of the dependent variable "I am not interested in using derivatives".

25 of 94 respondents agreed with this statement	Coefficient	Std. Error	z	p-value	
Constant	-3.22621	1.72648	-1.8687	0.06167	*
I have prior experience of hedging fodder	-1.95022	0.904033	-2.1572	0.03099	**
Virus/diseases is not a big concern	-0.311952	0.117866	-2.6467	0.00813	***
Derivatives minimising the milk price volatility	-0.643467	0.332529	-1.9351	0.05298	*
I think derivatives are time consuming	0.931257	0.280135	3.3243	0.00089	***
Future milk price volatility is worrying	-0.649783	0.215665	-3.0129	0.00259	***
I am often updated regarding milk price	1.43529	0.500168	2.8696	0.00411	***
Good financial result during 2012	0.722132	0.254419	2.8384	0.00453	***

Mean dependent var	0.265957	S.D. dependent var	0.444211
McFadden R-squared	0.536804	Adjusted R-squared	0.389865

Probit, using observations 1-94
Number of cases 'correctly predicted' = 84 (89.4%)

6.5 Model V: Not Sure

Model V, in table 11, shows that 39.4 % (0.393617) of the respondents answered yes to that dependent variable. In 75 cases of 94 observations the model's prediction was correct, which in turn corresponds to a correct prediction in 79.8 % of the observations. Farmers, who were worried of doing wrong and worried for volatile milk prices, tended to be doubtful about using derivatives. These farmers are the ones who should be interested in using the instrument according to Franken et al. (2012) and Patrick et al. (1985). Another thing that indicates that the farmers should be interested in using derivatives is that they did not own forest and their company had a bad result during 2012. They are therefore exposed to a high risk and should be interested to reduce it because they were worried about the milk price, but as Harwood et al. (1999) describes, a farmer, which was running a company with low income, was more likely to not use derivatives. Farmers, who had more hectares than other farmers, were also more likely to be doubtful. This is also in opposite to what previous studies have shown. Shapiro & Brorsen (1988) and Goodwin & Schroeder (1994) found in their studies that size is positively related to the use of derivatives. Despite the fact that they should be interested in using derivatives according to previous studies, many of the farmers had a lack of understanding regarding how derivatives are functioning and this explanation together with the theory of Technology Adoption Lifecycle could elucidate why these farmers are doubtful when it comes to their interest in using derivatives (Rogers, 2003).

Model V also shows that farmers with a stanchion milking system where more likely to be doubtful about using derivatives, which could indicate that they are laggards who are more traditional and not interested in the adopting new technologies (Rogers, 2003). These farmers

could be considered to be more conservative and are therefore not interested in the use of derivatives. They can also have a stanchion milking system because of expensive investments if they want to change system on the farm and as Hardwood et al. (1999) concludes it is of big importance to have good risk managing knowledge when the leverage is getting high to avoid bankruptcy. As Patrick et al. (1985) reveals, farmers strives for safety first and a big investment can be risky as well as moving on to adopt a new financial instrument as derivatives.

A correlation with virus and diseases as a source of concern and the interest in using derivatives with whoever that offers the service has not been seen in previous studies. In this study the correlation has seen to be significant and cannot be ignored.

Table 11. Model V shows the probit analysis of the dependent variable "I am not sure if I am interested/ I don´t know"

37 of 94 respondents agreed with this statement	**Coefficient**	**Std. Error**	**z**	**p-value**	
Constant	-4.39	1.34551	-3.2627	0.00110	***
I think price volatility of milk is worrying	0.406873	0.147768	2.7535	0.00590	***
I am worried of doing wrong when using derivatives	0.504837	0.156682	3.2220	0.00127	***
Price of milk is a big source of concern	0.309587	0.125072	2.4753	0.01331	**
Virus/diseases is a big source of concern	0.213715	0.100533	2.1258	0.03352	**
I own forest	-0.00356296	0.00170412	-2.0908	0.03655	**
Hectares of crops	0.00289401	0.00156584	1.8482	0.06457	*
Good financial result during 2012	-0.35445	0.179703	-1.9724	0.04856	**
Stanchion milking system	0.935681	0.367286	2.5476	0.01085	**

Mean dependent var	0.393617	S.D. dependent var	0.491171
McFadden R-squared	0.410749	Adjusted R-squared	0.267919

Probit, using observations 1-94
Number of cases 'correctly predicted' = 75 (79.8%)

6.6 Analysis of Empirical Result

The differences between factors and empirical findings of the farmers interested or not in using derivatives are discussed in this section. The findings are divided into two groups, positive and negative farmers and those results are discussed in relation to what previous studies have shown.

6.6.1 Interested in using Derivatives

Farmers that were interested in using derivatives also had a wider experience of using derivatives which corresponds to what Makus et al. (1990) revealed in their study that it is a positive correlation between earlier usage of forward contracts and usage of derivatives.

Farmers in this study with an interest in using derivatives did not think derivatives was time consuming and were less worried of doing wrong when using derivatives and also less afraid of being lock up for a long time. According to Rogers (2003) this implies that these farmers are in the category innovators or early adopters who are more risk loving and curious of new technologies. The average age of the farmer was lower in relation to all respondents, which is described by Mofokeng & Vink (2013) to have a correlation with a higher usage of derivatives. Of those who were interested in the use of derivatives, more of the farmers had income outside the farm in relation to all respondents and according to Shapiro & Brorsen (1988) risk averse farmers spread their risk and have more off-farm income. A risk averse farmer is also more likely to use derivatives to minimising the risk of being affected by price volatility. Farmers who are interested in hedging using a bank are slightly younger than the average farmer of this study. According to Hakelius (1996) older farmer have a tendency of using a cooperative rather than other stakeholders. In this study younger farmers were more interested in using a bank instead of their dairy processing company.

Interested farmers had on average a more general partnership as the legal form which according to Wu et al. (2014) is related to a better credit situation. Shapiro & Brorsen (1988) concludes that a bad financial situation increase the use of derivatives which not support the findings in this group. Farmers interested in the use of derivatives owned on average more land and the average herd size increased, which correlates to Shapiro & Brorsen's (1988), which revealed a positive correlation between size and the usage of derivatives. The positive farmers were also on average supporting more full time workers, which also correlates with a larger size of the farm. Less of them had a stanchion milking system and more had newer system like an AMS and tandem/batch system, which indicates that these farmers have invested in new systems and could be in a higher debt position than other farmers and are therefore more interested in using derivatives (Wade et al., 2004; Shapiro & Brorsen, 1988). An interest in that situation could also indicate that the farmers are innovators and therefore are willing to try new technologies, both derivatives and new milking systems (Rogers, 2003). More of the positive farmers wanted to expand in relation to all respondents and less wanted to phase out, which implies that the company probably having a positive result and as Harwood et al. (1999) describes, farmers that are running a company with good health is more likely to use derivatives.

6.6.2 Not interested in using Derivatives

Farmers, who not were interested in using derivatives in the future, had less prior experience of hedging which correlates with the findings of Shapiro & Brorsen (1988). In opposite to interested farmers, the average farmer is older. This is also what has been seen in previous studies by Mofokeng & Vink (2013). The finding by Tauer (1986) that older farmers are more risk lover and should want to hedge is not supported in this study, this could be due to the lack of knowledge of the instrument. But Makus et al. (1990) on the other hand did neither find that type of correlation. On average more of the farmers not interested in using derivatives had sole proprietor as legal form. These companies had fewer owners and therefore have a poorer credit situation and should according to Shapiro & Brorsen (1988) be more positive of using derivatives.

The farmers not interested in using derivatives, on average, owned less land and had smaller herd size. A smaller farm size should imply a lower interest in the use of derivatives (Shapiro & Brorsen, 1988). Negative farmers did on average support less full-time workers, which also was correlated to the size of the farm and supports the previous studies of less usage of

derivatives. The milking system were on average more traditional were more had a stanchion milking system which could indicate either that the farmer is late majority when it comes to new technologies, that they don't want to have a higher leverage or that their financial situation is in bad shape for that type of big investments (Rogers, 2003; Shapiro & Brorsen, 1988). Fewer of the negative farmers wanted to expand than the positive ones and more of them wanted to phase out their dairy production, which also can indicate a bad financial situation.

7 Discussion

This chapter provides a discussion of how the findings in this study relate to what is presented in previous chapters and future challenges. The discussion is divided into several parts relative to the method, analyses and other factors.

7.1 Method Discussion

The analysis made in this study shows a high statistical significance, while the empirical statistics shows a high reliability. For example, the farmers in this study have the same geographical distribution as shown by national statistics. Even the delivered milk volumes to the different dairy processing companies in this study were allocated in a similar way as the recent statistics of market shares. Because the response rate was higher than desired (60 %) the margin of error is lower. That indicates a high statistical relevance of the study, which implicates that the data is sufficient for create generalized deductions.

The response rate of the posted questionnaires was 45 %, which could have been higher if the time for responding was expanded. The questionnaires were sent to the respondents during the same time as the EU-funds were supposed to be calculated and applied. Spring planting did also collide with the questionnaires because it started during the same period. This could have affected the response rate negatively. If the questionnaire were sent to the farmers during a less hectic period, the response rate would perhaps have changed for the better.

The decision about adding a second collecting method was made to increase the response rate. By calling the farmers the response rate increased beyond the desirable response rate. The biggest concern when changing the collecting method is that the interviewers should affect the respondents and in this case they might have influenced them negatively. As shown in empirical results and analysis the change in method did not significantly affect more than Model III. In this model, posted farmers were more positive toward the use of derivatives, which could be explained due to a higher response rate of farmers with a larger average volume of delivered milk, which according to other studies would have a higher willingness to use derivatives. There might be a difference between farmers interest depending on if they were phone called or posted due to differences in interest of the instrument. A farmer who is not interested and do not think derivatives are something good or useful, might have a deficiency of incentive to complete the questionnaire. A telephone call could be perceived as easier to answer and therefore also farmers uninterested of derivatives could answer. To get the study more representative to the reality it is important to not only have farmers with positive attitudes answering the questionnaire. Therefore the telephone calls could have made this study more representative to the reality in relation to only posted questionnaires.

In model III the farmers who were interested to hedge their milk price regardless who offers the service, the factor about where the farmer delivers the milk have been shown to have significance. Falköpings Mejeri had in the regression high significance but only four respondents answered that they delivered Falköping Mejeri. This factor is therefore not statistically relevant, but as those four respondents were answering in comparable ways the results became significant during the probit function.

The question about solidity of the company would have given an indication of the company's actual health in an objective way, instead of the farmers' estimated financial result during past

years. Solidity has also been shown to be highly associated with the use of derivatives and could have described how Swedish farmers' value their debt position in relation to the use of derivatives. A low answer rate in the question about solvency made this question unusable in the analysis because of low statistical relevance.

7.2 Regression Discussion

Less than 50 % of the respondents did not know how derivatives work and only 6 % could say that they knew how it works. Some of the farmers, who answered that they knew how it works, did not think derivatives lowered the price volatility. This indicates that they are likely not fully aware of how this instrument actually works. This, in turn, may have biased our findings. Lack of knowledge by some farmers was also noticed during the telephone interviews. Several of them showed an interest in the subject and asked questions about what derivatives are and how they work when the questionnaire was finished.

The question about prior experience could have been a problem in the study, as observed already in the pilot study. One of the three respondents had previous experience of hedging by securing the EU funds against currency changes and also had hedged fodder through a grain merchandiser but did not answer the previous experience question negatively. He did not consider a contract between two persons with a delivery in the future as a way to hedge against future price volatility. Several of the other respondents could have answered in the same way because their low knowledge about derivatives.

Some factors, which had high relevance in previous studies such as formal education, were not significant in this study. The results in this study could have been different if the knowledge of the dairy farmers would have been wider. As knowledge improves the results in this study could become more like previous studies have shown, with the same correlation between the factors in previous studies and willingness. If this study will be made in a few years the result could be significantly different due to the more experience the dairy farmer gets in the subject. The milk price has been high during a period of time and is expected to decrease, which have been seen to be significant to the use of derivatives. Many crop farmers started to use derivatives after a year of good prices followed by a large price drop and this could also be the case for the dairy farmers. Dairy producers are more risk preferring than other primary producers and will probably be less risk preferring when policies changes.

There is an increasing interest regarding the use of derivatives from speculators and those who want to buy the good such as dairy processor. Dairy processing companies are relying on a certain volume generated by the farmers and farmers, who are affected by high price volatility, could risk going bankrupt, which surely would have an impact on the dairy producer. To make the dairy farmers financially sustainable in the long term knowledge about the functioning and purpose of derivatives is needed or the Swedish dairy industry could be ousted by other countries such as U.S. or New Zealand. These countries are today one step ahead of Sweden and many of the farmers and dairy processing companies could learn from their success and mistakes to become financially sustainable in the long term.

7.3 Empirical Discussion

The previous studies, which has been used in this study is based on different types of farmers, mostly crop producers but the result from the empirical summary shows no significant differences in the characteristics of the farmers.

The positive farmers had more experience of using different types of derivatives and therefore have a higher knowledge of the instrument. They were diversifying their income both by hedging their different income sources and also by having an off-farm income. The positive farmers had a better credit situation and the company was larger both according to herd and acres. The farmers were more curious and not afraid of adopting new technologies as new types of milking systems.

The group of positive farmers could increase in the future if knowledge of the instrument improved and usage of derivatives increased. Younger persons are more used to computerized technology and could therefore find them easier to use. In Sweden it is not legally to invest in a stanchion system and the farmers therefore have to invest in more expensive systems. Many of the small dairy farmers will have to make a decision if they are able to continue when the stanchion system becomes less competitive.

The negative farmers had less prior experience of using derivatives and their characteristics as being older, having a worse credit situation, smaller size of herd and farm all together tells that they would be interested in lowering their financial risk in the future. Their answer that they have more tied up system and more of them wanted to phase down their production in the future supports the implication that they are late majority when it comes to adopt new technology. They might be more positive in the future when the bigger mass of people starts to know and use this new instrument, due to their uninterested preference of new technology.

7.4 Ethical Discussion

There has been a discussion about if derivatives are ethical to use and some of the Swedish banks do not use derivatives in agricultural commodities and do not speculate in them. This can result in a negative attitude even by other users of derivatives and send wrong signals to the farmer. One could argue that not protecting farmers and giving them the tools to be sustainable in the future could be more unethical than speculating in food. There could be more unethical to grow crops for fuel on our fields when people are starving in other places around the world, derivatives is however not competing with peoples need for food. The question is more about if starvation is influenced by derivatives and if the starving people get it tougher due to speculation in food prices. The question that remains is if there is support to speculate in the price of something that is unevenly distributed among the world citizens and if the use of derivatives would make it harder to solve world starvation.

7.5 Conclusion

The probit function shows that farmers, who are usually concerned about milk price level and variability, did not want to use derivatives. While farmers, who run a company with a good result and did not think that derivatives were hard to learn, wanted to use derivatives.

Derivatives are in reality best suited for farmers, who are risk averse and not willing to bear risk. The results in this study could be due to low experience and knowledge about how the derivatives work. In the future when derivatives are more common among dairy farmers this would change. It is important that all participants on the Swedish dairy market unite and start to investigate what will be influencing the dairy market and how they want to handle it.

The lack of knowledge in derivatives should be an interesting result to all stakeholders in the dairy industry. Getting a financial sustainability in the agriculture should be essential to all stakeholders. The Swedish Ministry of Rural Affairs could support education programs in farm risk management to develop Swedish dairy production as in other countries. A small investment in education programs could in a policy point of view result in a payoff that far exceeds the investment as the ratio between return and risk improves. Universities can educate farmers and students in risk management tools and support research in the topic. Also the Federation of Swedish Farmers together with the banks may be interested in developing the markets of derivatives market in Sweden.

7.6 Further Studies

This study has contributed to a greater understanding of how different factors influence farmers' interest in using derivatives. The study also shows a lack of knowledge regarding how farmers could minimise their price risk. As the volatility increases the knowledge of whom to minimise risk will become more important.

Farmers, who are interested in the use of derivatives according to this study, are the ones who are brave and willing to try new things and technologies, not the ones who are risk averse. This is, according to the theoretical background and previous studies, unexpected since the aim with derivatives is to minimise risk, something risk averse farmers should be interested in. It would be interesting to undertake similar studies in the future, in order to verify if the willingness to use derivatives changes according to deeper knowledge on the subject and larger diffusion of risk hedging instruments. Will the ones who are risk averse hedge their milk in the future? Will those who today are early adopters lose interest or is derivatives a tool that is here to stay?

Previous studies show that solvency is significantly related to the willingness to use derivatives. In contrast, in this study this feature was not significant. It would be interesting to make a survey focusing on this specific aspect in Sweden.

If this study would have been made talking a qualitative approach, this may have provided a deeper understanding of the farmers' reasons for using derivatives. Their knowledge of derivatives is only analysed from a subjective view and there were no further space for comments in the questionnaire. An interview in person would have provided deeper knowledge and would have revealed the reasons behind farmers' behaviors. The questionnaire does not reveal if they think they have lack knowledge of derivatives and are interested to learn more about the topic. It would be surely worth to develop the analysis of this aspect in future studies.

Bibliography

Articles & Reports

Ajzen, I., 1991. The theory of planned bahavior, *Organizational Behavior and Human Decision Processes*, Vol. 50, Issue 2, pp. 179-211.

Andersson, I., 2012. *Mjölkens kvalitet i besättningar med olika mjölkningssystem och av olika storlek*, Svensk Mjölk Rapport: 7095. Stockholm.

Anderson, K. B. & Mapp H. P., 1996. Risk Management Programs in Extension, *Journal of Agricultural and Resource Economics,* Vol. 21, pp. 31-38.

Bohlen, J. M., Beal, G. M., 1957. The Diffusion Process, *Special Report No. 18,* Agriculture Extension Service, Iowa State College, pp. 56–77.

Buckley, T., 2009. *Managing Price Volatility in Dairy Farming*. In Teagasc National Dairy Conference, Ireland, November 20-21, 2012.

Collins, R. A., 1985. Expected Utility, Debt-Equity Structure, and Risk Balancing, *American Journal of Agricultural Economics,* Vol. 67, pp. 627-629.

Damodar, N. G. & Dawn, C. P., 2009. *Basic Econometrics*, 5th edition, Singapore: McGraw Hill Companies Inc. International edition.

Dillman, D. A., 1991. The Design and Administration of Mail Surveys, *Annual Review of Sociology,* Vol. 17, pp. 225-249.

Eisenhauer, J. G., 2006. Risk Aversion and Prudence in the Large, *Research in Economics,* Vol. 60, No. 4, pp. 179-187.

Ejlertsson, G., 2005. Enkäten i praktiken: En handbook i enkätmetodik, 2nd editon, Lund: Studentlitteratur.

European Commission, 2013, *Monitoring Agri-trade Policy Agricultural trade in 2013: EU gains in commodity exports Agriculture & Rural Development*: Agricultural Trade Policy Analysis unit

Flaten O., Lien G., Koesling M., Valle P.S. & Ebbesvik M., 2005. Comparing Risk Perceptions and Risk Management in Organic and Conventional Dairy Farming: Empirical Results from Norway, *Livestock Production Science*, Vol. 95, pp. 11-25.

Ford, S. A., & Babb, E. M., 1989. Farmer Sources and Uses of Information, *Agribusiness: An International Journal.* Vol. 5, pp. 465-476.

Franken, J., Pennings, J. & Garcia, P., 2011. *Measuring Risk Attitude and Relation to Marketing Behavior.* Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012.

Gabriel, S. C. & Baker, C. B., 1980. Concepts of Business and Financial Risk, *American Journal of Agricultural Economics,* Vol. 62, pp. 560-564.

Garner, C., 2010. *A Trader's First Book on Commodities: An Introduction to The World's Fastest Growing Market*, 2nd edition. Upper Saddle River, New Jersey: Pearson Education.

Goodwin, B. K. & Schroeder T. C., 1994. Human Capital, Producer Education Programs, and the Adoption of Forward- Pricing Methods, *American Journal of Agricultural Economics*, Vol. 76: pp. 936-947.

Gravelle, H. & Rees, R. 2004. *Microeconomics* 3rd edition. Harlow, England*:* Pearson Education Limited.

Grinyer, A., 2002. The Anonymity of Research Participants: Assumptions, Ethics and Practicalities, Social Research Update: Issue 36, University of Surrey.

de Haan, C., van Veen, T. S., Brandenburg, B., Gauthier, J., Le Gall, F., Mearns, R. & Siméon, M. 2001. *Livestock Development: Implications for Rural Poverty, the Environment, and Global Food Security.* Washington D.C.: The International Bank for Reconstruction and Development/ The World Bank.

Hakelius, K. 1996, *Cooperative Values - Farmers' Cooperatives in the Minds of the Farmers.* Diss. Uppsala: Swedish University of Agricultural Sciences.

Hardaker, J. B., Huirne, R. B. M., Anderson, J. R. & Lien, G., 2004. C*oping with Risk in Agriculture,* 2nd ed., Oxfordshire; CABI Publishing.

Harwood, J., Heifner, R., Coble, K., Perry, J. & Somwaru, A., 1999. *Managing Risk in Farming: Concepts, Research, and Analysis.* Market and Trade Economics Division and Resource Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 774. Washington, DC 20036-5831.

Hemström, C. & Giertz, M., 2013. *Bolagens rättsliga ställning: Om enkla bolag, handelsbolag, kommanditbolag och aktiebolag*, 10th edition. Stockholm: Norstedts Juridik AB.

Iwarson, T., 2012. *Bättre betalt för skörden – Riskhantering för lantbrukare.* Vaxholm: Sterners förlag AB.

Lukkarinen, J. & Lannhard Öberg, Å., 2012. *Marknadsöversikt – mjölk och mejeriprodukter*, 2014:7. Jönköping: Enheten för handel och marknad.

Makus, L. D., Lin, B-H., Carlson, J., Krebill- Prather, R., 1990. Factors Influencing Farm Level Use of Futures and Options in Commodity Marketing, *Agribusiness: An International Journal,* Vol. 6: pp. 621-631.

Martin, S., 1996. Risk Management Strategies in New Zealand Agriculture and Horticulture, *Review of Marketing and Agricultural Economics,* Vol. 64: No.1, pp. 31-44.

Martinez, S. W. & Zering, K. D, 1992. Optimal Dynamic Hedging Decisions for Grain Producers, *American Journal of Agricultural Economics*, Vol. 74: No. 4, pp. 879-888.

Maynard, L., J., Wolf, C. & Gearhardt, M., 2005. Can Futures and Options Markets Hold the Milk Price Safety Net? Policy Conflicts and Market Failures in Dairy Hedging, *Applied Economics Perspectives and Policies*, Oxford Journals, Oxford, UK. Vol. 27: No 2, pp. 273-286.

Menapace, L., Colson, G. & Raffaelli, R., 2013. Risk Aversion, Subjective Beliefs, and Farmer Risk Management Strategies, A*merican Journal of Agricultural Economics,* Vol. 95: No. 2 pp. 384-389.

Mishra, A. K. & Goodwin, B. K., 1997. Farm Income Variability and the Supply of Off-Farm Labor, *American Journal of Agricultural Economics,* Vol. 79: pp. 880-887.

Mofokeng, M. & Vink, N., 2013. *Factors Affecting the Hedging Decision of Maize Farmers in Gauteng Province*, 4th International Conference of the African Association of Agricultural Economists, Hammamet, September 22-25 2013, Tunisia.

Neumann, J. & Morgenstern, O., 1953. *Theory of Games and Economic Behavior*, Princeton: Princeton University Press.

Neurath, C. 2012. *Råvaruhandel ett etiskt dilemma*, Svenska Dagbladet, November 22.

O'Brien, R., 2007, A Caution Regarding Rules of Thumb for Variance Inflation Factors, *Quality & Quantity*, Vol 41, No. 5, 99. 673-290.

O'Connor, D., Keane, M. & Barnes, E., 2008. *Managing price risk in a changing policy environment: the case of the EU dairy industry.* Paper prepared for presentation at the 108st EAAE Seminar 'Income stabilisation in a changing agricultural world: policy and tools', Warsaw, Poland, 8-9 February, 2008.

Patrick G R., Wilson P N., Barry P J., Boggess W G., and Young D L., 1985. Risk Perceptions and Management Response: Producer-Generated Hypothesis for Risk Modeling, *Southern Journal of Agricultural Economics*, USA, Vol. 17, No. 2, pp. 231-238.

Pindyck, R. S. & Rubinfeld, D. L, 2009. *Microeconomics.* 7th edition, Upper Saddle River, New Jersey: Pearson Education.

Robson, C., 2011. *Real World Research*, 3rd edition. Oxford: Blackwell.

Rosati, A. & Aumaitre, A., 2004. Organic Dairy Farming in Europe, *Livestock Production Science*, Vol. 90, No. 1, pp. 41-51.

Rogers, E. M., 2003. *Diffusion of Innovations*, 5th edition. New York: Free Press.

Sarris, A.H. & Freebairn, J., 1983. Endogenous price policies and international wheat prices. *American Journal of Agricultural Economics*, Vol. 65, pp. 214-224.

Saunders, M., Lewis, P. & Thornhill, A, 2009. *Research Methods for Business Students,* 5th editon. Harlow: Pearson Education Limited.

Sckokai P., 2012. *How will the balance between supply and demand be affected by market forces, organisational systems of the supply chain (in particular POs and IBOs) and policy measures, including market support mechanisms, in a non-quota regulatory framework?,* In Expert's Opinion Report ,Conference "The EU dairy sector: developing beyond 2015", Brussels, September 24, 2013.

Shadbolt N. & Olubode-Awosola F., 2013. New Zealand Dairy Farmers and Risk: Perceptions of, Attitude to, Management of and Performance under Risk and Uncertainty, funded by New Zealand dairy farmers through DairyNZ and the Ministry for Primary Industries through the Primary Growth Partnership, New Zealand.

Shapiro, B. I. & Brorsen, B. W., 1988. Factors Influencing Farmers' Decisions of Whether or Not to Hedge, *North Central Journal of Agricultural Economics,* Vol. 10: pp. 145-153.

Swedish Competition Authority (Konkurrensverket), 2011. *Mat och marknad - Från bord till bord,* 2011:3. Stockholm: E-Print AB.

Tauer W. T., 1986. Risk Preferences of Dairy Farmers, *North Central Journal of Agricultural Economics,* Vol. 8: No. 1, pp. 7-15.

Tsetsekos, G. & Varangis, P. N., 1998. *The Structure of Derivatives Exchanges: Lessons from Developed and Emerging Markets,* World Banks Publications.

Valvekar, M., Cabrera, V.e. & Gould, B.w. 2010. Identifying cost-minimizing strategies for guaranteeing target dairy income over feed cost via use of the Livestock Gross Margin dairy insurance program. *Journal of dairy science*, Vol. 93: No. 7, pp. 3350-3357.

Wade, K.M., van Asseldonk, M. A. P. M., Berentsen, P. B. M., Ouweltjes, W. & Hogeveen, H., 2004. Economic efficiency of automatic milking systems with specific emphasis on increases in milk production, In: de Koning, H. & de Wageningen, C. J. A. M. (eds.) *Automatic Milking*, Wageningen Academic Publishers, pp. 62-67.

Wolf, C. A., 2012. Dairy Farmer Use of Price Risk Management Tools, *Journal of Dairy*

Science, Vol. 95: No. 27 pp. 4176-4183.

Wu, F., Guan, Z. & Myers, R., 2014. Farm Capital Structure Choice: Theory and an Empirical Test, *Agricultural Finance Review*, Vol. 74, No. 1, pp. 115-132.

Internet

Arla Foods, www.arla.se
Facts & Figures 2012, 2014-02-17, 19:30
http://www.arla.com/service-links/Investors/Facts-and-Figures/

DairyCo, www.dairyco.org
1. Rabobank Global Dairy Top-20 Released, 2014-03-31, 17:34
http://www.dairyco.org.uk/news/news-articles/september-2013/rabobank-global-dairy-top-20-released/#.UzmKIPl_s28

2. Risk management in dairy, 2014-02-19, 17:52
http://www.dairyco.org.uk/news/dairyleader-articles/winter-2013/reducing-your-risk/#.UwTY6SgxW3k

Dairy Markets, www.dairymarkets.org
The world dairy situation, 2014-05-09, 12:23
http://www.dairymarkets.org/Workshops/2014Milwaukee/Presentation/Pilet.pdf

The Dairy Site, www.thedairysite.com
Evolution of the Market Situation and the Consequent Conditions for Smoothly Phasing out the Milk Quota System, 2014-05-06, 21:33
http://www.thedairysite.com/articles/3451/evolution-of-the-market-situation-and-the-consequent-conditions-for-smoothly-phasing-out-the-milk-quota-system#sthash.mLdnNEnY.dpuf

Eurex Exchange, www.eurexchange.com
Eurex Trading fees and prices, 2014-09-07, 21:26
http://www.eurexchange.com/exchange-en/trading/trading-fees-prices/

Fonterra, www.fonterra.com
Milk price methodology, 2014-02-17, 21:07
https://www.fonterra.com/global/en/Financial/Milk+Price+Methodology

Land Lantbruk, www.lantbruk.com
Först i Sverige med att prissäkra mjölk, 2014-04-09, 20:18
http://www.lantbruk.com/lantbruk/han-ar-forst-i-sverige-med-att-prissakra-mjolk

LRF Mjölk, www.lrf.se/mjolk (The Federation of Swedish Farmers, Milk)
1. Antal mjölkföretag - per månad och år, 2014-02-10, 17:42
http://lrf.se/Medlem/Foretagande/LRF-Mjolk/Statistik/Mjolkforetag/Antal-mjolkforetag/

2. Mjölkinvägning 2012, 2014-02-17, 19:40
http://lrf.se/Medlem/Foretagande/LRF-Mjolk/Statistik/Mjolkinvagning/

3. Guldmedaljen för förstklassig mjölk, 2014-05-19, 20:42
http://www.lrf.se/medlem/foretagande/lrf-mjolk/gard-och-mejeri/guldmedaljen/

Oxford Dictionaries, www.oxforddictionaries.com
Risk, 2014-04-10, 13:07
http://www.oxforddictionaries.com/definition/english/risk

SCB (Statistics Sweden), www.scb.se
Agricultural businesses regarding legal form, 2014-04-09, 12:43
http://www.scb.se/sv_/Hitta-statistik/Statistikdatabasen/Variabelvaljare/?px_tableid=ssd_extern%3aForetagFormL&rxid=1deb73d9-3764-4e0b-a7ac-9de11611ca6f

Växa, www.vxa.se
Bättre djurhälsa en vinst för alla, 2014-04-30, 15:00
http://www.vxa.se/Radgivning-service/Djurhalsa/

Appendix 1. Questionnaire

Tired of fluctuating prices?

To you who is a dairy farmer,
As a Swedish dairy producer today you can hedge the milk price using financial instruments traded at the European Exchange Market with help of a bank. The derivative market of milk is new, only a month ago the first contract was traded. During January this year the difference between the Swedish settlement price and the Eurex exchange was 0.8 SEK/ kg milk. Today the European Commission, banks and policymakers pay a lot of attention to this topic and there is a growing interest from dairy farmers worldwide. Dairy producers in USA hedged their production for a long time and in Germany and Ireland education programmes started to help farmers understand the instrument. The derivatives even out the prices over time and are thereby minimising the risk of falling prices but it requires knowledge to understand. Dairies can offer derivatives but a low demand do not create an incentive for dairies to change their pricing strategy, further information and example if found on page 6.

We are three agronomist students at the Swedish University of Agricultural Sciences developing a research project that investigates i) the interest of dairy producers to hedge their settlement price and ii) the role that banks and dairy companies may play in order to develop/design a sound hedging strategy. We are studying which the factors that affect the dairy producers' attitude to trading in futures in milk on an exchange and with that we need **Your** help. You have been randomly selected through the list of membership from LRF Mjölk and the purpose is that your answers together with the others will underpin a development in the dairy sector. The survey is made anonymous and we guarantee that individual answers not will be read. Instead of your name you will get a code that have the purpose of knowing if you have answered so you don't get a reminder. The survey consists of short questions about your dairy firm and of you as an owner, which is estimated to take approximately **15 minutes** to answer. The survey will be a part of a master thesis that will be public published in SLU's database Epsilon. To give the thesis as fair results as possible, it is important that you respond to all questions and return the questionnaire in the attached and franked envelope. If you have any questions about the survey you are welcome to contact:

Name: *Ankie Hilmerby*
Telephone: 0705-XX XX XX
E-mail: anhi0002@stud.slu.se

We thank you in advance for taking the time to answer our survey. Your reply is very valuable!

Julia Andersson Ankie Hilmerby Anna Sundin Lundbe

Questionnaire

Derivatives

1. **Derivatives are quite new in the dairy industry and few are familiar with the instrument, which statement corresponds best regarding your thoughts of risk management tools and derivatives?**

	Choose one:
I know how it works	○
I know roughly how it works	○
I have heard of it	○
I don't know what it is	○

2. **Are you interested of using derivatives for hedging milk?**
More information and example on page 6.

	Choose one:
Yes, if a dairy offers the service	○
Yes, if a bank offers the service	○
Yes, regardless of who offers the service	○
No, I'm not interested	○
Not sure/ Don't know	○

3. **Do you have prior experience of using derivatives for:**

	Yes	No
Hedging fodder through a merchandiser?	○	○
Hedging currencies in European funding?	○	○
Hedging crops through a crop-trader	○	○
Hedging crops through a bank	○	○
What is the hedged proportion of crops (%)?	_____	

4. **Arrange the factors that you consider are the premier source of worry on a scale of 1-7 where:**
1 = The biggest source of concern
7 = Smallest source of concern

Milk Price	____
Political Changes	____
Interest Rate	____
Input Prices	____
Virus/ Deceases	____
Climate/ Weather	____
Meat Price	____

Questionnaire

5. Which statement corresponds best on your thoughts of derivatives of milk?	Fully agree	Broadly agree	Don't know/ Not sure	Agrees Partly	Do not Agree
a) Derivatives are minimising the risk of volatility in price	○	○	○	○	○
b) If I use derivatives my income generated by milk will decrease	○	○	○	○	○
c) I think derivatives are difficult to learn and understand	○	○	○	○	○
d) I think derivatives are time consuming to work with	○	○	○	○	○
e) Future volatility in milk price is a source of concern	○	○	○	○	○
f) I'm worried about being fooled when using derivatives	○	○	○	○	○
g) I'm worried about doing wrong when using derivatives	○	○	○	○	○
h) I'm worried about being tied up during a longer time	○	○	○	○	○
i) It's important for me to be low leveraged	○	○	○	○	○
j) It's important for me being aware of other dairies' prices	○	○	○	○	○

6. What corresponds best regarding your awareness of milk prices? *How often do you check the milk price?*	Several times a day	Daily	Every other day	Some times	Never/ don't care
	○	○	○	○	○

7. What corresponds best regarding your thoughts about the interest rate of your loans? *I lock up the interest on my loans*	Always true	Often true	Don't care	Rarely true	Never true
	○	○	○	○	○

Questionnaire

Questions about You & the Company

8. What is your year of birth?

_____

9. How many owners do the company have?

_____

10. Are you: Choose one:

Male ○

Female ○

11. How many persons translated to full time work on the farm, including you?

_____

12. Do you have an income from other employment than the farm? *Choose one:*

No ○

Yes ○

Estimated proportion (%)

_____

13. What is your highest level of education: *Choose one:*

Primary school ○

Secondary school ○

University degree ○

Post Graduate degree ○

14. What legal form is used for the company? *Choose one:*

Limited Company ○

Sole Proprietor ○

General partnership ○

A combination ○

Else: ○

_____

About the farm

15. Where is your farm located? *Choose one:*

Götaland ○

Svealand ○

Norrland ○

16. Are you leasing land? *Choose one:*

Yes ○

No ○

17. How many hectares of forest do you own?

_____

18. How many hectares are used on the farm?

_____

19. How many hectares are you growing crops on?

_____

Questionnaire

20. Which proportion is used as fodder of the total numbers of hectares (%)?

_____

21. How many lactating cows do you own?

_____

22. How large is the recruiting proportion (%)?

_____

23. What do you think about the company's future? *Choose one:*

- *Expanding* ○
- *Keeping constant/ Slightly improve* ○
- *Change production* ○
- *Phase out* ○

24. The production is: *Choose one:*

- *Organic* ○
- *Conventional* ○

25. Estimate the company's solidity (debts/total assets) (%)?

_____

26. Have you received any awards or been ranked on top lists for your production? Choose one:

- *Yes* ○
- *No* ○

27. How many tonnes of milk are you yearly delivering?

_____

28. Which breed has the herd?

_____

29. What kind of milking system is used on the farm? *Choose one:*

Tied up/ Stanchion barn

- *Automatic System* ○
- *Carrousel/rotary* ○
- *Tandem/Batch* ○
- *Combination* ○
- ○

30. How far is it to your dairy processor? *Choose one:*

- *0-30 km* ○
- *31-60 km* ○
- *61-90 km* ○
- *91 km or more* ○

Derivatives: Information and examples

Last questions

31. Which dairy processor do you deliver to? *Choose one:*

- *Arla* ○
- *Coop* ○
- *Emåmejeriet* ○
- *Falköpings Mejeri* ○
- *Gefleortens Mejeriförening* ○
- *Gäsene Mejeriförening* ○
- *Hjordnära Mejeri* ○
- *Norrmejerier* ○
- *Sju Gårdar* ○
- *Skånemejerier/ Lactalis* ○
- *Wapnö Mejeri* ○
- *Östgöta Mjölk* ○
- *Taking care of the milk by my self* ○
- *Else:* ○ _____

32. Where do you primarily find current market information about milk? *Choose one or several:*

Give examples

- *Facebook* ○ _____
- *Twitter* ○ _____
- *Blogs* ○ _____
- *Other sites on internet* ○ _____
- *Newspapers* ○ _____
- *Newsletters from banks* ○ _____
- *Newsletters from dairies* ○ _____
- *Agronomics* ○ _____
- *Agricultural newspapers* ○ _____
- *Consultancies* ○ _____
- *Else:* ○ _____

33. Choose what corresponds best to your company's financial results?

	Big profit	*Profit*	*Neutral*	*Loss*	*Big loss*	*Not sure*
2013	○	○	○	○	○	○
2012	○	○	○	○	○	○
2011	○	○	○	○	○	○
2010	○	○	○	○	○	○

Thank you for your participating!

Derivatives: Information and examples

A **future contract** operates in the same way as a stock deal where the delivery and payment is placed in the future, at the expiration day. You do not need to stay with the contract until the expiration day; you can shut it down by doing an opposite affair. In other words if you first bought a future contract you close the contract by sell back the contract. Trading prices are published on bank and exchange web pages but also in ordinary newspapers. The produced milk is not traded physically through the future contract, but to the dairy that is your ordinary contractor. On the contrary dairy companies also could offer contracts with fixed prices and in turn hedge the producers' total volume of delivered milk to an exchange, similar to the contracts that exist in the crop industry.

Hedging even out prices and the example below show that the total result from selling milk and future contract is the same in both cases and the risk for price volatility is gone. It doesn't matter if the price has increased or decreased when you have signed a future contract, your revenue are stable.

Example:
You **sign** a future contract of 5 *ton* that expires in 4 months when the price of skim milk powder (SMP) is ***4000*** EUR/ ton on the exchange.

1. **If the price *increase* after 2 months and you want to *close the contract:***
You sell the same volume (5 ton) when the price is ***4200*** EUR/ ton. An exchange fee of 1.5 EUR/ 5 ton and a commission fee of 0.1 % of the investment to the broker is added. At the same time you deliver your milk to the dairy at a price of ***4100*** EUR/ ton.

Outcome of future contract	(4000 EUR/ ton – 4200 EUR/ ton)* 5 ton	-1 000 EUR
Cost of the future contract	1.5 EUR/ 5 ton + (0.1 % * 20 000 EUR)	– 21,5 EUR
Income from the dairy	4 100 EUR/ ton * 5 ton	20 500 EUR
Total results	**20 500 - 1 000 - 21,5**	**19 478,5 EUR**

2. **If the price *decrease* after 2 months and you want to *close the contract:***
You sell the same volume (5 ton) when the price is ***3600*** EUR/ ton. An exchange fee of 1.5 EUR/ 5 ton and a commission fee of 0.1 % of the investment to the broker is added. At the same time you deliver your milk to the dairy at a price of ***3500*** EUR/ ton.

Outcome of future contract	(4000 EUR/ ton – 3600 EUR/ ton)* 5 ton	2000 EUR
Cost of the future contract	1.5 EUR/ 5 ton + (0.1 % * 20 000 EUR)	– 21,5 EUR
Income from the dairy	3 500 EUR/ ton * 5 ton	17 500 EUR
Total results	**17 500 + 2000 – 21,5**	**19 478,5 EUR**

Appendix 2, Variance Inflation factor (VIF)

Minimum possible value = 1.0
Values > 10.0 may indicate a collinearity problem

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient
between variable j and the other independent variables

Model 1

Q14c	1.002
Q5g	1.002

Model 2

Q5c	1.002
Q12	1.002

Model 3

Q5e	1.023
Q5h	1.057
Q42	1.048
Q32d	1.008
Met_1_mail	1.026

Model 4

Q3a	1.283
Q45	1.061
Q5a	1.180
Q5d	1.068
Q5e	1.158
Q6	1.346
Q33b	1.183

Model 5

Q5e	1.121
Q5g	1.138
Q41	1.197
Q45	1.142
Q17	1.131
Q19	1.201
Q33b	1.097
Q29a	1.163